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Abstract number: 008-0679

Abstract title: Responsive lean supply chain

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POMS 19th Annual Conference

La Jolla, California, U.S.A.

May 9 to May 12, 2008

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Title & Summary

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Case study in a Japanese vehicle manufacturer in the UK (full paper)

Summary:

In the past two decades, Japanese vehicle manufacturers (VMs) have transplanted their lean production systems and vehicle development processes to the US and Europe; Meanwhile Western VMs have established an equivalent performance with their Japanese rivals in manufacturing.

Due to the fierce competition and ever rising customer demand, companies need to have more responsive supply chains in order to have a substantial advantage over their competitors. This paper is aiming to investigate the strategies adopted by a leading Japanese car manufacturer based in the UK. Important questions include what strategies are adopted for achieving quick response to market demand meanwhile maintaining a lean supply chain, how these different strategies are applied and together form a responsive lean supply chain, and the issues and difficulties in implementation.

Key words: supply chain, lean, agile, automotive

Responsive lean supply chain

Case study in a Japanese vehicle manufacturer in the UK (full paper)

1. Introduction

Supply chain management in the automotive industry has been intensively and extensively studied. The traditional downstream supply chain paradigm in the automotive industry began with lean manufacturing. The lean concept can be traced back to the Toyota Production System (TPS) with its focus on the reduction of waste within the manufacturing environment (Ohno, 1988). The focus of lean supply chains is the elimination of all waste, including time, to enable a smooth schedule to be established (Naylor et al., 1999). Lean manufacturing implies a ‘zero inventory’, just-in-time (JIT) approach, that has brought mass production to high levels of efficiency (Womack et al., 1990). The idea of ‘lean manufacturing’ (Womack et al., 1990) and the concept of ‘lean thinking’ (Womack and Jones, 1996) have attracted much research interest in the last decade, and indeed influenced and positively impacted many market sectors ranging from automotive to construction (Aitken et al., 2002), especially in those industries where low cost is the crucial factor for market winners (Mason-Jones et al., 2000b, Aitken et al., 2002, Christopher and Towill, 2001). It is the consensus that the applicability of lean is that market demand for the product is relatively stable and predictable, and the product variety is low (Towill and Christopher, 2002b).

Many successful examples of lean practice can be found in the automotive industry (Warnecke and Huser, 1995, Lamming, 1996, MacDuffie and Helper, 1997, Ohuallachain and Wasserman, 1999, Taylor, 1999, Gulyani, 2001). It is not surprising

to see that focus is given to the application of lean manufacturing in the automotive industry, as the initial success of lean production were found in the Japanese car manufacturer Toyota. Lean manufacturing has been tested with a high degree of success in reducing waste, cost and inventory, thus improving efficiency.

However, due to fierce competition and rising customer demand from the turbulent and volatile market, companies need to seek competitive advantage not simply by adopting the lean principles but defining and developing other domains to create and accomplish a more balanced approach (Cusumano, 1994). Lean is not the universal solution to meet all the needs in supply chain management. In order to have substantial advantages over the rivals and to meet the fluctuating market demand, companies need to have more flexible and responsive supply chains. This responsiveness and the flexibility to change in product mix or volume have been termed agility (Christopher, 2000).

Conventional supply chains have been forecast-driven, but agile supply chains are more likely to be demand-driven and information-based (Christopher et al., 2004). The idea of agility in the context of supply chain management focuses on flexibility (Aitken et al., 2002) - The original business concept was based on Flexible Manufacturing Systems (FMSs) through automation to enable rapid change in product mix or volume; and responsiveness - the ability to respond rapidly to unpredictable changes in demand or supply (Christopher, 2000). In cases where the demand is fluctuating and the requirement for product variety is high, agility is desired (Towill and Christopher, 2002b).

The lean and agile approaches are not two distinct or exclusive supply chain models in business operation; and are not to be viewed in opposition or isolation of each other. They can coexist if properly managed. Researchers have examined the lean and agile paradigms which have been successfully designed and operated in total supply chains of various industries, such as: fashion retailer, personal computer, electronics products, bicycle, lighting factory, carpet maker and precision mechanical products (Naylor et al., 1999, Christopher, 2000, Christopher and Towill, 2001, Mason-Jones et al., 2000a, Aitken et al., 2002, Towill and Christopher, 2002b, Bruce et al., 2004, Goldsby et al., 2006, Mason-Jones et al., 2000b). In general, the approaches are: postponing product differentiation, adopting the de-coupling point and product re-engineering. Towill and Christopher (2002a) illustrated how firms could combine the two strategies, for example a bicycle manufacturer adopted lean production in winter and agile in the summer; a carpet company applied the lean paradigm to some products through the use of technology, and agile to others. While an electronic company achieved upstream lean and downstream agility through product re-engineering and locating the de-coupling point.

2. Recent studies of the automotive industry

The fierce competition, fluctuating market demand and rising customer requirements also apply to the automotive industry. Turner and Williams (2005) pointed out that customers are becoming more demanding and the sheer variety of cars create an increasingly complex challenge. Customers will have different preferences and specific requirements for each car, which includes the range of body-styles, engine sizes, colours, options, and trim levels etc. As a result, VMs are experimenting with the dilemma of providing the exact vehicles and reducing the escalating costs and

complexity in manufacturing (Alford et al., 2000). It is argued that lean supply chains do not prove to be the universal recipe for staying ahead of today's volatile and competitive business environment (Richards, 1996, Aitken et al., 2002). This is especially true since focusing on efficiency does not automatically generate quick response to the market demand. VMs are forced to seek competitive advantage not simply by following the lean principles that everyone already knows and uses, but by defining other domains of competition (Cusumano, 1994, Alford et al., 2000). In other words, to create and balance an efficient and responsive total supply chain is the next imperative goal for the automotive industry.

The recent studies and literature in the automotive supply chains seem to emphasize flexibility and responsiveness, such as: how VMs achieve mass customisation and adopt postponement strategies to meet sophisticated customer requirements and fluctuating market demand. For instance, Alford et al., (2000) discussed that VM are facing sophisticated customers, mass customisation is the enabler to better meet the needs of customers and its application in the automotive industry. They argued that it was uncertain how the model of vehicle manufacturing engendered by lean production will meet the challenge of mass customisation. Since lean can not automatically guarantee flexibility and responsiveness. They suggested the need to understand the relationships with suppliers and the assembly process and to find a balance between cost management and the devolution of risk, and to create an optimum system for mass customisation. In addition, postponement is known as a supply chain strategy that delays product differentiation at a point closer to the customer (Van Hoek, 2001), Wadhwa and Bhoon (2006) examined the feasibility of postponement in vehicle manufacturing through business redesign, and suggested that

the postponement strategy is a bridge to ensure customization can be done quickly and inexpensively once actual consumer demand is known. Childerhouse et al., (2003) studied current practices concerning information flow as perceived by typical first tier suppliers in an automotive supply chain. They emphasized that information sharing is an essential feature of supply chains needed to compete in such competitive environment.

However, it seems that whilst attention has been given to improving agile manufacturing in the automotive industry, very little has been done on how automotive companies manage to balance both leanness and agility, and what strategies have been adopted to achieve the combination of efficiency and responsiveness in their supply chains. This paper aims to introduce, explore and exemplify the strategies and issues of achieving and balancing both a responsive and a lean supply chain in an automotive manufacturer. This paper discusses the approaches and strategies for achieving a lean and responsive supply chain within this company, and to examine the two paradigms that can be combined within a total supply chain. It is anticipated that the findings will give a set of possible approaches on how to balance both efficient and responsive supply chains in the automotive industry and may also suggest lessons for other manufacturing sectors.

3. The design and approach of this paper

In this paper, the primary data has been collected from a Japanese vehicle manufacturer in the UK. The data collection was conducted in February and June 2007. The data included over 7 hours of face to face semi-structured interviews with senior managers from different departments and observations recorded from two plant

visits at various work stations and production lines within the plant. Complementary data has been gathered from text books, company websites, industry reports and marketing databases.

The following section will offer a brief introduction to this company. A figure will then be presented to illustrate the approaches and strategies that contribute to becoming both lean and responsive. The activities shown in the figure will be broken into three sections; upstream, midstream and downstream. Quotes from the interviewees will be given to support and illustrate the discussion. Finally, the conclusions of the study will be given.

4. The responsive lean supply chain in a Japanese automotive company

The company is a well known Japanese automotive manufacturer founded in 1930s. It produces a wide range of mainstream cars and trucks. The plant in the United Kingdom was completed in 1980s. This factory is said to be the largest car plant in the United Kingdom and is widely recognised as the most productive factory in Europe. By 2007, it has produced 400,000 vehicles per year.

From the analysis of the interview data, a figure has been generated to illustrate the approaches and strategies adopted by this company in order to achieve a responsive lean total supply chain; they are shown in Figure 1 as below. In this figure, the total supply chain is divided into upstream - sourcing and components, midstream—manufacturing, and downstream - distribution which is consistent with Van Hoek (2001), arrows indicate which activities contribute to which part of the total supply chain.

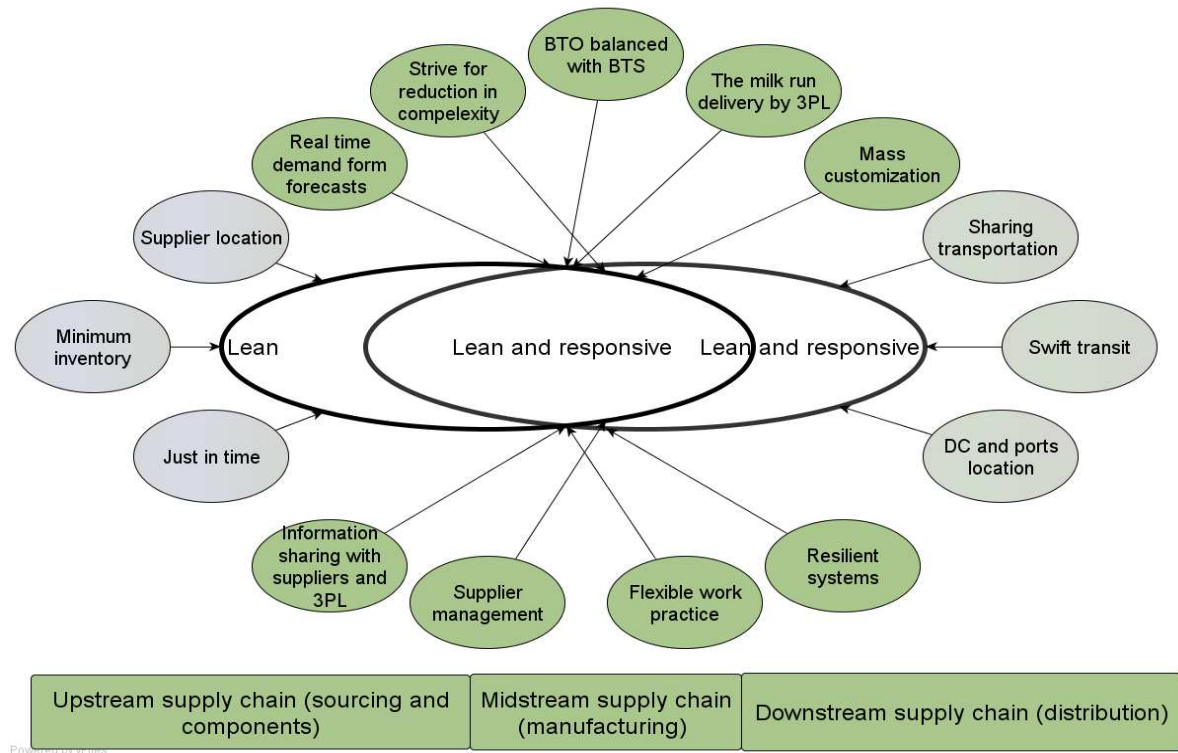


Figure 1. The approaches to achieve the lean and responsive total supply chain

The approaches and strategies are categorized according to the predominant contribution to each part of the supply chain. Although some approaches for instance, just in time, may contribute to both upstream and midstream supply chain, or even to the total supply chain. The next section will discuss and illustrate each approach in details to substantiate the findings.

4.1 The approaches to achieve lean upstream/midstream supply chain

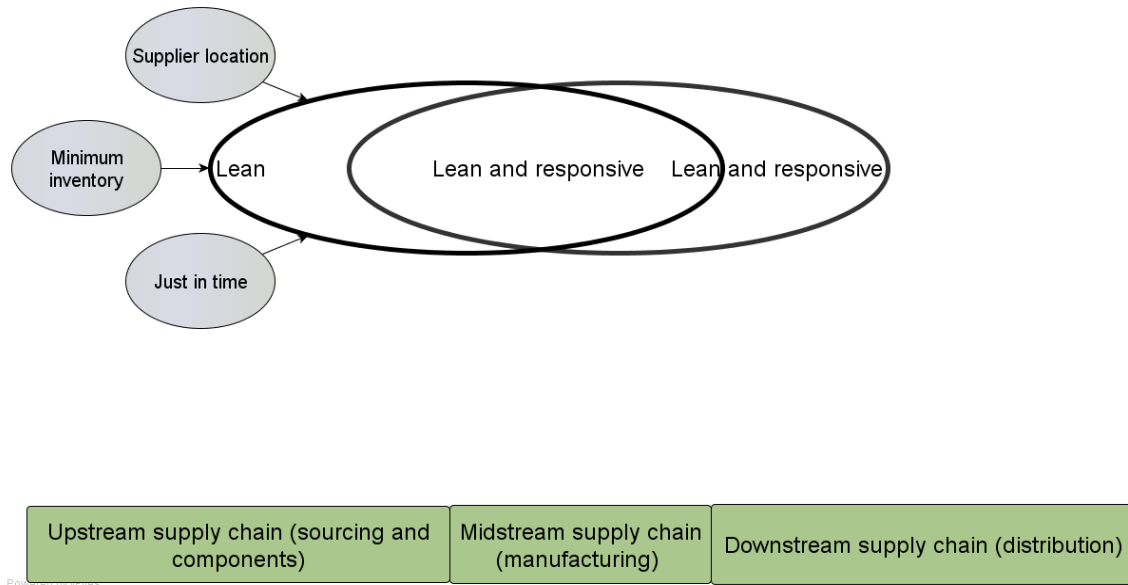


Figure 2. The approaches to achieve a lean upstream supply chain

4.1.1 Supplier location

The majority of parts and components are from the UK, with the rest sourced in Europe. There is a supplier park located in the same area as the plant; more than 40 key suppliers are resident within 50km of the factory and supply over 4,000 parts and components. The geographical closeness reduces transportation delays and aids JIT delivery.

4.1.2 Minimum inventory

At this plant, parts and components are kept in a minimum inventory, suppliers and third party logistics deliver the required parts and components in the right order at the point of fit to the production line to match the specifications of each vehicle. All the parties share production plan information and only produce and deliver what is

needed. Whilst most manufacturers are removing inventories from either upstream suppliers, or downstream dealers, this company shows that it is feasible to reduce inventory in a total supply chain.

4.1.3 Just in time

The philosophy behind just-in-time is the elimination of waste, for instance, equipment, material, parts, space and labour. This plant applies JIT delivery and JIT manufacturing throughout the plant and beyond. The production plan/delivery plan is sent to the suppliers and 3rd party logistics (3PL) electronically, thus suppliers and 3PL will only deliver and produce what is needed. Parts and components are delivered every two hours in a JIT manner to the point of fit. From the plant visiting tour, it was observed that some components are only stored by the assembly line for 12 minutes before being used.

The above factors are some approaches for achieving lean supply chain in this plant. Most importantly, in this plant it is recognized the lean practice is not a destination, but a journey of continuous improvement.

4.2 The approaches to achieve lean and responsive in a midstream supply chain

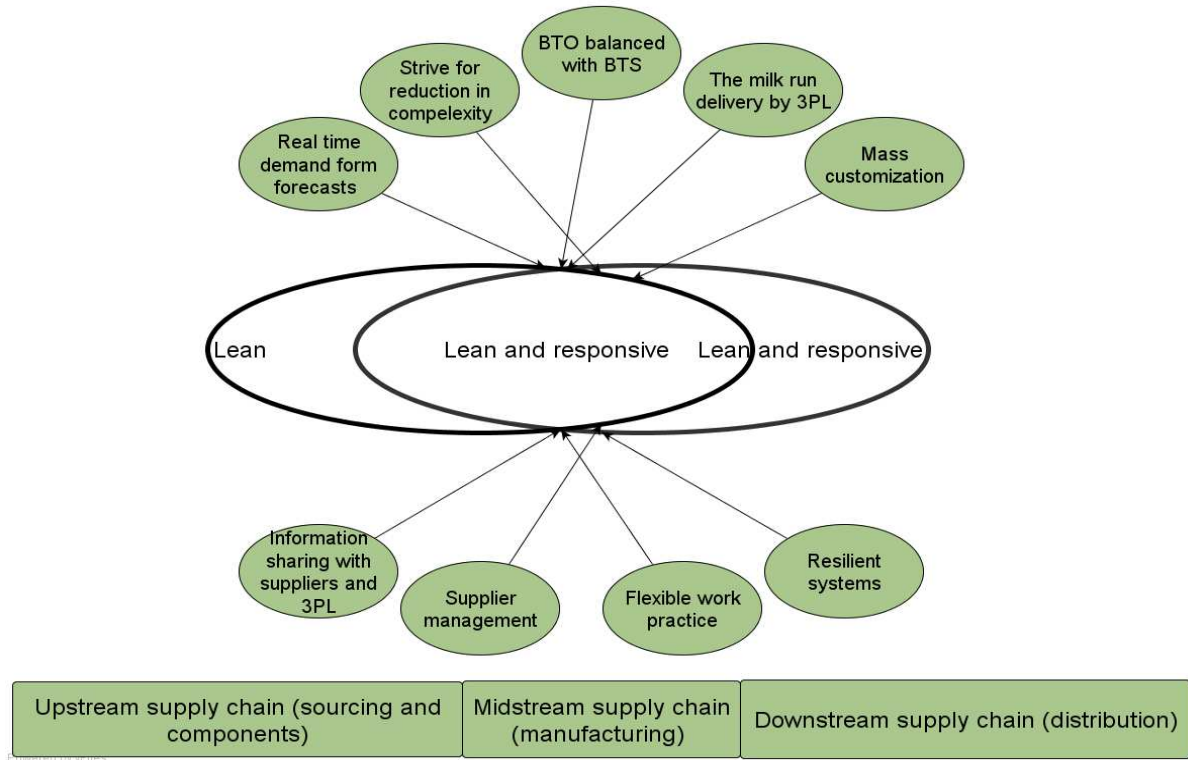


Figure 3. The approaches to achieve lean and responsive in the midstream supply chain

4.2.1 Real time demand form forecasts

This plant collects orders on a daily basis, those orders will go in the main scheduling system and structure the weekly/monthly forecast, and generate the production plans. This enables the company to form the production plan largely based on actual market demand.

4.2.2 Strive for reduction in complexity

'...to be able to build exactly what you want in the right time, and give the customer what they want, you have to be able to reduce complexity. And that is slightly confusing in that you would think that by increasing the complexity you can give a wider variety of choice to the customer. But then that doesn't make the flexibility of building easy for us...'

'if we wanted to reduce cost by taking stock out the pipeline, there is the possibility that we could run out of our stock. Also if we took out cost by reducing the amount of variance, we could lose customers satisfaction. So we have to be flexible enough to give customers what they want, but not end up with a pipeline of stock that we don't need.....potentially we could end up with lot of obsolete stock. Obsolescence costs us fortune, especially on high cost items.....'

(Quotes from interviewee B, manager from quality assurance, the plant)

In the automotive industry, the complexity of the products has always been a constraint to achieving flexibility and responsiveness. This company has been focusing on standardization and reducing complexity in order to build what customers want at the right time. It manages to have better standardization of the products, therefore the complexity and specifications of each vehicle can be added in at the very last point of the production line.

4.2.3 Build-to-order balanced with build-to-stock

In this plant, it has got over 65% build-to-order, which means 65% vehicles on the production line have already been purchased by the customers. The remainder of production is build-to-stock and is based on the predicted sales forecast. These forecasts are based on historical data and the daily orders.

4.2.4 The milk run delivery

In the past the 200 plus suppliers, both from European and the UK delivered their parts by themselves each day or every two days to the plant. Now a 3PL firm collects parts from each supplier and delivers them to the plant. This delivery strategy is called the ‘milk run’ and this method has reduced transportation costs and increased efficiency.

4.2.5 Mass customization – specification is added in at the last point of fit

This plant has achieved mass-customization; the specifications are literally added at the point of fit. This strategy of delayed vehicle differentiation at the point as closer as possible to the customer is so that the required vehicle can be customized quickly and inexpensively. This company works closely with its suppliers and third party logistics based on their production systems and supported by their flexible working practices.

4.2.6 Information sharing with suppliers and third party logistics

This company works closely with its partners and shares information with them. Suppliers and 3PL can easily check inventory, order information and production plans, and can quickly respond to the market demand and customer specifications.

4.2.7 Supplier management

'You have to have very strict quality and delivery KPI's – key performance indicators. Everybody has to adhere and has got to be absolutely spot-on...'

(Quotes from interviewee A, section manager from the company technical centre)

The collaboration and coordination with suppliers ensures the efficiency and responsiveness of its supply chain, this company uses KPI (key performance indicators) to manage their suppliers and always makes sure that their suppliers strictly adhere to the targets for good quality and disciplined delivery. In this plant, 97% of parts and components are delivered on time, and over 98% of cars enter the finished vehicle compound within two hours of their allocated slot. The strict supplier management ensures a smooth operation and production, and enhances the quick response to the market demand.

4.2.8 Flexible work practice

'....the problem with the market is that it fluctuates, it's very seasonal. For example, we're building very few convertible cars in the winter.....also particularly in the UK, when it comes to new registration, there will always be

a busy period.....we can handle the peaks and the drops of production by altering our production schedules....we call it stand up and stand down... ’

(Quotes from interviewee B, manager from quality assurance, the plant)

In order to balance the low-seasons and peak time workload, this plant alters their work schedules, for instance, working additional shifts and applying flexible work practice through stand-up and stand-down. This plant gives the employees who work in the production area their Friday shifts off. During busy times, the employees will pay those back by working additional shifts in the weekend when the company needs them. The suppliers also have got the same agreement as the employees; they will work the required shifts to support the production line, based upon the shared production plan. A flexible workforce is an important factor in the company achieving a quick response to the volatile market demand.

Furthermore, in order to maintain the workforce flexibility, this company applies a philosophy of ‘1 man – 3 jobs and 3 men – 1 job’ which means, a worker is trained to be able to do at least three different jobs, and at least three people should be capable of doing each job. This also means that workers are flexible in operating in the different workstations, which enhances workforce flexibility.

4.2.9 Resilient systems

‘.....there’s also something very important, it has to be a resilient system, resilience means that when things go wrong, there has to be a way of being able to build around the problems.’

(Quotes from interviewee B, manager from quality assurance, the plant)

This company is pursuing resilient systems both within and outside the plant. If anything goes wrong, there will be a back-up plan or solution to solve the problems and to ensure the smooth operation of the production line. The resilient systems ensure the smooth operation of the production schedule, and avoid the waiting time caused by unexpected events. For instance, if there is a delay in a delivery, all the parties involved will automatically apply the back-up plan to ensure the delay is minimized.

4.3 The approaches to achieve a lean and responsive downstream supply chain

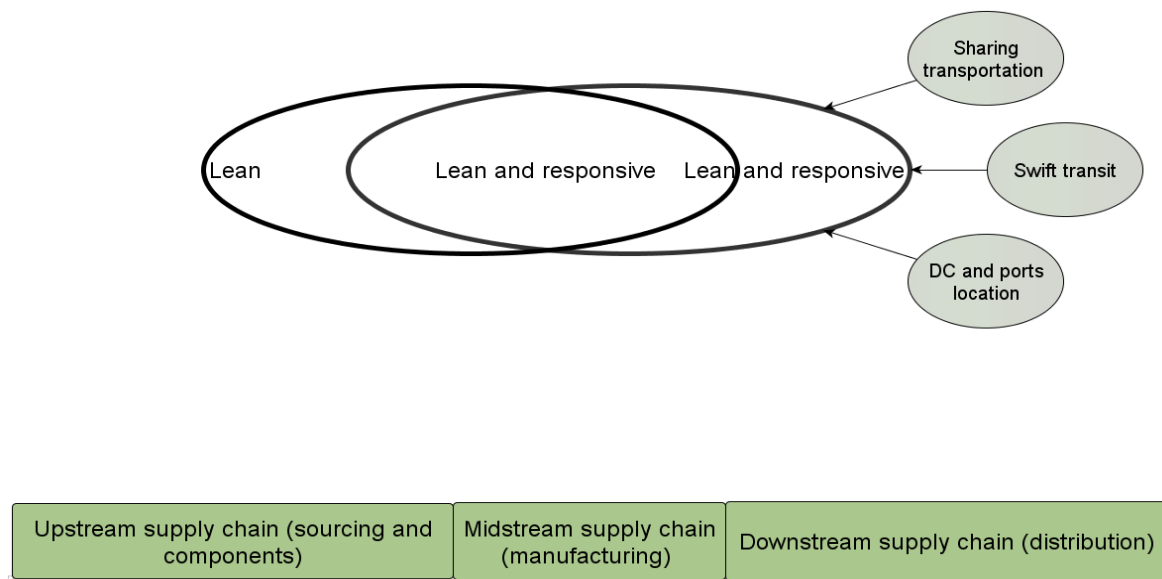


Figure 4. The approaches to achieve responsive in the downstream supply chain

4.3.1 Swift transit

A transporter comes to the plant in every two hours, and each one can take about 8 to 10 vehicles depending on the model. Finished vehicles are constantly transferred onto the lorries. Every one minute a car comes out the factory and is put on the transporter.

The onward transportation will also be managed in a swift manner to achieve highly responsive and fast transportation.

4.3.2 DC and ports location

The distribution centre (DC) is only one mile away from the plant which makes it very convenient. In addition, the plant and the distribution centre are close to large ports and other transportation networks and major roads.

4.3.3 Sharing transportation

‘.....we share and cut the logistic cost, we could possibly share the same container with companies like Renault or Honda, or Ford.....’

(Quotes from interviewee B, manager from quality assurance, the plant)

This company uses third party logistics to ship vehicles to overseas countries. To reduce the cost in transportation, the third party logistics will combine vehicles with the same destination and share containers to eliminate the cost. In addition, each shipment will try to avoid coming/going with empty containers.

It is always assumed that the downstream supply chain (transportation and distribution) should apply the agile paradigm. However, due to the fierce competition over costs, companies have to find ways of reducing costs, via the utilization of third party logistics. This company shows that there are also approaches for companies to be lean and responsive even in the downstream supply chain. It can therefore be

suggested that lean could also apply in the downstream supply chain to help companies to have a greater competitive advantage.

5. Conclusion

In this paper, a total supply chain in automotive manufacturing environment has been examined. Approaches and strategies which contribute to becoming both lean and responsive have been illustrated. In order to contribute to the knowledge of total supply chain management, a model has been proposed that shows how lean and responsiveness approaches can be combined successfully and effectively in a total supply chain. This paper has also demonstrated that whilst the downstream supply chain is usually expected to be agile, it can include both lean and responsive paradigms. Both efficiency and responsiveness are equally important for companies to survive and thrive. The combination of lean and agile paradigms can optimize the total supply chain and enables companies to obtain both efficiency and responsiveness.

The limitation and constraints of this study are that the research covered just in one company, also it was also conducted only in a single automotive industry, thus it is not guaranteed that the strategies and approaches are also applicable to other companies in different industries. The further research is being done in different automotive companies, and comparable studies conducted in other industries.

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