Material Flow Improvement

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Contents

Abstract

Louis Vuitton’s workshops and their supply chains are continuously changing in order to meet growth in sales and ever-faster product-life cycles. Organizations evolve and new systems are implemented.

In this context, the workshop needs to increase the control over its flow of material. This lack of control results in inappropriate supplies (generating material excess and/or shortages) or losses and wastes of material, which has financial consequences for the workshop.

The analysis identified areas of potential improvement and broke down the project into three subjects: improving technical data reliability, defining the process of production ramp-downs and monitoring the performance of the warehouse. Each project started by a period of analysis, followed by proposals, implementation and follow-up. All of them appealed to “change management” practices.

The projects brought concrete gains on material control. Bills of material and stock levels are more reliable, production ramp-downs are in control. The main outcomes of the projects are methods: production ramp-downs procedure, raw material quality monitoring, control process monitoring. The control of material flow is now set as a goal for the team, improvements are followed and shared. Thus this project contributed to give the workshop the means to sustain improvements on material flow.

Keywords: Material flows, waste reduction, performance indicators

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Foreword

I had the opportunity to join Louis Vuitton's workshop in Issoudun from January to July 2010 as an intern in the logistics division. I have been in charge of a project aimed at increasing the control over the flow of material in the workshop.

This project constituted my final work as a student to prepare a double degree:

- From the Master In Production Engineering of Chalmers University in Göteborg, Sweden
- From the Ecole des Mines de Saint Etienne in France

Expectations from Chalmers University and from the Ecole des Mines were initially quite different. The master thesis is oriented towards academics: the goal was to show how theories could be relevant to a practical situation, whereas the Ecole des Mines' approach is probably more pragmatic and focused on the tasks performed. Being convinced that these two approaches are complementary, I try to match these two expectations in this report.

From a personal point of view, this internship was very beneficial on several aspects. From a cultural point of view, discovering the luxury industry and its specific constraints on quality and time-to-market was very interesting. On the technical side, I learnt tools and applications that are essential in a production environment. I learnt how important it is to synthesize ideas and how to manage changes on the shop floor.

In the beginning of June I was given the opportunity to ensure the logistics function of the subcontracting area (planning supplies and coordinating the development of new components with suppliers). This challenging period gave me an opportunity to take responsibilities and to develop interpersonal skills, which will be extremely beneficial in the future.

Introduction

Louis Vuitton and the LVMH group

The brand Louis Vuitton has been founded in 1854 by Louis Vuitton, a trunk-maker in Paris. A century and a half later, the company is now one of the world's most famous fashion brands and is part of the LVMH group.

The LVMH (Louis Vuitton – Moët Hennessy) group, founded in 1987, is the world's largest luxury group. It aims at "representing the most refined qualities of western "Art de vivre" around the world". It is organized around six activities represented by more than 60 luxury brands.

- Wines and Spirits: Cognac (Henessy), Champagne (Moët & Chandon)
- Fashion and leather goods : Louis Vuitton, Givenchy, Kenzo
- Perfume and cosmetics : Dior, Guerlain
- Watches and jewelry : Tag Heuer
- Selective retailing : Sephora
- Other activities : Newspaper Les Echos

The group's sales amounted to 17 billion Euros in 2009. The same year, it made an operating profit of 3.2bn euros and a net profit of 1.9bn euros.

LVMH employs more than 77 000 people, under the direction of Bernard Arnault who owns 64% of the group. It is part of the CAC40 stock exchange index. The LVMH share, whose price doubled over 2009, was worth 88 Euros in April 2010.

Louis Vuitton is the leading name in the "Fashion and Leather goods" unit. The company produces trunks, leather goods, ready to wear, shoes, watches, jewelry and accessories.

With more than 15000 employees under the direction of Yves Carcelle, Louis Vuitton grows at a sustained pace. Its sales amounted to 6.3bn euros with a 5% revenue growth in 2009, in spite of the poor economical conditions. The main geographical markets are Europe, the US, the Middle East and Asia. Asia, and more specifically the Chinese market, is turning into a key place with a 20% revenue increase in 2009.

The company strives to blend innovation with tradition. The "Monogram canvas", used since 1896, has turned into the ultimate symbol of Louis Vuitton's products.

The brand's image is built on the idea of excellence based on the traditional craftsmanship along with the "made in France" production pattern. A strong focus is made on sales: the products are sold without any promotional offers in 446 exclusive stores located in 52 countries. The act of buying has to be a unique moment for the customer.

Louis Vuitton’s production system

Louis Vuitton dedicates 7 factories (out of 17) to its leather goods. One is located in the US (San Dimas, near Los Angeles), one in Spain and five in France.

The Issoudun factory, entirely dedicated to leather goods, is composed of 2 workshops separated by a few kilometers: “Issoudun” and “Condé”. The factory has been the property of Louis Vuitton since 1982 but there has been a long tradition of leather craftsmanship in the area.

The factory employs about 500 people. A large majority of the workforce is composed of skilled operators called “maroquiniers”, which represents the direct workforce.

The organization of the workshop

The workshop is organized between the following divisions:

- Production

Making the products according to time, cost and quality requirements
The “Maroquiniers” are supervised by team managers, under the direction of a production manager. There are two production managers, one for each workshop (“Issoudun” and “Condé”)

- Technical division

Providing production with technical support

- Industrialization (“Mise au point”)

This unit develops new products for the factory. The main task is to adapt the designers’ drawings to industrial requirements.

- Methods

This unit creates and improves the production setup necessary to make a product. They work on line balancing, process mapping or production improvements.

- Maintenance

- Logistics division

Controlling the flow of materials, from supplies to shipments
My missions took place in this division; therefore the description is more detailed.

- Planning

The planners determine each line’s planning, in order to optimize the factory’s capacity. There are two planners, one in each workshop.

- Purchasing

This unit monitors the inventories and passes orders to the suppliers in order to provide production with the materials needed. There are three purchasers.

- Outsourcing

Some parts of the products are outsourced. One team manager, supervising 7 operators, is responsible for this process (material shipment, goods reception, quality control, etc.)

- Warehousing

All the raw materials (leather, canvas and metal parts) are received, controlled and disposed in the warehouse before being sent in production. Two team managers with a dozen operators are responsible for this area.

- **Quality and continuous improvement**
- **Financial division**
- **Human resources**

The 6 managers of these divisions constitute the executive board of the factory. The board is directed by the factory manager.

Problem definition

The Alma Project

A large part of my missions at Louis Vuitton have been initiated by the Alma project. Here is a presentation of this project.

Alma is a project involving Louis Vuitton's factories, suppliers and subcontractors. It aims at centralizing purchasing needs of all the workshops in order to optimize the purchasing process and to improve quality control over raw material. This project will provide new tools and, as a consequence, new methods. In the factory, these changes will mostly affect the purchasing and industrialization teams who will have to work in a more collaborative way than before.

The Alma project has strong needs that are necessary for a successful implementation: a new industrialization software, "Linkit" (editing Bills of Materials, abbreviated as BOM) will be directly linked to the new procurement system called Alma. Therefore the purchasing team will be more dependent on the technical data than before.

On the logistics side, one of the main changes is that purchasing orders will be issued automatically based on the values of the inventories, through the Alma system. For that reason, it is necessary to have reliable inventories: to make sure that the values of the physical inventories match the values in the system.

The need to control material flows

On a broader level, there is a strong need to improve the control on material flows in the factory. An analysis made by the company showed that considerable amount of material was wasted or even lost without explanation. Two areas of potential improvement had been identified.

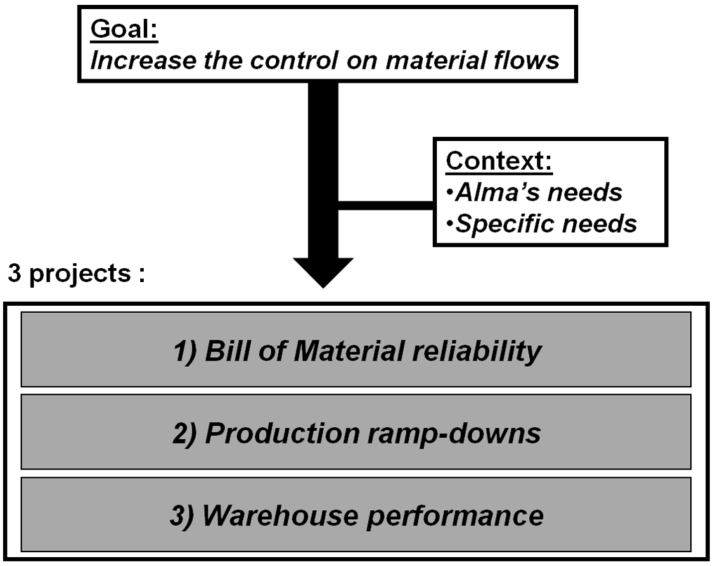
The first area of potential improvement is the ramp-down periods in production, in the end of a product's life. The process is not fully controlled and generates remaining inventories. The second area is the warehouse, which has no performance indicators. It is therefore difficult to follow improvements on material flows. A more detailed analysis on these areas will be given in the next parts.

Synthesis

The need to improve the control on material flows, along with Alma's specific needs, defined three missions within the project.

1) Improve technical data reliability
   This area will be referred to as the ***"Bill of Material reliability" Project***
2) Improve material efficiency during production ramp-downs
   This area will be referred to as the **"Production Ramp-downs" Project**
3) Define and implement performance indicators for the warehouse
   This area will be referred to as the **"Warehouse Performance" Project**

Figure 1: Problem definition



General analysis methods

Frame of reference

Three main areas define the theoretical framework of this project: supply chain management, methods engineering and change management.

The idea of controlling material flows can easily be linked to the field of study of supply chain management. T. Mentzer (2001) defines a supply chain as “a set of three or more companies linked by one or more of the upstream and downstream flows of products, services, finances and information from a source to a customer.” He defines supply chain management as “the systemic, strategic coordination of the traditional business functions within a particular company and across businesses within the supply chain, for the purpose of improving the long term performance of the individual companies and the supply chain as a whole”. Another definition is given by Harland: “Supply chain management is the management of a network of interconnected businesses involved in the ultimate provision of product and service packages required by end customers”. It is important to notice that studying the supply chain covers any type of flow and not only material. These definitions give the scope of supply chain management: supply chains are not only the interactions between one company and others, but also the interactions within the company itself.

Each part of the project is linked to supply chain management issues. Bills of material have an influence on the purchasing process (external supply chain) and stock levels (internal supply chain). Managing efficient production ramp-downs involves both to optimize purchases and to develop an optimal organization of the flows within the workshop. On the third project, the focus on warehouse performance is a core topic for supply chain management since it has influences on the way raw material is managed. According to Ritzman and Krajewski (2004), “raw material management is of foremost importance since it coordinates the purchasing process, production control and distribution for the company”.

Methods engineering is a discipline whose main goal is to gain productivity in production processes. Freivalds (2009) describes the methods engineer as the person “responsible for designing and developing the various work centers where the products will be produced. […] That engineer must continually restudy the work centers to find a better way to produce the product and/or improve its quality”. The recent theories of “Lean” manufacturing, as made famous by the Toyota Production System (TPS) brought new developments to these practices.

The Toyota Production System is built around the idea of waste reduction. In “The Toyota Way”, Liker (2004) identifies eight types of waste: Overproduction, waiting, unnecessary transport, overprocessing or incorrect processing, excess inventory, unnecessary movements, defects and unused employee creativity. Several renowned tools can be used in order to reach the goal of waste reduction, such as pulled systems (Kanban), Value stream mapping or 5S.

Working on material flow improvement at Louis Vuitton appeals to this continuous improvement and "reengineering" approach. Controlling material flows is an example of actions to reduce material waste and excess inventory.

The third angle of the project is managing the change. The mission on warehouse performance implies to redefine an initial organization and to bring cultural changes by defining performance indicators. It has therefore implications on people that must be taken into account. This aspect will be studied more specifically in the "Warehouse performance" part.

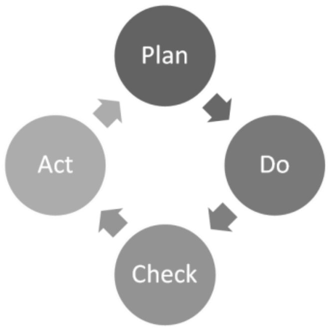
General methods

Project planning tools

The project has been divided into three sub-projects. A general method, inspired from PDCA cycles, has been defined to lead this project.

The PDCA cycle proved to be a simple and efficient method of leading projects. It is composed of the following sequence that repeats until the goals are reached (Harper-Smith, 2009) :

- Plan the tasks using project planning techniques
- Do the tasks as they are planned
- Check the progress
- Act based on the result of the "Check step". Confirm/change decisions, review the planning.



As its name suggest, the main idea of a PDCA cycle is to sustain the improvements over time. A new cycle starts once the previous one is finished. The key to sustain improvements is standardization, which turns a company into a learning organization.

Freivalds (2009) describes the systemic procedure used by methods engineers as: Select the project, get and present data, analyse data, develop ideal method, present and install method, Develop job analysis, establish time standards, follow up. This program has been adapted in order to match the project's specific needs. The final method selected to lead the project is:

1) Analyze the problem
2) Elaborate proposals
3) Validate proposals with the people concerned
4) Implement the solution
5) Train people: *Any improvement had to be sustainable*

6) Follow up the results
7) Improve the solution

Analysis tools

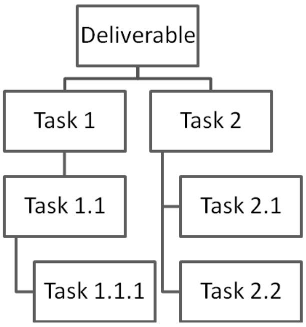
The first part of the project required tools to analyze the current situation. A large part of the pre-analysis has been made through the simple but very efficient “5Ws” technique.

The « 5 Ws + H» method could appear as simplistic but came as a very efficient way of analyzing any situation and its context. It consists in finding the answers to the questions “What”, “Who”, “Why”, “Where”, “When” and “How”. This method has been systematically used in the project, to analyze initial situations and to present results. More specific analysis was then carried on each specific topic.

Planning tools

The “Work Breakdown Structure” (WBS) technique has been extensively used in planning the project.

WBS is one of the basic tools for project planning. As its name suggests, it consists in breaking down the projects into tasks and subtasks. The first action is to define the project’s “deliverables”, which are the expected outcome. Then each deliverable appears as the results of its sub-tasks.



The main advantage of WBS is to provide a structured and hierarchical view of the tasks before planning them. Creating the WBS together with the project team is also a great team building tool since it forces the team to work as a group in order to define the project’s deliverables and tasks (Harper-Smith, 2009).

The Work Breakdown Structure of the whole project has been elaborated during the analysis period. It is presented as Appendix.

Communication tools

This type of project involves many people and divisions within the company. Therefore a large part of the work consists in communicating with all the actors involved in the projects. This was mainly done through meetings and interviews, which could be very different depending on the goals: elaborating proposals, giving information, training people, etc.

According to the Harvard Business Review, the essential point when preparing a meeting is probably to **define the objective**. Many meetings end up in time wasted because the objective is not defined or clear enough. Four types of meeting can be defined:

- **“Informative-digestive”**: when a point has to be shared with a group of people. This type of meeting could be held on a regular basis to follow the progress of a project.

- **“Constructive-originative”:** when the goal is to use the group to elaborate creative ideas. It answers the question “What shall we do?”

- **“Executive responsibilities”**: when the goal is to define each actor’s responsibility in a process. It answers the question “How should we do it?”

- **“Legislative framework”** : when the goal is to officially change an organization

The project at Louis Vuitton appealed to all of these types of meetings. “Constructive” meetings were usually the first step to elaborate proposals, and then came the “Executive responsibilities” meetings to define more precisely the organization. “Informative” meetings kept the group updated on the progress and “Legislative framework” meetings crystallized the final choices.

“Bill of Material reliability” Project

Background

The material planning in Louis Vuitton is made through a MRP (Material Requirements Planning) system, which requires a high accuracy of technical data. A MRP system traduces a production plan (production of finished goods on a timeline) into material requirements. The MRP has three inputs (Ritzman, 2004):

- Bills of material (BOM)
- Production planning
- Stock levels

Production planning is turned into requirements for each article through the Bill of material. Stock levels are taken into consideration in order to adjust the quantities that need to be ordered. The accuracy of Bills of Material is crucial in such as system, as Jonsson points it (2009): “Information in bills of material plays a crucial role for many applications in the area of manufacturing, planning and control.[…] Material allocations can take place automatically, and BOMs are necessary to be able to use material planning methods”. Since the quantities of material ordered depend on the BOM, it is necessary to have an exact match between the values in the BOM and the physical reality of the product. If it is not the case, it will end up in shortages or excessive supplies.

A remarkable example in the workshop could be given to illustrate this point. The stock of a specific reference of canvas was growing for no clear reason. After three months, one of the purchasers realized there was an error in the BOM: the indicated quantity was twice as much as necessary, which generated unnecessary supplies. The excess of stock amounted to about a thousand linear meters of canvas as a result. This opposite scenario has to be considered as well. In case an element is missing in the BOM or has quantities smaller than necessary, this will result in limited supplies and shortages of material.

Analysis and methods

The analysis of the problem has been broken down into sub-questions, using the “5Ws” method.

What – *the errors that are found in BOMs*
Errors in BOMs can be separated into two main types. First of all, the content might be wrong, which means that either the wrong references might have been used, or that some references are missing. The other type of errors concerns parameters of the BOM. A number of parameters has to be declared for each reference in the BOM. These parameter could be related to technical issues (surfaces, %of waste when the material is cut, etc.) or to supply issues (conditioning unit, supplier, etc.)

Who *– the users of BOMs*
Only two categories of users can access BOMs: the industrialization service and the purchasers. This information is essential in order to define procedures with tasks separated for each user.

When and How- *The process of BOM creation and modification*
The BOMs can be accessed through two different phases. During the **product development phase**, the industrialization service carries several tests on the product in order to make a prototype and to validate its production. BOMs are created during this period. They evolve a lot until the product is finally launched in production, both on the contents (the material used: canvas, threads, glues, adhesives, etc.) and on the parameters (especially surfaces). It is therefore a critical period as far as BOMs are concerned.

There is a frequent need to update the BOMs for production demands during the **product life phase**. For example, team managers in production might want to change adhesives, glues or threads to improve their process. Updating BOMs in such cases is essential for the supply reasons presented earlier.

Why *– the causes of errors in BOMs*
Most of the errors in the **product development phase** are a result of the difficulties of the users to be fluent with the new system. What is more, there is no final check of the BOM before the product is launched in production.
In the product life phase, the fact that BOMs are not automatically updated when changes are made in production generates errors. There is so far no organization describing the roles and actions to update a BOM: Responsibilities are poorly defined between team managers (production), methods and industrialization. Along with this need to update the BOMs, it is also essential to make sure that the change has been approved by a technical expert (a member of the industrialization team) before any physical implementation.

Decisions

Two axes of work have been selected based on the main causes of errors in BOMs. The first axis is to define a validation procedure for the product development phase. The goal is to make sure that BOMs are checked (on the content and parameters) before the product is launched in production
The second axis is to define and implement an organization guaranteeing that the BOM is always matching the physical reality of a product through all its life.

Results

"BOM Validation" procedure

As it was decided after the analysis, the first step was to create a validation procedure for BOMs. The format selected is a 2-pages check-list. All the points to check are related to the contents and the parameters of the BOM. The users of the procedure are the members of the industrialization team and the purchasers. It has been decided to keep the check list as simple to use as possible. Parts have been separated for each user.

The manager of the industrialization team ensures that all the points in the check-list have been ticked by the people who built the BOM (one member of the industrialization team, one purchaser). This has to be done twice: before the “prototype” phase is validated and before the product is launched in production.

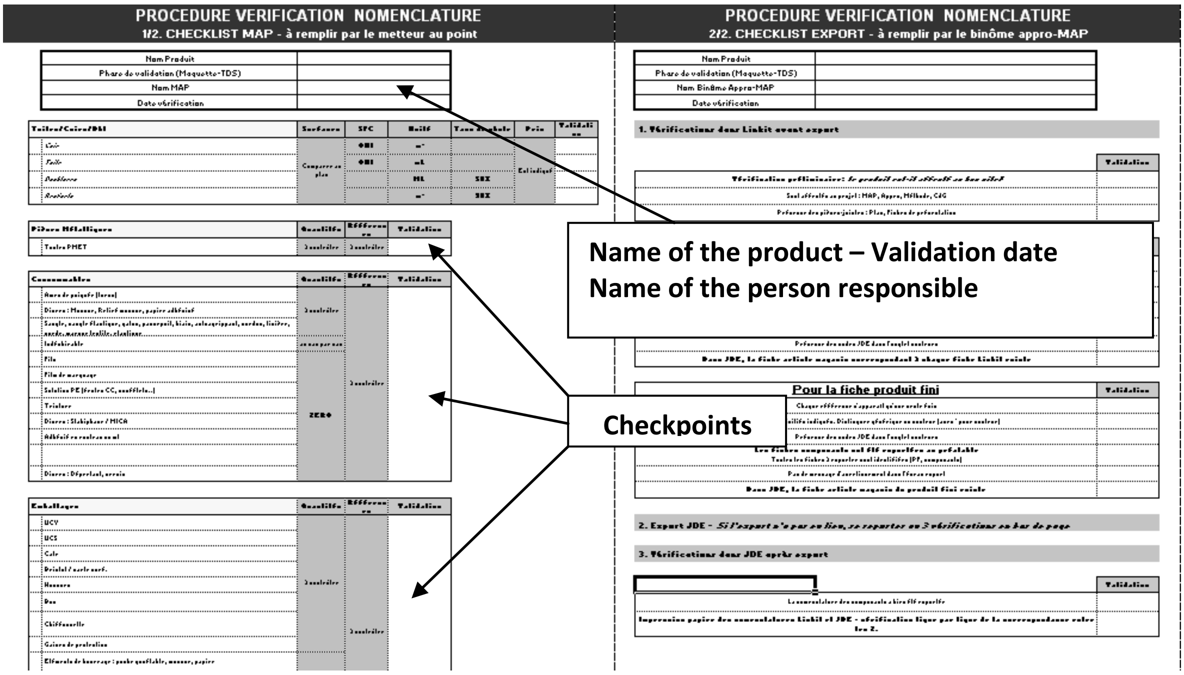


Figure 2: BOM validation procedure

“BOM update” procedure

Another procedure has been implemented in order to improve BOM reliability, this time focusing on the “Product Life” phase.

The format of the procedure is a single page document, providing an easy way for team leaders to follow a structured process when implementing a change on their line. The users are the team leaders, industrialization team and the methods team. The procedure is divided into three steps:

Step 1: Change on the production line by the team leader
The team leader indicates on the document the references he wants to change and forwards it to the industrialization team.

Step 2: The industrialization team proceeds to the BOM updates according to the documents transmitted.
The document is given back to the team leader.

Step 3: The team leader informs the “methods” team to make subsequent changes on the production line.

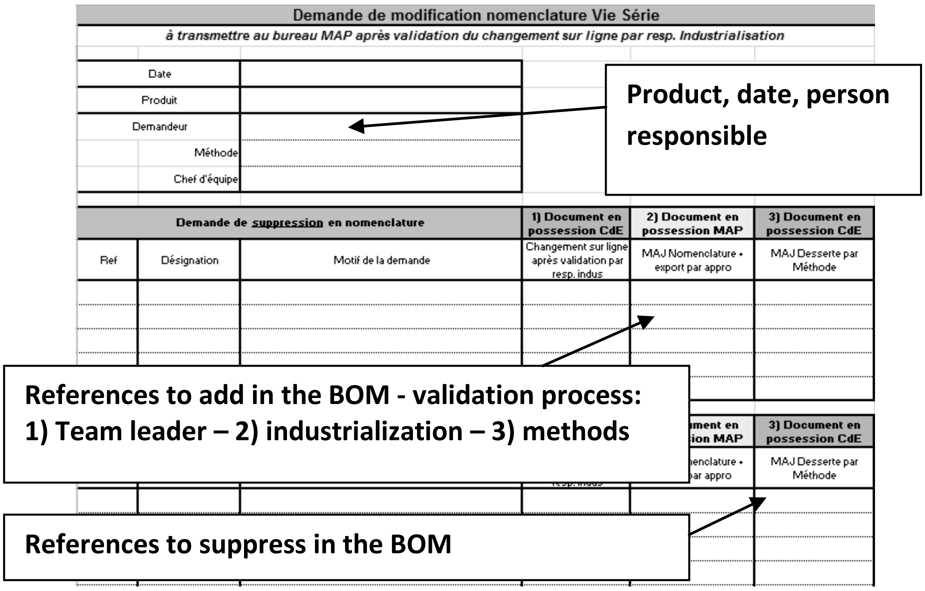


Figure 3: BOM update procedure

Gains

These procedures gave a clearer definition of roles. The “BOM validation” document provides a structured and efficient way to check BOMs, whereas the”BOM update” document is an easy way to check if the product and its BOM are synchronized, and gives an history of the changes. Processing requests for BOM updates is made easier for the Industrialization team, since all the documents are gathered in a centralized way.

The next step for Louis Vuitton is the creation of an automatic way of checking the BOMs. This new tool, called “check-BOM” was created in May 2010. It analyses automatically a number of parameters on all the Bills of Material. However, it has some limitations. It has for example no critical eye on the technical content of the BOM. What is more, it is only a corrective tool and it is much more beneficial to have a BOM right from the first time than to correct it from the result of the check BOM. For these reasons the two procedures created during the project will still be useful.

“Production ramp-downs” Project

Specific background

As a fashion brand, Louis Vuitton’s products have a high turnover. The trend has been growing over the last years. As a consequence, many new products come in production whereas others are stopped. The products stopped could be permanent products such as the “Montecarlo” (which was produced since 1999) or “One-shots”, products launched for a short amount of time (a couple of months) with a limited number of units.

In 2009, 12 products were stopped in production. Between January and February 2010, 5 products were stopped. Similar figures were found during the previous years.

Goals definition

The main issue with production ramp-downs is the amount of remaining stocks: stocks that remain after the stop and which will not be used. In some cases, they can be sent to other Louis Vuitton factories. Otherwise they will be destroyed. In any cases, the remaining material will lose value which explains why it should be avoided.

The 12 stops of 2009 generated several hundreds of thousands Euros of remaining stock. For a specific product, the amount of remaining stock represented a 7% lost of material for the whole project. These figures defined the first goal which is to **have as little remaining stocks as possible.** Together with this goal, it was essential to **define an indicator** to challenge the whole process of production ramp-downs.

The second issue is to coordinate actions between support services and production. These actions could be related to logistics (supply parameters have to be changed for example) or to technical aspects (prepare technical specifications for after-sales customer service). Therefore the second goal is to **coordinate these actions through a procedure specifying each actor’s role.**

Analysis of the production process

In order to define how to reach the goals defined above, it is necessary to understand the production process in the factory.

The flow of material

There is a basic sequence to make a product:

1) Cutting

Different processes are used depending on the type of material (Leather, “LV” canvas, other canvas)

2) Preparation

Sub assemblies are made from the cut parts (leather, canvas) and other components.

3) Assembling

The product is assembled from its sub-assemblies. Most of the stitching operations, requiring delicate manual work, are made during this step.

There is a 3-weeks production lead time as the timeline below shows:

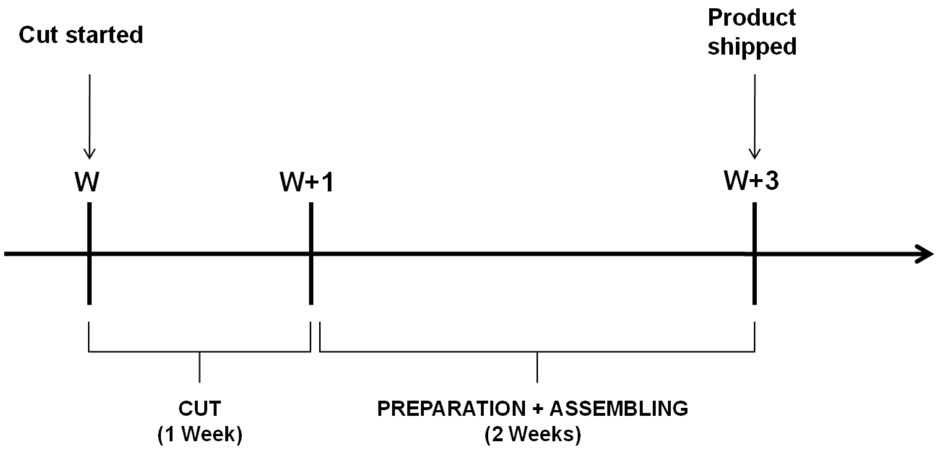


Figure 4: Production lead-times

All the raw material is supplied from the warehouse. A number of parts or sub-assemblies (handles, zips, etc.) are outsourced. These parts are sent to the preparation and assembling units from the “outsourcing” area (which is equivalent to the warehouse)

As the flowchart shows, there are several types of stocks in the factory:

- Raw material : material in the warehouse + outsourced components
- Work in Progress : in the Cutting, Preparation and assembling processes
- Safety stocks

A main safety stock is created at the end of the preparation area for each line of product. Its role is to quickly provide the assembling and preparation unit with cut components in case of variations such as, on the one hand, delayed supplies, shortages or, on the other hand, over-consumption due to scraped parts. On average, the size of the safety stock is made of the amount of material equivalent to 20 products. (Its size depends on many parameters such as the pace of the line, the scrap rate on the product, etc.)

The flow of material could be described as a "semi-pulled" flow. It is pulled by sales: the quantities that the factory must produce are decided according to sales previsions. The products are sent to a central warehouse located in Cergy (near Paris) before being dispatched to the shops.

However, the flow can be defined as "Pushed" internally. It uses the system of Work orders (WO). Work orders are created once the quantities to produce are decided. Each Work Order defines the name of the product, the quantity to produce, the week the product has to be shipped. Starting a WO in the factory initiates the Cutting process. From that moment on, the material is pushed through the preparation and assembling units until the product is finished. That is why the production process could be defined as "pushed" within the factory, even though it is pulled by sales.

The first consequence of this process is that **all the Work In Process belongs to Work Orders.** Any part on the production line can be allocated to a Work Order. Another consequence is that the safety stock is supplied in an alternative way. A kanban system is used to recomplete the safety stock. All the parts in this stock are out of Work Orders.

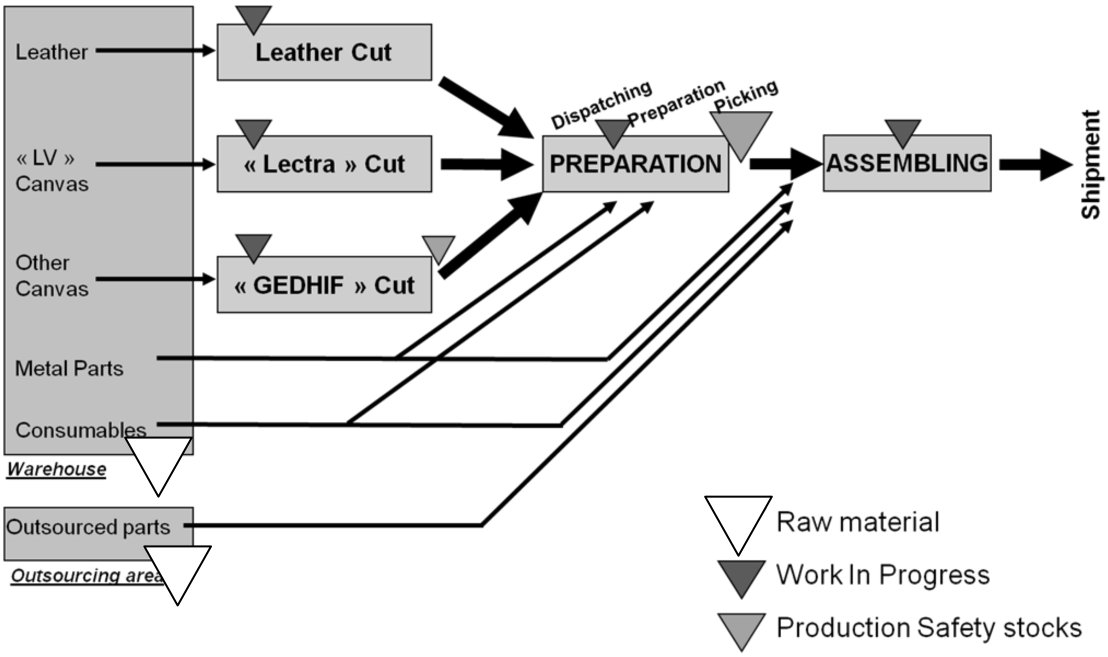


Figure 5: flowchart of the workshop

Production ramp-downs process

Remaining stock identification

Two different locations have been identified for the remaining stock: the warehouse and the production line. Each one of these locations reveals a specific malfunctioning.

- **Remaining stock in the warehouse**

This type of remaining stock consists of uncut material, metal parts or other components that have been supplied but were not necessary for production. The reason is that this material has been over-supplied. The main reason for this is the unstable production forecast that leads purchasers to order material in quantities that might exceed production requirements.

According to Jonsson and Matsson, "demand uncertainty is a direct result of the increasing rate of change in the market and ever-shorter product-life cycles". This is particularly true in the fashion industry such as Louis Vuitton's and explains well how supplies could be left over after production. Another phenomenon, called the Bullwhip effect, comes into play. It is a well-know cascade effect that turns small demand variations close to the customer into great variations upstream in the supply chain. The following graph illustrates this effect. This phenomenon has been observed within Louis Vuitton's workshops and explains how stocks grow and why material often remains unused when it is decided to stop producing a product.

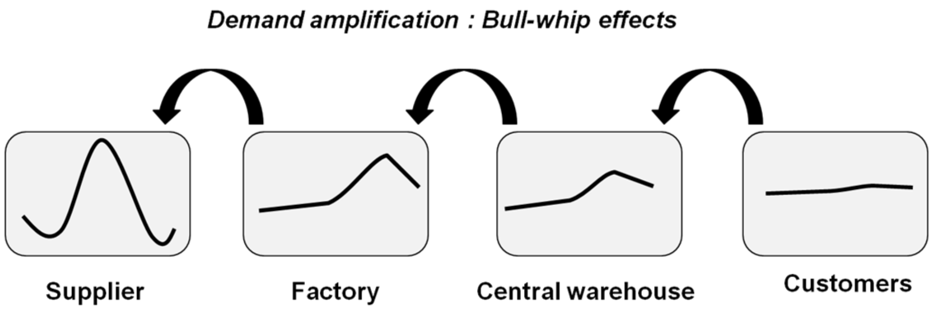


Figure 6: The Bull Whip effect (adapted from Jonsson, 2006)

The first conclusion of the analysis is that remaining stocks in the warehouse are mostly the consequence of unstable production forecasts. Purchasers need to have clearer information on products' end of lives (date and quantities of the last Work Orders) in order to **adjust the quantities of their last purchasing orders.**
It can be mentioned that shorter purchasing lead-times would help coping with these unstable production forecasts.

- **Remaining stock on the Production line**

To stop a product in production means to stop sending Work Orders to the production line. As a consequence, the exact amount of material to finish the last Work Orders will be sent to production and there should normally be no remaining stock. However, some material does not belong to any work order: safety stocks and other excessive stocks.

The safety stock is constantly recompleted thanks to a kanban system, out of the WO system. Therefore this stock will be left over if the kanban cards are not removed before the end of production. It has been observed that other stocks, independent from WOs, tend to appear on the production line. They are not "official" stocks, but usually created by team managers in order to prevent shortages on their line. Since they are out of Work Orders, they will be left over after the end of production.

The second conclusion of the analysis is that in order to suppress remaining stocks on the production line, the main issue is to **send back to production the excess on the lines (all the stocks out of work orders: Safety stock and others)** before the last orders are sent.

Procedure elaboration

Benchmarking

The first step is benchmarking within the workshop. The goal is to determine if something has already been done on this issue and the factors of success and/or failure.

A procedure had been created the year before. This procedure presented the main actions that were necessary for a successful production ramp-down, displayed as a list on an excel-spreadsheet.

However the current procedure was not fully applied. The first reason is that no pilot had been defined for the process. Therefore actions were not applied by the actors concerned. The other reason is that people were not fully aware of the procedure. Communication had been too limited when defining the process.

Redefinition of a procedure with planning techniques

- Tasks definition

The goal was to identify all the necessary actions (description – actors – duration)
This was mostly done using the “5W’s” technique, along with “constructive-originative meetings” (as defined in the methods part).

- Sequence definition

The goal was to determine precedence constraints and milestones among the list of tasks defined earlier. The sequence was then displayed using Gantt charts, which are, along with WBS, a major project planning method.

Presentations – corrections

This was done through meetings that could be classified as “informative” and “executive responsibilities” (as defined previously). The goal was to agree on each actor’s responsibility. One major informative meeting has been held with each workshop.

Testing

The procedure was tested on two production ramp-downs. Team leaders were involved in the process and gave their feedback. The basic process of the production ramp-downs procedure as it was defined is presented on the following chart.

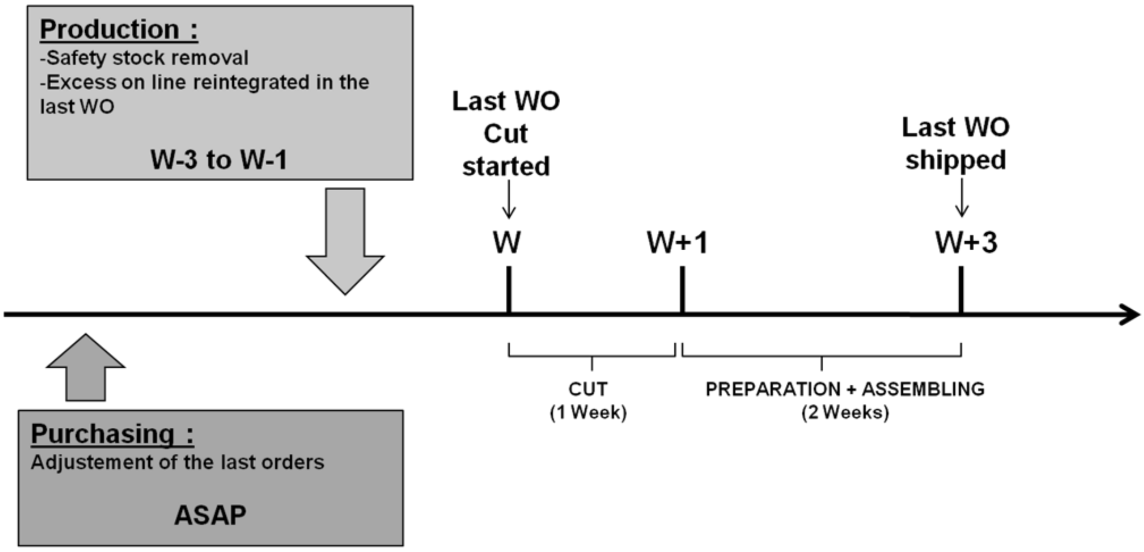
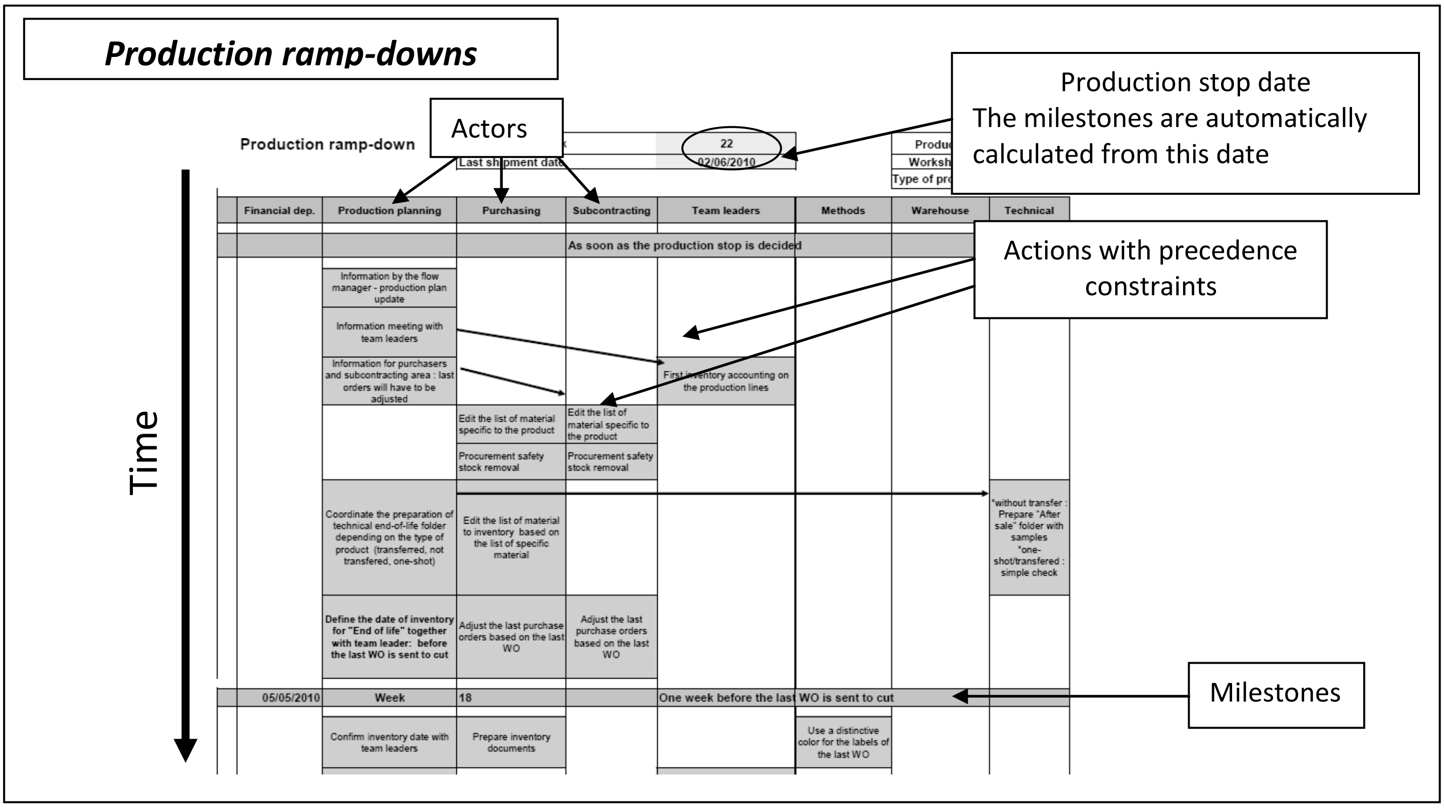


Figure 7: Basic description of the production ramp-downs procedure

Results

"Production ramp-downs" procedure

The outcome of the project is a written procedure that aims at decreasing the amount of remaining stock, both on the production lines and in the warehouse. Its format is inspired from Gantt charts. A snapshot of the procedure is presented below. The complete procedure is presented in Appendix 2.



Gains

The procedure has been officially used on one production ramp-down after the testing period. After the ramp-down, there was no remaining stock on the production line. The remaining stock in the warehouse amounted to 5% of the total cost of material for the whole project.

This result is encouraging. Two factors have been identified in order to improve it. First of all, **the pilot should be given more time to support the production staff in the process.** It has also been agreed that even with a well defined procedure it is still difficult to manage the last purchases. **A more stable production forecast would help purchasers managing the end of product life.**

The procedure as it is defined is only a first step in decreasing the remaining stock. Defining this procedure was essential in order to coordinate actions for production ramp-downs. However, it is agreed that most of the remaining stock is caused by over-supplies due to unstable production forecasts combined with the current MRP purchasing system.

A major project is currently being implemented in the workshop. It aims at implementing pulled flow from the shops to the workshop, therefore avoiding batch production and the bullwhip effect that today generates excessive supplies and/or shortages. As a consequence, production ramp-downs should come in a more progressive way than today. Purchases will be more stable from one week to one other which will avoid the creation of excessive stocks.

“Warehouse performance” Project

General analysis

The first activity of the warehouse is to control the quality of incoming raw material. Three types of raw material are used in the workshop:

- Leather: skins are received on pallets. Cow leather represents by far the largest volume of raw material. Other exotic leathers are used for special products: ostrich, alligator, etc.
- Canvas, received by rolls
- Metal parts : buckles, tucks, zips, etc.

The core activity of the warehouse is to stock raw material. Three different areas have been defined for leather, canvas and metal parts. The run-out time is about one month on average in the warehouse. The material is then delivered to the production lines by the operators. The material is picked in the warehouse following the “First in, First out” rule.

The first step in the analysis was to identify which indicators would be relevant for the warehouse, keeping in mind the major goal of controlling the flow of material. This analysis has been made in two different ways. It started by benchmarking with the other Louis Vuitton workshops. Five of them have been contacted on the phone in order to determine which indicators were used and how they were followed and animated in the warehouse. This external analysis was followed by a definition of the specific needs of Issoudun’s workshop.

Three criteria were used as guidelines through this internal/external analysis:

- Cost : *the warehouse must control and optimize its costs*
- Quality : *the warehouse is responsible for controlling the quality of incoming material*
- Time *: the warehouse should avoid shortages on production lines*

Three main axes have been identified from this analysis:

1) Improve stock level reliability
   Make sure that physical values of stock and values in the ERP[1] always match
2) Create/Improve a tool to manage the quality control process
3) Define indicators to monitor the quality of the material received

The main outcome of benchmarking with other workshops was to realize that the warehouse needed not only indicators, but also some way to communicate on them. For that reason it has be decided to **create a daily briefing in order to share the indicators with the team.**

The Work Breakdown Structure of this project is presented below:

[1] ERP: Enterprise Resource Planning. The IT system that is used to monitor the activity of the factory

Figure 8: WBS - Warehouse Performance

Analysis and Methods - Stocks

The best way to analyze stocks reliability was to start from the results of inventory accountings that are made every quarter for each type of raw material in the warehouse (Leather – Canvas – Metal Parts). I decided to focus first on leather since it represented the highest amount of stock in the warehouse.

The graph below shows the results of the last inventory accountings for the main reference in leather. The goal of these accountings is to determine whether the amount of physical stock matches the values in the IT system. The graph shows that there has been a gap between physical values and those in the system on the first and the last accountings.

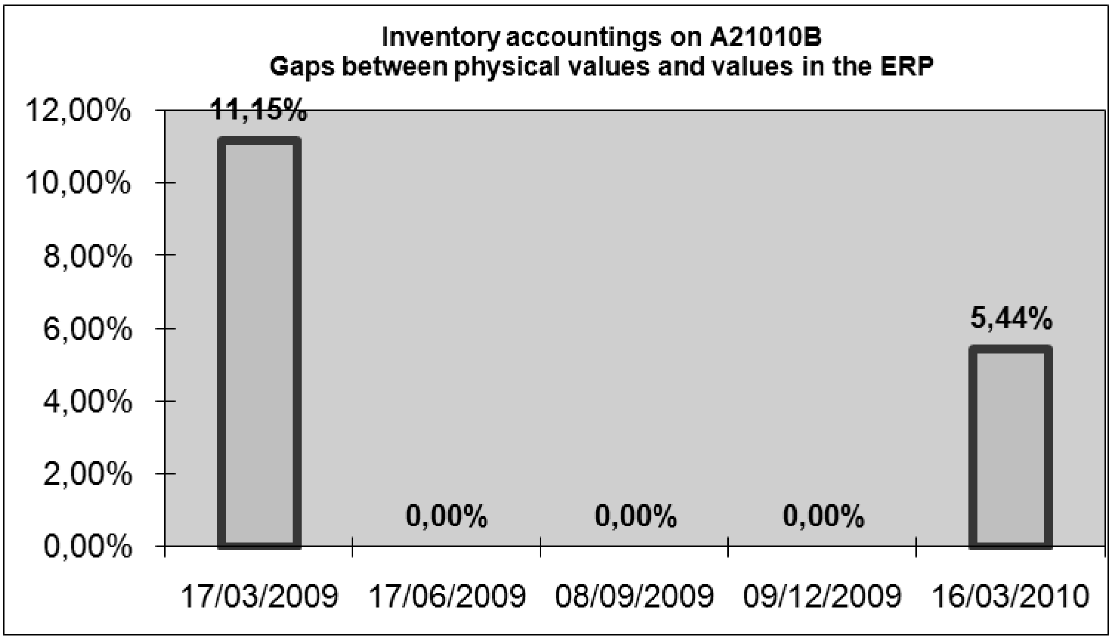


Figure 9: inventory accounting results

On three accountings, it can be seen that there was no difference between physical values and those in the system, which supposedly was very positive result. However, after a deeper analysis of stock movements, it appeared that many stock adjustments had been made in between, using "unofficial" ways. For example, a lack of material could be easily regulated through special movements (for example, missing parts could be declared as parts used for repairing issues).

The following chart integrates the hidden adjustments. In one year, the amount of hidden adjustments exceeded 3 times the number of official adjustments.

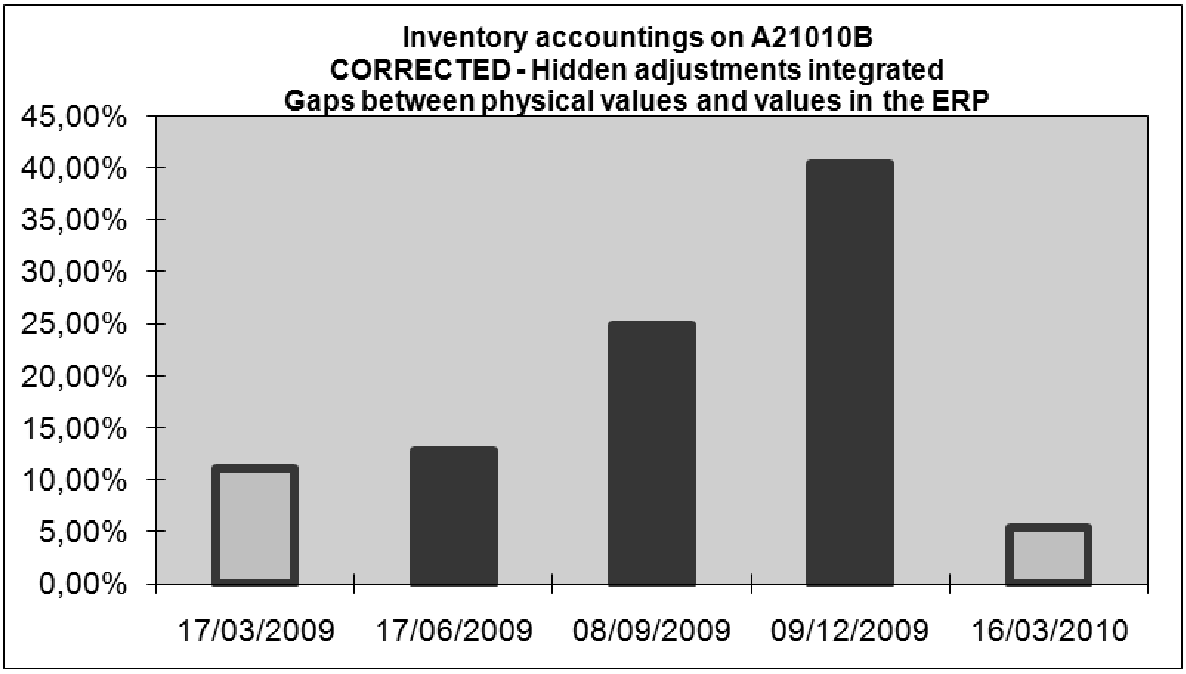


Figure 10: Inventory accountings results corrected (hidden adjustments taken into consideration)

It was essential to stop these hidden adjustments that made the measurement of stock level reliability wrong. Work on improvements would be possible only once the measurements were right.

Decisions

According to the analysis on stocks, the decision has been taken to improve stocks in two steps.

The first step is about control: “Hidden” adjustments should be stopped. All adjustments should be integrated in the indicator, in order to get a right measure of stock adjustments. The second step is to define action plans in order to decrease the gaps found during inventory accountings.

The method chosen for the first step was to rewrite procedures defining how to declare stock movements in the ERP and to train the operators on these procedures. Then SQL-queries were created in order to control the accuracy of these movements.

It was then decided to increase the control on stocks in order to monitor closely the improvements. The goal was to define a planning of inventory accountings that would be sustainable to follow, knowing that each accounting is time-consuming. It was therefore necessary to identify the right references to control and the right frequency to account them. This was made by defining a new planning of inventory accountings with the help of Pareto charts.

The method used is defined by Jonsson and Matsson (2009) as "Cycle counting", which means counting small group of items cyclically. Using this method, the important point is to adapt the frequency of counting to the volume of each item.

Pareto charts consist of displaying a sorted bar-chart of the item, based on a comparison criteria, in order to quickly identify "the vital few and the useful many" (Bergman, 2004). It is frequently used for quality improvements in industry, considering that usually problems can be solved once at the time. It helps dedicate one's time to the most critical issues and not waste it on unimportant ones.

The graph below shows the Pareto chart of leather consumption in the warehouse. It confirms the Pareto-rule: out of more than 200 references, the main reference (A21010B) represents 30% of the total leather consumption. The first six references represent 80% of leather consumption.

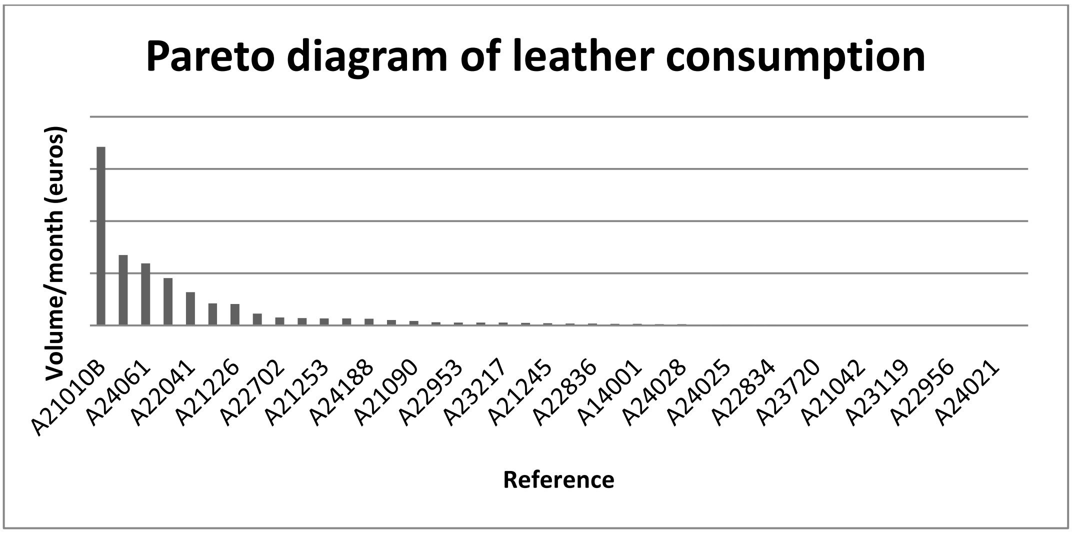


Figure 11: Pareto diagram of leather consumption. Each bar represents a reference of leather

From this chart it was decided to make one accounting per day (5 days a week), following the rule:

- The first reference: counted once a week
- Next 8 references : counted every two weeks
- The other references would be counted once every quarter as it was planned before.

A structured method, inspired by "causes and effects" diagrams, has been developed in order to analyze gaps between physical values and ERP and to build action plans from them. Cause and effects diagrams, also known as Fishbone diagrams or Ishikawa diagrams, were first introduced in 1943 by Ishikawa.

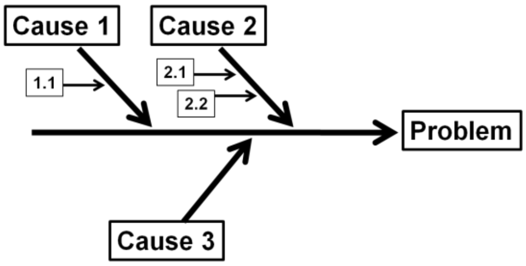


Figure 12: Causes and effects diagrams

They aim at identifying the root cause of a problem by making a classification between the possible causes. In order to get a structured list of causes, the “7Ms” method could be used.

The 7Ms are: Management, Man, Method, Measurement, Machine, Material, and Milieu. These 7Ms can be used as headlines for Cause and Effects diagram. However, it is necessary to go deeper in the analysis and to identify sub-causes for each of them (Bergman, 2004)/

The chart below (in French) shows the method developed. Inspired from Cause and Effect diagrams and by the 7Ms, it identifies all the possible causes that might have created an inventory gap.

This document should be considered as tool for communication and training with the operators.

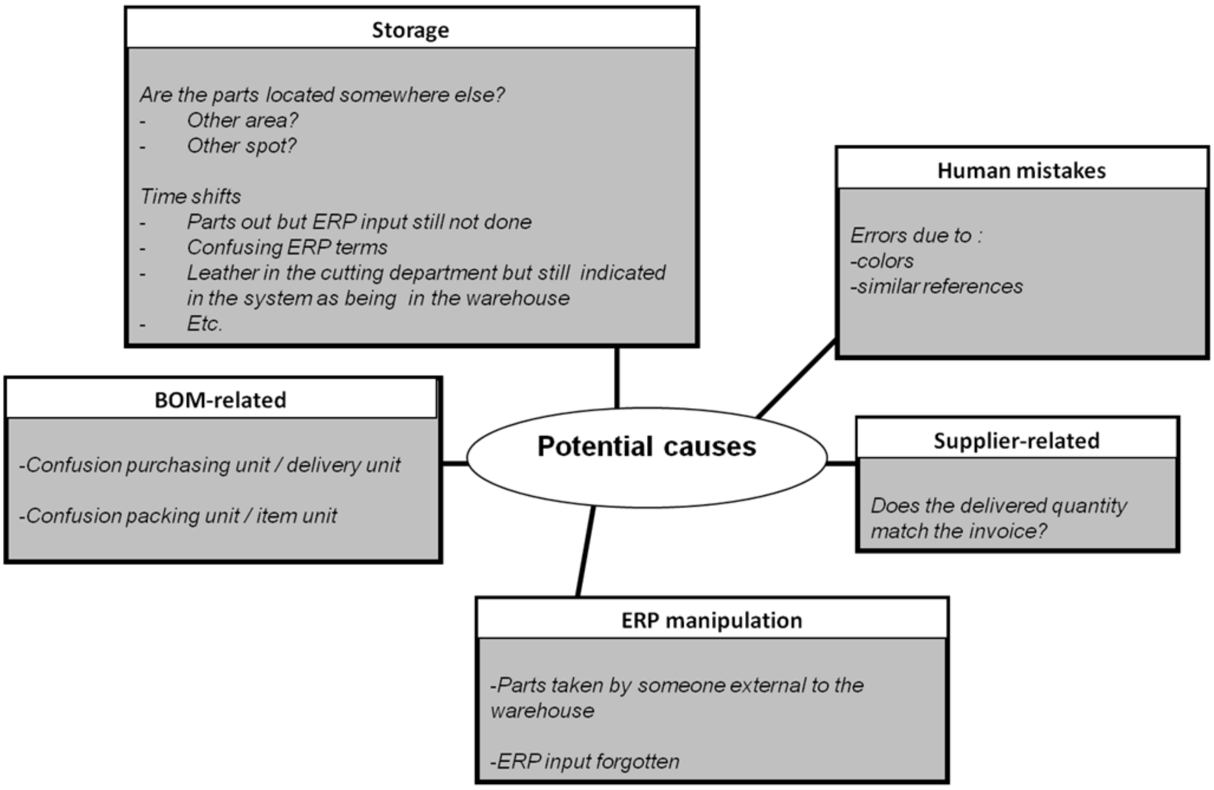


Figure 13: Method developed to analyze inventory gaps

Analysis and Methods – Quality Control process

Theoretical background

As presented before, inspecting raw material is one of the warehouse's core activities. Material inspection has always been a main concern in the field of quality management. According to Bergman (2004) and the Total Quality Management approach, inspection should be avoided and quality should be guaranteed upstream: "In modern quality philosophy, activities are guided towards process improvements so that defective units will not be produced. The practice of inspecting incoming goods is therefore no longer particularly interesting. Through active quality improvement together with the supplier, we can, in the long run, abolish inspection."

However, quality requirements at Louis Vuitton are severe and the warehouse cannot, at the moment, afford to skip quality inspection. For this reason the warehouse still heavily relies on *acceptance sampling* for incoming lots. Acceptance sampling consists in inspecting a number of parts from the lot received and make the decision on the acceptability of the whole lot from the result of inspection. Pyzdek (2003) defines the three essential elements of acceptance sampling as:"

1. The sampling plan. How many units should be inspected? What are the inspection criteria?
2. The action to be taken on the current lot or batch. Actions include accept, sort, scrap, rework, downgrade, return to vendor, etc.
3. Actions to be taken in the future"

The sampling plan in the warehouse is mostly based on the type of material received. Leather is systematically inspected by 100%. Metal parts and canvas follow a classic sampling scheme, with about 5% parts inspected. The actions taken usually include to sort the parts and then to scrap the KO ones. Action plans are then taken together with the supplier.

As the Total Quality Management approach suggests, the next step for the warehouse is to progressively decrease the importance of inspection and to guarantee quality from the supplier. This would bring cost savings (scrap rate decreased) and time savings (less inspection).

Goals definition

The following chart displays the material flow in the warehouse. The material moves between two areas: buffer stock (before control) and controlled stock.

All the material is controlled according to the "First In, First Out" rule. This "FIFO" rule is skipped for urgent needs. There are several control procedures depending on the type of material (leather, canvas, metal parts).

My work focused on the leather control process. For this process, the goal is to control the time spent in buffer stock. Limitations have been defined: the time spent in buffer stock should not exceed 2 weeks. Therefore it was necessary to monitor the control capacity.

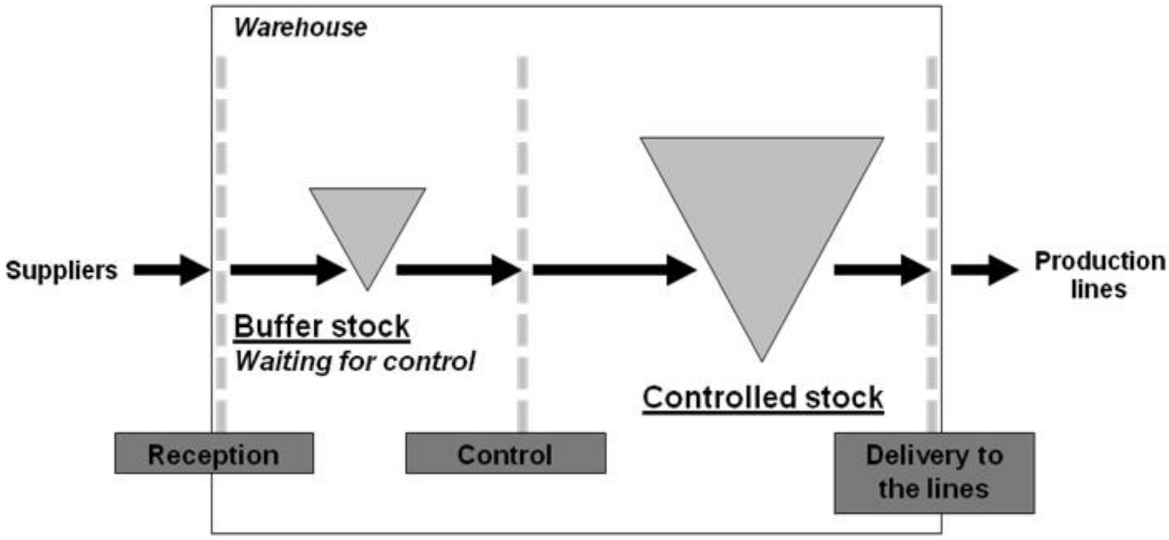


Figure 14: Material flow in the warehouse

Current tool evaluation – improvement proposals

A spreadsheet-based tool already existed to monitor the control capacity.
Its function was to predict the size of buffer stock over 5 weeks from the following data:

- Expected deliveries (from queries in the ERP)
- Available control capacity (number of man-hours in the week)

The tool had been created two years after some time studies on the control process. It is used on a weekly basis by the warehouse manager.

From the analysis, the following improvements were suggested:

- Simplify the user interface

The current application needs many manual operations before displaying the results, which takes time and often generates errors in the data. This could be more automated.

- Add a feedback on the control done

The current application uses the time measurement results in order to make a forecast on the buffer stock size. But there is no feedback on the actual amount of material that has been controlled. Adding this function would help manage the performance of the control process.

- Re-think the display of results

The idea is to display all the results on a single graph that could be easily understandable.

Analysis and methods – Quality monitoring

Goals definition

All the data related to the quality of the material received is gathered from the control process defined before. Every control operation is followed by a control report that is entered in a database. Each report is specific to a delivery. For metal parts, reports are written only in case of rejection whereas reports are always made for leather. The skins are controlled and classified into several "choices": #1 (very good), #2, #3, #4 and rejection. For each delivery a percentage of each choice can be calculated.

There was initially no compilation of the control reports. For this reason, it is difficult to identify clear trends in the quality of deliveries. Therefore it was decided to develop indicators which would achieve two goals: to monitor quality over time on specific references, and to make comparisons between several references.

Format definition

The only data source for this indicator was the control reports. They are sent to a database accessible from an intranet platform. All the data in the database can be extracted in excel format. For this reason, it has been decided to build the indicators in excel format, mostly using pivot tables.

Analysis and methods – Change management

From a broader perspective, this project on warehouse performance implied some cultural changes, especially regarding the introduction of daily briefings which was quite difficult to implement at first.

Managing change often meets resistance from the people affected. For this reason it is important to identify which obstacles might be encountered and how to overcome them. Harper-Smith and Derry (2004) identified a four-step sequence for change implementation: Denial, Resistance, Exploration, and Commitment. These steps have been encountered during the project. The graph below illustrates this process on our concrete case.

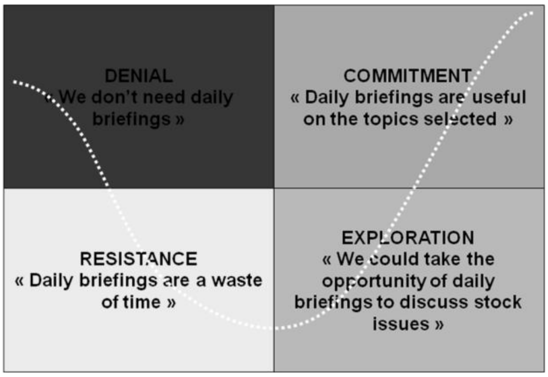


Figure 15: the four steps of change applied to the implementation of daily briefings

Since successful change implementation greatly depends on the people who will be affected, it is essential to understand how they will interact with the project.

A useful tool is the "power vs. support matrix" presented below.

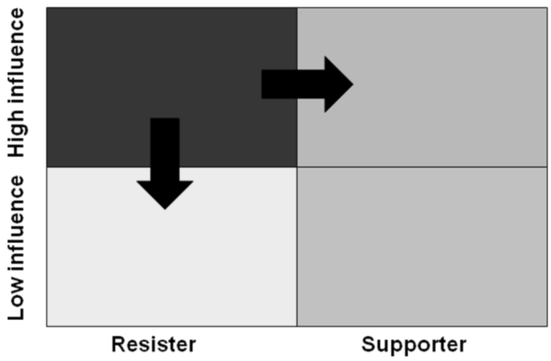


Figure 16: power vs. support matrix

The main idea is that the project's success could be jeopardized by resisters with high influence. On the other hand, supporters with high influence should be highly relied on as drivers of the project.

According to Delaunay and Moret (2009), four main principles must be followed by the project manager in order to achieve a successful change:

- Make sure oneself really wants to change
- Be clear and communicate by giving reference points
- Determine the right actions and show the example
- Reward the actors

Results

Implementation of daily briefings

The first result of the project is the implementation of daily briefings. Even though quantitative gains are difficult to determine, benefits related to staff involvement have been observed. The daily briefing is a team-building tool. It provides the team manager with a tool to share the goals and results. It improves daily work efficiency since sharing information improves coordination. The team is involved in continuous improvements regarding stocks or quality.

Stocks level reliability

The result of this part of the project is the implementation of new methods and routines that brought quantitative gains.

Step 1 - Control of stock adjustments

Clear procedures have been written in order to stop "hidden" adjustments. Training has been given to the operators. SQL-Queries have been developed in order to control stock movements and to quickly identify "hidden" adjustments. The warehouse manager uses these queries on a weekly basis. Therefore the approach chosen is based both on prevention/training and on control.

This tool has been implemented on metal parts movements. Before, the number of hidden adjustments could be estimated to 30% of the movements made in the ERP. With this system this number has decreased to 10%. It can still be improved.

Step 2 - Reliability improvement

The work on inventories brought concrete results. On the last leather inventory accounting, the percentage of gap on all references was 1, 1%. **On the main reference, it decreased to 0, 29%** (compared to 5,4% three months before), which shows that considerable progress had been made and that action plans were paying off. The goal is now to extend the method developed on leather to all the raw material in the warehouse.

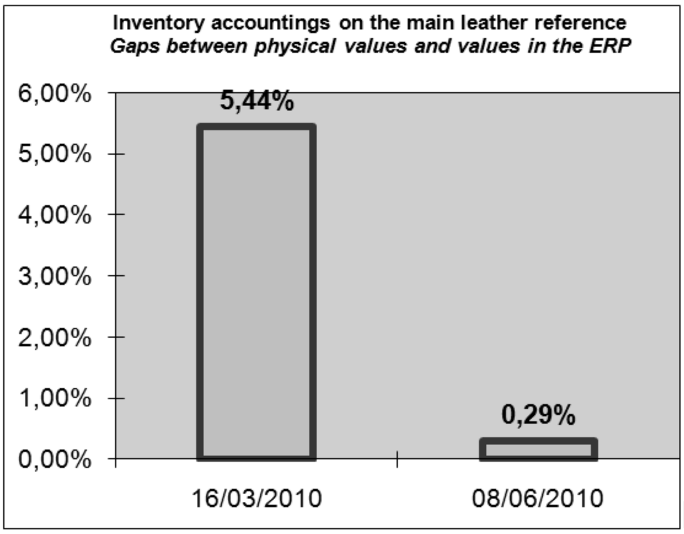


Figure 17: Improvements on stock level reliability

Quality Control monitoring

The main result of this part is the development of a tool (from the existing one) to help monitor the control process for incoming leather.

For the "forecast" part, the amount of buffer stock from one week to one other is calculated as follows:

$$\text{Buffer}_{week+1} = \text{Buffer}_{week} + \text{Deliveries}_{week} - \text{Controlled Qty}_{week}$$

Control Process Monitoring

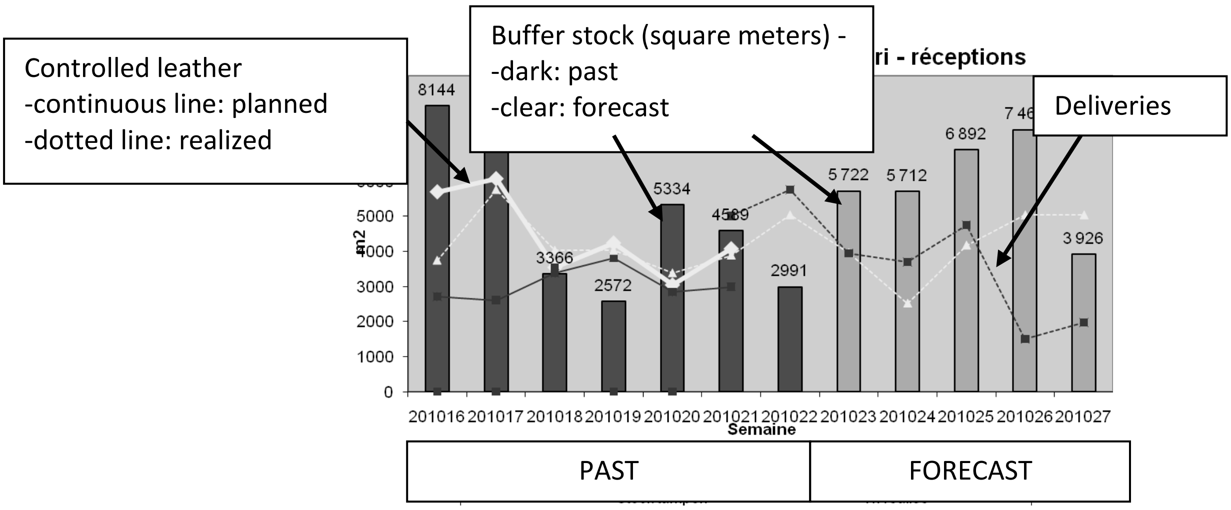


Figure 18: Control monitoring

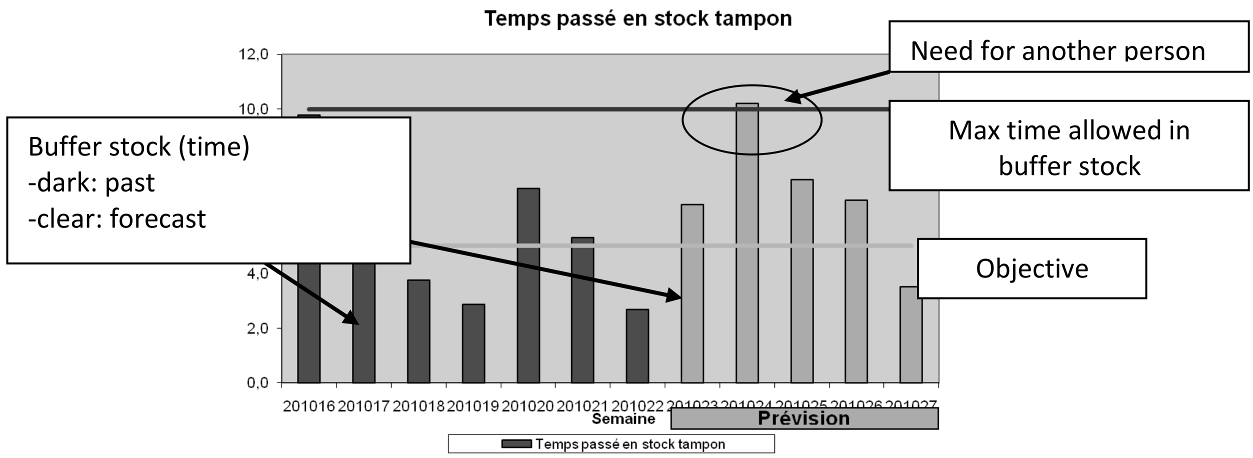


Figure 19 : Buffer stock monitoring

Gains

- **Ergonomics**

The new tool is easier to use than the previous one. The analysis takes about 15 minutes.

- **New functions:**

The new functions include: Quantity controlled vs. prevision, quantity received vs. prevision, prevision of time spent in buffer stock

- **Help on decision :**

It is possible to determine from the forecast (up to five weeks) whether the control capacity (number of controllers) will be adapted to the amount of leather in buffer stock.

This tool proves to be useful in two concrete cases. The first case is when the tool determines that the control capacity will not be enough. The warehouse manager can then negotiate the possibility to have a third operator for a certain period. Another case is when the tool indicates that the buffer stock would be low which enables to plan other activities for the operators (such as training)

Quality monitoring

Two indicators have been developed to help monitor quality in the warehouse.

Leather Indicator

This indicator compiles results from control reports over time. The yellow line shows the quality goal to which the supplier is committed. Two types of analysis can be performed:

1. Single reference study over time
2. Comparison between references

The graphs below show the indicator for one reference of leather. The time period is January to May.

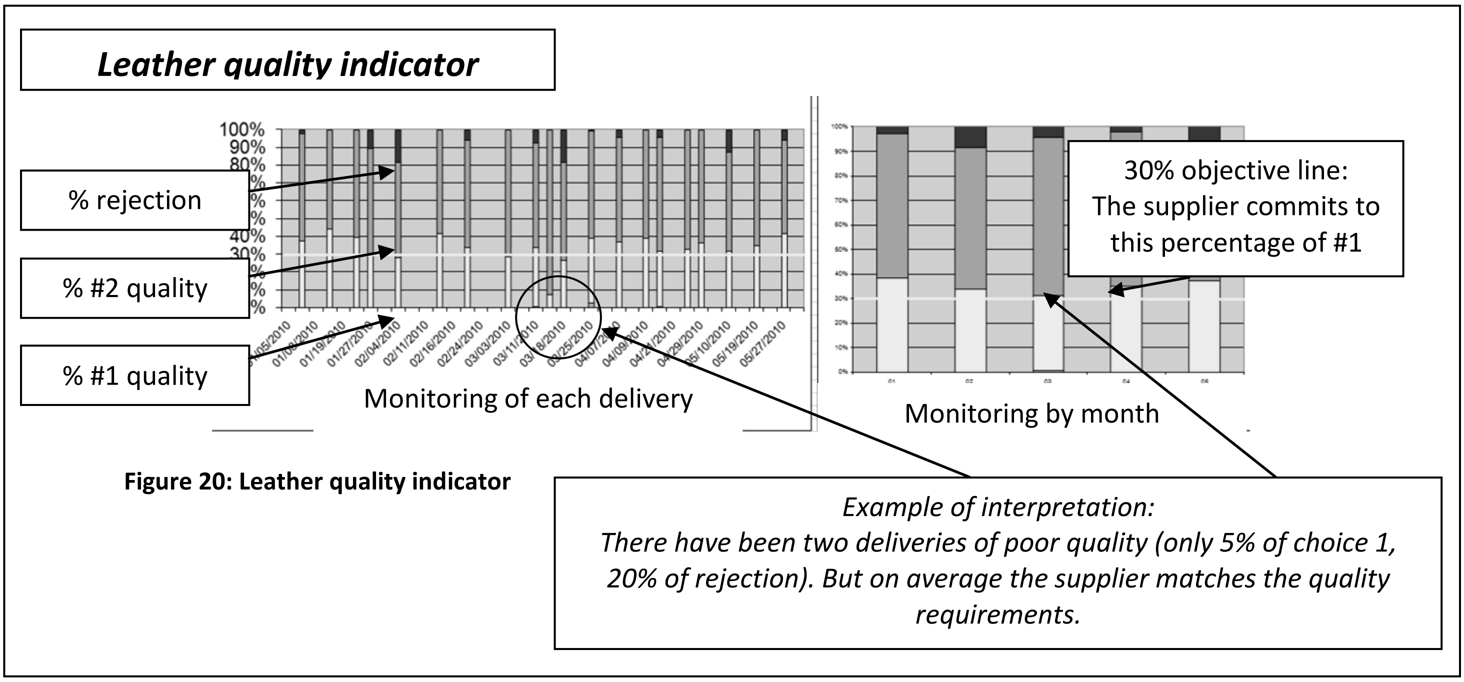


Figure 20: Leather quality indicator

Metal Parts Indicator

This indicator sorts the references of metal parts according to the highest scrap rates over a defined time period. It also gives the equivalent value of the scrap parts.

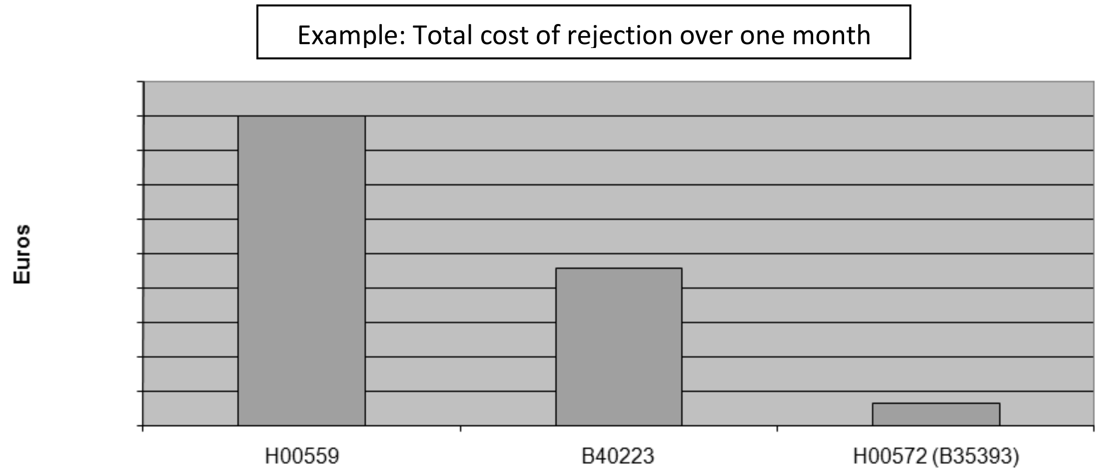


Figure 21: Metal parts quality indicator

Gains:

These indicators are followed on a monthly basis. They are used on two levels:

Externally - Between the workshop and its suppliers

The indicator gives a global view on the quality of the material received (% of choices for leather, % of non conformities for metal parts) which is a good tool to provide feedback to suppliers.

The leather indicator provides a quick overview of the last deliveries: major trends can be identified as well as variability from one delivery to one other. This gives a factual basis when dealing with suppliers on quality issues.

Internally – Within the workshop

With the workshop, the main benefit of the leather indicator is to make a link between process difficulties and the quality of the material received. This is especially true as far as the cutting process is concerned.

The metal parts indicator enables the warehouse team to set priorities among quality alerts. It is also a good tool to make the controlling operators more sensitive to quality issues.

Conclusions

This project on material flow improvement has been broken down into three sub-projects that brought concrete results.

Procedures have been created to ensure the reliability of Bills of Material, both in the "product development" and the "product life" phases. A process has been defined in order to decrease the amount of remaining stock during production ramp-downs. Performance indicators have been set for the warehouse and are animated through daily briefings. As a consequence, stock level reliability has improved. The quality control process and its results are monitored. Action plans based on the results are defined in the workshop and with the suppliers.

Along with these results, considerable effort has been spent on providing methods to sustain the improvement process.

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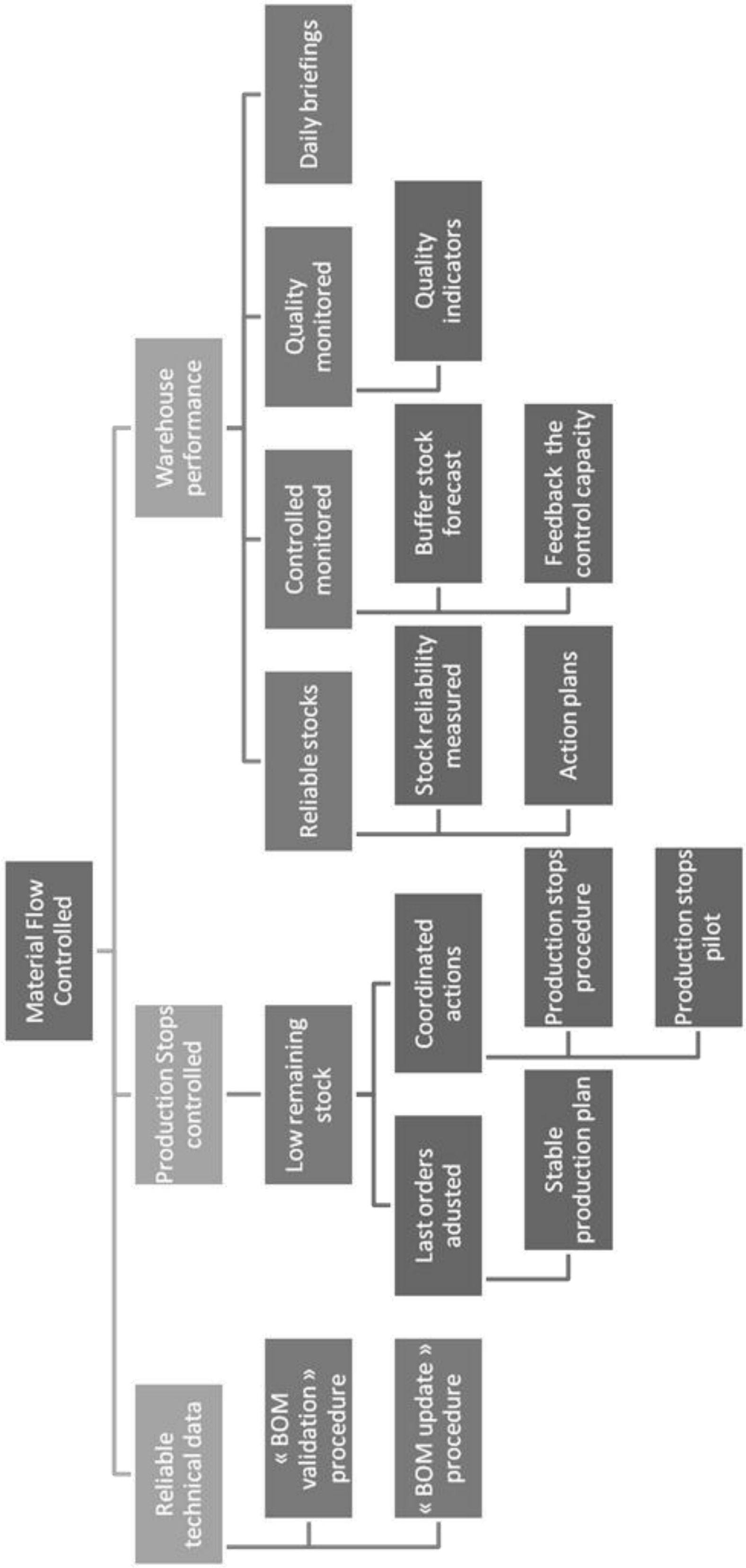
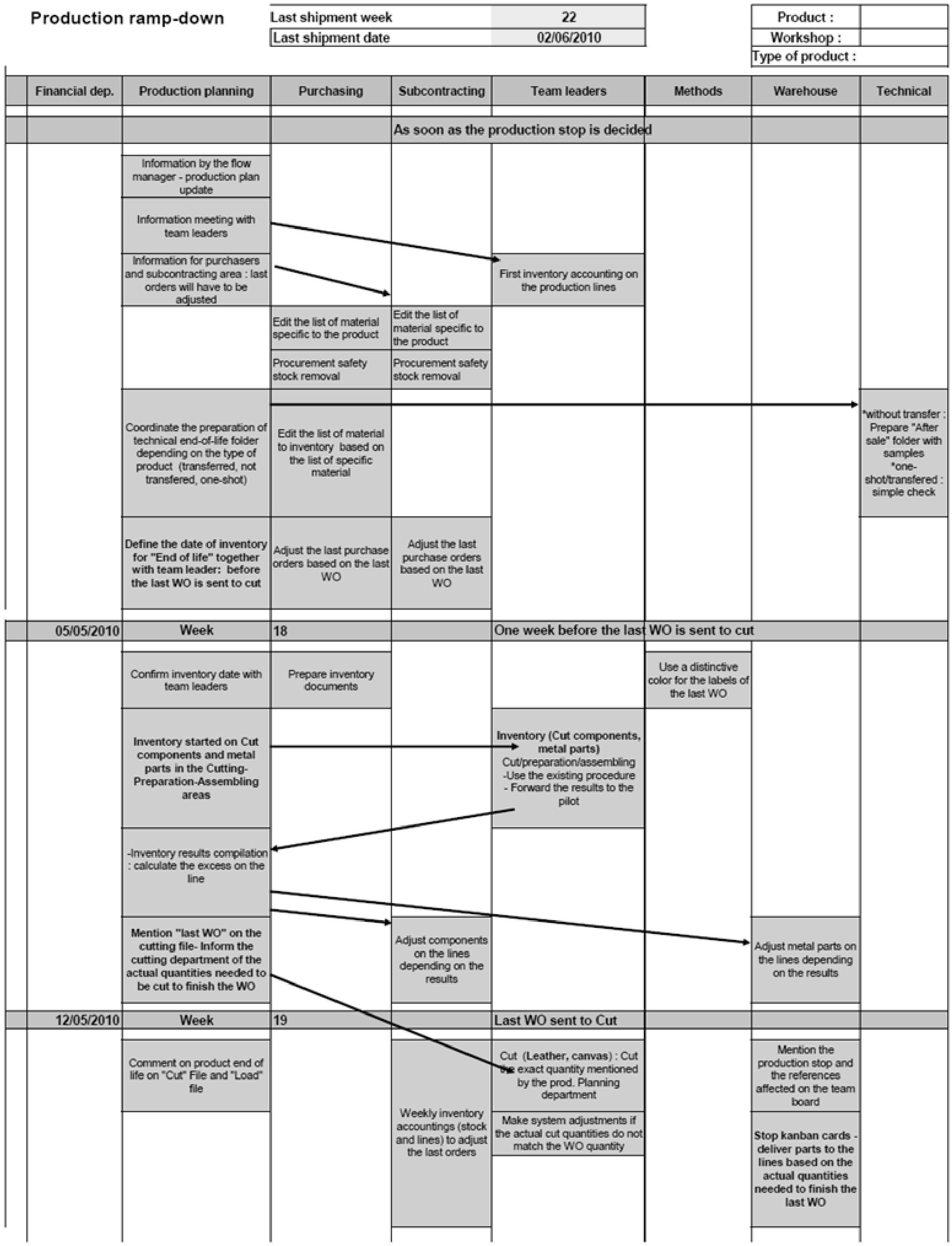
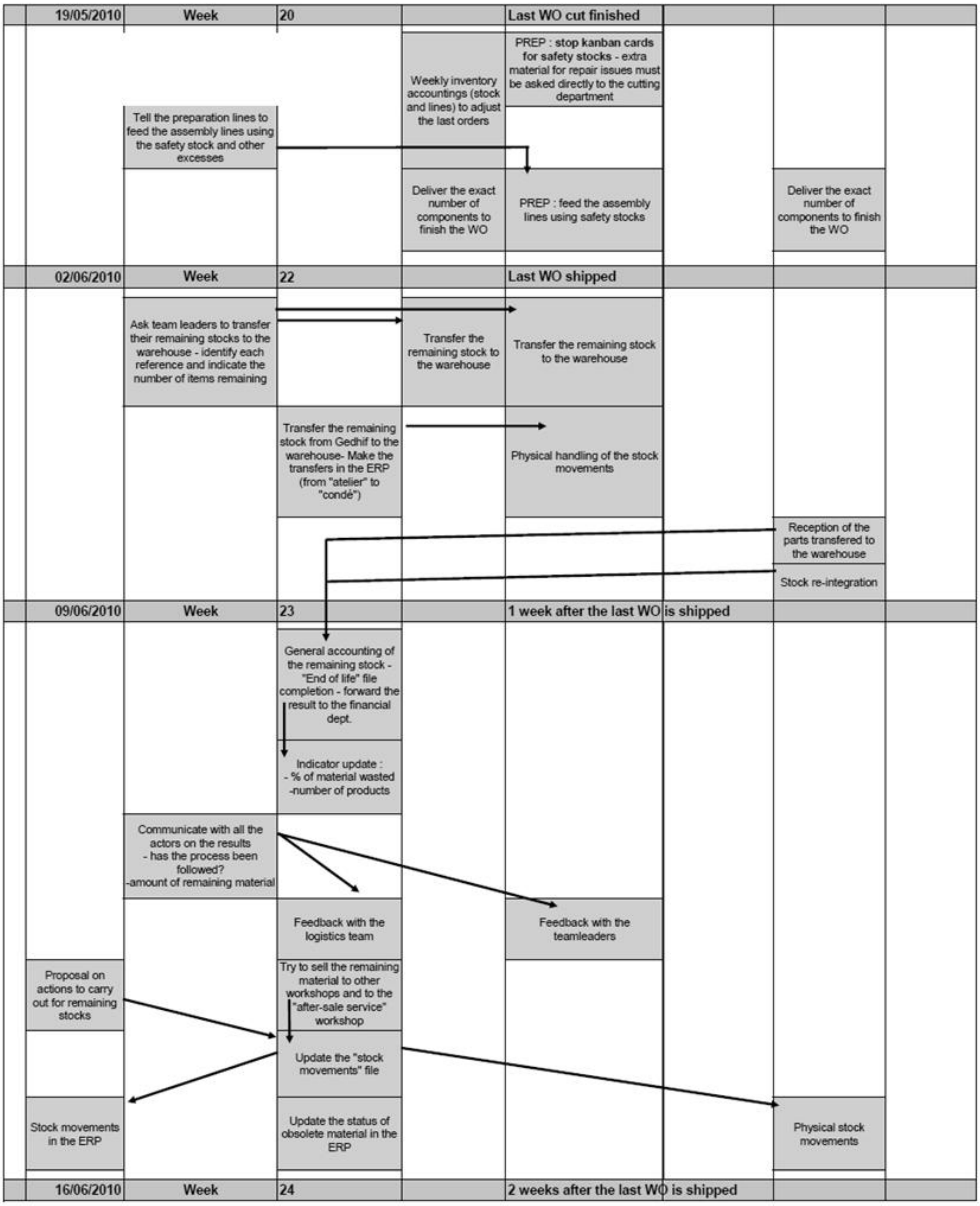
Appendix 1 - Work Breakdown Structure (WBS) of the project



Appendix 2 – Production ramp-down procedure




19/05/2010
Week
20
Last WO cut finished
PREP : stop kanban cards for safety stocks - extra material for repair issues must be asked directly to the cutting department
Weekly inventory accountings (stock and lines) to adjust the last orders
Tell the preparation lines to feed the assembly lines using the safety stock and other excesses
Deliver the exact number of components to finish the WO
PREP : feed the assembly lines using safety stocks
Deliver the exact number of components to finish the WO
02/06/2010
Week
22
Last WO shipped
Ask team leaders to transfer their remaining stocks to the warehouse - identify each reference and indicate the number of items remaining
Transfer the remaining stock to the warehouse
Transfer the remaining stock to the warehouse
Transfer the remaining stock from Gedhif to the warehouse- Make the transfers in the ERP (from "atelier" to "condé")
Physical handling of the stock movements
Reception of the parts transfered to the warehouse
Stock re-integration
09/06/2010
Week
23
1 week after the last WO is shipped
General accounting of the remaining stock - "End of life" file completion - forward the result to the financial dept.
Indicator update :
- % of material wasted
-number of products
Communicate with all the actors on the results
- has the process been followed?
-amount of remaining material
Feedback with the logistics team
Feedback with the teamleaders
Proposal on actions to carry out for remaining stocks
Try to sell the remaining material to other workshops and to the "after-sale service" workshop
Update the "stock movements" file
Stock movements in the ERP
Update the status of obsolete material in the ERP
Physical stock movements
16/06/2010
Week
24
2 weeks after the last WO is shipped