Structuring supply chains based on product segmentation commerce essay

The world has just gone through one of the worse crisis since the Second World War. In order to reduce the negative impact, companies have tried to reduce cost by any ways, by freezing all expansion, by reducing the number of employees, by launching quick wins project in order to free-up cash…to summarize nothing sustainable. In order to catch a sustainable growth that will reduce the impact of any future crisis, to obtain a competitive advantage, companies need to design an optimized supply chain. This optimization will lead to a supply chain that are no more a cost but an competitive advantage, a supply chain that brings value, a supply chain that become strategic. The time and the cash spend to source; to produce and to distribute product and services are so huge that companies can't afford to ignore it. When designing its supply chain, companies need to keep in mind that " ONE SIZE DOES NOT FIT ALL", meaning that one supply chain configuration can't fulfil each customer's requirements. Indeed, each customer has different needs which can't be fulfil in the same way. One customer may seek for a company able to provide reactive supplies, while another company is seeking for minimum purchasing cost… Providing different product/service implies having different supply chain configuration. The objective then is to provide different global services which go far beyond the product itself. Nowadays, companies can't provide a product only. They need to provide a global service – meaning that they have to provide quality service which goes with the product. The level of quality that needs to be reached is then determined by the customers' requirement and willingness to pay a certain price. Customers may want seek for a good quality/price product, some other may want to have a extremely high quality and innovative product, some other are looking to receive the product at their

place the next day they purchased it,... And in order to be able to provide this global service that includes the product, companies need to design their supply chain accordingly.

This thesis is focusing on understanding the different choice that a company can make when designing its tailored supply chain. Each product is designed differently, and each product (or service) is meant to be for one specific customer. The time when Ford was making one single car for everyone is over. We will focus on how to design its supply chain based on product segmentation.

We will first identify the different type of supply chain configuration a company can choose based on its corporate strategy. We will then try to define the meaning of the segmentation and what are the main criteria to perform it. This will lead us to identify the different models that currently exist, models that will help companies to segment, categorize and design tailored supply chains. Then we will try to apply the models on a real case and try to redesign the company supply chains going from an AS IS statement to a TO BE ideal situation.

Product Segmentation and Supply Chain Segmentation

Segmentation Definition

Segmentation can be defined as: " Process of defining and sub-dividing a large homogenous market into clearly identifiable segments having similar needs, wants, or demand characteristics." [http://www. businessdictionary. com/definition/market-segmentation. html].

The main purpose of segmentation is to help to decide what configuration of the business is the most suitable for what customer. The concept of " one size does not fit all" has for meaning that each customer has a different need and this need cannot be fulfilled in the same way the other customers need are fulfilled. In supply chain the purpose of segmentation is to configure the processes in a way that will lead to a competitive advantage and then to profit. However, we cannot fulfill in a different way each single customer as this will increase the cost so much that the company won't survive. Thus, it is important to build groups that have similar needs and provide one single service for this group.

Different type of Supply Chain

Functional Product VS Innovative Product

The idea of categorizing product in order to identify the most suitable supply chain is not new. In 1997, Fisher introduced a new concept in order to better serve the customers. Fisher said that " the first step in devising an effective supply chain strategy is therefore to consider the nature of the demand for the product one's company supplies", [Fisher]. He identified several factors that will influence the design of the most suitable Supply Chain, factors such as Product life cycle, demand predictability, Product variety and market standards for lead times and services. Thus, he started by categorizing product based on theirs characteristics. He identified two types of products: Functional Product and Innovative Product. The main difference of these two types of product influence the type of supply chain needed to optimize the supply of these products. Fisher defines Functional Products are products with long life cycles and with low demand uncertainty. Conversely,

innovative products are products having a short life cycle with high demand uncertainty. Fisher went event further as you can see on the Table 1 below in the distinction between Functional and Innovative Products:

Figure 2: Matching supply chains with product characteristics (Source: Fisher, 1997)

Hau L. Lee also developed Fisher's idea on the distinction between Innovative and Functional Products as you can see on the table below:

Table 1: Demand Characteristics[1]

The impact of this distinction on the Supply Chain type is tremendous. The choose to develop a Lean Supply Chain or an Agile Supply Chain is easier thanks to this new distinction as we will see on the next part.

Lean, Agile, Leagile Supply Chain

Based on the functional and innovative products concept, we are now able to introduce different supply chain strategy. Each companies' objectives are different, thus when designing its supply chain, the aim of this new organization will be different. We are introducing here different strategy when designing its supply chain: The Lean Supply Chain aims to reduce the waste and thus the cost while providing high quality products/services. The Agile supply chain's objective is the flexibility to fulfill the customer demand while this one's predictability can be very low. The Leagile strategy is a hybrid solution, combining the Lean and Agile strategy in one.

The first time we heard about Lean Manufacturing was in 1988 by John Krafcik in a article he wrote in the Sloan Management Review: " Triumph of the Lean Production System"[2]when he was describing the Japanese production model which is essentially the elimination of waste. Naylor et al provided with a interesting definition: " Leanness means developing a value stream to eliminate all waste including time, and to enable a level schedule" [Naylor et al.]. Since then, the concept becomes much broader. Indeed, Christopher and Towill highlighted the fact that the Lean Supply Chain works better with a stable demand and where variety is low[3]: which correspond to the functional products. From this statement we can already start to have a clearer view on what supply chain for what products; thus, functional products need Lean Supply Chain. The lean supply chain will focus " on cost reduction for standardized mass-products" [Volker Stich, Jan Christoph Meyer][4].

The origin of agile concept " lie partially in flexible manufacturing systems (FMS)" [M. Chritopher, D. Towill]. The Agile Supply Chain allows using a highly flexible supply chain in order to better serve the customer. As for the Lean definition, Naylor et al. introduce a definition for agility concept: " Agility means using market knowledge and a virtual corporation to exploit profitable opportunities in a volatile marketplace" [Naylor et al.]. With an Agile Supply Chain it is much more efficient and effective for product with high volatility in the demand and high variety which correspond to the innovative products.

In the table below, Chritopher and Towill went even further in the difference between a Lean and an Agile Supply Chain:

Table 3: Comparison of Lean Supply with Agile Supply: The distinguishing Attributes[5]

Distinguishing Attributes

Lean Supply

Agile Supply

Typical Products

Commodities/Functional

Fashion Goods/Innovative

Marketplace Demand

Predictable

Volatile

Product Variety

Low

High

Product Life Cycle

Long

Short

Customer Drivers

Cost

Availability

Profit Margin

Low

High

Dominant Costs

Physical Costs*

Marketability Costs**

Stockout Penalties

Long Term Contractual

Immediate and Volatile

Purchasing Policy

Buy Materials

Assign Capacity

Information Enrichment

Highly Desirable

Obligatory

Forecasting Mechanism

Algorithmic

Consultative

*Physical Costs: All Production costs, distribution costs and storage costs

**Marketability Costs: All obsolescence costs and stockout costs

If only, both agile supply chain advantages and Lean Supply Chain advantages could be put together to build a perfect supply chain, it would be the best of both world. Coming from this pursuit of perfection, the concept of " Leagile" [Naylor et al] supply chain appeared. This concept suggests using lean supply chain for the upstream flows and the agile supply chain for the downstream flows. In practice, this strategy is using what is called " The decoupling point" or " Postponement". This concept principle is to keep sub assembly inventory and to produce finished goods only when the order is know. Chritopher and Towill pointed out one important fact is the information " de-coupling point": they argue that " the furthest point upstream to which information on ' real' demand flows i. e. information which has not been distorted by inventory policies such as re-order points and re-order quantities" contributes to the Agility of a company.

Figure 1: " The decoupling point"[6]

Stable and Evolving Supply Chain

As pointed out Volker Stich and Jan Christoph Meyer, all the approach discussed earlier are focusing on the demand side. Hau L. Lee introduced a new concept called Stable and Evolving supply processes. This concept is focusing on the supply side of the supply chain. Hau L. Lee provided a useful definition as follows:

" A stable supply process is one where manufacturing process and the underlying technology are mature and the supply base well established." [Hau L. Lee]

" An evolving supply process is where the manufacturing process and the underlying technology are still under early development and are rapidly changing, and as a result the supply base may be limited in both size and experience." [Hau L. Lee]

There is more difference between stable supply processes and evolving supply processes, the figure 2 is summarizing some of these differences. The link should be made with Fisher's Functional and Innovative products: Functional products tend to use a more mature and stable supply process but this is not always the true. Hau L. Lee provides several example summarized in the figure 3.

Figure 2: Supply Characteristics. (Source: Hau L. Lee)

Figure 3: The uncertainty Framework: Examples. (Source: Hau L. Lee)

Segmentation Factors

Determining the Customers Needs: Order Winner and Market Qualifier

The definitions of " Order Winner" and " Order Qualifier" found in the APICS dictionary are quite interesting:

Order winners are " those competitive characteristics that cause a firm's customers to choose that firm's goods and services over those of its competitors. Order winners can be considered to be competitive advantages

for the firm. Order winners usually focus on one rarely more than two) of the following strategic initiatives: price/cost, quality, delivery speed, delivery reliability, product design, flexibility, after-market service, and image."
[APICS Dictionary 2008][7]

Order qualifiers are " those competitive characteristics that a firm must exhibit to be a viable competitor in the marketplace." [APICS Dictionary 2008][8]

When Terry Hill invented this new concept of " Order Winner" and " Order Qualifier", he aimed to linked operations' objectives with Marketing's one. The operations people were then in charge of managing the supply chain in a way that the company will obtain a competitive advantage and win the market.

As you can see on the APICS definition, several strategic initiatives have been identified: price/cost, quality, delivery speed, delivery reliability, product design, flexibility, after-market service, and image. Based on that, R. Mason-Jones et al. combined the Fisher concept with Hill concept as you can see on the figure 2. The key information is that companies need to excel and focus on the Market Winners factors while being highly competitive on the Market Qualifiers. The figure 3 shows that the company is focusing on Cost and obtained a competitive advantage on the price. The important point is that this company is not neglected the others key competitive factors and its performance is always above the critical minimum performance which if it would have been below, it would have eliminated the benefice acquired from the competitive advantage.

Figure 2: " An example of using the classification matrix based on market winners and market qualifiers" [Source: R. Mason-Jones et al.]

Figure 3: " The performance matrix" [Source: Nabil Montassir]

Another concept that needs to be took into account is the difference with " Importance" and " Performance" BLABLABLABLABLABLA

Corporate Strategy (Operation Excellence, Customer Intimacy, Innovation Excellence)

When designing a new Supply Chain or even redesigning an existing one, it is important to be consistent with the corporate strategy. The supply chain needs to be aligned with the overall company strategy. We can summarize nowadays strategies by three main one: Operation Excellence, Customer Intimacy and Innovation Excellence.

The operation excellence meant to provide the best quality/price ratio. The objective is to decrease the cost in order to sell it at the most competitive price without reducing the quality. The market winner is definitely the price. This strategy is likely to suit a Lean Supply Chain which aims to reduce the waste and therefore the cost.

The Customer intimacy is focusing on providing the highest service level to its customers. Agility, flexibility, reactivity are suitable adjective to describe the aim of this strategy. The price is no more the market winner but the Service level is. Agile and Leagile Supply Chain is likely to be the best strategy to compete on this market.

Innovation Excellence as the name indicates has to be at the cutting edge of innovation. The company wants to provide always the most advance product. The cost is higher than the other product and the company aim to touch the Early Adopters who are willing to pay a higher price to get an advanced product, thus the market winner is Innovation. The forecast for these kinds of products are difficult and the stockout as well as the obsolescence can be very high. Therefore it requires a rapid time-to-market if the product knows a rapid growth.

Supply Chain Key Classification Variables

From the table 2, A. Lovell, R. Saw and J. Stimson identified key cost drivers of the supply chain. They conclude that " all costs apart from manufacturing there is a small set of drivers: throughput level and variability; product size and weight; value and the demand variability/service factor" [A. Lovell, R. Saw and J. Stimson]. They even go further by reducing this number to three by combining the value with size and weight to form product value density" [A. Lovell, R. Saw and J. Stimson]. Using these three key cost drivers, supply chain segmentation can be done. Each group of products resulting from this segmentation will share common characteristics.

Table 2: Principal Cost Drivers in the Supply Chain" [Source: A. Lovell, R. Saw and J. Stimson]

In the same spirits, J. Aitken, P. Childerhouse, M. Christopher and D. Towill identidfied five key market characteristics that will be use to design Supply Chains. They use the term " DWV" [Christopher and Towill (2005)]: Duration of life cycle, Time Window for delivery, Volume, Variety and Variability[9].

They argue that for Short life cycles products, the end-to-end supply chain lead time needs to be reduced and optimized which will allows a higher flexibility and a faster time-to-market. Volume and Variability are similar to Lovell et al throughput level and demand variability. However, variety has been taken into account in Lovell concept: Higher the variety is lower the average demand by SKUs will be as the demand will be spread across a greater number of SKUs. It will require a higher flexibility to produce the right product at the right moment. A postponement strategy is well adapted to this kind of environment.

Before going further, the table below summarized the key factors that will influence supply chain segmentation:

Table 2: " Factors influencing Supply Chain Segmentation" [Source: A. Lovell, R. Saw and J. Stimson]

Segmentation Methods and Model: Choose your supply chain strategy

From the previous part on the segmentation factors, we have found different criteria:

From these different criteria, many people developed different model and matrix to help them in segmenting the supply chain. In this part we will introduce those models, try to explain their advantage and disadvantages. At the end, we will choose the one we think the most complete and use it during the practical part of this thesis.

Many of the models we will introduce use the same concept

Volker's 4 fold's model:

The criteria used by Volker are the Demand predictability and the customer needs. The demand is either easy to predict or non-predictable. The customers require low cost or high flexibility. From this matrix, we can obtain 4 different type of Supply Chain: the Accurate SC, the Agile SC, The Cost-Efficient SC and the Responsive SC. The cost-efficiency represent to the Lean Supply Chain we introduced before. A predictable demand which allows " high planning accuracy and therefore enables the most efficient design of the involved processes" [Volker] combines with the cost as the order WINNER in clearly indicates that a Lean SC (or Cost-efficient SC) as the best fit. At the opposite, when the demand is non-predictable and the order WINNER is the service level (through the high flexibility) the most suitable Supply Chain will be the agile one. When the demand is predictable and the customer requires high flexibility, it requires the " highest accuracy in the planning processes, to guarantee the required availability and flexibility". The last part is the responsive one the Supply Chain needs to be cost effective while the demand is unpredictable which suggest that a Leagile Supply Chain is the most suitable one.

Figure 5: " Supply Chain segments and Supply Chain phenotypes" [Volker]

Advantage: The main advantage is its simplicity, easy to understand and to use. It includes the customers' needs.

Disadvantages: From the table " Factors influencing Supply Chain Segmentation", we can see that this model is using only Market's criteria. It doesn't include any product criteria or source criteria. The throughput level

is also missing which makes difficult to determine the importance of the product and the manufacturing strategy that we will use. Therefore, this model is missing key decision factors. This model is limited to the strategy level and doesn't go on the operational level which makes difficult to configure the supply chain.

Hau L. Lee's model:

Same type as the Volker's model, Lee's model is using one same criterion: the demand predictability (or the demand certainty). The other criterion is the Supply Uncertainty. The segmentation possibilities: Efficient, Risk-hedging, responsive and agile corresponds at the same concept we introduced before.

Advantage: Simple and take into account the supply side.

Disadvantage: As for Volker's model, it doesn't include any product factors. And it doesn't include the throughput level. This model is limited to the strategy level and doesn't go on the operational level which makes difficult to configure the supply chain.

REL's 9Box:

This model use two factors: the Throughput level (in value) and the demand variability

It divides the products in three major groups and three different supply chain strategies:

Green group: The characteristics of this group are a high throughput level and a low variability in the demand. Easily to forecast using statistical methods, the accuracy needs to be very high as the service level should be high. The value of those product are high so the DIO " Days of Inventory Outstanding" needs to be low in order to avoid to have too much cash tied up in the supply chain. This group is the major group and needs to get the full attention and the priority from the business.

Orange group: As for the green group, MTS " Make-to-Stock" strategy will be privileged with an average or medium customer service level. The priority is given to the green group. The forecasting method used would be a statistical method or a smoothing average. The forecast accuracy needs to be high and the days of inventory target should be put on average: again the priority is given to the green group. This group's demand certainty is in overall lower than green groups and the throughput level is lower as well.

Red group: This group's main characteristic is the low demand certainty that make difficult to drive the supply chain. Thus the manufacturing strategy privileged is the MTO " Make-to-Order" strategy. As it the fluctuation in demand is too high, the forecast become highly challenging and the accuracy target should be Medium/Low and the DIO target near none.

Advantages: Much more operational than the other model we have viewed so far. It goes in a much deeper level than the other model. It is as well simple to use and easy to communicate.

Disadvantages: It doesn't include product characteristics into account. It doesn't include the supply side factors and doesn't include customer's

needs. In addition, it gives us information on the supply chain configuration but forget to identify the supply chain strategy: Lean, Agile, Leagile…

Product Value Density Model:

The main difference of this model with the others is that this one is using three segmentation factors while the other methods were using only two. Indeed, this model is using the Product Value Density, the throughput level and the demand-service factor (variability of the demand). From the table showing the supply chain cost (see chapter " Supply Chain Key Classification Variables", table XXX), Lowell identified four major factors that impact cost all along the Supply Chain: the Throughput level, the product size and weight, the product value and the demand variability. These four factors become three by combining product size and weight and the product value forming the Product Value Density (PVD). This model can be representing in a three dimensional graph but for ease of comprehension only two dimensional graph will be used (see Figure XXX). Thus, we will consider: the demand variability-service and the throughput; the PVD (product value density) and the throughput; the PVD and the demand variability-service.

When introducing his model, Lowell concentrates on the inventory and the transportation side of the supply chain as you can see o n the figure XXX below.

Advantages: Take into account product and market factors.

Disadvantages: Mainly focus on operational level and focuses on the inventory and transportation part of the supply chain.

DWV's model:

This model is the one I chose for the practical part. This model is more a guide than a matrix. By the letters DWV, we always take into account all the main factors when determining the supply chain design and configuration.

Duration of life cycle, Time Window for delivery, Volume, Variety and Variability

Variety = postponement

The chosen model:

The model chose for the practical part is the first one we have shown, the Volker's model. But we will change it a little so it can include the throughput level (in value) as well as the variety level. So this new model is using four different factors: The customers need, the demand Uncertainty (or variability), the throughput level and the variety level. The throughput level helps us to prioritize the resources through an ABC analysis of the value per product or family of product (ex; Do we really need to build an agile supply chain for a C class product?). It is important to understand the customer needs but business is business and if one customer is not really profitable then the importance for us decrease as much as the throughput level decrease. The variety level helps us to identify the product that may need a postponement strategy.

Key Performance Indicators

Before to go forward, it is important to introduce the Key Performance Indicators (KPIs) that we could/should/will use to keep visibility on the supply chains. KPIs are like a speedometer on a car that helps us to know at what speed we are driving.

When dealing with an Agile Supply Chain, the performances that we need to keep a close eye on them are:

OTIF (On Time In Full): Companies set up Agile strategy to fulfill a specific needs for their customers. They need to get a product when they want, where they want and at the right quantity. And these customers are willing to pay a higher price to get their suppliers that flexible. So any companies setting up an agile supply chain need to make sure that the OTIF performance are extremely high to not disappoint their customers.

Forecast Accuracy: If our purpose is to have a Lean strategy, then the forecast accuracy needs to be high. In general, when having a lean supply chain, companies have a " make-to-stock" production configuration which is equivalent to a " forecast-to-stock". Having a bad forecast accuracy will lead to mismatch between demand and supply. Either the company will end up having excess inventory or not lost sales.

This KPIs analysis can be done for each of them. Each time we will introduce a new KPI, we will try to explain how important it is for one or another supply chain configuration.

Supply Chain Design – Practical Example

The supply chain design consists on how to structure its supply chain. It involve the configuration of your sourcing (" Source") strategy, the production (" Make") strategy and the distribution (" Deliver") strategy. All these strategy together represent the Supply Chain Configuration or design.

Electrolux

" Make" configuration

In this part, we have to take different decision, like the production configuration MTS, MTO, ETO, Batch Size, Prioritization, Temporal & Physical Postponement...)

" SOURCE" Strategy

(Suppliers Partnerships, Suppliers Selection, Suppliers Performance & Service Level…)

" DELIVERY" Strategy

(Delivery Lead Time, Transportation Modes, Service Level…)

Inventory Strategy

(Safety Stock Level, Inventory Level, Inventory Location, Physical & Spatial Postponement)

Segmentation Model (Nine Box, Product Value-Density Model, Agile & Lean Matrix...)

Nous effectuerons :

Case study

Ce que je pense faire, c'est en effet d'utiliser les matrices présentés dans la deuxième partie et les appliquées a cette entreprises pour restructurer sa supply chain. Les indicateurs de performances seront également intégrer.

Ce cas doit être l'illustration des choix faits en fonction de ce que vous avez trouvé en II (la fameuse matrice de décision)

SNECMA Presentation

Industry Specification

SNECMA current strategy

SNECMA " TO-BE" Supply Chain based on product Segmentation Model

Case Study Conclusion