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**A COMPARATIVE ANALYSIS OF THREE INDUSTRIAL
SUPPLY CHAINS: AUTOMOTIVE, PHARMACEUTICAL AND
FASHION**

BY

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ABSTRACT

Background: The great amount of economic changes brought about by globalization has had long lasting effects on long established manufacturing models, whose origins went back to pre-war and post-war mass production predicated by Ford and others. A world more open to competition has meant that market leaders have now to compete on a global basis, forcing their suppliers, and the suppliers of their suppliers, to follow suit and adopt a global approach. Competition has thus shifted from firm vs. firm to Supply Chain vs. Supply Chain, which justifies the interest of practitioners in how these competitive dynamics happen but also in how those dynamics internal to supply chains evolve. This thesis is aimed at investigating how these dynamics have been evolving and where they are heading to, while offering a comparison between three distinct industrial supply chains: Pharmaceutical, Fashion and Automotive.

Summary of Findings:

- The separate analysis of the three supply chains has highlighted differences in power dynamics, with the PSC showing a basically producer-driven structure, the FSC a buyer-driven structure and the ASC a fully producer-driven structure.
- Such structure has been shown not to be completely static, as they have all undergone changes to different extents. The PSC is growing increasing dis-intermediated, thus becoming more producer-driven; the FSC has witnessed a long-term shift from mass producer-driven SC to buyer-driven, thanks to own-brand mass retailers; the ASC has preserved its producer-driven structure but has become increasingly tiered, as suppliers have concentrated on core-competencies and outsourced non-core processes.
- These changes have often come about as a result of concurrent changes in consumer demand, which has gradually become more sophisticated, requiring a larger degree of customization as consumers become more aware of trends.
- As a result, demand has become ever volatile, rendering forecasting-based production unable to cope with varying demand. Hence, attempts to reduce NPD lead times, thus creating a responsive SC. Elements of agile supply chain management are being incorporated in the PSC, while the most successful fashion retailers have made QR the key to their success stories. The ASC has found it harder to conciliate lean SCM practices with a BTO model, thus making it likely that a hybrid approach will become the norm among carmakers.

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LIST OF ABBREVIATIONS

3PL: Third-Party-Logistics provider;
ASC: Automotive industry Supply Chain;
ASN: Advance Shipping Notice;
AWP: Average Wholesale Price;
BRIC: Acronym for Brazil, Russia, India, and China;
BTO: Build-To-Order;
BTS: Build-To-Stock;
CAD: Computer Aided Design;
CAM: Computer Aided Manufacturing;
DC: Distribution Center;
EDI: Electronic Data Interchange;
EIS: Emergency Inbound Shipping;
FFS: Fee-For-Service;
FSC: Fashion industry Supply Chain;
FTL: Full-Truckload;
IT: Information Technology;
JIT: Just-In-Time;
LTL: Less-Than-Truckload;
NAFTA: North American Free Trade Agreement;
NPD: New Product Development;
OBM: Original Brand-name Manufacturer;
OEM: Original Equipment Manufacturer;
POS: Point of Sale;
PRTM: Pittiglio Rabin Todd & McGrath;
PSC: Pharmaceutical industry Supply Chain

QR: Quick Response;
R&D: Research and Development;
SC: Supply Chain;
SCC: Supply Chain Council;
SCM: Supply Chain Management;
SCOR: Supply-Chain Operation Reference;
SCVI: Supply Chain Vulnerability Index;
SKU: Stock-Keeping-Units;
TPS: Toyota Production System;
WAC: Wholesale Acquisition Cost;
WTO: World Trade Organization;

CHAPTER 1 INTRODUCTION

1.1 – BACKGROUND

The fast pace at which globalization has proceeded during the past 20 years has brought about essential changes in the way firms, across the industrial spectrum, position themselves within their respective supply chains. Renewed Western openness with regard to international trade has come about via increasing economic integration with previously closed, sometimes hostile, neighboring countries. In Europe, the politico-economic process of integration taken on by the European Union has allowed for a gradual extension of the single market, thus slashing most institutional barriers to the free movement of capital and labor. Similarly, the implementation of the NAFTA agreement has created, notwithstanding widespread protectionist tendencies among the political elites of its North American members, one of the largest free-trade areas in the world, centered upon the huge American market. Similar attempts, although far from achieving comparable results, have been made in South America, East Africa and South-East Asia. Contemporarily, the accession of more developing countries to the WTO – with a special mention for China – has sparked a decade long of growth in international trade, thanks to falling transport costs, thus shifting the focus from the mere geographical distance to a more topical economic distance.

The series of remarkable changes described above has not left pre-existent business models unscathed. The opening of foreign markets, previously difficult to access due to geographical and/or politico-economic reasons, has had powerful, if varied, impacts on the way firms in various industries interact with customers and suppliers. The outsourcing waves of the last couple of decades have often had the result of expanding the supply horizon of companies operating in the manufactory and process industry. However, this effect has not been homogeneously felt across the industry; the automotive industry, for instance, is far from losing its cluster-based model of supply chain: rather, it has replicated this system elsewhere, creating a network of supply-clusters around the main centers of production (Sturgeon, Van Biesebroeck et al. 2008) while, at same time, witnessing the unexpected centralization of R&D (Research & Development) activities in industrial clusters which, having lost their absolute primacy in production activities, have been increasingly able to re-invent themselves thanks to their unique knowledge endowment resulting from a century-worth of dominance (Sturgeon, Van Biesebroeck et al. 2008).

As previously noted, the opening of developing countries, such as China, India, Mexico, has had a profound impact of the sourcing pattern of several industries. The fashion industry, in particular, has been heavily affected by the easing of restrictions on garment imports from the developing world. The constant expansion, post World War II, of mass-produced apparel, together with the increasing dominance of retailers within the supply chain, has brought about a drastic decline in the apparel industry of countries where this had long been a fundamental contributor to the manufacturing sector (Doeringer, Crean September 2006). Yet, the fashion industry is a perfect example of the multiplicity of effects that have come about as a result of globalization

and the opening of markets; the decline of the apparel industry in countries such as the United States has been mirrored by the emergence of firms operating in niche markets, offering high value-added products to an increasingly wide customer base, as it has happened with French and Italian high-end-fashion firms (Brun, Caniato et al. 2008).

The last 20 years have not only brought developments in the field of trade liberalization. Even industries that have been at least partially shielded from international competition through regulation, as is the case with the pharmaceutical industry, have had to face up the challenges originating from public-health-care reforms in some of the largest markets, such as in the United States, where the introduction of the Medicare and Medicaid programs has changed the relationship between manufacturers and customers, initiating a possibly irreversible decline in the importance of wholesalers and the emergence of third-party logistics providers (3PLs) on the scene of logistics for pharmaceuticals (Christian L. Rossetti, Robert Handfield et al. 2011).



Figure 1: Global Supply Chain (Sousa, Liu et al. 2011)

1.2 – THE SUPPLY CHAIN

Before continuing with the aims of this research, it is useful to offer a short clarification over what is intended with “Supply Chain”. Chopra and Meindl (Chopra, Meindl 2007) define it as *“all parts involved, directly or indirectly, in fulfilling a customer request”*, thus coming to encompass all activities concerned, from manufacturing, to transportation, warehousing, retailing, etc.

The Supply Chain thus comes to consist of a constant flow of products, information and funds in all directions of the chain, which should be optimized in order to maximize the overall value generated (Chopra, Meindl 2007). It thus comes as no surprise that such value creation is highly dependent on the design and management of the Supply Chain, which can always make the difference between a successful venture and a highly disappointing one (Chopra, Meindl 2007).

1.2.1 DEFINITIONS OF AGILE AND LEAN SC

Later in this analysis the concepts of Agile and Lean SC will be often employed to describe the characteristics of a supply chain and it is therefore important to provide the reader with definitions of these two terms.

Christopher (Christopher 2000) defines agility as *“business-wide capability that embraces organisational structures, information systems, logistics processes and, in particular, mindsets”*, its key characteristic being flexibility. On the other hand, lean supply chain principles *“require cooperative supplier relationships while balancing cooperation and competition”*, so that *“supplier partnerships and strategic alliances represent a key feature of lean supply chain management”* (Nightingale 2005).

1.3– SCOPE AND AIM OF THE RESEARCH

What has been briefly discussed above could have already attracted the attention of the reader over a rather important issue with regard to research in the field of Supply Chain. The impact of political, social and economic transformations has been diverse, with both positive and negative effects on the industry as a whole; however, the manner in which each industry has been affected has proven different, as the characteristics of each industry's supply chain are rather divergent. Although several common features can be easily recognized, each industry-specific supply chain has required *ad hoc* research that would have to deal with the hardships of applying teachings from other industries through a general Supply Chain framework. This need has been one of the reasons behind the rapidly increasing interest, during the past decade, for Supply Chain as a discipline on its own right.

Scientific literature dealing with industry-specific issues, with regard to supply chains, is vast, so much that any practitioner would easily find at least a minimal amount of research on any major (and often minor) issue. Yet, while much has been written on the minutiae of each industry's supply chain, very little has been done to offer an inter-industry overview and comparison of supply chains, as well as of their current issues. While there is plenty of research comparing intra-industry supply chains in the fields of automotive, textile, food processing, etc., any person interested in understanding the main characteristics and issues of several industrial supply chains would probably get lost in an ocean of scientific material, with little available in the way of a reasoned comparison.

It is, therefore, the aim of this thesis to offer a first, limited attempt to provide a qualitative comparison of a series of industry-specific supply chains. Given the time- and space-constraints of a master thesis, this research will be limited to three industries: the automotive industry, the fashion industry and the pharmaceutical industry. The purpose of this research will thus be to offer a comparison between the supply chains of the three industries listed above, individuating the main issues each one is facing.

For the aims of this thesis, the reason behind the choice of these three specific industries in order to perform a supply chain comparison is twofold. Firstly, the economic importance of the pharmaceutical, fashion and automotive industry is beyond dispute. In 2006 total sales of prescription drugs topped a whopping US\$600bn, with most of the growth coming emerging BRIC countries (Herper, Kang 2006), thus revealing that fast-developing countries will play an increasingly important role in the industry. Similarly, plenty of growth has come from BRIC countries for the automotive industry, a symbol of industrial development worldwide, employing directly 9 million workers worldwide, with approximately 50 more million jobs resulting from manufacturing and service activities centered on automotive clusters building close to 60 million vehicles a year (OICA 2007). The textile and fashion industry, a historically labor-intensive sector, has seen a drop in its contribution to total employment in many developed countries, while creating plenty of jobs in developing ones, as a result of outsourcing (Doeringer, Crean September 2006), although it still accounts for a large share of manufacturing in countries such as Italy (EconomyWatch 2010).

The above, together with the wide availability of academic literature dealing with specific issues concerning the supply chains of these three industries make them ideal subjects to an inter-industry supply chain comparison.

1.4– METHODOLOGY

This thesis will perform a qualitative comparison between the respective supply chains of three industries: fashion, automotive, pharmaceutical. Each industry's supply chain will be dealt with in separate chapters. Every chapter will begin with a presentation of the general characteristics of the respective industry's supply chain; the major issues concerning each supply chain will be dealt with.

Given the breadth of the topic to be covered in this thesis, as well as the wide range of issues with regard to each of the three supply chains taken into consideration here, this qualitative comparison will be based on an extensive literature review, which will include studies performed on specific niches or at company-level, as well as intra-industry comparisons. This will allow for the identification of general characters of each supply chain, as well as of the main issues which need to be discussed in detail.

Furthermore, an interview has been conducted with a logistics professional working for TNT Express. TNT Express provides premium logistic services, such as emergency inbound shipping and tailor-made solutions for corporate customers requiring highly a flexible but punctual delivery service. This interview will provide the basis for a chapter dealing with the increasingly important role of third-party logistics providers in contributing to a more agile supply chain structure.

Once each of the three industries' supply chains will have been dealt with in detail, the actual comparison will be performed through a qualitative analysis. This will serve the purpose of highlighting similarities and differences between the three supply chains, as well as how industry-specific supply chain issues are being taken on in each case.

Finally, a last chapter will state the conclusions of this research, as well as recommendations for further research.

Additionally, it should be pointed out that, with regard to the pharmaceutical industry, the preparatory literature review has yielded a prevalence of academic material dealing with the US drug market. Even though this might appear to be a limitation, it need not necessarily be. To begin with, the US pharmaceutical market is by far the largest in the world (Christian L. Rossetti, Robert Handfield et al. 2011), accounting for 47% of the global prescription drug market in 2008 (Wyld 2008). Furthermore, the strong market-oriented structure of the American health care system, together with the large amount of regulatory activity of the last two decades, make it an ideal source of insights in the industry, in a time when repartition of health care costs between government and citizens, as well as the role to be played by the private sector, have come under increasing scrutiny virtually everywhere in the developed (and increasingly in the developing) world. This is exactly the reason why the predominance of US-centric material should not be considered a major limitation of this study.

1.5– LITERATURE REVIEW

As it has already been specified above, the scientific justification of this thesis is to attempt a first approach at comparing supply chains across a range of very different industries, a research area that has been found surprisingly lacking, given the importance of this topic.

It is then unsurprising that little exists, in terms of academic literature, dealing directly with inter-industry comparison of supply chains. That is to say that, in order to conduct

this research, reference will be made, for the most part, to academic work dealing in a separate fashion with specific issues concerning each supply chain.

Yet, a decent amount of research has been conducted on comparing certain critical supply chain issues among different industries. In *"Comparison of Quality Management Practices: Across the Supply Chain and Industries"* (Choi, Rungtusanatham 1999), the authors attempted an exploratory study on whether quality management practices among manufacturing firms operating within the automotive and electronics industries – as well as other related industries – significantly differed across a three-level supply chain divided between: final assemblers; top-tier suppliers; tertiary-tier suppliers. Research was conducted by means of surveys: the results of the statistical analysis of the answers to the surveys yielded results that contradict the previous belief that quality management practices among tertiary-tier suppliers are not at the same level as the other two levels of the supply chain. However, a statistically significant difference was found in strategic quality planning practices between the automotive and electronics industries, with the former seemingly more attentive with regard to such practices.

One important study, *"Arcs of integration: an international study of supply chain strategies"*, focused on the effects of different degrees of integration between manufacturing firms and their suppliers and customers on productivity (Frohlich, Westbrook 2001). The authors' analysis took into account five levels of interaction with suppliers and customers, as well as several categories of productivity improvements and compared the latter's levels among firms classified according to their focus and level of interaction with either customers or suppliers. The authors found strong evidence in support of the hypothesis being tested, which is that those firms classified as "Outward-facing" – i.e. those firms with a level of interaction with the both of customers and suppliers falling within the upper quartile – would experience higher productivity gains when compared with either "Inward-facing" firms (that is to say with very little or no integration with customers and suppliers) or manufacturers with integration limited to either suppliers or customers (but not to both).

The difficulty of applying insights on supply chain issues originating from industries with rather different conditions and characteristics has accentuated the pace at which the productivity gap has been growing between those companies with top-tier supply chain operations and those lying in mid-quality supply chain control. This has increased the need for a widely accepted, standard-setting general supply chain framework adaptable to the widest range of industries. The collaboration between consultancies Pittiglio Rabin Todd & McGrath (PRTM), Advanced Manufacturing Research (AMR) and several US and multinational companies from a wide range of industries yielded the creation of the Supply-Chain Council (SCC); aim of the SCC was to elaborate and spread a common supply chain framework: the result was the supply-chain operations reference model (SCOR), "the first cross-industry framework for evaluating and improving enterprise-wide supply-chain performance and management." (Stewart 1997).

One important issue with regard to supply chains is that of "vulnerability", that is the exogenous and endogenous characteristics of a supply chain that determine the degree of susceptibility to disruption of the latter. However, measuring vulnerability has proven difficult for several reasons, ranging from the different meaning attributed to this

concept by different practitioners, to more practical measurement issues. In “*A comparison of supply chain vulnerability indices for different categories of firms*” an attempt was made to measure and compare vulnerability levels among firms operating in several industries, including: automotive; engineered products; food and consumer goods; information and communication technology; logistics; process manufacturing; wholesale and retail; other industries (Wagner, Neshat 2012). Using a supply chain vulnerability index (SCVI) based on graph theory, the authors measured the level at which a series of factors generate supply chain vulnerability, grouped in three categories: demand side, supply side and supply chain structure. The results have highlighted several relationships between vulnerability and certain variable such as company size, supply chain performance, number of employees, etc.

Furthermore, a wide selection of academic literature dealing with specific issues concerning the supply chains of the automotive, fashion and pharmaceutical industries has been selected.

With regard to the automotive industry, several fundamental issues have been treated extensively in academic literature. Issues concerning the changes to the tier structure of the automotive supply chain, as a consequence of the introduction of modular supply is at the center of “*Rethinking the supply chain: an automotive perspective*” (Doran 2004); following previous insights in these issues, “*Supply chain modularisation: Cases from the French automobile industry*” (Doran, Hill et al. 2007) offers a clear example of how modularization of supply has been affecting tier suppliers and car manufacturers, determining increasing risk-sharing and a stronger need to concentrate on core competencies.

Several topical issues concerning the fashion industry have also been treated extensively. The effects of the shift towards mass distribution in apparel retail in countries such as the United States are the focus of “*Can fast fashion save the US apparel industry?*” (Doeringer, Crean September 2006), which also highlights the radical changes in the supply chain of the US apparel industry which would have to come about in order to take advantage of the growing ‘fast fashion’ or ‘street fashion’. A strikingly different situation is described in “*Logistics and supply chain management in luxury fashion retail: Empirical investigation of Italian firms*”: the authors show how increasing control over the supply chain of luxury Italian fashion brands is determined by the necessity to maintain high quality standards and brand awareness, with cost reduction representing only a secondary objective (Brun, Caniato et al. 2008).

The supply chain dynamics of the pharmaceutical industry have also been widely researched by the academic community. The existence of criticalities and vulnerabilities within pharmaceutical and biotech firms logistic setup is one of the most researched issues within the industry’s supply chain; the vulnerability of most firms in the industry to theft and counterfeiting, as well as the lack of best-practice in the industry’s supply chains are the topic of “*Supply chain pain*” (Jim Miller 2011). On the changes intervening in terms of regulations concerning product pedigree, as well as on the increased disintermediation of drug distribution to end-users, “*Forces, trends, and decisions in pharmaceutical supply chain management*” (Christian L. Rossetti, Robert Handfield et al. 2011) found that these are some of the top priorities for the industry, as

well as a fundamental field of research for logisticians in the field of biotech & pharmaceutical supply chain.

1.6– STRUCTURE

This thesis has been structured in seven chapters; the current introduction constitutes Chapter 1. Chapter 2 will deal with the Biotech and Pharmaceutical Industry supply chain; Chapter 3 will deal with the Fashion Industry supply chain; Chapter 4 will deal with the Automotive Industry supply chain. Specific issues relating to each industry's supply chain will be discussed separately, within each chapter, in dedicated subchapters. Chapter 5 will deal with how a third-party logistics provider such as TNT intervenes in the three supply chains in question by providing premium services addressing known criticalities. Chapter 6 will provide a thorough qualitative analysis of the previous three chapters in order to perform a comparison between the three industries' supply chains, highlighting similarities and divergences. Finally, in Chapter 7 the conclusions of this research will be stated.

1.6.1 – RESEARCH QUESTION

The idea of SCM as a separate discipline is relatively recent. Similarly, firms have slowly come to acknowledge the SC as encompassing all the actors involved in the production process. This slow progress has often made it hard to elaborate a valid general framework applicable to most industrial supply chains, meaning that industry-specific approaches have prospered. However, major manufacturing industries such as the automotive sector have come to pioneer new SCM approaches, thus influencing other industries thanks to the visibility carmakers are able to offer. This has contributed to the formulation of generally valid models of SCM based on the relationship between demand and supply. Yet, differences do exist and such models are often applicable to different industries only after hybrid models incorporate the best practices of the pre-existing model with new one. It is therefore of interest to analyze how these differences have come about and to what extent three selected supply chains still differ from each other.

This thesis will, therefore, attempt to answer the following research question:

“To what extent do the supply chain structures of the Pharmaceutical, Fashion and Automotive industries differ?”

CHAPTER 2 THE PHARMACEUTICAL INDUSTRY SUPPLY CHAIN (PSC)

2.1 – CHARACTERISTICS OF THE PSC

During the last two decades, the pharmaceutical industry has been experiencing a change in business conditions brought about by a series of factors of regulatory, competitive and operational nature. Already in the 1990s, government efforts in much of the developed world aimed at containing rising public health costs, often by increasing consumer awareness, thus improving the position of end-users within the pharmaceutical industry supply chain. The impact of substitution, for instance, has been putting pressure on pharmaceutical companies to maximize profits and assure adequate compensation for huge R&D efforts within a relatively limited time-window, during which patent protection shields companies from cheaper substitute drugs (Booth 1996). Similarly, the above stated change in the strategic position of end-users (patients) within the supply chain, has been the consequence of reform partially shifting decisional power – in terms of choice of medication – from General Practitioners to patients, who have been able to enjoy a wider range of – previously “prescription-only” – “general-sales list” drugs, as well as the availability of much cheaper substitute medication with effects equivalent to those of “branded” drugs (Booth 1996, Pamela Danese, Pietro Romano et al. 2006).

As the industry has begun to feel the effect of the issues described above, attention for improved supply-chain practices increased, although not at a pace comparable to that of other industries (Christian L. Rossetti, Robert Handfield et al. 2011). Even though the concept of supply chain had already emerged, the idea of Supply Chain Management as a driver of value creation *per se* had not gathered consensus yet. The vast and complicated nature of the pharmaceutical industry, originating by multiple relationship between biotech and chemical firms supplying raw materials, proper pharmaceutical firms, wholesalers, government agencies and private buyers has been a major impediment to the development of a general framework apt to streamlining its supply chain. Supply chain optimization had, so far, been limited to single functions within the wider supply network, with little existing in terms of centralized planning of processes (Booth 1996). It is thus important to continue this analysis by having a closer look at the components of the industry’s supply chain.

Generally speaking, the configuration of the pharmaceutical industry supply chain does not wildly differ from that of other process industries. Active and inactive drug components are synthesized in bulk from chemical agents supplied by the chemical industry; drugs are then processed and packaged by manufacturers, stored in warehouses and transferred to wholesalers (thus adding an intermediation stage to the supply chain) or, increasingly often, directly through 3rd-party logistics providers (3PLs) to pharmacies and medical institutions, through which they eventually reach end-users, that is patients (Madadi, Kurz et al. 2010).

In order to better understand the main actors of the supply chain, it is interesting to have a closer look at some of these.

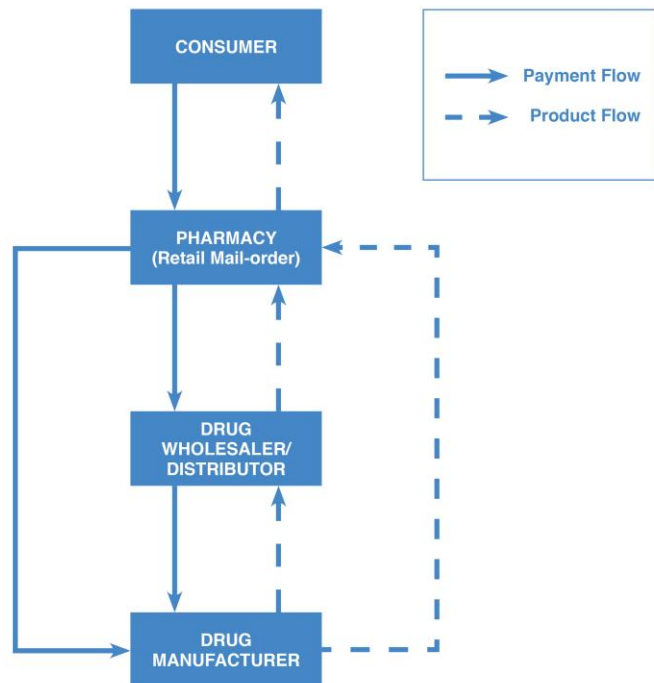


Figure 2: Structure of the PSC (The Health Strategies Consultancy LLC 2005)

2.1.1 – MANUFACTURERS

As seen previously, radical regulatory changes during the last two decades have been the rationale behind the deep changes that have been affecting the pharmaceutical industry. This is true in particular for manufacturers, whose position of strength within the supply chain has been challenged by the entrance of new competitors as a consequence of moderate market deregulation. At the same time, the expiration of patent protections over a large number of drugs opened the doors to investment in substitute medications, of equivalent efficacy to that of “brand” drugs (Booth 1996). This

caused the market to split between long-established “brand-name” drug manufacturers, including widely known firms such as Pfizer, Johnson & Johnson, GlaxoSmithKline, etc. and “generic” drug manufacturers (The Health Strategies Consultancy LLC 2005). While the former would undertake heavy R&D activity – aimed at pursuing new patents – as well as aggressive marketing activities aimed at exploiting their brand recognition, the latter would simply concentrate on manufacturing low-cost generic drugs, so much cheaper as no R&D costs had to be recouped through the relative short span of patent protection (The Health Strategies Consultancy LLC 2005).

The immediate reaction of the “established” drug manufacturers to the challenges brought by generic drug competitors was not an effort to reduce costs through an improved supply chain, as there was still little understanding of this concept within the industry. On the contrary, the new wave of competition sparked a series of mergers aimed at re-equilibrating the competitive dynamics within the pharmaceutical industry, thus much increasing market consolidation (Booth 1996). Another driver of consolidation was given by cost-reduction, as informed, for instance, by specific contract clauses in some of the high-stakes mergers above; this was, for instance, the case of the merger between Glaxo and Wellcome, which included a clause calling for cost reductions; similarly, the merger between Pharmacia and Upjohn included a specific clause mandating US\$500 million of savings to be obtained through merger and resource rationalization (Booth 1996).

However, the position of drug manufacturers within the pharmaceutical supply chain has remained relatively stable through the years and only very recently have they begun to look into the opportunity of expanding their scope. In fact, the collocation of drug manufacturers upstream in the supply chain has allowed for the juxtaposition on intermediaries controlling the distribution process to the retail system, including pharmacies, hospitals, government agencies and (where applicable, such as in the US) certain health-plans (The Health Strategies Consultancy LLC 2005). Direct distribution to the ultimate users, that is patients and consumers, is still very limited, as the established relationship between pharmaceutical manufacturers and wholesalers has proved very resilient, thanks to the sale volumes involved in transaction between the two parties.

Renewed introspection caused by stiffened competition and regulatory changes has been the driving force behind renewed interest in the supply chain. Attention has thus shifted from single functions to a more centralized and seamless control of the series of processes involved in the manufacturer’s supply chain. The importance of such a mindset shift is even more evident when changing market conditions put in jeopardy the healthy returns that have characterized the industry over the past decades. Perfected control over the supply chain has allowed drug manufacturers, up to some extent, to mitigate the constantly looming specter of a mismatch between supply and demand while, at the same time, achieving economies through a review of the existing production capacity(Booth 1996). According to Booth (Booth 1996), the importance of streamlined supply chain practices within the drug manufacturing industry is evident when the main priorities of a manufacturer are individuated:

- Cost reduction, to be achieved through the rationalization of production resources and possible recourse to outsourcing;
- Optimal choice of locations for production and distribution facilities;
- Matching supply and demand;
- Inventory rationalization.

However, the impact of optimal supply chain practices has and will not be limited to cost-reduction, itself a reason behind the previous lack of focus on Supply Chain Management (SCM) within the pharmaceutical industry. SCM has been proven to be beneficial (in several industries) to the delivery of new products, to the exploitation of new markets and distribution channels, as well as being positively related to increased customer satisfaction (Booth 1996).

Furthermore, the opening of international markets and the reduction in economic distance between countries has increasingly contributed to the shift of the horizon of the pharmaceutical supply chain from a local, dedicated supply network to a global supply chain, which has allowed drug manufacturers to enjoy the benefits brought by a wider range of suppliers around the globe (Booth 1996). However, it appears quite clearly that the extension of the pharmaceutical supply chain on a global scale poses risks associated with the propagation of delays within its network. The risk of bullwhip effect (or Forrester effect) within the supply chain has been on the rise, as moderate delays at one end of the supply chain – say, at retail level – can affect the rest of the supply chain, amplifying their effect as the delays reach upstream (Booth 1996).

Yet, the change in the business relationship between drug manufacturers and wholesalers is by far the greatest challenge with regard to the supply chain of the former. Innovations and changes in the power dynamics within the industry's supply chain will be likely to arise as a consequence of this. The introduction of Fee-For-Service (FFS) contracts between drug manufacturers and wholesalers, with its activity-based-costing approach, was to shed some light on the actual costs incurred by wholesalers in providing value-added services; however, lack of transparency and little information exchange on the wholesalers' side with regard to the last leg of distribution, has strongly reduced the beneficial effects of this new system (Christian L. Rossetti, Robert Handfield et al. 2011). More on the topic of FFS will be presented in the next sub-section dealing with wholesalers.

Thinning margins and increased logistics costs in dealing with wholesalers have pushed drug manufacturers to search for new solutions to bring their products and, with increasing frequency, value-added services directly to retailers and customers. Yet, the traditional reliance of drug manufacturers on wholesalers for most of the logistics has left the former with little understanding of the drug supply chain process (Christian L. Rossetti, Robert Handfield et al. 2011). The very high service levels so far guaranteed by wholesalers to pharmacies and hospitals, granting several deliveries per week, have been met with skepticism by those drug manufacturers adventuring into direct distribution; cuts in such service levels have so far been met with resistance on the retail side of the supply chain, but will become increasingly common in the future, whether supply remains in the hands of wholesalers or moves to 3PLs and manufacturers, as the latter reassert their control over the whole supply chain, in an

effort to cut costs as margin grow increasingly under threat as a consequence of more efficient government-mandated purchases of drugs and related services (Christian L. Rossetti, Robert Handfield et al. 2011).

2.1.2 – WHOLESALERS

The drug wholesale market has undergone a slow but radical consolidation process during the last half century. In 1949 the market was fragmented between 275 authorized wholesalers in the United States of America (Thani Jambulingam, Ravi Kathuria et al. 2009) but, by 2009, fewer than 20 were left. Three giant wholesalers, namely McKesson, Cardinal Health and AmerisourceBergen, controlled respectively about 34%, 30% and 25% of the market by the year 2004 (The Health Strategies Consultancy LLC 2005), a market worth 80% of the US\$291 billion-worth of prescriptions filled every year in the US.

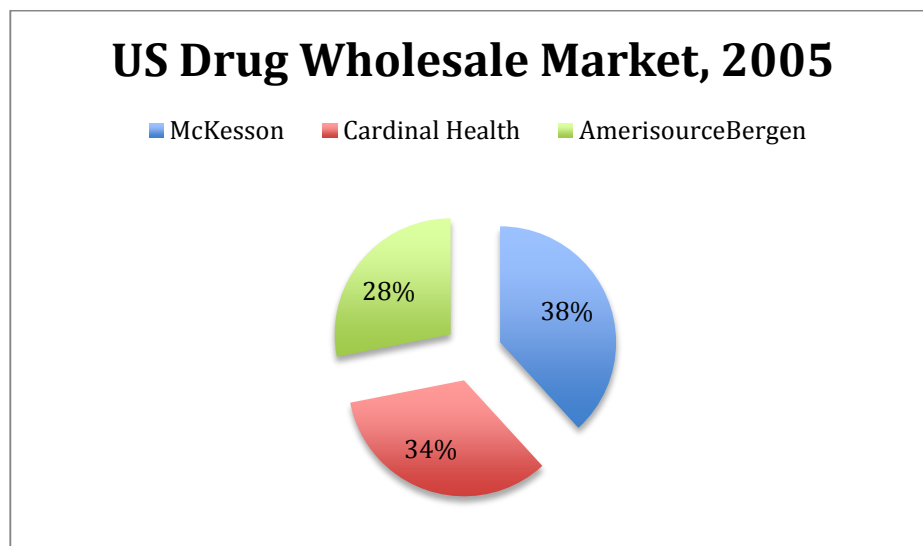


Figure 3: US Drug Wholesale Market, 2005 (The Health Strategies Consultancy LLC 2005)

Wholesalers represent, by far, drug manufacturers' biggest customers; they purchase drugs in bulk, which are then resold and delivered to retailers (brick-and-mortar and mail-order pharmacies), hospitals, long-term care institutions, government agencies, small-size medical facilities (The Health Strategies Consultancy LLC 2005). Furthermore, a certain degree of specialization has emerged, with some wholesalers now focusing on special drugs and medical services (The Health Strategies Consultancy LLC 2005) with specific logistic requirements, such as medications supplied within the so-called "cold-chain", that is drugs and biotech products with a very limited shelf-life, with attached requirements in terms of temperature and humidity, thus entailing *ad hoc* transport solutions (i.e. special reefer containers) (Christian L. Rossetti, Robert Handfield et al. 2011). This marks a deep shift in core competencies from the

past, when wholesalers were only concerned with relatively basic tasks, such as warehousing, inventory management and delivery. The role of wholesalers was thus that of intermediary between drug manufacturers and retailers, government agencies, hospitals, etc. This position within the pharmaceutical industry supply chain was also responsible for the revenue strategy that characterized wholesalers until very recently: these would manage large inventories, creating a buffer between suppliers (drug manufacturers) and retailers (or, again, other institutional and private customers). This would allow wholesalers to speculate on the wedge being created between their actual acquisition price from manufacturers and the published “average wholesale price” (AWP) or “wholesale acquisition cost” (WAC) (Christian L. Rossetti, Robert Handfield et al. 2011, The Health Strategies Consultancy LLC 2005). Even though discounts on the published AWP or WACs, as well as rebates, both on brand and generic drugs are and have always been the norm when dealing with pharmacies, this has been less true in dealings with big purchasers such as the US federal Medicare and Medicaid programs, whose acquisition costs have been proven to be consistently higher than those of private purchasers (Christian L. Rossetti, Robert Handfield et al. 2011). Better control over government price mandates has been reducing this rich source of revenues for wholesalers (Christian L. Rossetti, Robert Handfield et al. 2011).

Thinning margins and cost cutting have been at the base of the decision of wholesalers to shift from the previous speculative revenue model to a service-based one, more specifically the above-mentioned Fee-For-Service (FFS) model. This model is built upon activity-based cost accounting, which matches specific services (in this case, value-added logistic services) to fees being charged for them (Christian L. Rossetti, Robert Handfield et al. 2011). At least in theory, this system should offer wholesalers a better control over the actual cost of providing each service while, at the same time, offering customers a better insight in the rationale behind the fees they are charged. But is that really so? A 2011 survey among leading drug manufacturers (Christian L. Rossetti, Robert Handfield et al. 2011) showed how FFS had had little impact on increasing transparency and trust between the manufacturers and wholesalers, with the former seeing FFS as often being unfair, simply another way of steepening prices; however, the reason behind this widespread opinion might once again lie in the little knowledge, among drug manufacturers, of the actual processes and volumes involved in storage and distribution activities carried out by wholesalers, as manufacturers have historically relied on the latter for such endeavors. Likewise, wholesalers have greatly increased the range of logistic services they are able to provide, as we have seen earlier, now offering re-packaging, specialty drug distribution, reverse logistics, electronic order processing, etc. (The Health Strategies Consultancy LLC 2005). Although drug manufacturers are clearly aware of the service levels offered by wholesalers, they have systematically failed to appreciate the risk level in the supply chain arising from the amount of investment in resources (such as warehousing, IT systems, etc.) necessary to keep service levels constant, thus causing them to dismiss fees charged by wholesalers as excessive (Christian L. Rossetti, Robert Handfield et al. 2011).

Indeed, this lack of understanding of the risks involved with the pharmaceutical supply chain has given rise to one of the biggest threats to the position of wholesalers as intermediaries. Manufacturers have thus attempted a disintermediation of the

pharmaceutical market by means of (a) stiffening competition in the market for pharmaceutical logistics services and (b) by dealing directly with retailers (Christian L. Rossetti, Robert Handfield et al. 2011). In the first case, drug manufacturers have sought to enroll 3PLs on their side, thus hoping to increase competition: yet, however interested 3PLs may be in expanding their market share in this sector, they remain reluctant to commit the amount of resources, in terms of inventory holding costs, necessary to maintain the current service levels (often up to 5 deliveries per week), preferring to concentrate on growing niche market involving point-to-point distribution (with small inventories), such as the “cold-chain” (where inventories are necessarily limited by the short shelf-life of this kind of medications), track-and-trace services and time-sensitive premium services involving the delivery of customized medical treatment directly to patients (Christian L. Rossetti, Robert Handfield et al. 2011).

On the other hand, the US drug market has shown that mail-order pharmacies can take over increasingly large shares of the retail market, offering steeper discounts to customers by passing down savings obtained by skipping wholesalers altogether and dealing with drug manufacturers directly (Christian L. Rossetti, Robert Handfield et al. 2011). The next sub-section will deal more in detail with mail-order pharmacies.

2.1.3 – PHARMACIES

Pharmacies represent the retail stage of the pharmaceutical supply chain, being responsible for most of the final distribution to customers. The wave of consolidation has been investing the pharmacy market too, with a series of mergers and acquisitions aimed at gaining bargaining power with wholesalers. The latest such acquisition has shown the increasingly international character of this sector, with the largest American pharmacy chain, Walgreens, acquiring a 45% stake in Alliance Boots of Switzerland, a very familiar presence on British high streets (Felsted 2012).

Two main categories of pharmacy can be individuated: brick-and-mortar and mail order. The first category includes a variety of types, including pharmacy chains, independent pharmacies, pharmacies at mass retailers, specialty pharmacies. Brick-and-mortar pharmacies do not usually deal directly with drug manufacturers, but purchase medications from wholesalers, with the exception of large retailers, whose pre-existing logistic infrastructure does not make them dependent on the services of wholesalers (Christian L. Rossetti, Robert Handfield et al. 2011, The Health Strategies Consultancy LLC 2005). The same goes for mail order pharmacies, whose very lean structure, based on strategically located distribution centers (DCs from now on), fleets of distribution vehicles and inventory control systems (The Health Strategies Consultancy LLC 2005) also allows them to skip wholesalers altogether. Mail order pharmacies receive their orders via phone, fax, mail or, increasingly, via Internet. Orders are then processed electronically (for the most part) and dispatched from DCs to be delivered to customers (The Health Strategies Consultancy LLC 2005).

Drug Sales by Pharmacy Distribution Channel in the US, 2004

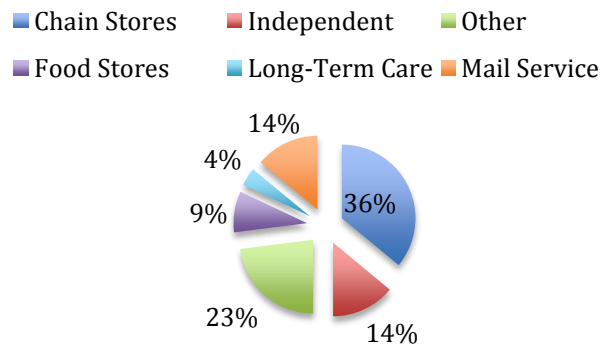


Figure 4: Drug Sales by Pharmacy Distribution Channel in the US, 2004 (The Health Strategies Consultancy LLC 2005)

Nevertheless, the role of pharmacies is not limited to simple retail activities, as they are also responsible for interaction with the customers, advising on cheaper generic substitutes, on possible side effects or issues arising from interaction with pre-existing conditions or other medications (The Health Strategies Consultancy LLC 2005). Being at the end of the pharmaceutical supply chain, pharmacies (in particular brick-and-mortar ones) are in a unique position within the industry to acquire information and providing professional support to customers.

The series of changes occurring within the industry's supply chain will increasingly affect pharmacies, in particular those based on the old brick-and-mortar model. In particular, the high standards of service level enjoyed by retail pharmacies will come increasingly under threat as power shifts back to drug manufacturers. Currently, retailers receive between two and five shipments a week, with the majority of them receiving two or three per week. The choice of the delivery frequency is usually determined on the best combination between the latter and price, so that higher frequency is usually not preferred to lower purchase prices (Christian L. Rossetti, Robert Handfield et al. 2011). However, increasingly often, vertically integrated drug manufacturers consider the current service level excessive and unsustainable; similarly, lack of satisfaction, on the manufacturers' side, with the current fee regime for wholesale services is likely to further depress wholesalers' revenue from future FFS agreements, thus causing reductions in service levels in order to offset lower fees (Christian L. Rossetti, Robert Handfield et al. 2011). This, in turn, is likely to foster growth in the mail order pharmacy business, whose lean structure will put it in a considerably advantageous position.

CHAPTER 3 THE FASHION INDUSTRY SUPPLY CHAIN (FSC)

3.1 – CHARACTERISTICS OF THE FSC

As we have seen in the preceding chapter, supply chains present themselves as a set of business relationships between different actors within the same industry. However, these relationships do not usually involve full equality between the various actors. Instead, it is very often possible to individuate a dominant segment of the supply chain, with either producers or buyers holding sway over the other agents, a concept known as “power” (Hines, McGowan 2005). As we have seen in the previous chapter, the major “players” within the pharmaceutical supply chain are drug manufacturers, thus characterizing this supply chain as producer-driven. On the other hand, the fashion industry is a perfect example of the opposite case: a buyer-driven supply chain, where large retailers exercise a large amount of discretionary power over the other tiers of the chain (Tyler, Heeley et al. 2006). A buyer-driven supply chain presents a production network with a tiered structure, where retailers source their supplies from multiple producers in several countries (Tyler, Heeley et al. 2006), thus further characterizing this kind of supply chain with a high level of outsourcing. This description fits almost perfectly the supply chain structure of the fashion industry. As we have seen earlier, outsourcing has been a major issue in many developed countries, in particular because of its impact on employment in labor-intensive industries such as the garment and apparel one. From its post-World-War-II peaks, the contribution of the fashion industry to total employment has gone declining, in particular as the pace of outsourcing to developing countries increased: in the United States, the industry employed approximately 1 million people in 1980, while it nowadays employs less than one-third of that figure (Doeringer, Crean September 2006); in the United Kingdom, the once mighty textile industry suffered shared the same fate of most of the British manufacturing sector, with employment plunging from 2 million workers in 1923 to less than 200,000 in 2002 (Hines, McGowan 2005), making it yet another victim of the British deindustrialization.

Just like other industries, the fashion industry supply chain used to be producer-driven, with retailing happening for the most part through small outlets, hence empowering garment manufacturers; at the same time, suppliers would cluster in garment districts, such as in New York City (Doeringer, Crean September 2006). However, the post-World-War-II advent of mass distribution was to change forever the face of the industry, as small, fragmented distribution was replaced by large chains of retailers, often dealing in a multitude of different consumer products (as in the case of Wal-Mart), thus increasing retailers’ bargaining power, starting the shift from a supply chain to a buyer-driven one. Rising competition on between retailers, coupled with the opening of South-East Asian countries to foreign investment, created the ideal conditions for outsourcing garment production to countries characterized by low labor costs, thus largely eliminating reliance on expensive (and unionized) domestic production (Doeringer, Crean September 2006). Enthusiasm for the high margins made possible by lowering production costs caused high-street fashion manufacturing to all but disappear from developed countries. However, the extension of the fashion industry supply chain to

embrace outsourced production in other continents has brought about new issues that were not carefully taken into consideration during the emotional wave of outsourcing. In order to properly appraise such issues, it is important to first understand how the industry's supply chain is structured. Without counting producers of the very raw material, such as cotton, wool, etc., the fashion industry supply chain presents a tiered structure, consisting of: yarn manufacturers, fabric manufacturers, garment manufacturers, distributors (i.e. retailers) (Forza, Vinelli 1997).

Furthermore, the industry has long been characterized by a seasonal pattern, with two main periods, Spring/Summer and Autumn/Winter; product development, including all of its phases, ranging from design to distribution, usually begins one year in advance, meaning that lead times for new products are very long, even while shorter, mid-season periods are being introduced (Tyler, Heeley et al. 2006). The effects of this pattern on the main actors of the industry's supply chain will be discussed, as well as the impact of Quick Response and Fast Fashion on lead times and supply relationships.

As yarn and garment manufacturers work very closely in relatively complementary processes aimed at providing "raw material" for garment manufacturers, they shall be incorporated in a single sub-chapter.

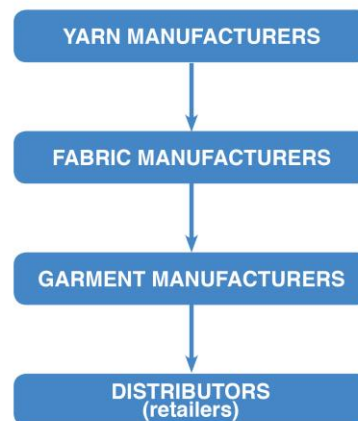


Figure 5: Structure of the FSC (Forza, Vinelli 1997)

3.1.1 – YARN AND FABRIC MANUFACTURERS

The advent of outsourcing within the fashion industry, together with the empowerment of retailers within the supply chain, meant that suppliers at the lower stages of the supply chain were put under ever-increasing pressure for flexibility and reactivity in an otherwise very inflexible supply chain model. Yarn and fabric manufacturers are at the bottom of this supply chain, as high-street retailers begin their product development process with forecasting activity, aimed at predicting future trends, and fabric/yarn selection, often in concomitance with seasonal fairs and trade shows showcasing ideas for the new season (Tyler, Heeley et al. 2006). While high-street brands experience lengthy lead times to market new products, lead times for yarn and fabric manufacturers are often much longer, with the development of new fibers taking up to five years and that of fabrics up to one year (Tyler, Heeley et al. 2006). These long lead times are coupled with fixed deadlines, as yarn and fabric manufacturers need to showcase their latest produce at seasonal fairs, each happening once or twice a year, in order to attract customers and take orders. This last aspect shows already two weaknesses. Firstly, yarn and fabric manufacturers experience long lead times while being stuck with fixed schedules set by the seasonal fairs; secondly, the fact that the fabric development and manufacturing process begins much in advance means that it is decoupled from the garment manufacturing process, thus increasing the inventory risk looming on fabric manufacturers (Tyler, Heeley et al. 2006). In order to remove this risk altogether, fabric manufacturers operate only as a result of an order, minimizing the size of their inventory. However, this practice reduces output flexibility to a minimum, meaning that unexpected extra demand for a certain garment item at a retailer would leave the latter exposed to a stock out, as there would be little chance to restock in time to take advantage of the extra demand (Tyler, Heeley et al. 2006). Similarly, wrong forecasts about the next season's trends would leave the retailer incapacitated to respond by quickly developing new products, as this supply chain structure does not allow for any such flexibility (Forza, Vinelli 1997).

3.1.2 – GARMENT MANUFACTURERS

If retailers have been the winners of the outsourcing wave of the last few decades, garment manufacturers, at least in Europe and North America, have been the big losers, as most of their business disappeared as branded fashion would shift production to developing countries. The outsourcing wave came in different waves, beginning with post-war Japan and continuing to the Asian Tigers, China and, more recently Indochina (Gereffi 1999). The driving force behind this production shift was the quest for higher gross margins through decreasing labor costs. Developing, low-wage countries in Asia and Eastern Europe, opening up to foreign investment, offered the perfect conditions for delocalization and, later on, outsourcing. Whereas garment manufacturing in developing countries began with the shift of basic, simple tasks, increased investment

and more experienced personnel meant that local firms were able to perform an “industrial upgrade”, that is offering integrated services allowing foreign brands to outsource virtually the whole production and logistic process (Gereffi 1999). Local garment manufacturers were thus able to become OEMs (Original Equipment Manufacturers), acquiring new competencies and a better knowledge of international markets, often entering the market on their own, turning into OBMs (Original Brand-name Manufacturers) (Tyler, Heeley et al. 2006). This allowed Western fashion brands to realize a huge change in their supply chains and business models, shedding manufacturing activities and concentrating on design and brand promotion (Tyler, Heeley et al. 2006, Gereffi 1999).

Yet, at the same time, increasing competition among garment manufacturers in developing countries, coupled with the stronger bargaining position acquired by brand names has meant that the former have been growing under increasing pressure to provide timely and quality service, under the threat of being cut off the supply chain (Hines, McGowan 2005). The stronger bargaining power of buyers has been creating a situation where developing-world garment manufacturers are often the ones that end up paying the price of wrong forecasting, as buyers will often try to refuse delivery by individuating defects that would have been normally accepted (Hines, McGowan 2005). A concomitant process of market consolidation has forced small-time manufacturers, those lacking the economies of scale to compete in low-margin garment manufacturing, to form one more tier of suppliers for larger manufacturers, thus moving to a lower tier within the supply chain (Hines, McGowan 2005). At the same time, the surviving domestic manufacturers have been asked to offer more, at lower prices (Hines, McGowan 2005), often in order to make up for the lack of flexibility of extended supply chains (Hines, McGowan 2005). Furthermore, the ability of garment manufacturers to reduce costs and shape their own supply chain has been largely reduced, as they have been locked in business relationships with suppliers selected and imposed by brand names, causing one further instance of bargain-power loss towards buyers (Hines, McGowan 2005).

Though allowing for reduced production costs, thanks to much lower wages, this outsourcing strategy shows strong responsiveness limits, due to the geographical position of the manufacturers (Tyler, Heeley et al. 2006). Shifting production to other continents, over very long distances, has meant that the impact of the logistic element on the supply chain has increased drastically. The relative time-sensitivity of apparel means that all sorts of delays in the logistic process can cause severe stock-outs at the retail stage, with consequent loss of service level: strikes at ports, natural disasters, customs-clearance delays, etc. all contribute to increase the systemic risk of a global supply chain.

3.1.3 – DISTRIBUTORS (RETAILERS)

The aforementioned shift in power allocation within the fashion supply chain from producer-driven to buyer-driven has been triggered by the advent of large chains of

multiple retailers with a stronger bargaining position than the previous multitude of small retailers. However, this shift has caused one more fundamental change. These chains of retailers largely abandoned the previous multi-brand retail model, focusing instead in developing their own brands while, at the same time, outsourcing the production process (Gereffi 1999). In a similar drive to skip middlemen, several brand names expanded their retail networks, thus bringing their products directly to customers. These movements up- and downstream the supply chains have thus contributed to let the distinction between brands and retail gradually fade away, one more reason to discuss the two together in this section.

Indeed, the rise of large retailers has been the driving force behind the original outsourcing wave, as brand names would vertically disintegrate, concentrating on core competencies such as design, marketing, brand promotion and, increasingly, distribution. However, the emphasis posed on outsourcing and cost-reduction has had, as we have already seen, the negative consequence of stiffening the supply chain, wildly reducing responsiveness to changes in consumer demand (Tyler, Heeley et al. 2006). The seasonal pattern of the product development process is one key determinant of the supply chain's lack of flexibility. The original arrangement, providing for two seasons, namely Spring/Summer and Autumn/Winter, has been largely replaced by a series of shorter phases within each season, normally between three and five, lasting 8 to 12 weeks each (Tyler, Heeley et al. 2006). The reason behind this new pattern is to be found in a deep change in consumer demand. Over time, thanks to mass media, glossy magazines and such, consumers have grown increasingly fashion-aware, demanding a wider variety of products, with shorter lead times between new collections (Barnes, Gaynor Lea-Greenwood 2006). Such a major development has gradually shown the limits of this supply chain structure. Product development has to start approximately one year earlier – a rather long time frame for products with a short shelf life – meaning that most decisions with regard to design and fabrics have to be made way in advance (Tyler, Heeley et al. 2006), in a market characterized by high volatility and low predictability (Christopher, Lowson et al. 2004). The decision-making process would thus rely on demand forecasting based on historical sales data, thus very often missing out completely on the actual trends (Tyler, Heeley et al. 2006); it is nowadays generally recognized that the wild unpredictability of demand for fashion makes even vaguely accurate forecasting impossible (Christopher, Lowson et al. 2004).



Figure 6: Forecasting Accuracy - Time Horizon Accuracy (Lurquin 1996)

Forecasting and design activity has long been coupled with the choice of fabric, again very early in the designing stage, as the obvious reluctance of manufacturers to carry inventories makes it necessary to order almost everything well in advance of the actual season: on average, UK retailers have already committed 60% of their buying budgets 6 months before the season, a figure that increases to 90% by its beginning (Birtwistle, Siddiqui et al. 2003), thus allowing for little or no flexibility in the face of varying tastes and trends. This highly inflexible process appears to be even more wasteful when one considers the fact that, on average, only 30% of all designs end up being implemented (Tyler, Heeley et al. 2006), evidence of flaws within the design and decisional process.

This series of inefficiencies within the supply chain has forced retailers to rethink their global approach to supply, reconsidering the actual advantages brought about by offshore production; thus the interest in relatively recent supply chain management concepts such as Quick Response and Fast Fashion. The growing importance of these two concepts will be discussed in detail in the following section.

3.2 – QUICK RESPONSE AND FAST FASHION

As we have seen so far, issues of rigidity and time framing have long plagued the standard supply chain structure of the fashion industry. The characteristics of this supply chain have long rendered it decoupled from actual consumer demand, with harsh consequences for retailers, in the shape of wrong product mixes and excess inventories. For instance, protracted difficulty to sell a certain product line often forces

retailers to mark-down prices, a process that, on average, costs retailers 14.6% of annual sales (Christopher, Lowson et al. 2004); on the other hand, unexpected extra demand for a certain item cannot always be matched by quickly ordering more, thus causing stock-outs that end up costing about 4% of annual sales (Christopher, Lowson et al. 2004). In order to counter the wild variability in demand, retailers have thus been forced to carry expensive inventories, whose cost amounts to approximately 6.4% of annual sales, thus bringing the total costs associated with demand variability to an astounding 25% of yearly sales (Christopher, Lowson et al. 2004).

Thus the necessity, for own-brand retailers, to rethink their supply chain strategy in terms of reactivity to changing fashion trends, rather than concentrating on reducing manufacturing costs alone.

3.2.1 – TOWARDS AN AGILE SUPPLY CHAIN: QUICK RESPONSE

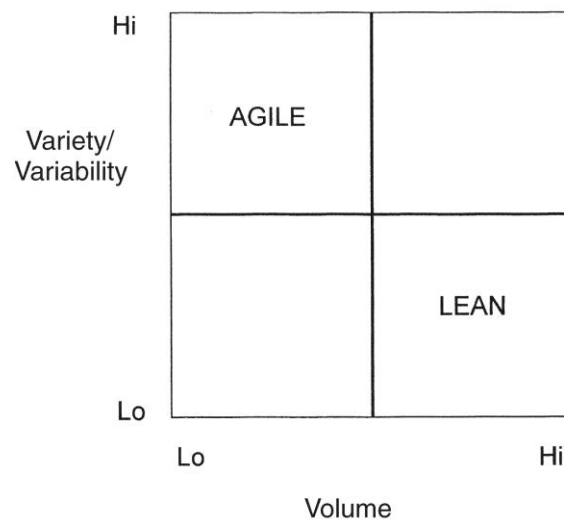


Figure 7: Agile vs. Lean: Agility suits best high volatility, low-volume production, while leanness works best with high-volume and low variation in demand (Christopher 2000)

Consumer habits have been changing rapidly during the last couple of decades, as a consequence of greater availability of information, in the form of specialized publications – i.e. “glossy magazines” – influencing consumer tastes rapidly and often unexpectedly, thus further reducing the already slim chances of getting forecasts right (Christopher, Lowson et al. 2004). The original seasonal pattern – Spring/Summer & Autumn/Winter – has been gradually replaced by much smaller phases or seasons, as a result of consumers’ demand for a much more rapid turnover, with new items or entire new collections available at retailers every few weeks (Barnes, Gaynor Lea-Greenwood 2006). Hence the emergence of high-street, own-brand retailers specialized in catering

directly to consumers' tastes, thus reducing reliance on guess work months afore and creating a responsive supply chain: Zara of Spain and H&M of Sweden have come to embodiment of this new approach, which has come to be known among practitioners as "Fast Fashion" (Barnes, Gaynor Lea-Greenwood 2006).

Though retailers had long been aware of the nasty side effects of their global supply chain strategies, the process of review and rethinking of their SCM practices has been happening gradually. Originally, reluctance to give up their sourcing strategy based on far away low-wage countries pushed fashion retailers to look at other industries for ways of mitigating the staggering costs arising from demand uncertainty. In order to reduce inventory costs, for instance, fashion retailers looked with great interest at the example of car-manufacturer Toyota of Japan, whose TPS (Toyota Production System) pioneered the concept of *lean* supply, a form of JIT (Just-In-Time) applied to the manufacturing stage of its supply chain, providing for the elimination of delay drivers such as lack of communication and buffers between consecutive processes (Bruce, Daly et al. 2004). However, as Toyota itself has since discovered (Christopher 2000), *lean* does not imply responsive, too, as an equally fast distribution process did not match rapid production cycles.

The limits of *lean* supply showed that the focus on inventory minimization was not the correct approach. On the other hand, the concept of *agile* supply has been found to be the most easily adaptable to the changing requirements of the fashion industry. *Agile* supply has thus paved the road to the adoption of a fashion supply chain based on the Quick Response (QR) concept, which allows for a high degree of responsiveness to variations in demand by reducing lead times through better integration and information exchange throughout the supply chain, from yarn and fabric manufacturers, to garment manufacturers and retailers (Bruce, Daly et al. 2004, Lowson 2001). An *agile* supply chain, in order to actually qualify as such, should possess a series of characteristics (Christopher 2000): it should be *market sensitive*, i.e. able to rapidly respond to unexpected changes in fashion trends and consumer demand; it should make intensive use of IT and information systems such as EDI (Electronic Data Interchange) and, increasingly often, Internet (which carries the advantage of permitting information flow between different IT systems, without necessity for standardization, unlike EDIs) in order to create a *virtual* supply chain between its different actors; the adoption of information exchange systems should be the starting point of *process integration*, that is the integration between the different actors of the fashion supply chain of processes such as product design and development.

The adoption of QR in the industry's supply chain has allowed retailers to achieve a certain level of agility. Indeed, the main characteristics of QR fit the bill for a rather agile supply chain: this system works rather optimally with industries such as the fashion one, with large numbers of SKUs (Stock Keeping Units) with a short life span and high gross margins (Lowson 2001); QR is based on allowing rapid response to real-time changes in demand. The application of a QR-based strategy is gradual and not always complete. In general, according to Birtwistle, Siddiqui et al. (Birtwistle, Siddiqui et al. 2003), this process has three stages:

- At the first stage, IT systems are adopted; information about SKUs is constantly recorded and updated through electronic POS (Point of Sale) systems by scanning barcodes. Furthermore, this real-time data, together with other business documents, is shared with suppliers through EDI or the Internet;
- At the second stage, retailers should be able, thanks to their better control over information, to reduce their inventories and the batch-size of their orders. This would happen by implementing automatic replenishment methods and Advance Shipping Notice (ASN) EDI systems. Better information exchange with suppliers should also be coupled with a shift to floor-ready merchandise, thus further slashing the storage requirements and so smoothing out the replenishment process;
- At the third stage, total supply chain performance becomes the benchmark to measure performance, as full supply chain integration is achieved in terms of joint product development, market analysis, etc.

The design process and project transmission to manufacturers can also be much quickened thanks to modern software packages, such as CAD (Computer Aided Design) – which allows digital design which can be easily sent over the Internet to manufacturers – on the brand side, and CAM (Computer Aided Manufacturing) on the manufacturing side (Christopher, Lowson et al. 2004).

3.2.2 – *NOR LEAN NOR AGILE: SCM AT ZARA AND BENETTON*

Yet, is converging on a purely agile supply chain model always the best option? As it happens, the answer is negative. Even though, as we have seen, forecasting accurately fashion trends and demand for each apparel item is nearly impossible, this can be done with sufficient precision with regard to certain items that tend to sell constantly, with limited variation in demand volume. In fact, this removes the negative side effects of outsourcing to far away low-wage countries, as the need for responsiveness hardly an issue. The remainder of the product mix can follow a QR supply chain structure, in order to accommodate the trend-based, variable part where forecasting is not an option.

This is largely the case of Zara, a Spanish-based own-brand retailer with a strong presence in Europe and fast-expanding retail networks in Asia and North America. Zara exemplifies a hybrid approach, combining the best of the old and QR approaches (Christopher 2000, Christopher, Lowson et al. 2004).

Table 1: Key Financial Figures for Inditex Group, 2010/2011 (Inditex 2012)

Fiscal Year	2011	2010	2011/10
Net Sales	13,793	12,527	10%
Net Profit	1,932	1,732	12%
Nr of Stores	5,527	5,044	483
Nr of Markets	82	77	5
Employees	109,512	100,138	9,374

Highly skilled design teams utilize real-time information provided by scouts and electronic POS data in order to cater to the current tastes of consumers. As a vertically integrated fashion retailer, Zara can count on a network of suppliers working exclusively for the Inditex holding, its parent company, allowing for flexible deployment of capacity to counter fluctuating volumes (Christopher 2000). At the same time, Zara is able to carry on in-house a certain amount of processes where high volumes, together with state-of-the-art automated factories, allow for significant economies of scale (Christopher, Lowson et al. 2004), thus combining elements of lean supply to an otherwise agile setting. Furthermore, those products for which variability of demand is not an issue can easily be manufactured directly in the Far East at low labor costs (Christopher 2000). This supply chain structure allows Zara to take advantage of low wages in Asia to source those apparel items for which the inventory risk is low, while catering to new trends directly from its facilities in Spain and through suppliers in Morocco. Zara is thus able to design, manufacture and deliver new items in as little as three weeks (Birtwistle, Siddiqui et al. 2003), while replenishing its stores with new designs every three weeks, thus encouraging shoppers to visit more often (Christopher 2000).

Similarly, Italian fashion retailer Benetton, which pioneered this hybrid approach, is able to respond to changing fashion trends by relying on a huge amount of local small contractors, offering a high level of flexibility in the change of volume swings (Christopher, Lowson et al. 2004). Similar QR initiatives have been introduced by other international retailers, such as Wal-Mart and JCPenney, as well as by world-famous brand names such as Levi Strauss and Nike (Birtwistle, Siddiqui et al. 2003).

CHAPTER 4 THE AUTOMOTIVE INDUSTRY SUPPLY CHAIN (ASC)

4.1 – CHARACTERISTICS OF THE ASC

The process of expansion of industrial supply chains, coming to encompass supplier networks on a global scale, has had the side effect of speeding up the deindustrialization process of several developed countries, shifting their economic models from low value-added manufacturing to the service industry. Yet, one category of relatively labor-intensive manufacturing has survived – for the time being – in several countries that have otherwise adopted a service-based economy: the automotive industry. The high levels of know-how have contributed to the continual survival of Western and Japanese carmakers, even while emerging ones would experience strong growth in their local, developing markets, such as in the case of China and India. The industry has thus come to represent, in the developed world, the embodiment of manufacturing and blue-collar work, as well as the symbol of the industrial resilience of a country.

Nevertheless, the industry has not stayed the same through the years. On the contrary, it has proved to be one of the most dynamic business environments, pioneering new industrial techniques and providing other industries with precious teachings. Its supply chain has been among the first to become subject to academic attention, given its relative complexity, coming to be at the center of all the major transformations witnessed by the automotive industry since its very beginnings. It was through the advent of Fordism – the “democratization” of car – that automobiles were first available, through mass production, to the general public, abandoning its status of rich-only extravaganza (Waller 2004). Mass production became the defining feature of the automotive industry, with large numbers of workers employed at assembly lines throughout the world, as the post-World-War-II economic boom in Europe, North-America and, later, Japan literally motorized million of people, as carmakers came to be increasingly seen as national champions to be protected from foreign competition.

However, this state of things was not to last indefinitely. The mix of protectionism and mass production that had characterized the industry until the eighties produced market saturation and widespread inefficiency, while the gradual opening of national markets to foreign competition further thinned already declining margins. Carmakers largely responded by trying to make the best out of the situation by entering markets they were once largely barred from; by relocating production capacity to countries with lower labor costs; by reviewing their supply chain, seeking to remove inefficiencies.

From what is stated above, it already emerges a rough picture of the power relationships within the automotive supply chain. Most of the changes in the supply chain briefly listed above originate from carmakers, whether new production plants are opened in developing countries, whether the supply chain expands on a global scale, thus characterizing the Automotive Industry Supply Chain as producer-driven (Gereffi 1999), meaning that the carmaker sits at the core of its own supply chain, determining its structure even in absence of vertical integration.

As in other industries, several actors intervene in the supply chain of the automotive industry. Vehicles are designed and projected by carmakers, increasingly often in collaboration with specialized ateliers and suppliers, the latter being responsible for the manufacturing of individual car parts, which will be assembled by the carmaker into a finished car that will then have to be sold through an authorized car dealership (S&P *Net Advantage Industry Surveys: Auto and Auto Parts*. 2005). Of course, other parties intervene in the ASC, but the process previously described offers a stylized representation of the supply chain. However, this chapter will first deal with suppliers and then, together, with carmakers and dealers; the rationale behind this choice is that carmakers and dealers enjoy a direct, middleman-free relationship, where the dealer's role is to represent the carmaker's interests with customers; furthermore, as the supply chain moves towards a slightly more buyer-driven model, car dealers are becoming a fully integrated part of the manufacturing process, thus further making the case for a joint sub-section.

Table 2: Vehicle Production Statistics 2010 (OICA 2011)

Country	Cars	Commercial Vehicles	Total	% Change
Total	58,341,703	19,362,284	77,703,987	25.9%
China	13,897,083	4,367,678	18,264,761	32.4%
Japan	8,310,362	1,318,558	9,628,920	21.4%
Germany	5,552,409	353,576	5,905,985	13.4%
South Korea	3,866,206	405,535	4,271,741	21.6%
India	2,831,542	725,531	3,557,073	34.7%
USA	2,731,105	5,031,439	7,762,544	35.4%
Brazil	2,584,690	797,038	3,381,728	6.2%
France	1,924,171	305,25	2,229,421	8.9%
Spain	1,913,513	474,387	2,387,900	10.0%
Mexico	1,386,148	956,134	2,342,282	50.0%
Iran	1,367,014	232,44	1,599,454	14.7%
UK	1,270,444	123,019	1,393,463	27.8%
Russia	1,208,362	194,882	1,403,244	93.5%
Czech Rep.	1,069,518	6,866	1,076,384	9.5%
Canada	967,077	1,101,112	2,068,189	38.8%
Poland	785	84,474	869,474	-1.1%
Turkey	603,394	491,163	1,094,557	25.9%
Italy	573,169	265,017	838,186	-0.6%
Slovakia	561,933	0	561,933	21.8%
Thailand	554,387	1,090,126	1,644,513	64.6%

4.2 – SUPPLIERS

4.2.1 – FROM FORDISM TO LEAN SUPPLY CHAIN

The importance of supplier of car parts, within the automotive industry supply chain, has long been growing in importance, as increasing technological requirements have gradually shifted their role from one of simple manufacturing to one of heavy R&D activity, often in partnership with carmakers, occasionally taking part to the design process of vehicles (Zirpoli, Caputo 2002). Most of the changes the industry has been incurring throughout its history presupposed a certain degree of adjustment in the relationship between suppliers and carmakers.

Indeed, the process of globalization of the automotive industry, begun in the mid-eighties, deeply affected suppliers, as the old Fordism model came to be challenged. Originally clustered around the main national car manufacturing centers (Sturgeon, Van Biesebroeck et al. 2008), such as Detroit in the US, suppliers largely lost their “local” character, accompanying – whether willingly or out of necessity – carmakers in their globalization process, setting up branches and creating new production capacity in foreign countries, thus reducing the need for carmakers to resort to expensive imports of car parts over long distances, a practice furthermore frowned upon by governments looking to boost local employment in exchange for further market openness (Sturgeon, Van Biesebroeck et al. 2008). Plants and logistics infrastructure had to be set up as close as possible to the new production built by carmakers abroad, while trying to optimize capacity and minimizing transport costs. Vertical disintegration at carmakers meant that the manufacturing of more parts, such as seats, would be outsourced, thus creating further business opportunities for suppliers (Sturgeon, Van Biesebroeck et al. 2008). Yet this also meant that carmakers, which were already quickly discovering the advantages of relocating certain assembly lines to low-wage countries in their same region, also became increasingly aware that these countries could also provide certain car parts whose size and relatively lower value added would make them apt to be transported over longer distances, on the contrary of more bulky and time-sensitive parts that would still have to be sourced relatively close to the assembly plant (Zirpoli, Caputo 2002, Sturgeon, Van Biesebroeck et al. 2008). The resulting change in the geography of the ASC meant that it was becoming increasingly globalized, while preserving the “cluster” model for those activities (such as R&D) requiring a flow of ideas, skills and competencies between suppliers and carmakers, as well as for the manufacturing of specific car parts whose characteristics (such as size) make long distance sourcing not feasible (Sturgeon, Van Biesebroeck et al. 2008).

The globalization of the automotive industry also made it possible for different approaches, from the carmaker perspective, to the handling of business relationships with suppliers, to be compared and tentatively replicated outside of their origin markets, often with mixed success. US carmakers, which pioneered mass production and were at the base of the first automotive clusters in the world, have been increasingly basing their relationship with suppliers on market criteria (Sturgeon, Van Biesebroeck et al. 2008); in other words, American carmakers, fully conscious of being at the forefront of a

producer-driven supply chain, have been emphasizing the contractual nature of their relationship with suppliers, adopting an arm-length approach, all but eliminating the long-term, co-profitability side of the buyer-supplier relationship. After every contractual obligation is satisfied, continuous collaboration is not assured and future NPDs (new product developments) are open to bids from other suppliers, thus increasing competition (Sturgeon, Van Biesebroeck et al. 2008). However, the downsides of this purchasing practice are several: on the carmaker side, lack of long-term commitment to a certain supplier means that all the capabilities and technical knowledge with respect to their joint project will have to be absorbed and fully “digested” within the contractual period, in order to be able to continue independently if another supplier takes over (as the new supplier would lack the in-depth knowledge of the project arising from having participated from the beginning) (Sturgeon, Van Biesebroeck et al. 2008); furthermore, in a time when suppliers are involved more and more in NPD, an adversarial relationship, lacking reciprocal trust, is likely to compromise that seamless continuation of production processes that are at the base of the modern concept of *lean* supply chain (Zirpoli, Caputo 2002).

On the other side of the Pacific Ocean, Japanese carmakers (as well as other Japanese industries) have been long developing a radically different approach to the supply chain, often symbolized by Toyota’s SCM practices, known as “Toyotism” (Zirpoli, Caputo 2002). This model goes back to the concept of *keiretsu*, an industrial and service conglomerate encompassing all kinds of business activities; this model, combined with widespread cross-shareholding among Japanese firms (including, often, competitors) is considered to be at the base of the close-knit relationship between Japanese carmakers and their suppliers, a relationship that, unlike the American case, goes way beyond the mere contractual obligations, extending to reciprocal trust and long-term commitment to revenue sharing and growth (Sturgeon, Van Biesebroeck et al. 2008). Yet this model, for all its success in turning Toyota and Honda into successful carmakers, has largely failed to replicate its conditions outside of Japan (Sturgeon, Van Biesebroeck et al. 2008), though it has likely played an important role in establishing the strong presence of Japanese carmakers in the US, where they have been consistently reputed by suppliers to be “fairer” buyers than their US competitors (Sturgeon, Van Biesebroeck et al. 2008).

4.2.2 – IMPACT OF LEAN PRODUCTION AND MODULARITY ON SUPPLIERS

As seen in the previous chapter on FSC, greater wealth and wider access to information have both contributed to rendering consumers more aware and more interested in “unique” products responding to their actual tastes and requirements. This has been holding true with regard to the automotive industry, as consumers in the developed world (but also those among the rising middle-class of the BRIC countries) have been growing increasingly tired with the highly standardized, mass-produced models which used to characterize the car market. Under pressure from consumers and competition, carmakers reacted by increasing the customization possibilities and the differentiation between models (Morris, Donnelly et al. 2004). At the same time,

carmakers pushed forward the adoption of Toyota-style SCM practices, adopting lean production and modular parts (of which more will be said in the next sub-section), thus streamlining their production processes while, at the same time, trimming off those in-house processes which could be easily outsourced in order to increase efficiency and concentrate on core competencies (Morris, Donnelly et al. 2004). This is particularly true of European carmakers, which have largely refrained from adopting an adversarial posture towards their suppliers, without adopting the Japanese model of exclusivity, preferring to set for a hybrid relationship model, which allows for competition between suppliers, without endangering their long-term profitability (or even survival) through price wars and predatory behavior.

This much has been even more necessary after the advent of modularization, that is the utilization of common parts – “modules” – across a range of different models, which allows carmakers to reduce the number of unique components, while offering a wider range of vehicles to the public (Morris, Donnelly et al. 2004). Modularization has been a great opportunity for suppliers, as it has meant an increase in the pace with which carmakers have been outsourcing previously core activities, through the creation of modular parts (Holweg, Miemczyk 2003) such as cockpits, gearboxes, etc., expanding the business opportunities for suppliers and thus creating space for further 2nd, 3rd, etc., tier outsourcing, as the larger and more advanced suppliers would move to providing one-stop-shop services ranging from supplier selection and management, to R&D and assembly (Doran, Hill et al. 2007, Morris, Donnelly et al. 2004). On the other hand, this has also meant that suppliers have been involved in the NPD process more than ever, taking up more responsibilities and, correspondingly, more costs arising from expanded R&D activity (Morris, Donnelly et al. 2004), often side by side with OEMs.

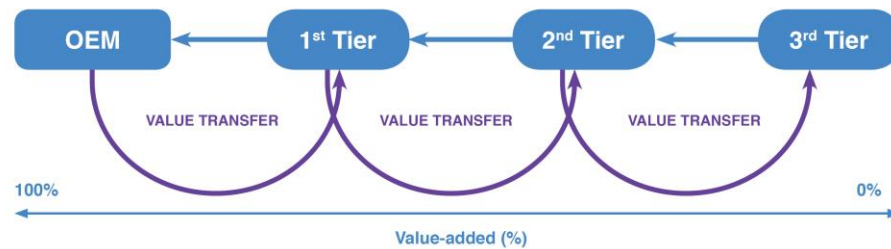


Figure 8: Value Transfer along the tiered ASC as a consequence of modularization (Doran, Hill et al. 2007)

This intense exchange of ideas and information, in turn, further increases the need for physical proximity – even in the digital era. This necessity adds up to the more practical need to keep the manufacturing activity of modular parts (or distribution centers thereof) within close range from the assembly lines, in order to minimize costly disruptions to the production process, thus favoring the creation of supplier parks, where the main actors of the upstream supply chain may interact more closely (Morris, Donnelly et al. 2004). It is therefore not a surprise that supplier parks are a feature of the European and South-American automotive industry, while they are more than rare in North America and Japan: the adversarial nature of the relationship between American carmakers and their suppliers discourage long-term investment in car-parks, while Japanese carmakers seldom involve suppliers in the NPD process, thus removing the need for proper supplier parks.

The need for supplier parks has gone hand in hand with the increase in the share of the production process that is outsourced by the OEM. Conceiving a vehicle as the combination of a series of modules, rather than of a huge amount of independent pieces has simplified the supply chain of OEMs, reducing the number of suppliers they need to deal directly with (Doran, Hill et al. 2007). Each module is sourced by a specific supplier that, in turn, sits downstream its own supply chain, and so on down to the supplier of raw materials such as steel and aluminum. The value chain, that is the process of creation of the value-added product – in this case a vehicle – has thus been greatly segmented, with carmakers, which used to conduct the majority of manufacturing processes in-house, now often limiting their contribution to the value

chain with the sole design activity (Doran, Hill et al. 2007), which is the case where so called “Tier 0.5” suppliers are able, thanks to their technical expertise, to take over the whole manufacturing process, from the coordination of suppliers of modular parts to assembly and distribution (Morris, Donnelly et al. 2004). Carmakers will thus limit their presence within the supplier park to mere landlord and supervision activity, leasing out buildings to suppliers, and, especially in Europe, running the assembly lines. This situation, however, highlights the fragile equilibrium between suppliers and carmakers, which retain ultimate control over the supply park, thus increasing the element of risk constituted by the cost both would incur in case of an abrupt end to their business relationship, in terms of sunk costs and relocation costs (Morris, Donnelly et al. 2004). This, on the other hand, has made supplier selection criteria stricter than in the past, in order to reduce the risk of an unproductive collaboration. Conditions that were once sufficient to obtain supply contracts are now merely necessary to qualify, including flexibility and a reputation for quality work at a reasonable cost; on the other hand, the conditions that are now determinant to winning supply contracts are much stricter than before, as suppliers are now required to have a global presence, in order to supply modular parts to different plants around the world, the ability to take part constructively to the NPD and established R&D activity (Doran 2004).

The ability of suppliers, in particular within the first few tiers, to meet – and exceed – the conditions listed above will increasingly be the key to surviving in an industry that is likely to experience increasing competition levels, as suppliers and carmakers from developing countries expand their horizons to encompass mature markets. Furthermore, greater requirements for customization, issues relating to holding excessively large inventories of “basic” models, as well as gripping production overcapacity in mature markets have all contributed to strengthen the interest of carmakers in a shift towards a demand-responsive, “Build-To-Order” (BTO) supply chain model. The resulting requirements of flexibility, punctuality and joint planning will greatly increase pressure on all supply tiers, bringing about a reorganization of the ASC aimed at incorporating the best practices of an agile supply chain to the long-established lean model. This transformation is more easily understood when shifting attention from suppliers to carmakers, the drivers of the automotive supply chain.

4.3 – CARMAKERS AND CAR DEALERS

4.3.1 – THE LEAN BUILD-TO-ORDER SUPPLY CHAIN MODEL

As the automotive industry has long been at the forefront of innovation with respect to production practices, it is not at all surprising to find that the same issues as other industries affect its supply chain. Indeed, in the previous chapter, the fashion industry has been described as suffering as a result of a supply chain model almost completely decoupled from demand, characterized by very long NPD processes and excessive reliance on forecasts that turn out to be wrong more often than not; the resulting losses caused by inventory costs, mark-down of oversupplied items and missed sale as a

consequence of undersupply, would all eat away at already thin margins. All of these issues can be encountered when analyzing the ASC, taking into account due differences.

Fordism established a production model that proved extremely resilient through the decades up to the late eighties (Sturgeon, Van Biesebroeck et al. 2008), mandating mass production of basic models; Henry Ford's intuition was correct to the extent that the economic conditions of the time allowed it to. Rapidly rising living standards among a population that was still largely lacking a vehicle made the fortune of post-war mass car production, extending it to Western European countries and to Japan within a couple of decades. As Western markets reached a certain level of maturity, the advent of Japanese cars brought a first change in the application of mass production, but not a change in the supply chain responsiveness to consumer demand. The *lean* production process pioneered by Toyota attracted the attention of the whole industry, which quickly adopted hybrid versions of Toyotaism (Sturgeon, Van Biesebroeck et al. 2008). Lean production allowed carmakers to streamline and expedite the manufacturing process by removing bottlenecks and reducing the incidence of bullwhip effects in case of delays along the supply chain. Yet the Build-To-Stock (BTS) – or Build-To-Deliver (BTD), a relatively slight variation thereof – model remained the dominant production structure in the industry. It is useful for the aims of this research, to provide a brief description of the supply chain in the case of BTS or BTD.

A BTS (or BTD) production process can be roughly compared to the old forecast-based supply chain model of the apparel industry seen in the previous chapter. The manufacturing process and, before, the purchase of supplies, is completely decoupled from actual consumer demand, as finished cars are added to the stock preemptively, while car dealers take charge of selling these vehicles on the market, thus creating a sort of buffer between consumers and carmakers (Waller 2004).

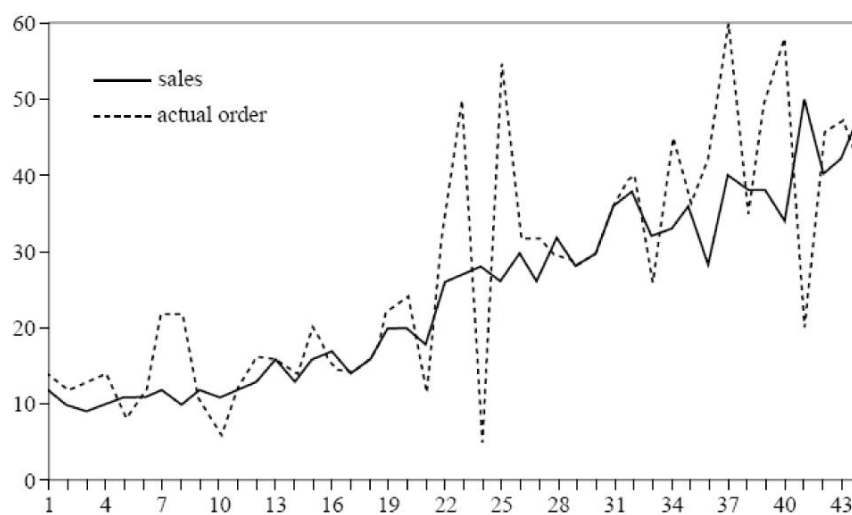


Figure 9: Actual Orders vs. Sales in the automotive industry (Koperberg 2006)

In this system, orders for new vehicles are based on aggregate analysis of market data, as well as of data provided by the sales department and by car dealers (Suthikarnnarunai 2008). This phase is followed by a planning and programming phase (Suthikarnnarunai 2008, Meyr 2004), divided between: *budget planning*, which includes the assignment of financial resources to each department, the setting of production volumes for each model, per year and the setting of a “volume goal” in terms of sales; while the time horizon for budget planning is, at best, monthly, the *master production planning*, although largely similar to the previous stage, enjoys a shorter time horizon, with quantities planned per week and based on forecasts which now include current order data, rather than historical data: of course, the longer the lead time, the less current order data becomes available, meaning that the degree of reliability of forecasts is reduced and carmakers run a greater risk of overproduction; finally, *master requirements planning*, with the shortest time horizon, provides suppliers and assembly lines with information about the kind of optional to be fitted in the vehicle, approximately 3 to 5 weeks before completion. Once the vehicles are ready, *allocation planning* distributes the finished cars, often in stages, through the distribution network.

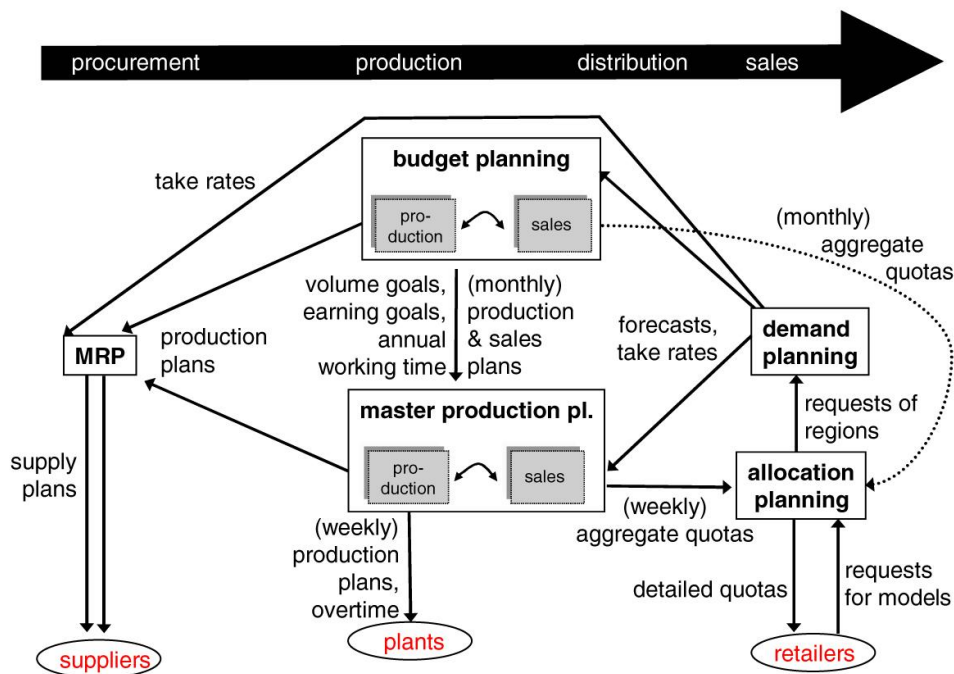


Figure 10: BTS/Forecast-driven planning in the automotive industry (Meyr 2004)

On the other hand, a BTD involves dealers more closely in the demand forecast process, comparing on a monthly basis the dealers' forecasts with the carmaker's own (Suthikarnnarunai 2008). Based on the comparison between these forecasts, dealers place their orders electronically, so that build-feasibility is checked, meaning that capacity and component availability is checked against the order; if the order is accepted, a bill of materials and a supply schedule are drafted and forwarded to assembly lines and suppliers, so that the manufacturing process may start

(Suthikarnnarunai 2008). However, this starts well in advance of any tangible knowledge of the actual market conditions, let alone of real-time consumer demand, meaning that, by the time factual information is acquired, vehicles are beyond the point where they can be heavily customized, causing them to be added to the stock of finished vehicles (Suthikarnnarunai 2008). Car dealers will then face the difficult task of selling finished vehicles in stock, convincing customers to accept models with optional set-ups and colors that are often very different from what they had in mind, in exchange for faster delivery and often heavy discounts on the official price (Waller 2004), thus strongly reducing the carmaker's margins on these vehicles.

4.3.2 – BUILDING TO ORDER: RECOUPLING SUPPLY AND DEMAND

The original car-manufacturing model was a highly artisanal one, with individual models being produced to order, making these cars unique, if expensive items. Fordism democratized cars, driving down their cost to the point that what a Ford worker's wage was enough to afford one. However, mass production did not signify the end of artisanal firms: rather, it furthered their exclusive status as ateliers specializing in expensive niche vehicles, such as sports cars (as in the case of Ferrari, Maserati, Aston Martin, etc.) or luxury sedans and limousines (such as in the case of Rolls Royce, Bentley, etc.), maintaining a Build-To-Order production system that adapted perfectly to market segments where the relatively few individuals who are able to pay exorbitant prices are also willing to wait through very long lead times in order to receive a vehicle as customized, personalized, as possible. This strategy has also allowed luxury carmakers to maintain a relatively agile supply chain with little inventory (agile, but not necessarily lean, as the very long lead times show).

The question of whether the BTO production model could be applied to mass carmakers, without having to give up streamlined manufacturing processes and without causing lead times to skyrocket, comes spontaneous and has come to represent the latest frontier of research in the ASC field. A shift to a BTO System would allow carmakers to drastically cut their finished car inventories, thus reducing costs, as well as reduce the incidence of lost sales and markdowns of cars in excess supply, thus driving up dangerously depressed margins on sales (Waller 2004). However, several critical issues intervene in making a pure BTO production system difficult to achieve in the short run. The first issue is with respect to order processing. Currently, lead times for order processing can be very slow, with up to 85% of total lead times being the result of delays incurred during this process, as orders are collected and stored in digital order banks and then distributed to various departments through legacy systems which allow for little speed and flexibility (Waller 2004). In order to achieve a BTO system, carmakers should then develop centralized, multifunctional order processing systems able to verify availability of productive capacity in a few seconds, as well as being able to automatically draft bills of materials and production schedules, communicating as precise a delivery date as possible to the dealer and the customer (Waller 2004). Internet-based order systems have allowed carmakers such as BMW of Germany to reduce order-processing time from approximately two weeks to a single

day (Meyr 2004). However, with time, the online order processing systems should progress towards encompassing several tiers of suppliers, in order to quickly communicate material requirements to them, thus awarding them with precious extra time to deliver their services, as well as to provide customers with a more realistic delivery date (Waller 2004).

The other great issue is that of capacity: demand for vehicles is, similarly to demand for other products and services, highly seasonal, meaning that shifting from BTS to BTO would expose OEMs and suppliers to wild fluctuation in capacity requirements (Waller 2004). However, better communication between tiers would help reduce uncertainty (as seen above); furthermore, further progress in modularity will allow both carmakers and suppliers to push forward the stage at which cars are further customized (for instance in terms of bumper color, GPS systems, audio systems, etc.), thus allowing for better capacity planning and flexibility (Waller 2004). Further issues regarding varying capacity requirements include the incidence of labor; more flexibility in the working schedule of workers, such as it has happened in Germany, will allow deploying extra capacity at a shorter notice, against the four-week overtime notice required in many European countries (Waller 2004): the importance of cordial relationships between labor and employers will become increasingly important in order to create a flexible and less delay-prone production system.

In general, a mix of BTS and BTO production appears to be the most easily achievable model, as conditions do not appear to be yet mature for a fully BTO system, as customers still show a preference for car dealers, rather than internet-based direct-order systems and manufacturers, on the other hand, have to embark on ambitious restructuring processes that will take time, especially in such a depressed market, to show bear fruit.

Table 3: Build To Order Programs at Selected Carmakers (Joe Miemczyk, Matthias Holweg 2004)

Vehicle Manufacturer	Program Name	Order-to-Delivery Target (days)
BMW	COSP	10
Ford	Order-to-Delivery	15
General Motors	Order-to-Delivery	20
Renault	Projet Nouvelle Distribution	21
Nissan	Scope, Answer, Icon	14
Toyota	N/A	14
Volkswagen	Kunde-Kunde	14
Volvo	Distribution 90	14

CHAPTER 5 PREMIUM LOGISTIC SERVICES

5.1 – SUPPLY CHAIN CRITICALITIES AS A BUSINESS OPPORTUNITY

Throughout the previous three chapters, one of the emerging patterns has been that of a shift from the mass-production model of manufacturing, pioneered in the automotive industry by Henry Ford, towards more sophisticated hybrids of lean and agile supply chains. The elimination of buffers or decoupling points within the supply chain has had the effect of smoothing out manufacturing, thus reducing lead times and facilitating the flow of information between manufacturers and suppliers. Yet, a streamlined structure also means that delays at any point of the supply chain may cause more severe disruptions to propagate upwards in what is known as the bullwhip effect(Booth 1996).

The need to prevent such disruptions from affecting the whole supply chain, causing manufacturers to face huge losses, has created the right conditions for a niche market of premium logistic services – such as emergency inbound shipments. TNT Express is a leading provider of such premium services, catering to the specific needs of multinational firms operating in a range of industries, including the three industries that constitute the object of this research.

Year ended at 31 December	2011	variance %	2010
Adjusted revenues	4,547	2.1	4,453
Adjusted operating income	380	(1.0)	384
Average consignments per day ('000)	725	1.0	718
Revenue per consignment (€) ¹	24.4	1.2	24.1
Average kilogrammes per day ('000)	14,661	2.6	14,288
Revenue per kilogramme (€) ¹	1.21	0.0	1.21
¹ based on reported revenues @avg10 rates (in € millions, except percentages)			

Figure 11: Figures Detailing TNT Express' Performance in Europe & MEA (*Building on Strengths: TNT Express Annual Report 2011. 2012*)

In order to capture precious insights from this leading logistic provider, the author has been able to conduct a semi-structured interview with Mr. Paul O'Donohue, Global Manager Business Solutions at the Global Customer Solutions of TNT Express. This semi-structured interview was based on a set of questions submitted to the interviewee beforehand, on which the actual interview was then built. The aim of this interview was to verify some of the insights from this thesis with an experienced logistics practitioner involved on a daily basis with the supply chains here considered. The interview ranged over TNT's involvement in the respective supply chains of the three industries: this will be summarized in the following three sub-sections.

Table 4: Main Conclusions from the Interview

Supply Chain	Growth	Services and Trends
ASC	Yes, but moderate.	<ul style="list-style-type: none"> • Emergency Inbound Shipping (EIS) • Expansion to emerging markets (i.e. Brazil) at the price of providing non-core services • EIS to reduce impact of breakdowns on SC
PSC	Yes.	<ul style="list-style-type: none"> • Delivery to Pharmacies • Possible interest in delivering customized services direct to patients
FSC	Yes.	<ul style="list-style-type: none"> • Express parcel and pallet shipping between stores, reducing inventory size at store • Express parcel service for high-end online retailers • Competition with post service

5.1 – ASC

The automotive industry represents an important market for TNT, which has been serving it for approximately 30 years. Even though TNT is able to provide logistic solutions on a global scale, its core market remains Europe, whose automotive market has been stagnating of late – due to its high maturity level and to the overcapacity plaguing several manufacturers – meaning that, while it does not offer high prospective growth, it remains an essential part of TNT’s operations.

As for the vast majority of industries it serves, TNT Express offers a premium parcel service – though, normally, LTL (Less-Than-Truckload) or FTL (Full-Truckload) shipping -, providing shipping solutions that cater to the specific needs of carmakers, such as emergency inbound shipping. Emergency inbound shipping consists of emergency deliveries of spare parts not readily available at the assembly line or through the carmaker’s ordinary logistics services. As such spare parts are not in stock or readily available within the supplier park, they need to be shipped as quickly as possible from a supplier to the assembly line. TNT Express offers a flexible service and reliable service, delivering parcels or pallets internationally within 24 hours, thanks to a dedicated control center offering a single point of contact for customers worldwide, thus facilitating the information flow within the company. The advantages brought to carmakers from this service are several, in particular with regard to limiting costly interruptions of the production process. In several cases, the cost of production delays, ranging usually between €250,000 and €500,000 per hour (*Interview of O’Donohue, P., Global Manager Business Solutions, TNT. 2012*), can increase further if penalties are included in contracts, thus creating a further incentive to use emergency shipment services, which command higher rates than ordinary shipping services, rather than risking huge losses

as a consequence of sudden breakdowns. This, on the other hand, raises the matter of where liability lies, once contracts for the provision of emergency inbound shipping services are signed, as carmakers have tended to push for liability to fall ultimately on the providers of such services, in case of further delays. Other carmakers, such as a leading European one, have been taken a radically different approach, refusing to recognize emergency inbound shipping as an integral part of their supply chain, preferring to invest in preventing bottlenecks from happening in the first place.

Furthermore, TNT has been looking for opportunities to operate on emerging BRIC markets, in particular India and Brazil. Brazil, in particular, has proven to be a challenging market. On the one hand, the strong presence of global carmakers, already enjoying a business relationship with TNT elsewhere, has made it easier for TNT to make its value proposition known in Brazil. On the other hand, the price for access to the fast-growing South-American market has been that of having to offer a wider range of services that would not usually fall within TNT's core market, such as LTL and FTL shipping, as foreign carmakers look for a partner able to provide a one-stop-shop logistic solution in a country where logistic services are otherwise scarce and hardly reliable.

5.2 – FSC

Again in the case of the FSC, TNT operates at the higher end of the market, where the value added of the apparel being shipped justifies the premium fees commanded by TNT's services. The emergence of vertically integrated own-brand retailers, such as Zara and H&M, shipping large batches of relatively inexpensive apparel in LTLs and FTLs, means that mass-retailers do not represent an interesting market for TNT, given its low margin, high volume, characteristics.

However, the fashion market as a whole still represents a growth market for a provider of premium logistics services such as TNT. Yet, most of the growth has come and will come from providing express parcel services to the luxury end of the fashion industry, offering, for instance, 24h guaranteed shop-to-shop shipments, thus helping retailers reduce the size of their inventory while keeping their service levels stable.

Online retailing also represents a possible growth market. However, competition in this market is fierce and a provider with the characteristics of TNT cannot compete on high volumes or low-cost shipping of time insensitive items, which fall within the core competencies of post services. Rather, once again TNT can compete on premium services, offering express parcel delivery for the online e-stores of high-end fashion retailers, whose products sell at prices that justify the cost of an express service. Also, wealthy customers of high-end retailers are probably more likely to consider their orders more time-sensitive, thus allowing online retailers to pass down most of the shipping costs more easily.

Finally, growth opportunities come from the quick shipping of samples from design centers to manufacturing countries, usually located rather far from each other. The adoption of the Quick Response model of supply chain makes the timely delivery of

samples to factories a necessity, meaning that express parcel shipping becomes fundamental in these cases.

5.3 – PSC

In the chapter dedicated to the PSC, it was mentioned that 3PLs were playing an increasingly important role in dis-intermediating the market, offering most of the logistic services previously monopoly of wholesalers. TNT has taken part of the rise of 3PLs within the supply chain, offering delivery services from drug manufacturers direct to pharmacies in several European countries. However, the interview confirmed the reluctance of 3PLs to take over all the logistic functions covered by wholesalers. Warehousing, in particular, is by no means a market of interest for TNT (presumably because of the capital-intensive, low-margin nature of this kind of service). Companies like TNT can help decrease reliance on large inventories by offering Just-In-Time deliveries, while in the interviewee's opinion, drug manufacturers should vertically integrate, taking over the warehousing services and outsourcing delivery to companies like TNT. Furthermore, the increasing interest of drug manufacturers for premium, customized treatments to be delivered directly to patients appears to be a possible field of interest to TNT.

As for the issue of the likely reduction in the number of weekly deliveries to pharmacies, the interviewee has provided an opinion contrasting with what has emerged from literature review. The industry might be moving towards a more buyer-driven model, where the power of manufacturers may be partially offset by that of retailers, that is pharmacies, who may be unwilling to accept to carry larger inventories as drug manufacturers cut costs by reducing the number of deliveries.

CHAPTER 6 COMPARATIVE ANALYSIS

The previous chapters have been aimed at offering an overview of the supply chain structure of the pharmaceutical, fashion and automotive industry; the reasons behind their current supply chain structure, as well as the drivers behind the incoming transformations thereof have both been individuated through an extensive analysis of the available academic literature.

However, providing overviews of three distinct industry supply chains fulfills only in part the aims of this research, which go as far as to offer an exploratory, reasoned comparative analysis of the supply chains in question, in order to individuate common characters, as well as common trends in their ongoing changes.

The next sub-sections will thus serve the purpose of performing a comparative analysis, based on two main criteria: power and structure (i.e. agility, leanness), as these two issues have emerged as central to the transformation the three supply chains are undergoing.

6.1 – POWER

Throughout the three chapters of this thesis describing the supply chain structures of the Pharmaceutical, Fashion and Automotive industries, one of the main themes has been the issue of power allocation between the various actors intervening in the production process. The concept of power, in supply chain context, has been widely researched, though no uniform definition exists. Harrison and van Hoek (Harrison, Van Hoek 2008) see power as the possibility for a member of the supply chain to assert control over another, thus potentially being a cause for conflict. This definition can be agreed upon as it characterizes the concept of power broadly, without adding either negative or positive connotations to this concept, as it has often happened in past studies on this topic (Hines, McGowan 2005). Anyhow, the importance given in the academic world to the issue of power makes it an ideal starting point for this analysis.

As explicated in the PSC, FSC and ASC chapters, power relationships in all of the industries concerned have not remained completely static, becoming subject to relatively important changes. In recent times, this has largely happened as a consequence of the enlargement of supply chains to a global scale. The automotive, pharmaceutical and fashion industries had long represented examples of producer-driven supply chains, where the power dynamics largely favored manufacturers, though with widely differing degrees of assertiveness between them.

The pharmaceutical supply chain clearly shows the characteristics of a producer-driven supply chain, being characterized by powerful manufacturers operating on a global scale, developing new drugs through massive R&D activities that eat up a very large chunk of their budgets. Furthermore, patent protection allows manufacturers to enjoy the fruit of their costly R&D process, shielding them from competition for a relatively

long term. Yet drug manufacturers have long failed to assert their power on the supply chain to its full extent, in terms comparable to those of the automotive manufacturers. Differently from other manufacturers, drug manufacturers have long favored the product development and marketing process over the whole downstream logistic process, disregarding earthly issues such as warehousing and distribution to retailers, often because of a deep lack of understanding of the logistic process as a whole (Christian L. Rossetti, Robert Handfield et al. 2011). This has allowed outsiders with an understanding of such processes to dig an important market niche, thus bringing about an intermediated market where retailers, such as pharmacies and hospitals, have long lacked interaction with drug manufacturers for purposes other than marketing, as they were largely left to deal with powerful wholesalers. The important role carved out by wholesalers within the supply chain appears to be thus a possible source of inefficiency. As they create a buffer between manufacturers and retailers, wholesalers create a decoupling point between supply and demand, causing inventory sizes to swell – the heritage of a time when wholesaler would profit from price fluctuations – thus increasing costs. Another consequence of wholesalers' past reliance on price fluctuations is that very high service levels became the custom, meaning that retailers now receive between two and five deliveries a week, thus reducing their inventory costs to a minimum (Christian L. Rossetti, Robert Handfield et al. 2011). This marks already a strong contrast with the assertive role of car manufacturers, which operate on a market with no intermediaries.

However, the reality of things has shown itself to drug manufacturers, as profits have come under pressure from the expiration of patent protection on many drugs, allowing generic drug manufacturers to compete on a larger scale than before. Lower profit margins have pushed drug manufacturers to look with renewed interest to reduce or eliminate altogether inefficiencies throughout their supply chain. Hence the emergence of the issue of power within the PSC, as manufacturers vertically integrate, taking over several logistic functions in order to reduce reliance on wholesalers, given the little transparency of the Fee-For-Service system. Manufacturers have thus become more conscious of the power embedded with their role and have thus begun a long-term dis-intermediation of the market. Yet, is the supply chain moving even more towards a producer-driven model? It needs not necessarily be so. Drug manufacturers and wholesalers have long undergone a series of mergers and acquisitions that have vastly consolidated the market, but this is also true of retailers, such as pharmacy chains (Felsted 2012). This should further empower them, allowing them to counteract the likely push of vertically integrated drug manufacturers for reduced service levels, given their reluctance to carry large inventories, with all the costs associated to this (*Interview of O'Donohue, P., Global Manager Business Solutions, TNT. 2012*). Furthermore, the emergence of mail-order pharmacies (at the moment a North-American anomaly) and heavy regulatory pressure in health-care related industries will probably dampen the rising assertiveness of vertically integrated drug manufacturers, thus producing a situation whereby wholesalers will gradually disappear, creating a more producer-driven supply chain that, paradoxically, could still envisage an improvement in the bargaining position of retailers. Additionally, heavy regulation appears to be the biggest shield protecting pharmacies, whether brick-and-mortar or mail order, from losing further to drug manufacturers. Government action, also in the form of antitrust rulings, might stop

manufacturers from vertically integrate to the point of bringing their products directly to the final consumers, thus protecting the position of retailers.

The gradual empowerment of buyers has been also the result of increased customer awareness, coming from regulatory changes allowing them a greater say in the choice of medications. Greater customer awareness is a feature common to all three industries here considered, mostly as a result of easier access to information and more widespread wealth. However, the way consumer “empowerment” has affected each supply chain is different. The pharmaceutical supply chain is witnessing the vertical integration of manufacturers as a response to thinning margins resulting from consumers being able to purchase generic substitute drugs, but it has also created opportunities for mail order pharmacies to compete with brick-and-mortar retailers on costs, thanks to their lean model(Christian L. Rossetti, Robert Handfield et al. 2011).

In the automotive industry, on the other hand, consumer awareness has come in the fashion of more gusto than before for a personalized vehicle. Consumer preference has moved away from mass-produced, largely equal vehicles to cars offering a wider range of customization possibilities (Morris, Donnelly et al. 2004). This has further consolidated the role of carmakers, as it has fallen on them to provide customers with innovative products. This, in turn, has contributed to changes in the production model towards lean hybrids. This further change has had the biggest impact on power equilibrium, affecting this time not the main actor, the carmaker, but its suppliers. As carmakers have sought to ride on the wave of globalization and expand their operations worldwide, tapping into growing demand from emerging markets, their main suppliers have been forced to follow up and set up shop in those same markets (Doran, Hill et al. 2007), in order not to lose contracts to more aggressive competitors or, increasingly, to local suppliers. However, the requirements in terms of flexibility and management skills necessary to run a supplier service on a global scale have not been met by all firms; a smaller number of players has emerged, consisting of those suppliers that have been able to adapt successfully to the new, global scale of their business. They in turn have been at the center of further outsourcing, offering opportunities to smaller suppliers to focus on a smaller range of core competencies, taking advantage of the fast-flowing ideas circulating in supplier parks. It can be thus said that the ASC did not experience a radical change in its power dynamics but rather, a further redefinition of the roles and competencies of all actors, bringing about greater specialization in single activities, from design to assembly. The role of retailers, that is car dealers, has been changing only to the extent that they are not required to hold as much stock as earlier, because of a gradual shift to BTO production and that carmakers have become slightly less reliant on their demand forecasting.

On the contrary, retailers have been at the head of a radical shift in power dynamics in the fashion industry. The era of mass produced garments has long ended. The whole textile industry has undergone a huge change from its mass-production, very labor-intensive origins. The post-war advent of mass retailing augmented the bargaining power of retailers, beginning the shift towards a buyer-driven supply chain. The opening of developing countries to foreign direct investment gave retailers the opportunity to break free of costly domestic suppliers and outsource production to countries characterized by lower labor costs(Gereffi 1999). Here, a further shift of power can be

individuated. Largely free from high labor costs, regulation and unionization, garment manufacturers in developing countries would be in constant competition among each other, therefore strengthening the bargaining position of buyers – i.e. retailers. Retailers' control over the supply chain has extended further upstream, choosing which suppliers garment manufacturers will have to use, thus denying them the possibility to establish their own supply chain and locking them in contractual relationship with selected fabric manufacturers. Similarly, empowered retailers were able to cajole those garment manufacturers left in Europe and the US to increase their productivity and flexibility without corresponding increases in remuneration, under the menace of further outsourcing to developing countries. The central role of retailers has thus come about as the result of trade liberalization and but the most recent trend, that of vertical integration, has come about as the result of greater consumer appetite for Fast Fashion, a form of fashion retailing much more responsive to consumer demand than the previous forecast-based NPD model (Barnes, Gaynor Lea-Greenwood 2006). Vertically integrated own-brand retailers like Zara have been able to take over certain production processes, while obtaining the necessary flexibility by creating a network of small manufacturers working exclusively with the Inditex Group, thus bringing the power of the retailer within its supply chain to levels never seen before in the fashion industry, assimilating them to the position held by carmakers in pre-globalization times.

Table 5: Power and related trends in the PSC, ASC and FSC (Source: Author's Elaboration)

Supply Chain	Power Distr. Before	Power Distr. After	Trends affecting Power
PSC	Producer-driven	Producer-driven	<ul style="list-style-type: none"> • Dis-intermediation • Consolidation among buyers
ASC	Producer-driven	Producer-driven	<ul style="list-style-type: none"> • BTO • Consolidation among suppliers
FSC	Producer-driven	Buyer-driven	<ul style="list-style-type: none"> • Own-brand retailers • Outsourcing • Vertical Integration

The analysis of the three supply chains in question has clearly shown how power distribution can often be the result of market changes. In fact, even the relative stability of the producer-driven ASC appears to be the result of consumers demanding increasingly sophisticated and customized vehicles, thus requiring high technical skills that create formidable barriers to the entry of new competitors, at least in markets where the quality level required by customers is of Western standards. Again in the case of the PSC, the possibility for consumers to opt for generic drugs has been at the center of drug manufacturers' efforts to vertically integrate and remove middlemen from the market, in order to the days of high margins. The fashion industry has shown how empowered consumers can cause power within a supply chain to shift radically,

favoring those actors that are better placed to quickly capture trends and rapidly deliver new items to fashion-conscious customers.

6.2 – LEAN, AGILE OR HYBRID?

Agile supply	<ul style="list-style-type: none"> • Quality • Cost • Lead time 	<ul style="list-style-type: none"> • Service level
	<ul style="list-style-type: none"> • Quality • Lead time • Service level 	<ul style="list-style-type: none"> • Cost
	Market Qualifiers	Market Winners

Figure 12: Market winners and market qualifiers for agile versus lean supply (Rachel Mason-Jones, Naylor et al. 2000)

One of the most visible similarities between the three supply chains analyzed in this thesis is the shift from what was, by and large, mass production to more sophisticated production models aimed at eliminating wasteful practices and thus increasing efficiency throughout the supply chain. Attempts were first made to streamline mass production of vehicles by eliminating a series of buffers throughout the manufacturing process that would increase the chance of delays and thus cause lead times to become too long and unpredictable (Bruce, Daly et al. 2004). However, the most important buffer of all remained (and still largely remains) in place, that is the reliance on imprecise forecasts, to be made long ahead of the actual sale, based on historical data and further forecasting activity conducted by car dealers, in similar conditions of uncertainty.

Here another similarity emerges with the fashion industry, which had long based its production process on forecasting trends based on historical data, but with little or no precision. In both cases, this long process, started way before the actual commercialization of the products concerned, would effectively decouple supply from

demand, creating unwanted stock that has to be rid of through mark-downs: car dealers end up having to offer substantial discounts to customers to convince them to choose a car in stock, rather than ordering another one; fashion retailers would have to run off-season sales in order to free space for new products by eliminating accumulated stock of unsuccessful apparel.

On the other hand, the pharmaceutical industry had long appeared immune to these problems. This was however simply the result of market intermediation by wholesalers, who would purchase drugs in bulk and then run inventories autonomously from drug manufacturers. While this guaranteed manufacturers with fat margins for many years, it also decoupled them from demand, making the restructuring required by falling margins in more recent years even deeper.

The example of Toyota had a great influence on all manufacturing industries, which largely adopted the most effective aspects of lean manufacturing. The pharmaceutical industry, for instance, long trailing behind in such matters, has been adopting lean manufacturing in order to streamline production processes (Chowdary, George 2011), within their growing efforts to correct decades of inefficiency and lack of understanding of supply chain practices. Most carmakers, of course, adopted Toyota's approach to production and also the fashion industry used insights from Toyotaism to reduce costly delays during the various manufacturing stages, with good results.

Yet even lean production did not intervene in removing the buffer between supply and demand in these three supply chains. All of this has become increasingly evident, as customers have shown increasing awareness and attention to trends. The similar reliance of the automotive and fashion industries on demand forecast means that both industries have been on the look for a way to obtain a supply chain more reactive to variation in consumer demand (and hence a more reactive production process) without having to give up the benefits brought by the highly streamlined lean manufacturing. The need for an agile supply chain, flexible and easily adaptable to varying demand has, however, been met by production constraints, in particular in the case of the automotive industry.

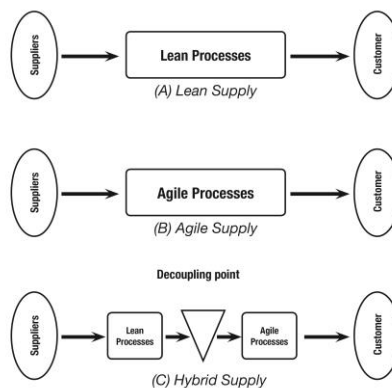


Figure 13: Lean, Agile and Hybrid SC, adapted from: (Rachel Mason-Jones, Naylor et al. 2000)

Indeed, the success of several own-brand retailers, such as Zara and Benetton, cannot only be explained with their ability to offer a fast response to changes in tastes and trends through Quick Response system. In fact, the success of these two retailers comes from their ability to combine QR with lean manufacturing outsourced to Asia (Christopher 2000). Maintaining elements of the forecast-based and combining them with the ultra-short NPD lead times offered by a QR system, Zara, Benetton and H&M have been able to respond to sudden changes in trends without having to give up completely to the economies of scale and to the low labor costs of mass production in developing countries. Furthermore, the ability of Zara to master lean manufacturing practices in a range of production processes has allowed it to vertically integrate these projects, obtaining economies of scale and reducing delays and uncertainty in its supply chain.

However, the relative simplicity of the FSC, which includes relatively few actors and the relatively low value added embedded in Fast Fashion apparel make the fashion industry a better candidate for the application of agile production practices than, say, the automotive industry. Through the review conducted in Chapter 4, what seems to emerge is that the complexity of the ASC, consisting of a myriad of tiered suppliers, does not lend itself to fully agile approach. As production plants – and labor agreements – have been conceived to operate at a constant pace, they could hardly cope with the highly seasonal pattern that characterizing demand for vehicles, neither in terms of capital, nor in terms of labor requirements. Nonetheless, an hybrid approach appears to be the key to a more demand-responsive ASC, maintaining a seamless lean structure, while adopting best practices that might render it more agile and hence more responsive to the customization requirements of customers. It is clear that better and faster information exchange between the two ends of the ASC is a necessity in times of overcapacity. Just as well, more flexibility in labor agreements should be in the interest of both unions and employers, as it would greatly increase productivity and reduce the need for layoffs in times of penury.

Finally, the pharmaceutical industry: long lagging behind in terms of supply chain management practices, the industry has only recently adopted elements of lean manufacturing in order to reduce costs. The next step, that is the introduction of agile practices will not happen rapidly and shall require acceleration in the process of disintermediation of the pharmaceutical market. Indeed, as long as wholesalers behave as a buffer between supply and demand, demand responsiveness within the supply chain will be impossible to achieve. Nevertheless, market disintermediation has long started and the involvement of 3PLs in the market, providing delivery services for drug manufacturers dealing directly with retailers (*Interview of O'Donohue, P., Global Manager Business Solutions, TNT. 2012*), might accelerate this process and provide a first element of flexibility. Similarly, the increasing assertiveness of mail-order pharmacies could also render the supply chain more responsive, thanks their lean structure that does not rely on attracting customers to showrooms in order to perform sales and their heavy usage of internet systems lends itself to fast, automated transfers of information to drug manufacturers.

CHAPTER 7 CONCLUSIONS

This thesis began with a brief introduction to the great changes globalization has brought to the world in recent years, changing old ways of conducting business and bringing about new challenges in terms of efficiency and innovation that established companies have had to face to survive on the new, enlarged horizon created by the opening of global markets. What was once firm vs. firm competition has gradually been transformed substituted by competition between supply chains, as both firms and practitioners have become increasingly aware that, at the base of a successful product, is the ability of all the actors contributing to its development, production and delivery, to deliver value added in their respective stages.

This comparative analysis has aimed to individuate how three different industries – Pharmaceutical, Fashion and Automotive – have been going through transformations in their respective supply chain structures, looking at how their main actors have been interacting among each other, while also providing readers with a concise description of the main characteristics of each SC.

Throughout the analysis, two themes have constantly emerged to qualify the nature of the interactions between different SC actors, both in hierarchical and physical terms. The concept of power has been largely discussed, as the dominant actors of each supply chain have been individuated and the physical shift of manufacturing from mass production and adversarial relations between supply chain members to lean, agile or hybrid systems involving higher collaboration and information exchange. The pharmaceutical supply chain has thus been characterized as becoming increasingly producer-driven, as drug manufacturers, on the one hand, and retailers, on the other hand, attempt to reduce costs and inefficiency by bypassing wholesalers, thanks also the renewed interest of 3PLs for this market. The fashion industry, on the contrary, has gone through a very long process of shifting from a producer-driven supply chain, dominated by mass-manufacturers of standardized garments, to a buyer-driven one, where own-brand high-street retailers appear to represent the future of the industry, thanks to their ability to blend economies of scale arising from lean manufacturing in-house, outsourced manufacturing in low-wage countries and highly demand-responsive QR production involving vertical integration and a series of dedicated (captive) suppliers working in exclusive. Only the automotive has seen no radical shift in power relationships, as the dominant position of carmakers has been further strengthened by specialization in high value-added design activities that create quasi-insurmountable barriers to entry; once the pioneers of lean production, carmakers have lately been looking for a higher degree of demand responsiveness, individuation in an increased share of BTO vehicles the answer to the costly practice of accumulating large stocks of basic versions of vehicles.

What has arisen from the analysis is that a common resistance to move from streamlined mass production to more responsive supply chains has often come from the adversarial characteristics of many manufacturer-supplier relationships, which have only begun to be overcome once profit pressure has started to erode long established market positions which had come to be seen as quasi-rents, in the past times of low

competition and protectionism. This is all to say that consumer demand, shaped by the huge information flows that characterize this digital, globalized era, has become the main driver of the transformation of manufacturers into demand-conscious cores of increasingly coherent supply chains.

7.1 – RECOMMENDATIONS FOR FURTHER RESEARCH

This thesis can be seen as an exploratory study on comparing different supply chains. Future studies could build upon this thesis to further explore similarities and differences between the supply chains of several industries, such as the aircraft manufacturing, mining, military, etc.

Furthermore, the pharmaceutical industry still has a long way to go to achieve SCM excellency, leaving plenty of space for studies investigating how agile SC systems could best be applied to this fundamental industry.

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APPENDIX – QUESTIONNAIRE SUBMITTED TO MR. O'DONOHUE OF TNT

AUTOMOTIVE INDUSTRY SUPPLY CHAIN (ASC)

1. What kind of services does TNT provide to the automotive industry?
2. How long has TNT been providing this/these service(s) for?
3. Does TNT consider the automotive industry a growth market? If so, why?
4. How would you rank the services your company provides to the automotive industry, in terms of contribution to profit?
5. Which service within the ASC, in your opinion, shows the greatest growth potential for a company like TNT?
6. There is increasing interest, among carmakers, for a more demand-responsive SC, to be achieved through a shift toward a “Build-to-Order” model of manufacturing. Do you see this shift as an opportunity for companies such as TNT? Why?

FASHION SUPPLY CHAIN (FSC)

1. What kind of services does TNT provide to the fashion industry?
2. How long has TNT been providing this/these service(s) for?
3. Does TNT consider the fashion/textile/apparel industry a growth market? If so, why?

4. Which service within the FSC, in your opinion, shows the greatest growth potential for a company like TNT?
5. Do you see the emergence of own-brand retailers, such as Zara, H&M, etc., as an opportunity for TNT? If so, how? If not, why?

PHARMACEUTICAL SUPPLY CHAIN (PSC)

1. What kind of service does TNT provide to the pharmaceutical industry?
2. How long has TNT been providing this/these service(s) for?
3. Does TNT work directly with drug manufacturers or wholesalers, or both?
4. Would you agree that companies such as TNT have the potential to “disintermediate” the market, by providing logistics services directly to manufacturers, thus bypassing wholesalers? Why?
5. The issue of warehousing is one of the main reasons why wholesalers have shown resilience in the face of competition by 3PLs, as the latter appear to be reluctant to offer this kind of service. What is TNT’s position on this issue?
6. As drug manufacturers attempt to diversify their business – as patent protection on many drugs is expiring – they have shown increasing interest, in particular in the US, for customized treatments to be delivered directly at the patient/customer’s domicile. Do you see a potential for this kind of service in Europe, maybe in collaboration with logistics providers such as TNT?