Optimization of a Supply Chain: Christian Dior Couture

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Abstract

Nowadays, all the enterprises in the fashion industry face the problem of variability of supply and demand. Working in fashion implies facing rapid changes, and the success or failure of a company is often determined by the company's ability to adapt and respond quickly to these changes. In addition to having to deal with large quantities of information, the companies must ensure the availability of all their products, in all the stores worldwide, while optimizing inventory levels. This research will focus on Christian Dior Couture and more specifically on the Eyewear.

The immediate objective of this research project is to optimize the inventory while maintaining the sales. The information on stock out rates crossed with the sales quantity, the stock and the coverage enables supply chain's managers to make decisions at a store level and at a reference level to reduce the stock at its optimal value without compromising the sales' level. In the future, further studies could be made to try and optimise the reordered quantities in addition to optimizing the current stores' stock.

Keywords:
Fashion industry, Variability, Supply and Demand, Inventory Levels, Christian Dior Couture, Accessories, Eyewear

Abbreviations:
CDC : Christian Dior Couture
SCM : Supply Chain Management
POS : Point of Sales
RTW : Ready-to-Wear
TBR : "To-be-received"
SKU : Stock-Keeping Unit
1 Introduction

This section pictures an introduction to the project by presenting the Supply Chain, logistics in the luxury industry and the company: Christian Dior Couture. The research questions, purpose and goals behind the project will also be presented.

1.1 Background

1.1.1 What is the purpose of a Supply Chain?

What is called “Supply Chain” is the group of people, enterprises and organization which participate in providing a service or delivering a product from a supplier to a customer [1].

The Supply Chain Management (SCM) is different from pure logistics in that it is primarily a form of knowledge used to design at the same time an operational and optimal management. This management includes the design of both the best sequence of tasks possible (depicted by the term “chain”) and the well-functioning of the logistics system, as set in the specifications.

Thus, the supply chain supports the overall management of material flows (or goods). To do this, it directly manages the concerned activities, or in any case is likely to ensure close cooperation with stakeholders or relevant third, in order to control / manage flows and stocks of finished products, ongoing products, semi-finished products, raw materials involved [2] ... but also:

- resources (internal human resources or external service providers: suppliers, storage, warehousing, transportation, freight, ...).
- the equipment necessary for the realization of logistics services (warehousing, tools, machines, material handling, clean vehicles, ...).
- supplies (packaging, consumables, energy and fuel sources ...).
- services (planning, warehousing, packaging, handling, transport, export, customs, billing ...).
- information systems.

In some activities, the proficiency of logistics can establish a competitive advantage against the competitors on the market with the key opportunity to increase sales and/or market share and to improve or defend the profit margin of the company.

When you first put in place a Supply Chain department in a company in which stock is involved, you find out that, from the start, stock has been continuously sent to the different point of sales but it has never been controlled.

During this internship, my main role will be to build a rotation of the global stocks while maintaining the sales to prevent unsold pieces to keep piling up and never disappear. At the same time it will be of the utmost importance to make sure that none of the stores lack any
of the best seller pieces or any newness while decreasing the stock on old collections' references.

This “double-challenge” is the key for a well-oiled Supply Chain in the fashion industry.

1.1.2 Why is the SCM necessary?

The SCM is the most essential department of a company since it manages the "operational efficiency". The Supply Chain Management can be applied to numerous factors, but it becomes critical when it comes to the company’s success and the customers’ satisfaction. Indeed the SCM helps improving the customer service by ensuring that the right assortment of products, as well as the right amount of it, are delivered on time. It must also make sure that these pieces end up in the right location according to the customers’ preferences. The SCM should also provide a quality after-sale support to the customers and a customized approach depending on the product itself.

The Supply Chain’s role is to globally apprehend the whereabouts of the products inside the distribution network. The SCM handles the flow of products by forecasting the sales and controlling the movements of stocks. It is basically the essential intermediate between the "uphill departments" (design, marketing, production) and the "downhill department" (the stores) without for all that meddling in the other departments’ areas of work. Its main purpose is to make coincide the offer and demand in order to optimize the sales.

1.1.3 The luxury industry confronted with the demands of Retail Management.

In terms of image and customer’s satisfaction, it is imperative in the luxury industry to provide an impeccable service. However, due to the fact that the luxury industry has met a severe mutation in its distribution mode in the past few years, most brands need to update their supplying methods in order to being able to provide such a service.

In fact, in order to totally control their brand from the idea of a product to the final customer, many companies have deserted the traditional "indirect approach" (also called Wholesale) to create their own store network (known as Retail). This type of distribution is the natural evolution of any strong brand because, with this controlled network of POS, the marketing side of the company can be fully mastered, the independence of the company is reinforced, complete universes with guidelines stories can be created within the stores and, last but not least, the profitability increases thanks to the growing margins of costs.

But to evolve from Wholesale to Retail is not an easy task. From this point, the company is the only responsible for the product from
its production until its effective sale. It has to handle the supplying of
the stores while avoiding stock-out situations as well as overstocks, it
has to decide on the most appropriate commercial choices adapting to
each POS and, finally, with a growing number of stores, it has to take
in charge a genuine international network whose handling requires an
adequate organization.
In the Retail model, the stakes can be qualified as follow: "always have
the right product, in the right place and in the right quantities".

Far from being specific to the luxury industry, this Supply Chain
problematic is the same in a lot of different sectors whose experience
in the domain can be instructive. In particular, it is the case of the
ready-to-wear brands which, despite their differences with the luxury
industry, present some interesting analogies. Indeed, since they were
confronted earlier to the stakes of Retail Management, they also had to
adapt and develop "Supply Chain guidelines". They actually were the
first to do so and this is the reason why today they still have prevailing
positions in the market. [27]

1.1.4 Logistics in the fashion industry: what are the
particularities and the specificities?

The main challenges for the Supply Chain in the luxury industry are
as follow [5]:

- **To adapt the logistics organization to the rapidly growing
  internationalization of its activities.** The different methods
  chosen by the luxury companies show themselves more or less
  able to handle a large-scale international expansion.

- **To face the diversification of products and brands.** There
  are an increasing number of references and fewer products for
  each reference, and the Supply Chain must handle, at competitive
  costs, products whose characteristics and marketing constraints
differ.

- **To predict the market fluctuations for the sake of fashion.**
  There are 5 different collections throughout the year (Cruise,
  Spring, Summer, Fall and Winter) so the available products change
  all the time. We call this phenomenon the "seasonality of the
  products".

- **To manage the constraints due to the multiplication of
distribution formats.** Logistics must be able to handle dif-
ferent volumes of orders depending on the origin of the request
(initial orders, replenishment orders, clients' orders, ...).

- **To optimize the inventory levels.** Inventory management is
  not just their systematic reduction but rather their optimization
  by avoiding stock-outs, creating value with speculative stocks,
  securing stocks and reducing the risk of depreciation.
To adapt to the problem of the accelerating time-to-market (shortening of products’ life cycle, frequent introductions of new models, seasonality issues, ...).

To handle the multiplication of distribution zones: there are more and more stores in Asia, China and Eastern Europe!

These strategic challenges determine the choices which the logistics organizations need to make in order to support and secure the development of the company [5].

Addressing these challenges, logistics organizations differ greatly. Depending on the type of approach which the Supply Chain chooses, three models of logistics organizations emerge [16]:

- The offensive (or proactive) model, making the Supply Chain a vector of overall support for the deployment strategies.
- The pragmatic (or reactive) model in which the Supply Chain is designed as a support function to be optimized. In this case, the luxury companies recast their logistics to respond to key issues in the sector.
- The traditional model, in which the Supply Chain process is limited to the optimization of one or more links in the value chain without trying to optimize a whole. The approach is primarily a logical improvement of existing processes.

The analysis of these models and their comparison enable us to understand the logistics choices followed by luxury companies and to assess in which way the Supply Chain is a key factor in improving the performances of the company.

1.1.5 What distinguishes the luxury industry from other fashion industry?

Compared to the classical issues apprehended by the fashion industry, the luxury industry has a few specificities of its own [27]:

- It needs to take into account the prospect of "VIP" customers which inserts exceptions into the products’ cycle. The luxury industry involves custom-made pieces, full deposit sales, bookings... It raises the issue of integrating these exceptions in the most industrialized way possible in order not to disturb the SCM.
- Often used in the "upscale" industry, for high value products and shallow depth of stock, the rebalancing consist in transferring pieces from one store to another for specific clients’ needs or in order to secure the sales’ trend. This process is quite expensive and time-consuming but it can be semi-automatized thanks to the SCM and therefore be integrated in the global management of flows.
- The "cleansing" process at the end of a collection often needs to be furtherly conducted than in classic Retail in order not to "disrupt" the new collection with former collection’s pieces.
It should also be considered that luxury brands can adopt a rarity strategy on some key products. In these cases, the stock is manually dispatched after a thorough analysis of the needs and sales of the different POS.

However, the tools and methods which enable to rationalize and automatize the supplying process of the stores' network of a luxury brand do exist since they are identical to the ones used by RTW brands. They neither question its specificity nor its creativity. On the contrary, they enable the luxury brands to provide an upscale service, the only service which suits the image of the luxury industry. 

1.1.6 Dior: ambassador of French Luxury

Christian Dior SA (commonly called simply “Dior”) is a French holding company which was created in 1946. Legacy of the dressmaker Christian Dior, the company has also diversified in a major way towards make-up, skincare, fragrance, fashion accessories, jewelry, leather goods, footwear and timepieces in addition to ready-to-wear. While the Christian Dior label remains largely for women’s offerings, the company also operates the Dior Homme division for men and the baby Dior label for children’s-wear.

Belonging to Bernard Arnault’s group of which it is the top holding company controlling LVMH, Christian Dior SA is one of the largest companies in the world in the luxury industry. As of September 2010, the company has more than 200 stores worldwide and has a turnover of more than 20 billions Euros.

1.2 Purpose

The research question of this project will be stated as:

**How to improve the sales at CDC, while maintaining the lowest stock possible in each Point of Sales?**

For this purpose, a case study will be conducted on Eyewear and then the findings will be generalized to the other products sold by CDC. The parameters which will be the most important are the *sales quantity* (the sales value could have been chosen instead, but since all Eyewear are approximately the same price at CDC, both parameters are quite the same to study), the *stock-out rates* (which is the percentage of stores which should have stock but don’t) and the *coverage* (which is the number of months of stock available). This goal will be considered achieved if the coverage for Eyewear is under 6 months in volume while the sales trend remains superior to last year’s sales. This will be done by performing a 6-months internship at Christian Dior Couture and conducting a case-study on the subject.
2 Related work

In order to find out what has been done in the area of optimization of logistics in luxury companies, this brief section will mention some of the research that has been done in the area. The first section will describe the research that has been done before on SCM and the existing theories, the second section will handle previous research in the field of logistics and in the Fashion Industry.

2.1 Supply Chain Management: previous research and theory

The SCM, introduced in the 80s, has been the subject of a special attention from the companies and has been the center of numerous research topics from the 90s on. The purpose of this section is to present a synthesis of the works previously written on SCM which show well the diversity and dynamics of this field, but also to emphasize the fact that none of the current theories on this topic enable to understand this concept in its whole.

Since the beginning of the 80s, the ever-changing markets led to a deep questioning of the traditional organizational models (centralized, hierarchical, wasteful,...) and to the emergence of a new paradigm [32]. The new forms of organizations are built on a customer-oriented and transverse process of managing [33]. These new structural forms all share common characteristics of flexibility, coordination, adaptability and anticipation [34].

However, the instability of global markets combined to the growing externalization of many activities (to follow companies’ process of re-focusing on their core competencies), leads to the quick evolution of the rules of competition. It seems to overtake the intra-organizational methods to use an inter-organizational method as a new management paradigm [35].

For more than 25 years, the SCM has been the core subject of an abundance of work : specialized magazines (Journal of Supply Chain Management, Supply Chain Management Review,…), thematic publications in many management papers (la Revue Française de Gestion in September 2008), numerous books,..
There are not many concepts which have known such a success (over 1000 articles from more than 50 magazines [36]).

The popularity of this concept should however not conceal the remaining interrogations: there are three main questions still pending. First of all, SCM is a largely polysemic term since there are many different definitions which encompass a wide variety of fields [37]. Then, there exists a desire to account for all forms of organization in the SCM which affects the complete understanding of the concept [38]. And last,
the choice of words to describe the SCM doesn’t reflect faithfully business practices [39]. These interrogations induce a growing effort to find theoretical foundations in order to fully understand the concept, which lead to number of meta-analysis.

2.2 Other previous research linked to the SCM

2.2.1 Related work in the field of Logistics

The basic supply chain approach is to try to forecast the future demand as accurately as possible based on the past demand. This forecasting is necessary to make sure to produce enough stock to satisfy the customers without producing too much stock which would lead to an inventory too big to be sold out and would cause the company to lose money [11].

The advantages of this method are that it needs only a small database and a few manipulations. The remaining unpredictability can be countered by setting a safety stock level [12].

Then, using the previous forecast, a supply chain plan is put in place to produce the optimal amount of products at lowest cost (or highest profitability).

The possibility to create and manipulate larger databases and to do so more quickly has led to new supply chain optimization solutions, which enable companies to predict the demand for each product, for each customer for each day. They can then compute the most desirable inventory level for each product and for each store: this optimized inventory level is called “model stock” [13].

2.2.2 Related work on the Fashion Industry

The Fashion Industry has always interested researchers, but what were usually considered are the sociological and psychological sides of this particular industry and the processes by which fashions are adopted by people and populations [6]. Along with this they tried to determine what we can call “cycles” in fashion [7].

Most of the earlier work intended to create tools and methods to forecast the demand of fashion products [10], however the reality which becomes commonly accepted, by both the ones who work in fashion and the ones who study it, is that fashion can’t be forecasted.

Instead, we need to represent fashion markets as complex open systems with high levels of “chaos” [10]. Nowadays, researchers tend to focus on the supply chain as a real-time problem, and try to find strategies and methods capable to deal with this “agile supply chain” [8, 9].
3 Method

This part of the report will explain what methods will be used during this internship at CDC. The first section will describe how the study will be conducted and the second section will show how the data which will be gathered during the internship will be analyzed. For the good conduct of this report, the exact process to follow must be quite clear and for that to be possible, it is first necessary to understand how the Supply Chain at CDC currently works. After describing the method and collecting the data, the results will be described in paragraph 4. and analyzed in paragraph 5.

3.1 Case Study

According to Dictionary.com, a case study is “a study of an individual unit, as a person, family, or social group, usually emphasizing developmental issues and relationships with the environment, especially in order to compare a larger group to the individual unit”.

This case study [18] will be organized in different phases according to the general organization of phases that is provided in Single and Multiple-Case Study Designs [14] as shown in figure (1).

This section will describe the way the case study should be done. Hopefully, all of these steps will be followed as thoroughly as possible; however, depending on the freedom given during the internship at CDC, a few of the steps might change along the way.

The first step here will be to design a plan on how to gather the data needed for the analysis and also to answer the following question: “How will these data be connected to the initial research question?”

The second step will be to actually collect the data. [24] In the case of this thesis, it will mostly be documents provided by CDC which will be used, as well as data which will have been compiled during the internship.

The sales data which will be needed for the analysis should be both on a store level and on a reference level. Information on how well the stores perform (number of sales per month, per year, the seasonality of sales, ...) will also be relevant, as well as information on how well each reference perform (Is it a best seller? Is it a real fashion statement?).

The stock data should also be at both a store and reference level and should be crossed with the size of the backrooms of the different stores and the number of pieces in display in each store.

It is important for all of these documents to be well structured to simplify the analysis which will come afterwards and to make it easier to give valid references in the next two steps. “There are five different ways of collecting data: documentation, physical artifacts, direct observations, interviews and archival records. Each have their pros and cons.” [15]

Documentation, physical artifacts and archival records can be used as solid references and will be very useful in this analysis, but not before
being thoroughly examined and analyzed to avoid using out-of-date data.
Direct observations will be performed on a daily-basis and will provide answers and valuable information on the organizations of the SCM at CDC.
The interviews will be replaced by conversations with the internship manager and will focus on the quantitative means to decrease the coverage while maintaining a low stock-out rates and a high level of sales. This is the reason why it is very important that all the questions on the matter shall be saked. Moreover, through these questions it will be possible to see the differences between the direct observations and how the SCM really works. These conversations will be very helpful in phase two.

![Figure 1: General organization of phases in the case study](image)

Once the data is collected, it is possible to move on to step three. The data now needs to be sorted and dispatched into two groups: relevant and non-relevant data. To conduct this case study, only the data which is considered relevant according to the research question will be used.
3.2 Analysis method

The data which will be collected is mainly information on stock out rates, sales quantity, stores’ stock, buffer stock, stock in transit, stock to be delivered and coverage.

The stock out rates can be calculated at both a store level and a reference level. At a store level, it is the percentage of references which the store should have in stock based on its optimal inventory but doesn’t have in stock compared to the number of references in the optimal inventory of the store. At a reference level, it is the percentage of stores which should have the reference in stock based on the optimal inventories but don’t have in stock compared on the number of stores which have the reference in their optimal inventory.

\[
\text{SOR}_{\text{store level}} = \frac{\# \text{ references in the store’s optimal inventory which are not in stock}}{\# \text{ references in the store’s optimal inventory}}
\]

\[
\text{SOR}_{\text{reference level}} = \frac{\# \text{ stores which have the reference in their optimal inventory but not in stock}}{\# \text{ stores which have the reference in their optimal inventory}}
\]

There are two different problematic stock’s situation:

- **The stock out situation**: in that case, the main issue is to lose sales due to the lack of stock on a particular reference.

- **The overstock situation**: it is when we have too many pieces in stock. In that case, there are two main issues possible. The first one is that the overstock pieces in one store might have greater chances of being sold in another store: we are then missing sales in that other store which could have taken benefit from these overstock pieces. The other main problem which is often overlooked, is that the backrooms of the stores are often very small and that these overstock pieces are taking room where some pieces with greater chances of being sold could have been stored.

The most important question that needs to be answered in order to analyze the data is “how to know if there is just the right amount of inventory?” One way is to compare the value of your current inventory to an “ideal inventory investment.” [19] Based on the predictable demand during a specific time period (previous sales for example, but forecasted sales would also work), the inventory coverage can be calculated. The method here is to choose a “target coverage”, which is the time the current stock needs to last until next delivery of new pieces, and to put in stores the amount of stock which guarantees this “target coverage”.

The coverage is basically the number of months of sales that a given stock covers. To calculate the coverage we use the following equation [28].

\[
\text{coverage} = \frac{N \times \text{store’s stock + buffer stock + TBR stock + stock in transit}}{\text{sales last } N \text{ months}}
\]

There are three main steps in the analysis method:
• analyze the sales for each store in the world and globally and see if there are some obvious choice to make to increase the sales.
• analyze the monthly sales and stock of each store and establish a classification of stores (Does this store sales mostly fashion items? Does it have a high traffic?).
• analyze the stock out rates, the coverage and monthly sales and decide of actions to be done to optimize both coverage and stock out rates.

3.2.1 Definitions

Before describing the three steps of this analysis, let’s explain some of the vocabulary which will be used.

• **Zone:** At CDC, the world is divided in 5 zones: Europe, China, Japan, the rest of Asia (which will be called Asia in the rest of this document) and the US.

• **SKU ("Stock-Keeping Unit"):** It is the reference of a product. [20]

• **Core:** It is an assortment of Best Seller references which are present in all the stores in important quantities. [21]

• **Growth:** The growth is calculated by using the following equation:

\[
growth = \frac{\text{this year's sales}}{\text{last year's sales}} - 1
\]

• **Depth:** When there is a large quantity of a particular SKU, we say that there is “depth” on that SKU.

• **Asian Fitting Eyewear:** It is a king of Eyewear specially adapted to Asian faces. [22] Since Asian people tend to have a smaller nose and less prominent cheeks, these Eyewear will fit them better than the International Fitting ones.

• **Seasonality:** It corresponds to the cyclic variation of sales.

• **High-Season stores:** These are stores which are opened during only part of the year.

• **To push:** To place large quantity of some SKUs in chosen stores in order to force the sales.

• **Target (or Model Stock):** To optimize stock levels, we calculate the most desirable inventory level for each product and for each store: this optimized inventory level is called “Target” or “Model Stock”.

• **Buffer Stock:** It is the stock which is already available in central stock to be sent in stores.

• **Retail Stock:** Stock in stores.
• **TBR Stock**: Stock “to-be-received”. It has been ordered but has not been delivered to central stock yet.

• **Year-to-date (YTD)**: It is the period of time between the beginning of the year and today’s date. Also the month-to-date (MTD) is the period of time between the beginning of the month and today’s date and the week-to-date (WTD) is the period of time between the beginning of the week and today’s date.

• **Sell-Through Rate**: It is the ratio of the quantity of pieces which has been sold of one particular reference versus the quantity ordered. [23]

### 3.2.2 Step 1
In this first step, a global analysis will be conducted at a zone level and at a store level. This analysis is meant to show global trends such as:

- which zone sells more Eyewear?
- are the zones’ growth positive?
- what kind of Eyewear does each zone sell most? (Asian Fitting, Colored, Fashion, …)
- does the zone sell a lot of Core references?
- what is the seasonality of the zone?

and more localized trends such as:

- which store has the best growth?
- is there a real gap between the best month and the worst month?

The goal of this analysis is to see if there is an obvious parameter to change in order to sell more pieces. For example, it might become clear that the best stores sell more than 50% of Asian Fitting pieces; therefore it could be a good idea to push some Asian Fitting pieces in the worst stores in order to improve their sales.

The data will be organized in tables and charts as shown in figure (2), figure (3) and figure (4).

<table>
<thead>
<tr>
<th>Zone</th>
<th>Sales YTD (in quantity)</th>
<th>Average monthly sales (in quantity)</th>
<th>Growth (in quantity)</th>
<th>Growth (in value)</th>
<th>Sales Eyewear “colored” (%)</th>
<th>Sales Eyewear “Classic colors” (%)</th>
<th>Sales Core (%)</th>
<th>Sales Asian Fitting (%)</th>
<th>Sales International Fitting (%)</th>
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Figure 2: Zone Analysis
3.2.3 Step 2

The goal of the second step will be to establish a classification of stores. Seven types of stores could be defined:

- **Flagships**: They are the biggest stores and are in tremendous growth both in quantity and in value. These stores have a large assortment of SKUs and there is depth on these SKUs. They are delivered almost every day.

- **Luxury Stores**: These stores sell less pieces but more expensive ones. They have a pricier assortment (and a lot of special edition SKUs) but there is no depth on these SKUs.

- **Stores In Growth**: They are smaller than the Flagships but we are willing to help them improve their growth, which is why we tend to push a lot of SKUs in these stores. Their main goal is to become Flagships.

- **Stores In Decay**: Their main goal is to be in growth, which is why we tend to give them a lot of Core references to help them get back on their feet.

- **Cheap Stores**: These stores have an average sale price which is very low. They are mostly high-season stores.

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Store</th>
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<td>1</td>
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![Seasonality - Eyewear - Europe](image)

Figure 3: Seasonality

![Store Analysis](image)

Figure 4: Store Analysis
• Too-Many-SKUs Stores: These are stores which mostly sell Core references and almost exclusively to tourists. Their goal is to reduce the sales on Core SKUS and to increase the sales on other references.

• Other Stores: These stores are mostly stores which are well positioned in prestigious places where a lot of people pass by and see them. They need to have stock for display but hardly sell anything.

This step is meant to give us a clearer picture of the stores, their capacities and their goals.

3.2.4 Step 3

Step 3 will try to define which actions should be taken to optimize both coverage and stock out rates. This analyze will be performed on two levels for each zone: a SKU level and a store level.

Firstly, for each zone and for each each SKU the following information should be gathered:

- last 2 months' sales
- the number of targets for this SKU in the entire zone
- last 5 weeks' stock out rates
- the number of pieces in buffer stock
- the number of pieces in transit (between central stock and stores)
- the total stock in the zone (retail stock + buffer stock + stock in transit)
- the stock to-be-received (TBR)

In a second step, for each store in the zone, the following information will be extracted from the database:

- last 5 weeks' stock out rates
- the number of SKUs which are in stock-out
- last 2 months' sales
- the number of pieces in display in the store
- the available stock and the stock in transit
- the number of targets in this store

From this information, the coverage for each store can be calculated.

This step is giving us essential information for this analysis.

The data will be organized in tables as shown in figure (5) and figure (6).
### Figure 5: Zone Analysis

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<th>SKU 1</th>
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### Figure 6: Zone Analysis

<table>
<thead>
<tr>
<th>Store</th>
<th>Stock Out Rate Week N-4 (%)</th>
<th>Stock Out Rate Week N-3 (%)</th>
<th>Stock Out Rate Week N-2 (%)</th>
<th>Stock Out Rate Week N-1 (%)</th>
<th>Stock Out Rate Week N (%)</th>
<th>#SKU in Stock-Out</th>
<th>Stock Last 2 Months (in quantity)</th>
<th>#Pieces in Display</th>
<th>Available Stock (in quantity)</th>
<th>#SKU in stock</th>
<th>Stock in transit (in quantity)</th>
<th>Coverage on hand (in months)</th>
<th>#Targets for the store</th>
</tr>
</thead>
<tbody>
<tr>
<td>Store A</td>
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<td>Store B</td>
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<td>Store C</td>
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</table>
4 Results

4.1 Data Collection

From the data collected, it appears obvious that there are two types of products that need to be analyzed differently: Newness and Carry Over References.

- What is called Newness are the items from the new collection.
- After a month in stores, these Newness can either be reordered, in which case they become Carry Over References, or not, in which case we just want to optimize the Sell-Through Rate.

4.1.1 Newness

There are two different ways to handle the Newness.

- The first way consists of putting these new references in every POS at first. Then, after about 3 weeks in the stores, transfers are completed to re-balance the stock in the stores which have shown the greatest sales’ potential for these SKUs. This way every store gets a chance at selling these Newness and it also enables the smallest stores to renew their assortments even though they might not sell a lot.
- The second way consists of putting the Newness only in Flagship stores. After about 10 days, if the references have shown potential, the SCM chooses to expand the perimeter to other POS being limited only by the initial orders quantities.

4.1.2 Carry Over References

After that, the Newness which is reordered will become Carry Over references and they can be part of this analysis. Based on the data collected in step 3, two types of analysis will be conducted: a SKU analysis for each zone and a store analysis.

First, let’s explain a few guidelines:

- The goal is to keep a retail coverage inferior to 4 months of stock.
- It is important to maintain a Stock-Out Rate inferior to 10% for each SKU and for each store, and inferior to 5% for Core references.

The parameters initially chosen were 3 months of stock and 15% of stock out rates. But they were iteratively adjusted during the study until these more optimal parameters became a general guideline.

4.2 Data Analysis

Once all the data has been collected and analyzed, each store belongs to a category and has a specific goal. Based on that goal and on the data collected in step 3 of this method, it will be possible to minimize the stock in each POS while making sure that no sale is compromised.
4.2.1 SKU analysis

There are 4 scenarios in which the guidelines explained in 4.1.2 are not respected as shown in figure (7).

**Figure 7: SKU Analysis: different scenarios**

- In the first scenario, the Retail Coverage is within boundaries but the Stock-Out Rate is too high while there is some buffer stock. In that case, the targets need to be reviewed because if they were optimal, the buffer stock would have been sent to the stores before it was in Stock-Out.

- In the second scenario, the Retail Coverage is still within boundaries, the Stock-Out Rate is too high but there is no buffer stock. In that case, some stock must be put back on the buffer stock. The solutions usually are to ask the producer for some pieces in priority on the order to-be-delivered or to transfer some stock from the buffer stock of another zone which needs it less at the moment.

- In the third scenario, the Stock-Out Rate is too high, there is no buffer stock but the Retail Coverage is too high. In that case, the

<table>
<thead>
<tr>
<th>Scenario 1</th>
<th>Sales last 2 months (in quantity)</th>
<th># Stores with Targets</th>
<th>Stock Out (%)</th>
<th>Buffer Stock (in quantity)</th>
<th>Stock in Transit (in quantity)</th>
<th>Total Stock Zone (in quantity)</th>
<th>Stock To-Be-Received (in quantity)</th>
<th>Coverage Retail Stock (in months)</th>
<th>Coverage Global Stock (in months)</th>
</tr>
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<tbody>
<tr>
<td>SKU 1</td>
<td>45</td>
<td>60</td>
<td>0% 2% 5% 9% 13%</td>
<td>2</td>
<td>88</td>
<td>50</td>
<td>M-1 &amp; Before</td>
<td>2.1</td>
<td>3.9</td>
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</tbody>
</table>

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<thead>
<tr>
<th>Scenario 2</th>
<th>Sales last 2 months (in quantity)</th>
<th># Stores with Targets</th>
<th>Stock Out (%)</th>
<th>Buffer Stock (in quantity)</th>
<th>Stock in Transit (in quantity)</th>
<th>Total Stock Zone (in quantity)</th>
<th>Stock To-Be-Received (in quantity)</th>
<th>Coverage Retail Stock (in months)</th>
<th>Coverage Global Stock (in months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SKU 2</td>
<td>45</td>
<td>60</td>
<td>0% 2% 5% 9% 13%</td>
<td>2</td>
<td>88</td>
<td>50</td>
<td>M-2 &amp; M-1 M M</td>
<td>3.9</td>
<td>3.9</td>
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</table>

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<thead>
<tr>
<th>Scenario 3</th>
<th>Sales last 2 months (in quantity)</th>
<th># Stores with Targets</th>
<th>Stock Out (%)</th>
<th>Buffer Stock (in quantity)</th>
<th>Stock in Transit (in quantity)</th>
<th>Total Stock Zone (in quantity)</th>
<th>Stock To-Be-Received (in quantity)</th>
<th>Coverage Retail Stock (in months)</th>
<th>Coverage Global Stock (in months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SKU 3</td>
<td>45</td>
<td>60</td>
<td>0% 2% 5% 9% 13%</td>
<td>2</td>
<td>150</td>
<td>50</td>
<td>M-2 &amp; M-1 M M</td>
<td>6.7</td>
<td>6.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scenario 4</th>
<th>Sales last 2 months (in quantity)</th>
<th># Stores with Targets</th>
<th>Stock Out (%)</th>
<th>Buffer Stock (in quantity)</th>
<th>Stock in Transit (in quantity)</th>
<th>Total Stock Zone (in quantity)</th>
<th>Stock To-Be-Received (in quantity)</th>
<th>Coverage Retail Stock (in months)</th>
<th>Coverage Global Stock (in months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SKU 4</td>
<td>45</td>
<td>60</td>
<td>0% 2% 5% 8% 8%</td>
<td>2</td>
<td>150</td>
<td>50</td>
<td>M-2 &amp; M-1 M M</td>
<td>6.7</td>
<td>6.7</td>
</tr>
</tbody>
</table>
stock must be re-balanced from slow-selling stores to best-selling stores in order to optimize the position of the stock in regard to the sales.

• In the last scenario, the Stock-Out Rate is within boundaries, there is no buffer stock but the Retail Coverage is too high. In that case, the targets need to be decreased, because if they were optimal, the Retail Coverage would be under 4 months of stock.

These 4 scenarios are the only problematic scenarios which can be encountered since, for all the parameters, the only concern is whether they are above or under a certain level.

4.2.2 Store analysis

There are 3 scenarios in which the guidelines stated in 4.1.2 are not respected as shown in figure (8).

Scenario 1

<table>
<thead>
<tr>
<th>Store</th>
<th>Stock Out Rate Week N-4 (%)</th>
<th>Stock Out Rate Week N-3 (%)</th>
<th>Stock Out Rate Week N-2 (%)</th>
<th>Stock Out Rate Week N-1 (%)</th>
<th>#SKUs in Stock-Out</th>
<th>Sales last 2 months (in quantity)</th>
<th>Pieces in Display</th>
<th>Available Stock (in quantity)</th>
<th>#SKUs in stock</th>
<th>Stock In transit (in quantity)</th>
<th>Coverage on hand (in months)</th>
<th>#Targets for the store</th>
</tr>
</thead>
<tbody>
<tr>
<td>Store A</td>
<td>0%</td>
<td>2%</td>
<td>5%</td>
<td>6%</td>
<td>13%</td>
<td>2</td>
<td>100</td>
<td>40</td>
<td>72</td>
<td>45</td>
<td>5</td>
<td>1.5</td>
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</table>

Scenario 2

<table>
<thead>
<tr>
<th>Store</th>
<th>Stock Out Rate Week N-4 (%)</th>
<th>Stock Out Rate Week N-3 (%)</th>
<th>Stock Out Rate Week N-2 (%)</th>
<th>Stock Out Rate Week N-1 (%)</th>
<th>#SKUs in Stock-Out</th>
<th>Sales last 2 months (in quantity)</th>
<th>Pieces in Display</th>
<th>Available Stock (in quantity)</th>
<th>#SKUs in stock</th>
<th>Stock In transit (in quantity)</th>
<th>Coverage on hand (in months)</th>
<th>#Targets for the store</th>
</tr>
</thead>
<tbody>
<tr>
<td>Store B</td>
<td>0%</td>
<td>2%</td>
<td>5%</td>
<td>6%</td>
<td>6%</td>
<td>2</td>
<td>47</td>
<td>40</td>
<td>128</td>
<td>45</td>
<td>5</td>
<td>5.7</td>
</tr>
</tbody>
</table>

Scenario 3

<table>
<thead>
<tr>
<th>Store</th>
<th>Stock Out Rate Week N-4 (%)</th>
<th>Stock Out Rate Week N-3 (%)</th>
<th>Stock Out Rate Week N-2 (%)</th>
<th>Stock Out Rate Week N-1 (%)</th>
<th>#SKUs in Stock-Out</th>
<th>Sales last 2 months (in quantity)</th>
<th>Pieces in Display</th>
<th>Available Stock (in quantity)</th>
<th>#SKUs in stock</th>
<th>Stock In transit (in quantity)</th>
<th>Coverage on hand (in months)</th>
<th>#Targets for the store</th>
</tr>
</thead>
<tbody>
<tr>
<td>Store C</td>
<td>0%</td>
<td>2%</td>
<td>5%</td>
<td>6%</td>
<td>13%</td>
<td>2</td>
<td>47</td>
<td>40</td>
<td>128</td>
<td>45</td>
<td>5</td>
<td>5.7</td>
</tr>
</tbody>
</table>

Figure 8: SKU Analysis: different scenarios

• In the first scenario, the Retail Coverage is within boundaries but the Stock-Out Rate is too high. In that case, the targets need to be increased for the SKUs which are in Stock-Out.

• In the second scenario, the Retail Coverage is too high while the Stock-Out Rate is correct. In that case, the targets need to be decreased for the SKUs which the store doesn’t sell.

• In the third scenario, both the Stock-Out Rate and the Retail Coverage are too high. In that case, all the targets must be reviewed (increasing the targets for the SKUs which are in Stock-Out and decreasing the targets for the SKUs which the store doesn’t sell) and the stores should also try to re-balance the stock from slow-selling stores to best-selling stores in order to optimize the position of the stock in regard to the sales.

In the same way as for the SKU analysis, these 3 scenarios are the only problematic scenarios which can be encountered.
4.2.3 Process

With this analysis, the targets are adjusted every week. After a month or so, the targets should be optimal and hence the stock will become optimal too in time, following the targets’ trend.

![Figure 9: Stock's trend following the targets' trend and becoming optimal](image)

Figure 9: Stock’s trend following the targets’ trend and becoming optimal

We can very clearly see the stock’s trend following the targets’ trend in figure (9) and becoming "optimal" in the end since it matches the sales exactly.

Of course, since the references are renewed all the time, this analysis should be done regularly in order to keep optimal targets for all the references, adapting the targets to the various events of the year.
5 Validity, Reliability

5.1 Validity

In this study, both internal and external validity will be of concern.

5.1.1 Internal Validity

“It is concerned with the degree of certainty that observed effects in an experiment are actually the result of the experimental treatment, rather than intervening or confounding variables.” [17]

The study lasted 6 months, and during all that time there was no shortage of production, so it can be assessed that the availability of stock did not have a role to play in the change of the results during that time.

Also, since 6 months is a long time, it is most likely that the changes observed were not induced by the seasonality of sales. Indeed, since the seasonality of sales on Eyewear is quite simple to define (high in the Summer and low in the Winter) as seen in figure (3), we can study only half of the year and still experience every bit of the seasonality (either from low to high or from high to low with a smooth transition in between).

5.1.2 External Validity

“It is concerned with the degree to which research findings can be applied to the real world, beyond the controlled setting of the research.” [17]

The wonder is whether the study and the results can be generalized to any company in the fashion industry and to any type of product.

Since the only hypothesis which were made on the product is that any reference has somehow the same price range, it is immediate to assume that this study can be generalized to any type of product were the variation of price is of small amplitude.

5.2 Reliability

We can assess that this study is reliable since:

- This report used reliable references to support the hypothesis throughout the different steps.
- All research material was saved on an external hard drive and used as both back-up and version control.
- Since very few hypothesis were made and the references which were used are easily findable on the Internet, a similar case study could use this method and these references.
6 Discussion

After this analysis, we expect the global coverage of Eyewear at CDC to be decreased since the stock will, hopefully, tend toward the sales and considering how the coverage is calculated (as a reminder $2^{8}$)

\[
\text{coverage} = \frac{\text{stores' stock} + \text{buffer stock} + \text{TBR stock} + \text{stock in transit}}{\text{sales last } N \text{ months}}
\]

And as expected, the analysis carried out previously reveals an improvement of the global coverage compared to the initial number of months of stock in each zone. With no change in the product perimeter, the general estimation is that the coverage can go down to 2 months of stock in each POS without losing any sales (providing that there is the right assortment of products in the store, it doesn't need to have more than 2 months coverage on references which have a high rotation rate).

Even if this improvement can seem huge, its possible realization in real condition is not ensured (one could even say nearly impossible given that new products are introduced constantly in the study while some other are removed once their season is over). This way, different constraints will prevent the optimized sequence to be reached in real conditions.

However, this analysis will enable to tend toward the optimized sequence as much as possible. Even though the improvement will not be perfect, it will be as perfect as it can be considering the real life conditions and it will be a noticeable improvement nonetheless.

In the case of Eyewear at CDC, the coverage managed to drop from 10 to 4 months of stock globally between January 2012 and May 2013. However, each time a new collection (and therefore a new group of SKUs) has been introduced in the POS, it tended to be delivered all at the same time and therefore the coverage rose again at once until the sales could compensate this sudden increase of stock.

With a constant product perimeter, which are the references which were present in the offer at the beginning of the internship, the coverage dropped from 10 months of stock to 3 months of stock.

On a larger scale, the coverage has largely improved since this study was put in place despite the “ups-and-downs” due to the launch of new products.

In this study, we know all the actual delivery lead time data for every store. However, the assumption that every store has the same delivery lead time is pretty accurate since we calculate the coverage for each geographical zone and since the stores of the same country have approximately the same delivery lead time give or take 2 days (which is a very small variation in the case of this study).

In fact, since the new collections are introduced with all the pieces being sent to the POS at the same time, these "ups-and-downs" can’t be avoided in any way.
In order to apply this optimization to any product, a few different hypotheses could have been chosen at the beginning of the study.

First of all, the optimization assumes that all products have the same price range. This allows the handling of quantities instead of costs which is far more intuitive when stocks are at stakes, but it also allows some straightforward optimization which would be difficultly applicable to products where the price changes are of large amplitude from one product to another since the customer's choice is always dependent of the price of the product.

The theories discussed in this paper are tightly related to Game's Theory in the sense that it is an ensemble of tools designed to analyze situations in which the optimal action to be realized by one "agent" depends on anticipations of what one or many other "agents" will do. The objective of Game's Theory is to find how to come up with the optimal situation just as it is the SCM's objective to optimize the assortment of product made available to each customer throughout the world.

In order to incorporate this side of the problem to the analysis, it would have been necessary either to work on stock's value instead of stock's quantity from the beginning and then to descend back to a volume level, or to find the average price of the products and then ponderate each quantity with its price compared to the average. This would have greatly complicated the calculations by adding a price ratio in front of every quantity used in the analysis. It could nonetheless be the subject of another study entirely since it would be an important improvement on this method.

This optimization also assumes that all stores have the same delivery lead time when in fact it is not the case. In order to take this parameter into account, it should be taken for granted that some stores which can be delivered in 1 day can have a lower coverage than stores which are delivered in a minimum of 10 days and still not miss any chance to sell the products.

From that could be calculated an “optimal” coverage for each store based on their own delivery lead time.

In this study, the goal coverage can in fact be considered as an average of these “optimal” calculated coverages.

In order to have a more thorough analysis, there are a few ground rules to be observed:

- One should be careful with targets increases when the category of products has already a high coverage: the optimal choice in that case is to try to make the store sell what it already has in stock before sending some more pieces. If a slow-selling store sells a particular product and has a target of 1, the right choice is often to leave a target of 1 even though the store will have to wait a few days until it receives the new piece after the sale. If you increase the target to 2, then you will probably never be out of stock on
this reference but you also might overstock your store, which is unnecessary.

- One should be careful with targets decreases when the global coverage is high: if the sales are not good, then it is important not to miss any sale at all. The optimal choice in that case is to make sure that the store is never out of stock on references which it sales.

- One should be careful with targets decreases when the category of products has already a low coverage: the store still needs stock in order to sell, and decreasing the coverage might lead to missed sales. The optimal choice in that case is to respect a minimum coverage of 1.5 month of stock.

- One should be careful with targets increases when the stock out rates are high. If the store is missing stock, then it can mean either of two things: the targets are not high enough and this is why the store has no stock while it should never be out of stock as long as the replenishment process is working, or (and this is the subtlety here) there is no more stock in buffer and therefore it is “normal” for the store not to be replenished correctly. In the second case, the target is probably well adjusted and shouldn’t be increased before there is stock again on the buffer.

All of these ”rules” were used in the case of this analysis. Actually, they were even elaborated little by little as the study went because they were found necessary for the method to keep improving itself.

This analysis, if used permanently on all categories of products will globally reduce the initial stock orders by optimizing the number of pieces sent to the stores while maintaining the sales (or even raising the sales, since a lot of sales will not be missed anymore due to a lack of stock in some stores).

What will come from this stock optimization is a better sell-through and therefore an increase of the company’s turnover.
7 Conclusion

7.1 Conclusions

Considering the variability of supply and demand in the fashion industry, it has been seen through this analysis how to monitor the availability of the products in POS worldwide while optimizing the inventory levels. This analysis has put a focus on Christian Dior Couture (where the 6-months internship was performed) and on a particular type of product within the offer: Eyewear.

I had the opportunity to be part of Christian Dior Couture's Supply Chain and to participate to the heavy task of managing the overall flow of Eyewear from supplier to customer. In order to do that, the present analysis was heavily used to set the optimal Model Stock for all Eyewear of the current collections and then challenged those targets every week to adapt them to the events worldwide (Christmas, Chinese New Year,...). It was also primordial to make sure that some re-balancing were completed when and where needed to optimize the sell-through and the sales.

After designing this research plan, the necessary data was collected and organized in tables to make easier its analysis. The collected data was mainly information on stock out rates, sales quantity, stores' stock, buffer stock, stock in transit, stock to be delivered and coverage.

First, the sales were thoroughly analyzed to see if there were some obvious choices to make in order to increase the sales.

Then it was the monthly sales and stock of each store which were studied to establish a classification of stores and set goals for each category of stores.

And finally, the stock out rates, coverage and monthly sales were calculated for each SKU and for each store, and actions to perform were chosen to optimize both coverage and stock out rates.

Once this analysis is done, the targets should be adjusted every week and after a month or so, they will converge to an optimal Model Stock and hence the stock should become optimal too in time, following the targets' trend.

This analysis lasted 6 months (which is a period long enough to assume that seasonality didn't influence my data) and during these 6 months, there was no shortage of stock whatsoever. From this it can be assessed that this analysis is internally valid. Moreover, since very few hypothesis were made in the beginning of my research, it can also be assessed that this research is externally valid. On the other hand, the reliability of the research was proven in the previous paragraph due to the reliability of both references and research material.
7.2 Future work

There are some aspects of the Supply Chain problem in the Fashion Industry which were not treated in this analysis and which could be interesting to look at. A few examples can be found below:

- One of the hypothesis which was chosen for this analysis, was that all the products (Eyewear in this study) have approximately the same price. It could be interesting to try to include the price range in the analysis to be able to generalize this study to any product. It would mean defining price ranges (for example "low-range", "mid-range", "mid/high-range" and "high-range") and repeat this analysis for each price range, giving stores different goals depending of the price range of the product in question.

- This optimal Model Stock which was created in this analysis could also be used to predict the perfect amount of pieces to produce for each product based on the sales and Model Stock of a similar product in term of fashion in previous collections.
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