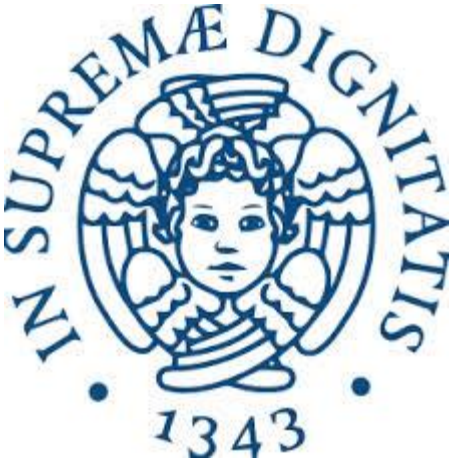

DIPARTIMENTO DI INGEGNERIA DELL'ENERGIA DEI SISTEMI,

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"Using Scrumban Method for Production Planning and Control in Manufacturing Companies"

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INDEX

Abstract

This thesis is the result of a study developed by the candidate about an instrument of Visual Management called “Scrumban”, which comes from the joint optimization of two techniques: “Kanban” and “Scrum”.

Scrumban is a Lean Production instrument originally used in Software industry; its principal function is to track the Works In Progress and to detect any bottleneck or problem all along the production line.

The aim of the work is to promote Scrumban introduction in manufacturing industry, identifying points of contact and differences with software field and to develop a standard Procedure that could guide its implementation in different companies in manufacturing industry.

The work contains a Procedure of implementation, which is based on a Case Study carried out by the candidate in a period of time between April 2015 and June 2015 at “Le Iene” Company head quartered in Scandicci (FI), supplier of several Luxury Brands like “Fendi S.r.l.”, producing small/medium size leather goods. The Case Study, by showing how the procedure has been applied, shows a “Model of Application” demonstrating the compatibility of this instrument in manufacturing industry.

1 INTRODUCTION

Nowadays companies operates with a common pattern: globalization, continuous technology development and constant and progressive change of customer's needs. (T. Laosirihongthong and G.S. Dangayach, 2005). These variables push the global industry to be dynamic, flexible, to reduce wastes and to find a good "costs-quality-time" trade-off, finally, to find another way of operating (Dangayach and Deshmukh, 2003); not reacting to these factors can only mean: low profits or, in the worst case, the failure.

The combined and continuous analysis of both external and internal environment of the company with the final purpose of identifying technological, economic, social and politic changes by comparing them with the production capacity, determines the next strategy (J. Febles Acosta, J.R Oreja Rodríguez, 2008); the objective is in fact to identify the existing gap and fill it as soon a s possible. Therefore remaining competitive means reviewing "Business Models" and strategies, breaking them down till operational objectives of the elementar levels (Voss, 1995; Li and Tan, 2004; Raymond and Croteau, 2006).

Starting from the last bit of the Twenty-first century, the answer to the Occidental industrial methodology of mass production, from standardization and indifferentiation of labour typical of "Ford Model" seemed to be called "Lean Production" which includes principles of flexibility, agility of the organization and of creative input of the individuals who participate in the productive process. Therefore the difference characterises instruments and modality and, luckily, not divergent ways of thinking; the gap can be then reduced with a

very high willingness and big efforts toward a significant renew and transformation of the culture and company traditions.

The Lean Production is an Occidental generalization and disclosure of the "Toyota Production System or TPS, called like this because born in "Toyota" (Taiichi Ohno (1995)," Toyota Production System: Beyond Large-scale Production"); this is a method of reorganizing the production and comes from a different and in some aspects alternative philosophy to the mass production, the series production and large scale production based on Henry Ford's Assembly Line.

TPS is based on the concept of "doing more by using less", this philosophy is pretty understandable if we think about the historical period when it is born; the immediate after war, when Japan was lacking in resources so that it had to utilize the few resources available and to take advantage of them it increase the productivity of the industry.

The Lean Production (R. Shah, P.T., 2007), is made of a mix of principles, methods and techniques for managing operations which aims are to maximise the perception of the final customer's value and to minimise wastes systematically; all of this is achievable only by involving motivated people within a continuous improvement prospective.

There are 5 guidelines - principles which characterise the Theoretical model of Lean Production:

- To define the Value from a customer prospective
- To eliminate wastes, in Japanese "*Muda"*.
- To run the activities smoothly (everything need to be realised by processes not functions, without stoppages or interruptions)

- To set the activities following the “pull” logic not “push” (starting an activity only when is required by the downstream process)
- To pursuit perfection through continuous improvement (Kaizen=continuous improvement)

According to these principles, the lean techniques operate; there is no need to remind here the importance of “Just in Time” (JIT) (Yasuhiro Monden (1998), Toyota Production System, “An Integrated Approach to Just-In-Time”) which solely on the basis of the final customer (pull logic) gives synchronization and rhythm ("tack time") to the production flow. Linked to the Just in Time technique it is very important the “Kanban”, like “CONWIP” which is a derivative; also “5S” technique, “Visual Control” and “Poka Yoke” give us the complete overall view.

Many companies from the Lean methodologies disclosure tried to apply them, to experience them. The software industry showed an increasing interest from 1990 as testifies the analysis conducted in “Nokia” to verify the real impact of the lean techniques against the classic ones (Maarit Laantia, Outi Salo, Pekka Abrahamsson, 2011).

If we take a look at the *automotive* industry, where the “Lean thinking” started, we can see that “Toyota” was not the only Japanese automotive company that introduced the Lean methodology, also “Nissan” and “Mitsubishi” married this innovative philosophy; a study measured how wide was the implementation of Market Flexible Customizing System (MFCS), between the Japanese automotive giants. Also cite (Bayou ET all, 2008) and (Nordin, N. ET all, 2010).

Considering the same industry, it is interesting a case study about the introduction of an "Agile supply chain assessment model" in an Indian organization, which produces components for automotive industry (S. Vinodh, S.R. Devadasa, K.E.K. Vimal, Deepak Kumar, 2010); we can now go through how the Lean Thinking has been spread within the entire Supply Chain.

Moving away from the manufacturing industry, we can observe how the Lean philosophy has been successfully introduced also in the healthcare industry, an example is represented by the application of the "A3 thinking", based on a graphic representation of the gap between current state and target with the objective of increasing effectiveness, safety and decreasing costs (Diane B. Kimsey, 2010); and it is still in the healthcare industry that researchers are trying to present a full range of examples about the implementation of Lean's principles in a complex system like the one of the healthcare (Antonio D'Andreamatteo, Luca Ianni, Federico Lega, Massimo Sargiacomo, 2014).

In addition to the many industries, Lean technique has been implemented also in the electrical sector (Wong, Y. C., 2009), in the electronic one (Doolen, T. L., Hacker, M. E., 2005); in the wood production (Ray, C. D. ET all, 2006), in the ceramic one (Soriano-Meier, H., Forrester, P. L., 2002) and in the CNCs industry.

In specific, keeping in mind that the final scope of a company should be creating value for the customer; anything that does not contribute to increase this value it is considered as waste (muda), from here the need of "waste fighting". There are two types of waste in every organization: the ones that do not create value for the customer but that are necessary to those activities that crate value; and then there are wastes that do not create value for the

customer but at the same time are not even necessary for those activities that create value for the customer.

The wastes that have been identified and analysed are 7: defects, overproduction, shipping, waiting, buffers, material handling, over processing (Figure 1). Mudas are also divided in two categories: wastes that cannot be eliminated immediately, and wastes that can be eliminated in a short period of time by using the proper methodology.

Figure 1- Wastes types

"Fighting wastes" includes different instruments that work on the following issues:

-planning and controlling the production and its progress status in order to keep the production flow running smoothly,

-reducing as more as possible the work in progress rate (WIP),

-reducing the batches in size in order to go towards just-in-time objectives and a pull strategies

To obtain the objectives listed previously, many Lean techniques applications have been implemented successfully in different industrial sectors. A very interesting one is the "Value Stream Mapping" (VSM) technique application, consisting in mapping the value flow to identify and eliminate wastes and non-value added activities in the purchasing

process of endovascular stents for an university department of interventional radiology (Ulf K. Teichgräber, Maximilian de Bucourt, 2012).

VMS has been the first instrument to be used, because it highlights the necessity of applying other techniques and it is critical for the success of the implementation, because it allows to build a solid and comprehensive action plan. Therefore its usage represents the best way to identify where the ways of improvement are. About that, there is another application case of VMS, this time in automotive sector for the production of cranks in a production plant in India (K. Venkataraman, B.Vijaya Ramnath, V.Muthu Kumar, C.Elanchezhian, 2014). And again, in a plant in Novartis in Switzerland, the VMS has been applied successfully in the development of pharmaceuticals (Mareike Heinzen, Samuel Mettler, Annina Coradi and Roman Boutellier, 2014).

The JIT is another popular technique applied successfully and other than the classical application its value has been appreciated also in the developing countries; in specific, in the prefab sector in Turkey, where quality and productivity issues are major, this technique brought a lot of benefits (Emel Laptali Oral, Gulgun M-st-koglu, Ercan Erdis, 2002).

As much as important there are the classical techniques in the service industry, where the first necessity is reacting to customer's feedback as soon as possible, so the JIT is the most used paradigm because it allows to eliminate wastes both in manufacturing and service industry (A. S. Aradhye, S. P. Kallurka, 2014).

Looking at the upstream, the balance of the production lines is the base line of many production systems so its effectiveness and efficiency are necessary also for the success of next implementations; a case study we could look at, is the application of line balance in

electronic sector (Gonca Tuncel, Seyda Topaloglu, 2012), similar to another case the solution to the balance, even if difficult due to the high uncertainty of the system, can be identified with two robust optimization methods (Öncü Hazır, Alexandre Dolgui, 2013).

Linked to line balance, follows unquestionably, the topic of inventory reduction between intermediate workstations; about that it can be found a case study where two definitions are presented and their standardization in the Mixed Model Sequencing with the minimization of the workload (MMS-W) for production lines with in series and parallel workstation in "Nissan" plant in Barcelona (Joaquín Bautista, Alberto Cano, Rocío Alfaro, 2012). About same topic it can be found another example of real application in the textile industry (Juliana Keiko Sagawa, Marcelo Seido Nagano, 2015).

Anyway it is difficult to apply the Lean techniques, there are many obstacles that can lead potential failures; to have a successful introduction process of lean production, the commitment of top management is an essential pre-requisite in order to avoid that the obstacles met during the execution of the project, do not bring the organization back to its prior state (Swank, 2003). In first place, every change needs to be carried out with determination, constantly and with the consciousness about the strategic objectives that the project is trying to achieve. In second place, the process of innovating the pre-existent organization, once has been defined, it should be pursuit continuously, with the necessary gradualism so that the activities are not affected.

The fear that the changes are not feasible due to the dimension of the company plus the high investment required in terms of human and financial resources, are all factors that can slow down the process of change and represent the main obstacles to face. An additional issue is often seems to be the wrong training which an organization that introduces Lean is

subject of; training is a key factor for the success and if it is carried out in the wrong way can bring serious problems (Taghi Javdani Gandomani ET all., 2014).

If we focus on the application of different instruments, we realise how difficult is keeping under control the production progress; in fact, in production planning and control, planning with methods of project management has been successful in many cases. Typical is the use of GANTT as planning instrument; unfortunately we can suddenly realise that this document needs some updates because it changed from the original plan; so this instrument will not be that useful unless we constantly keep it up to date (Harvey Maylor, 2001 and Kenneth N. McKay, Gary W. Black, 2007).

It becomes clear now why nowadays management (for example production management) need lean, flexible and visual (like schemes or charts) instruments more than ever; not to forget that one of the key concept of lean production, as we find with the Toyota Production System, is Visual Management.

The workspace needs to be organised and indicated so that it speaks for itself; that is why the horizontal signs, labels and other instruments are fundamental for lean production. Workers, through Visual Management, should have the information they look for immediately available. An example is the horizontal signposting or kanban cards, as well as projectors or screens located where the operators or the management can easily identify them. This will allow them rapidly to gain a complete up-to-date view on the situation, for example on the product progress or on the state of WIP in one or more lines (Tien-Lung Suna, Wen-Lin Kuob, 2002). Visual management needs to be standard, in other words everybody have to “read” it in the same way, without room for interpretations. For example, the stickers used in the horizontal signs, depending on the colour used, have a different

meaning; the one in yellow is used in the main zones, to identify the main areas; the red one is used to identify non-confirming areas or products. According to what stated before, in production it seems necessary to develop Visual Management techniques rather than to keep using the classic techniques of production planning and control.

A precursor of this innovative trend is software industry which under the name of "Lean Software Development" brings all the flexible and lean techniques taken form Lean Production reviewed and applied to the software field (Mary Poppendieck, Tom Poppendieck (2003), "Lean Software Development: An Agile Toolkit"). In parallel to JIT, Kanban and CONWIP, we find the Scrum, an *"agile framework for Software development"* created and developed by Jeff Sutherland and Ken Schwaber in "The Scrum guide" (1990).

Scrum is not a process or technique to build products but it is a framework with which it is possible to use different processes and techniques like Visual Management, in fact Scrum uses "Scrum tables", electronic (Figure 2) or classic whiteboards where the progress of the production of software products can be tracked and managed by teams that plan, organise and carry out their work. The word "Scrum" comes from *rugby* and it is used as a metaphor to indicate a team of people who work together so that every team player goes in the same direction, acting like a coordinated unit. The Scrum technique is mainly used with software development teams with the aim of increasing their performances through the definition of

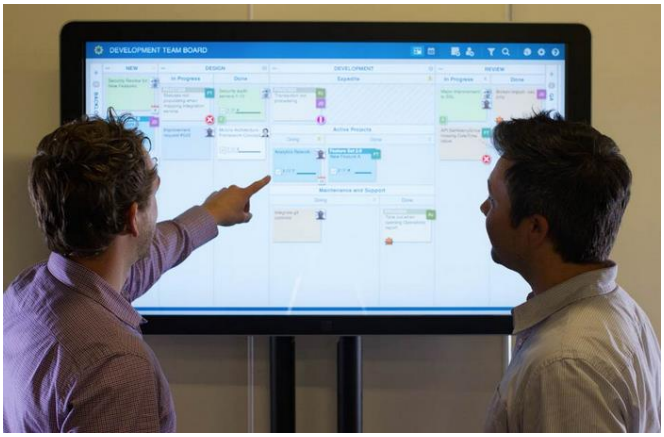


Figure 2 - Example of Electronic Scrum Table

the operating principles. These principles include a breakdown of the project in fast work blocks called “Sprint”, at the end of each one, the results are assembled and the software progresses, this means value for the customer.

Scrum utilises an iterative method and an incremental approach to optimize risk predictability and control in a continuous improvement prospective. It is present a real application of this technique (Nils Brede Moe, Torgeir Dingsøyr, Tore Dybå, A teamwork model for understanding an agile team: A case study of a Scrum project in Information and Software Technology, 2009).

However, Scrum is not the only one technique implement in software industry; in this direction, Scrumban, is a project management agile methodology, which is obtained from a mix of Scrum and Kanban with different aspects from both methodologies (Łukasz Sienkiewicz, 2012 and C. Ladas, 2008). This technique consists of a teamwork organised in small interactions monitored and controlled through a “Visual board” similar to Scrum and Kanban ones.

Meetings for planning are carried out to define which tasks need to be complete in the next step. The tasks are then added to the Visual Board and completed by the team, each member works on one task each time only. (Ladas, Corey. "Scrumban." Lean Software Engineering-Essays on the Continuous Delivery of High Quality Information Systems 2008). Many companies that were using Scrum to complete and to monitor their projects, agreed in using Scrumban thanks to the easy way of switching from Scrum to Scrumban (Natalja Nikitina, Mira Kajko-Mattsson, Magnus Stråle, 2012). For those companies that decide to apply Scrumban as first technique, the implementation process is more complex; Xiaofeng Wanga, Kieran Conboy e Oisin Cawley (2012), in an article report an analysis of

about 30 different experiences of lean methodologies application in software development industry.

If on one hand software industry introduced lean techniques long time ago, on the other hand who just experienced these techniques recently is *Luxury and Fashion industry* (Carmignani and Zammori, 2015); in this area it is interesting, from a Visual Management prospective, to spot simple instruments, effective and with an immediate impact to facilitate a quicker planning and progress control. It would be interesting, due to Scrumban huge success from earlier on with software, applying this technique to manufacturing especially in the Luxury and Fashion industry; in fact, even if this solution doesn't look too innovative, there are some similarities between Lean Software development and Lean production that push these new experiments.

It important to keep in mind that Toyota production System (TPS) has strongly influenced Lean Software Development methodologies (McKenna T, Whitty S.J.,2013) , therefore in its origins we find the "hidden" manufacturing production: the term "Scrum" from which Scrumban technique is born and has taken its fundamentals, it has been released and used in 1986 in two scripts written by Ikujiro Nonaka and Hirotaka Takeuchi; precisely in "New New Product Development Game" (1986) and later on in "The Knowledge Creating Company" (1995); these two people described a new approach to commercial product development which should increase flexibility and speed, based on case studies coming from automotive industry and printers production.

Therefore, it is important to notice how Scrum, even if used as a "software tool" finds its origins in manufacturing.

The aim of this work will be therefore to propose the application of Scrumban methodology to manufacturing, due to the important benefits experienced in other areas.

2 SCRUM AND KANBAN

Scrumban methodology, as the name is showing, is obtained by the union of different aspects coming from two techniques: Scrum technique and Kanban technique, both mainly used in software development.

This work will refer to Kanban technique as "Kanban system for software development, therefore it is not used as "labels system" as it is in Lean Production from Toyota.

To describe the methodology of applying the Scrumban technique, it is necessary to describe first both Scrum and Kanban techniques for a better understanding and to highlight their differences and areas where they are applied; after that, Scrumban methodology will be introduced which is in reality an overcoming of the two techniques put together.

2.1.1 Scrum

The main characteristic to look at in case we want to implement the scum methodology is labour organization: instead of having a big group of people taking a long time doing a big job, we have a small group of people taking a short period of time doing a small job but integrating regularly the small bits together till the whole project is completed.

Main macropahsis:

- To divide the organization in smaller teams that organise themselves independently and that are interfunctional. (Figure 3).

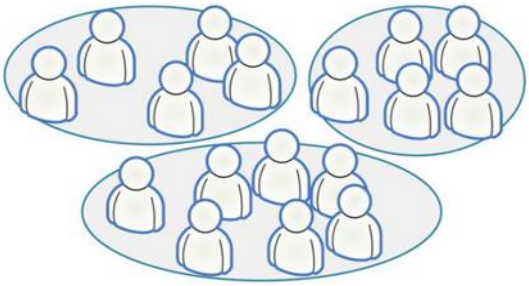


Figure 3- Interfunctional teams

- To detail the job in small and simple deliverables to achieve. Then order the deliverables based on the priority and estimate the effort to complete each of them. (Figure 4)

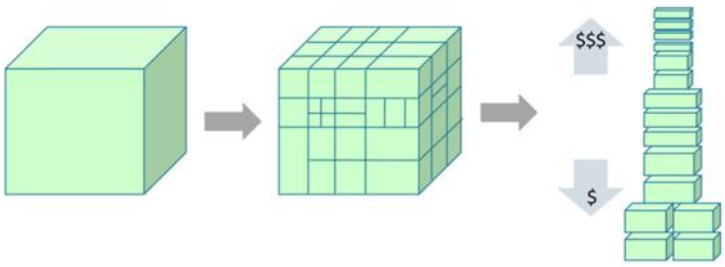


Figure 4 – Detailed Job

- To split the time in short iterations with a fixed length (normally from 1 to 4 weeks), assigning a code which can be potentially delivered, verified after each iteration. (Figure 5)

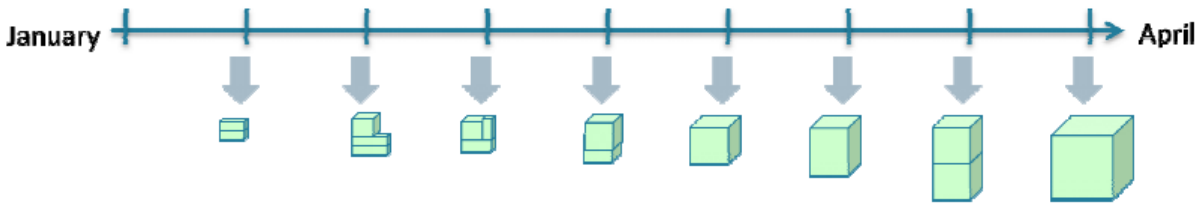


Figure 5 - Split with fixed length

- To optimise the release plan and to update the priority together with the client, based on the feedback obtained from each iteration.
- To optimise the process by realising a retrospective after each iteration

Scrum like Kanban, utilises a "Scrum board"

Scrum uses also a "*Burndown chart*" (Figure 6), a graphic representation of the tasks that need to be completed during the project; usually what is reported is a *"backlog"* (remaining work in hours or days) that is put on the *y*-axis and *time* on *x*-axis. The graph represents an

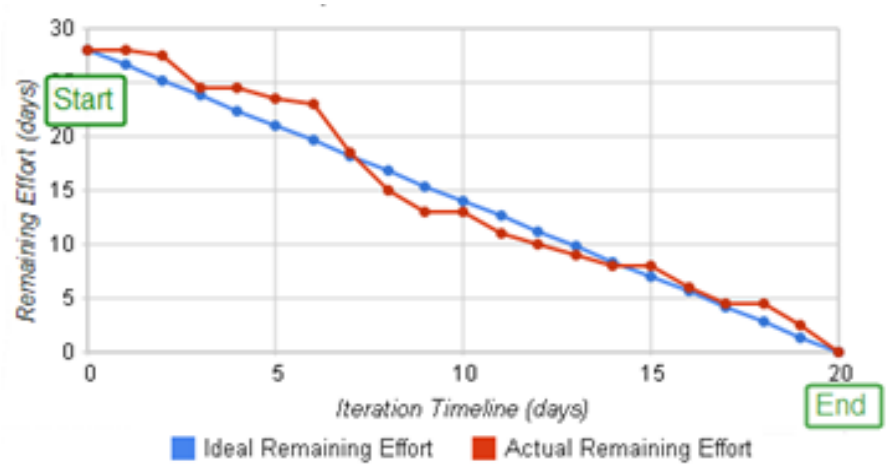


Figure 6 – Burndown chart

historical series of the work that needs to be done. This is useful to see when the work is most likely to be completed.

2.1.2 Kanban

The principle on which Kanban is based on, is the *Work in Progress (WIP)*; actually the name "Kanban" means "label" or "tag", which refers to a graphic sign that identifies that a new job can start, pulled from downstream, because the job that is currently processed has not reached the right stage yet.

Main Macrophasis:

- To subdivide the job in smaller parts (items), to write each item on a card and put it on a board called "Kanban board"
- The board should be structured using the columns that have names to illustrate where each item is in the workflow. (Figure 7)

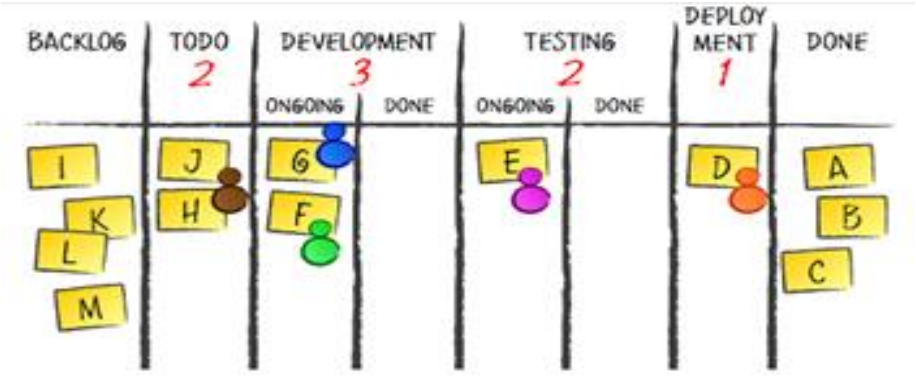


Figure 7 – Example of Kanban board

- To limit the Work in Progress (WIP); assigning boundaries to have a specific amount of items in progress at each stage of the workflow.

- To measure the lead-time (Avarage time to complete an item, sometimes also called "cycle time"), to optimise the process in order to keep the lead time as low and as predictable as possible.

2.1.3 Relation between Scrum and Kanban

Scrum and Kanban are two *Process instruments* and like any other tool they are not complete or perfect; choosing one instead of another depends on the context. Scrum is a more prescriptive method, it has "more rules to be followed"; it forces for example to have time boxed iterations and cross-functional teams, while Kanban pushes the use of visible panels and to limit the size of the queues. However, Agile's methodologies are called "light methodologies" because they are less prescriptive than the others.

Scrum prescribes 3 roles:

- Product Owner (defines vision and product priority)
- Team (implements the product)
- Scrum Master (removes obstacles and gives guidance to the process).

Kanban does not require specific roles; it doesn't mean that it is forbidden but just that it is not necessary. Theoretically, an organisation is free to add roles with both methodologies if needed; the main thing is that roles should add value and do not clash with other

Scrum prescribes time-boxed iterations

Scrum is based on time boxed iterations called in Scrum-language *"Sprint"*. It is possible to choose the length of those iterations, but the idea is to maintain the same length for all of them during a certain period which usually goes from 1 to 4 weeks time and therefore determining a pace. (Figure 8)

STARTING POINT OF THE ITERATION: an *Iteration Plan* is realised, the team selects from the backlog (the total workload that still needs to be done but it doesn't figure in the workflow yet) a specific amount of items based on the priority given by the Product Owner and the time left for the team to complete each iteration is defined.

DURING THE ITERATION: When the iteration is in progress, the team focuses on completing the items as planned. The scope of the iteration is the same.

END OF THE ITERATION: the team shows the working code to all the shareholders and ideally it could be delivered at this stage (ready to be used). The team can now run a retrospective meeting to discuss and improve the process just completed.

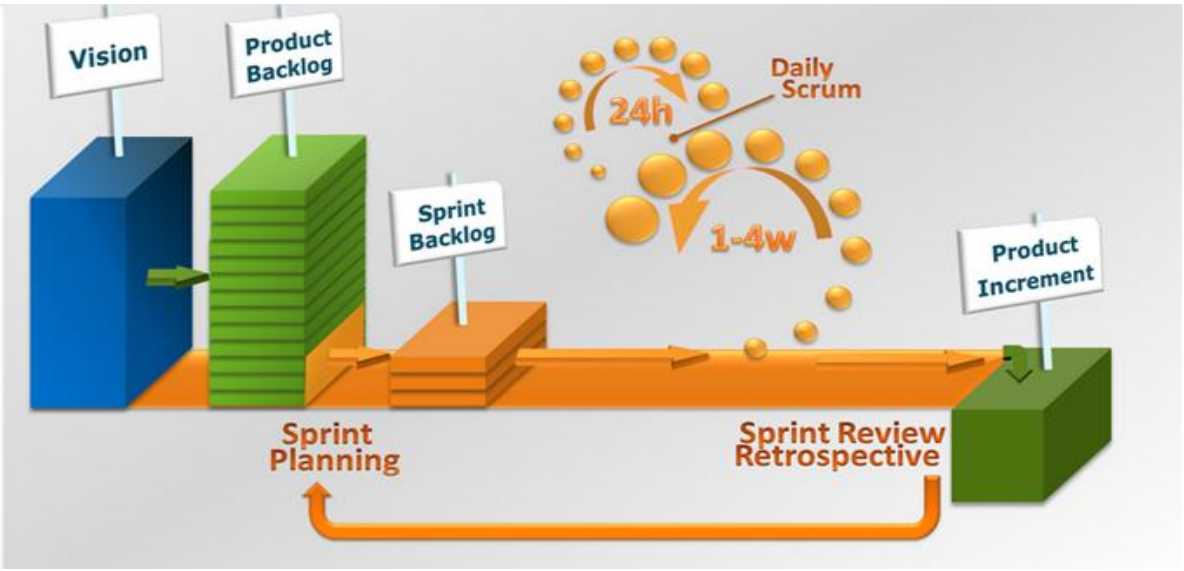


Figure 8 – Iteration's cycle

Therefore, a Scrum iteration is a single time boxed event which combines three different functions: planning, process improvement and (in the best case) release. (Figure 9)

Within the Kanban there are not time boxed iteration prescript, but it is possible to choose when to run planning, process improvement and release of the application.

It is possible to choose to do that regularly, for example "release every Monday" or starting planning at the beginning of each month.

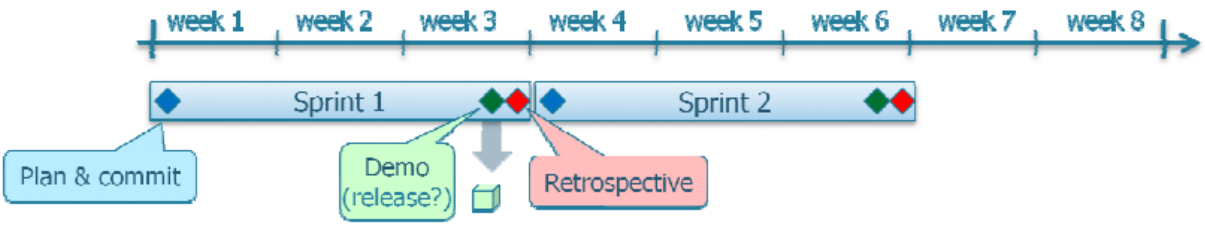


Figure 9 – Characteristics of Sprint

Approach to WIP for Scrum and Kanban

In Scrum, the backlog sprint shows which tasks need to be done during the current iteraction; this is commonly represented through cards organised on a board called “Scrum board”. Also, the Kanban utilises a similar board called “Kanban board”. The difference is on the WIP approach used by in two methodologies. (Figure 10)

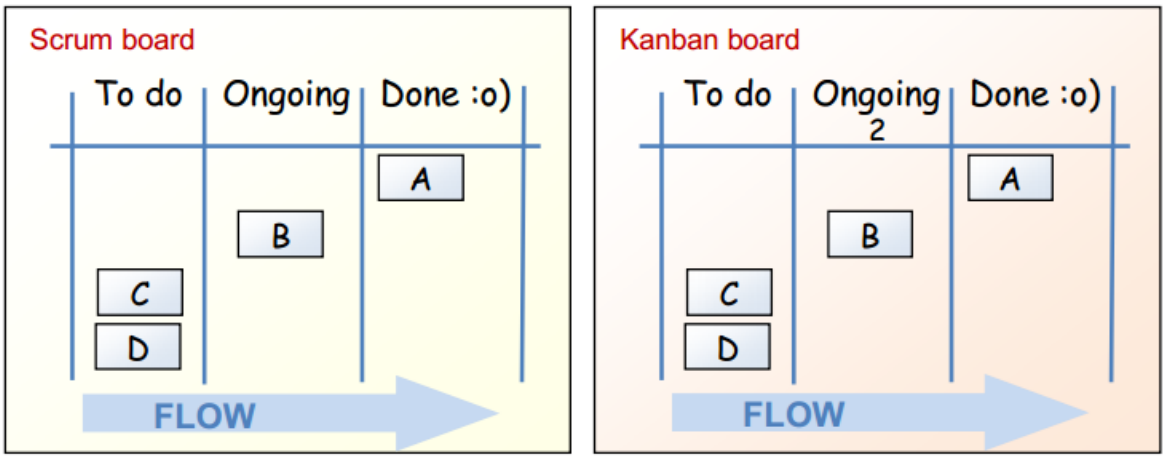


Figure 10 – Differences between Scrum and Kanban Board

Let us consider the simple case with three columns in both cases: *To Do, Ongoing, Done.* By observing the two tables, it can be seen that the only difference is the “2” in red in the “Ongoing” column of the Kanban Board. That number “2” means that “there cannot be more than two items in this column in a specific time”.

Within Scrum there are not these limits; there is anyway an implicit limit which corrisponds to a 4, so to the total number of items in the board. It often happens that some Scrum teams believe that processing too many items together is not effective therefore they limit the items in the current column; a sit can be seen the Scrum board became a Kanban Board. In general, Scrum and Kanban have different WIP approaches; Scrum limits its WIP

for *time units*, this means that once the team knows its speed, the time taken to process an item in the time unite, this becomes the WIP limit. In Kanban WIP is limited for workflow state; the limit of 2 items from the previous example, are related to a workflow state (Ongoing), the idea is to limit the WIP of any of the workflow state. In this way, referring again to the previous example, some limits to the "To do" columns should be set; once WIP limits have been agreed, it is possible to start measuring and predict the delivery times, which correspond to an average time that an item takes to go through its way on the board. Having predictable delivery times allows to reach a SLA (Service Level Agreement) and to plan realistic release times.

More differences Scrum-Kanban Board

What it would happen if we add an "E" item and a "Scrum board"?

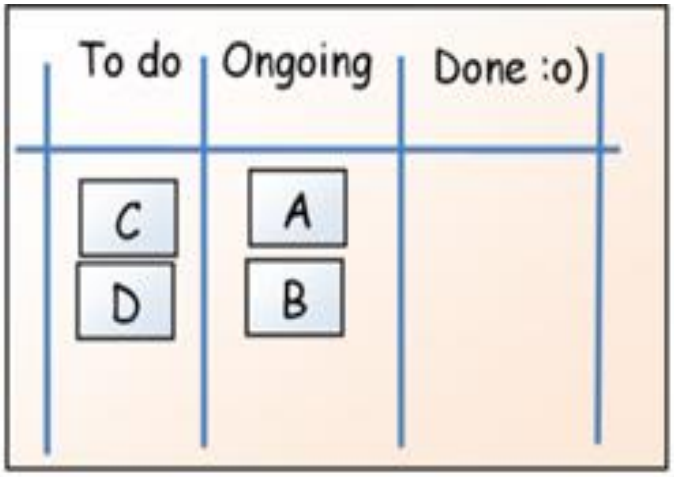


Figure 11- Characteristics of Scrum when we add items on board

Considering a board like the one over here (Figure 11), if we would like to add a new item at this point, the procedure would not include to add the item right after the current Sprint (the team is already busy working on items A, B, C, D) but to add “E” to the product backlog; it will be then the Product Owner to evaluate the priority of the item and processing it before or after the others. And, if we would like to add “E” to a “Kanban board”?

Let’s consider a board like this one:

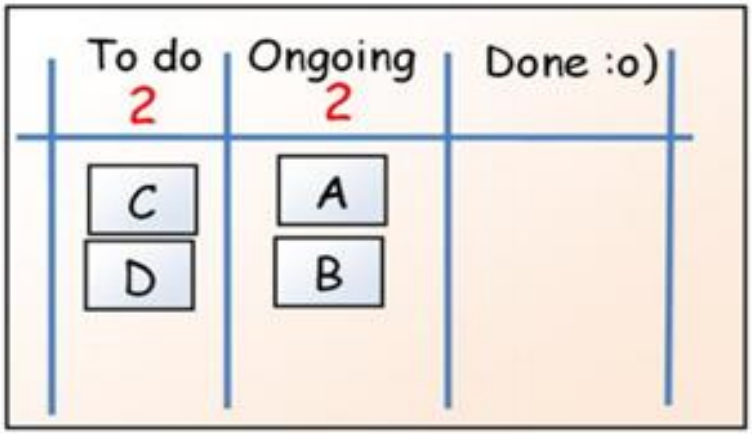


Figure 12 – Characteristics of Kanban when we add items on board

The team in this case will react in a different way; in the “To do” column there are already C and D items and an “E” could theoretically be inserted here but because there is a WIP limit equal to 2, it means that to introduce an “E” it will be necessary to eliminate either C or D; at the moment the team will be also working on A and B so when they will be finished, the team will insert the item with the highest priority in “To do”. (Figure 12)

A Scrum board is also reset after every iteration, this means that when the items of a single sprint have gone through every stage of the workflow till “Done”, the items will be removed; later, at the meeting for the planning, the table will be updated with the new Sprint. Regarding the “Kanban board”, what described before won’t happen because the table is pre-existing so it doesn’t need to be reset and updated to start from the beginning.

Scrum and Kanban are both empirics, this means that they are two methodologies that have to be experienced and customised depending on the context and the environment; both of them include few basic constraints that allow to assess the improvement of the process on which they are applied to (Kaizen). Kanban, as it has been said before, is less prescriptive than Scrum with which there will be more parameters to think about; this characteristic can be an advantage or a disadvantage depending on the context.

Kanban and Scrum led to not only a process improvement but they also build the basis of another Lean methodology called Scrumban, which represent itself a further *improvement*.

3 METHOD OF SCRUMBAN APPLICATION

Figure 13 – Scrumban combines Kanban and Scrum together

Scrumban approach combines Kanban and Scrum together (Figure 13) and it is commonly used in project development, in project update and its maintenance, in event-driven works with IT- help -desk hot –line support, other than agile teams focused on product development. Scrumban brings together the best characteristics of both techniques; the idea is to start form Scrum and then adding Kanban's characteristics step by step. The technique of Scrumban, in fact, uses the prescriptive nature of the Scrum and uses process improvement typical of Kanban to allow the team to continually improve. Improving quality, Just in Time work, reduced lead time and continuous improvement through waste and non-value added activities reduction, are the distinctive characteristics of Scrumban technique.

Principles of Scrumban:

1. **Visualize the workflow**. The workflow is visualized so that the team can follow how the tasks move from the initial request to completion. This provides both - a sense of project scope and understanding of the end goal.
2. **Pull work**. The team members pull tasks from the backlog into the progress columns themselves, depending on capacity and limits. Each team member chooses their tasks based on their capabilities and the ready column (placed between backlog and in progress columns) highlighting the priority tasks.
3. **Limit the work in progress (WIP)**. Each team member should be working on no more than one task at a time. To reinforce this rule WIP limits from kanban are used, limiting the number of tasks in the progress columns. This reinforces team collaboration and ensures any bottlenecks are resolved quickly.
4. **Plan on demand**. To save time and minimize waste, the planning is done only when necessary. The amount of tasks to be planned for an iteration is controlled, by putting a limit on the backlog column. The task limit is based on team capacity and prior iterations.
5. **Feature freeze and triage**. When approaching a project deadline, the feature freeze is used to stop the planning of any new features. At this time the team works on the already planned features and the project

manager implements the triage deciding which of those features will live (be released) and which ones are going to wait untill the next release.

6. **Review the work**. Kaizen is important and to improve the work, review and retrospective meetings from scrum are used. This ensures that incremental value is added after every iteration and that the team practices are efficient for future projects.
7. **Update daily**. Besides the planning and kaizen meetings, daily stand-up meetings are organized. It helps to get progress updates from the team and to solve any current team problems rapidly.
8. **Keep the team small**. The project team needs to be kept small - up to 10 people depending on the project. A team of this size is more efficient and easily managed, thus achieving the best possible result.

- ✓ STEP 1

First of all, there is the need of preparing a simple “Kanban boar” with three columns: To do, Work in Progress, Done. (Figure 14)

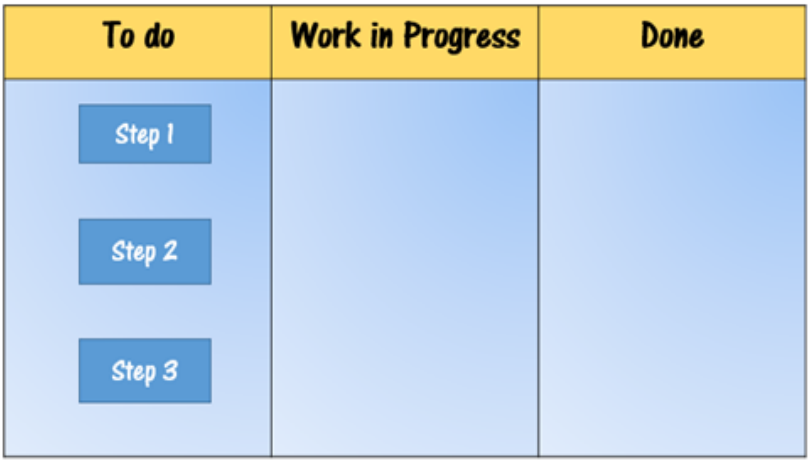


Figure 14 – Step 1

At this point the "To do" column needs to be filled up until there are enough items to be processed for the whole team by using sticky labels called "task cards", that can be differentiated by colour, regardless the Sprint Planning. Scrumban is a "pull" technique; team members are very conscious about this characteristic because the "task cards" in the "To do" column are not assigned to anyone in particular, but will be "pulled" by the team members that will choose them according to their preferences and their ability to start processing them; in the example the card 1 has been chosen by Jhon C. (Figure 15)

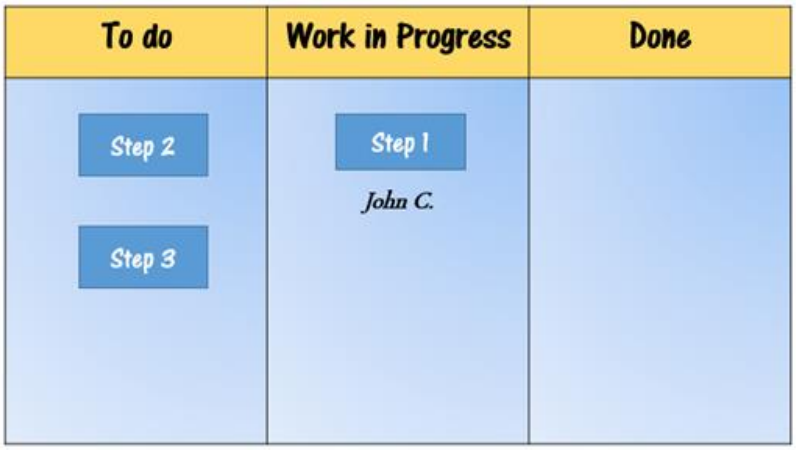


Figure 15 – Step 1 II

Now there is the need of adjusting the selection process and setting be processed first; these meetings can run every time the "To do" column and the backlog items come to certain number (number to be defined in each case).

This is a case of "*Planning ON DEMAND*"; limiting the number of meetings allows to eliminate time wastes by running them only when it's necessary and not after each single iteration. This approach allows to react better and more efficiently to the unplanned issues that may come up, because with less planned items the process is more flexible.

After the potential planning, each member of the team will choose and starting completing his own task; as it is shown in the Figure 16, other colleagues joined John.

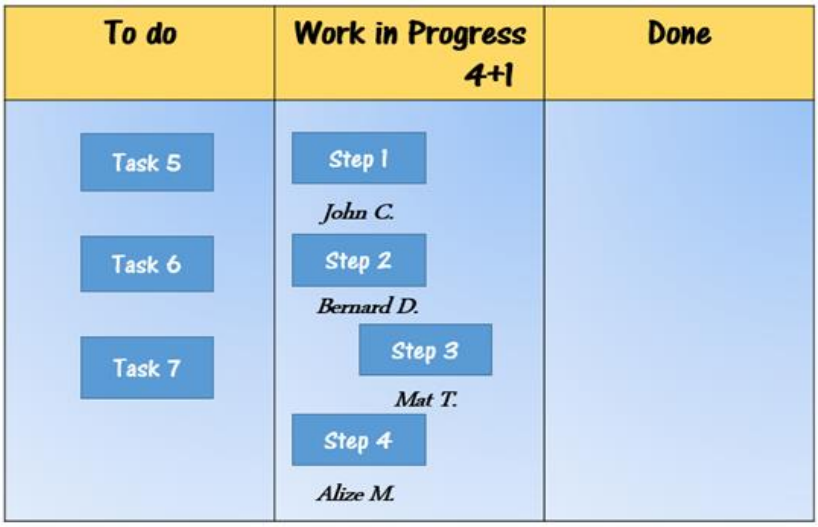


Figure 16 – Step 1 III

Like the Kanban, WIP limits must be defined so that each team member is focused on processing his own job until is finished and it's not distracted by a queued job; in Scrumban the WIP limit corresponds to the number of the team members because each one of them has one job assigned. In this case the WIP limit is equal to 4, this means that no more than

4 tasks can be processed at the same time; in case of multitasking the limit can be increate by 1 or 2 depending on the context.

If one task is particularly complex to be finished and the process is stuck from the beginning of the WIP, it is possible to send the task back and swap it for a new one. Only when the job with the first 4 tasks will be completed, the team members can take new jobs on.

- ✓ STEP 2

Now it is time to visualise the backlog and establish an approach to define priorities so the "To do" column can then be split in two: Backlog e Priority. Also the backlog should have a limit, based on team capacity. For example if the team can generally complete 2 tasks a day, they could complete 10 tasks over 5 working days.

The 10 limit can be assigned to the "To do" column which includes the Priority column in which are generally placed as many tasks as in the WIP column. The rule is that the backlog limit is kept low anyway.

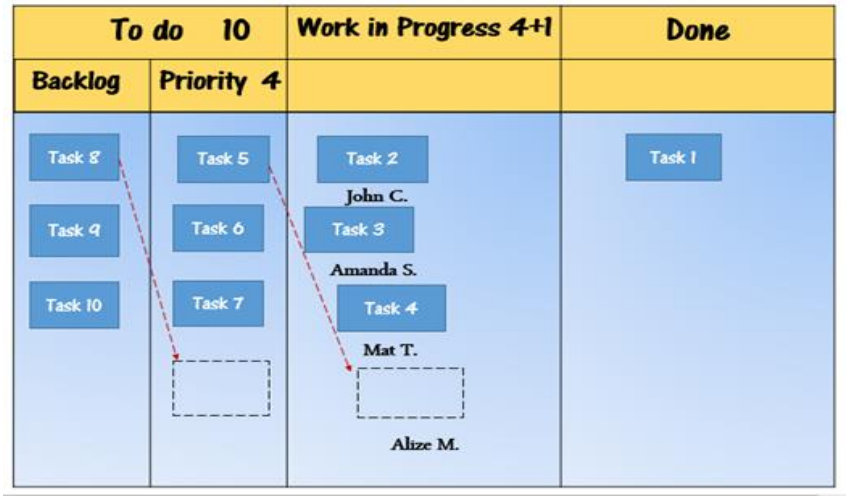


Figure 17 – Step 2

The arrows point the "task cards" movement. (Figure 17)

- ✓ Step 3

If we would have used the Scrum technique, the planning activity would be already finished because limited to the beginning phase; in this case instead, the WIP is divided in three further steps (Analyse, Develop, Test) (Figure 18), so to identify the "bottlenecks" and allowing the process to be carried more accurately and in deeper details. The WIP limit, as it can be seen from the picture, is equal to 5 even if the team members are 4 and this is because of the multitasking; so for example in case the Testing phase is momentously blocked, it is possible to start another task before the testing phase is completed for the previous items. This approach allows to visualise bottlenecks and to evaluate which phase is responsible for slowing down the process flow.

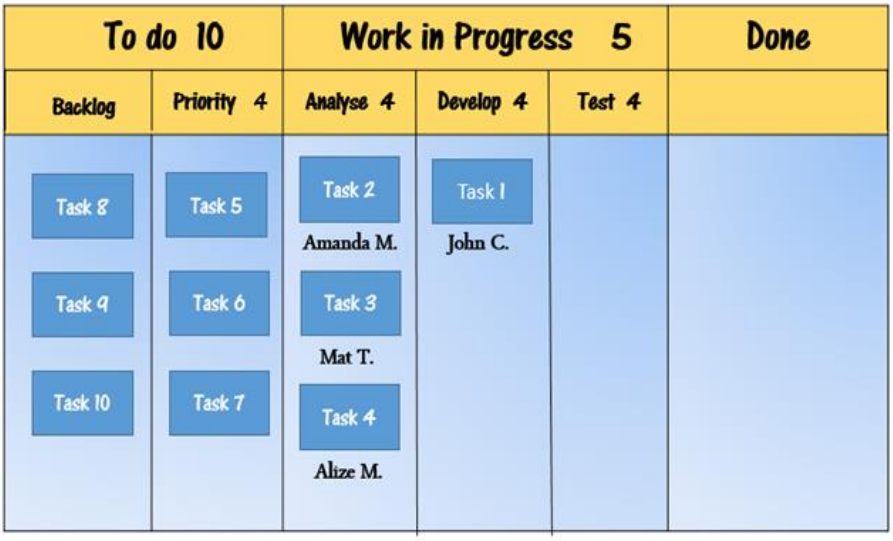


Figure 18 – Step 3

To calculate the cycle time more precisely, it would be good to insert "Queue columns" in which the items are temporarily assigned before they can pass through the next state; these columns have no limits and they can be seen as temporary "parking places".

- ✓ Step 4

When cycle time and average time are under control, the other parameters are derivatives; learning how to manage these metrics allows to find out how long an item will take to reach the final customer, how long it will stay in the Development phase, Test phase, etc. With this in mind, the tasks can be seen as "value or money bexes" because when they pass through the production flow, they gradually increase their value from a customer prospective so that the customer will pay a certain amount of money for it.

As it can be noticed in the board, also Scrumban like Kanban and Scrum uses “cards”, that through their moving between different status, allow a visual representation of the progress of the work on the different tasks.

The cards can be structured in different ways depending on the contest and needs; therefore below (Figure 19), one of the most common type is described:

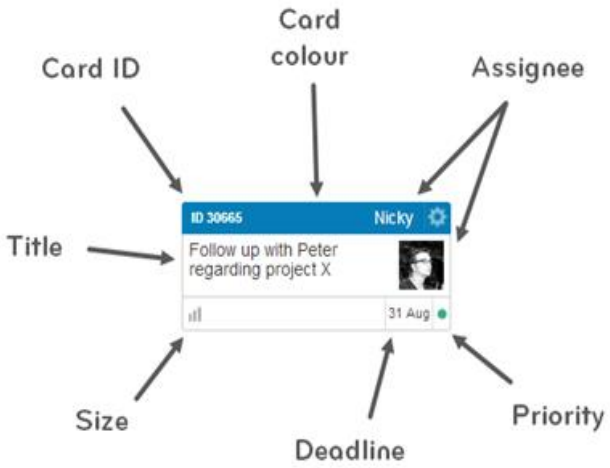


Figure 19 – Example of Card

Title: it describe with few words the task to be completed

Assignee: this is the person in charge of the item on the card; it is usually one of the members of the team who will be responsible of progress the items till all the phases are completed.

Card ID: this refers to the “serial number” which identifies the card; each card has its unique ID number so that is not confused with the others.

Priority: it is an attribute that allows to order the movement of the cards. Generally the priority is divided in three states: low, medium, high. The three status are identified with a different colour on the card.

Card Colour: the colour categorises the tasks (for example business category, personal, research); in Visual management the colour is critical, it is the first thing to be recognised by the operator; there are 6 different colours.

Deadline: it corresponds to the due date for the task to be completed.

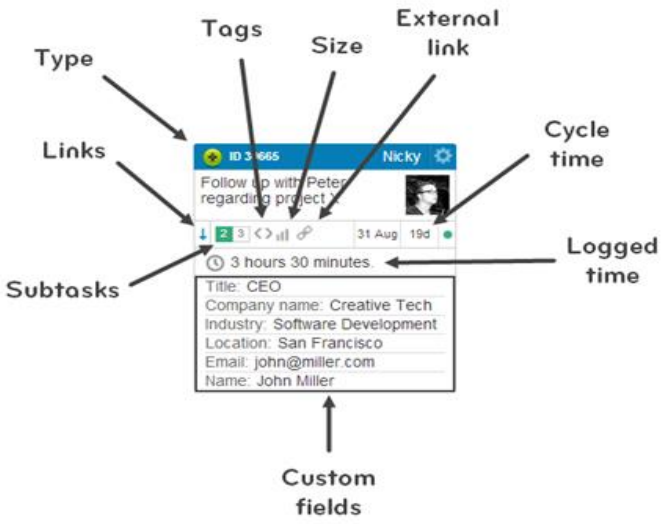


Figure 20 – Example of Card with additional fields

Size: it identifies how big and complex the task is.

Additional fields can be added (Figure 20):

Logged time: it corresponds to the time already spent on the task.

Custom fields: it includes a description of the attributes required by the customer

Links: it indicates connections between tasks. There are three hierarchical relationships possible: parent, child, relative.

Subtasks: these are the activities in which the task on the card is subdivided and they can be seen as a checklist that need to be done before moving the card.

Tags: these are the attributes that allow to identify and search the cards with that type of tag.

Task type: this allows to categorise the card.

Another example of cards is the one realised with a small piece of paper usually 10x15 cm or 13x18 cm. The piece of paper is organised in a pretty simple structure: filled out both on the front and on the back side of it. (Figure 21).

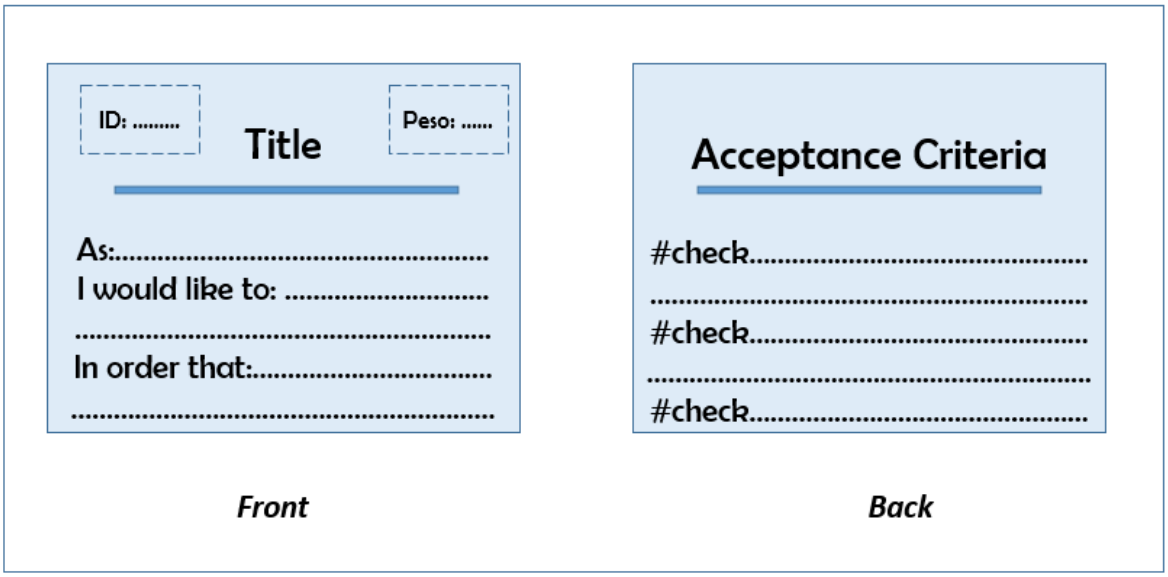


Figure 21 - Example of Card Structure

The front side includes title and description of the task. The title should summarise in two or three words the needs of the customer. The description usually includes user role, its needs related to the task required and its objective of the action. In this case is also useful to insert an ID code, for example like the ID in the tracking system and the weight in score, value that initially is zero and then will increase after planning on demand. The back of the paper includes the acceptance criteria, which are requirements that when will be fulfilled can lead to the completion of the task.

An example of how it should be filled (Figure 22):

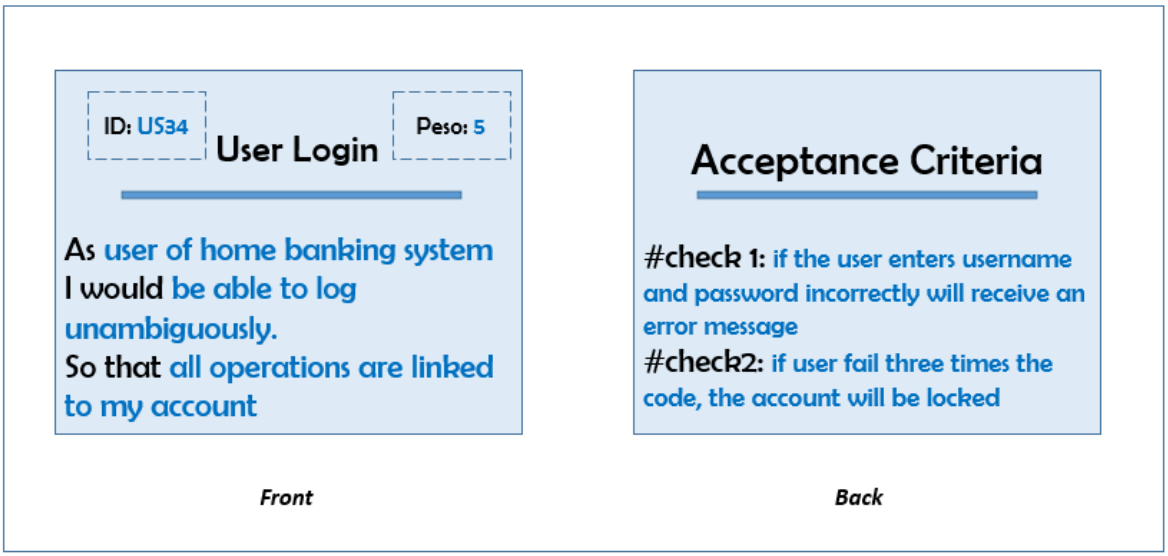


Figure 22 – Example of compiled Card

After the description of Scrumban methodology, some mandatory rules to follow and limits are listed below:

- To keep the number of Backlog as low as possible
- Planning only on demand
- To divide the Backlog in two columns so that the priorities can be visualised and it would be possible to decide which task is started before.
- To leave a bit of space for multitasking, but keeping it under control; the limit to the WIP in case of multitasking has to be slightly higher than the number of the team members.

- Decoupling planning and release
- Considering only cycle time and avarage time for performance measurement
- To have specialised team members, focused on what they prefer
- To allow team members to use a "pull" process

  Aiming for continuous improvement (Kaizen) as final object
- To allow continuous deployment for each task

After having described in details the three lean methodologies used in visual management, it is useful to summarise the main characteristics and to compare them by highlighting main difference and commonalities; see the table below (Table 1).

	Scrum	Kanban	Scrumban
Iterations	1-4 week sprints	Continuous work alongside releases shorter than one week or bigger iterations like goals	Continuous work with short cycles for planning and longer cycles for release
Work routines	Push and pull principle mixed with early binding to team members	Pull principle with late binding to team members	Pull principle with late binding to team members
Scope limits	Sprint limits total work amount	Work in progress limits current work amount	Work in progress limits current work amount
Planning routines	Sprint planning	Release/iteration planning, demand planning	Planning on demand for new tasks
Estimation	Must be done before start of sprint	Optional	Optional

Performance metrics	Burndown	Cumulative flow diagram, lead time cycle time	Average cycle time
Continuous improvement	Sprint retrospective	Optional	Short Kaizen event as an option
Meetings	Sprint planning, daily scrum, retrospective	Can be avoided	Short Kaizen event
Roles	Product owner, Scrum master, team	Team and other work specific roles	Team and other work specific roles
Team members	Cross-functional team members	Cross-functional team members, specialization is allowed	Specialization or preference to tasks
Task size	The size that can be completed in sprint	Any size	Any size
New items in iteration	Forbidden	Allowed whenever queue allows it	Allowed whenever queue allows it
Ownership	Owned by a team	Supports multiple teams ownership	Supports multiple teams ownership
Board	Defined/reset each sprint	Persistent	Persistent
Prioritization	Through backlog	Optional	Recommended on each planning
Roles	Scrum master, product owner, team	Not defined, may vary	Not defined, may vary
Rules	Constrained process	Only a few constraints, flexible process	Slightly constrained process
Fit for	Enterprise maturity for teams working on product or especially project which is longer than a year	Support and maintenance teams, continuous product manufacturing	Startups, fast-pace projects, continuous product manufacturing

Table 1 – Main characteristics of the three Lean Methodologies

4 SCRUMBAN METHOD IN MANUFACTURING INDUSTRY

The main objective of this work is to apply Scrumban technique to manufacturing as well as to the software industry due to the increasing attention paid to these areas as key points of an organization.

To ensure that these agile methods for work in progress' visualization work out well in a manufacturing industry, it is necessary to follow a procedure that allows to match the methodology with the production flow. This is the first difference with the software field because in that case, the model of Scrumban Instrument is given as a standard and any company can use the same methodology and apply it to its organization without major changes. In manufacturing, things are different because each industry has its own production flow, organisation, employees and products which may often follow a job flow kind of production.

Due to the uniqueness that characterizes the manufacturing industry, it is necessary to follow a procedure that allows the companies to be guided in the introduction of the Scrumban instrument.

As the flow chart below (Figure 23) shows and as the following description explains, this procedure is developed in the following steps:

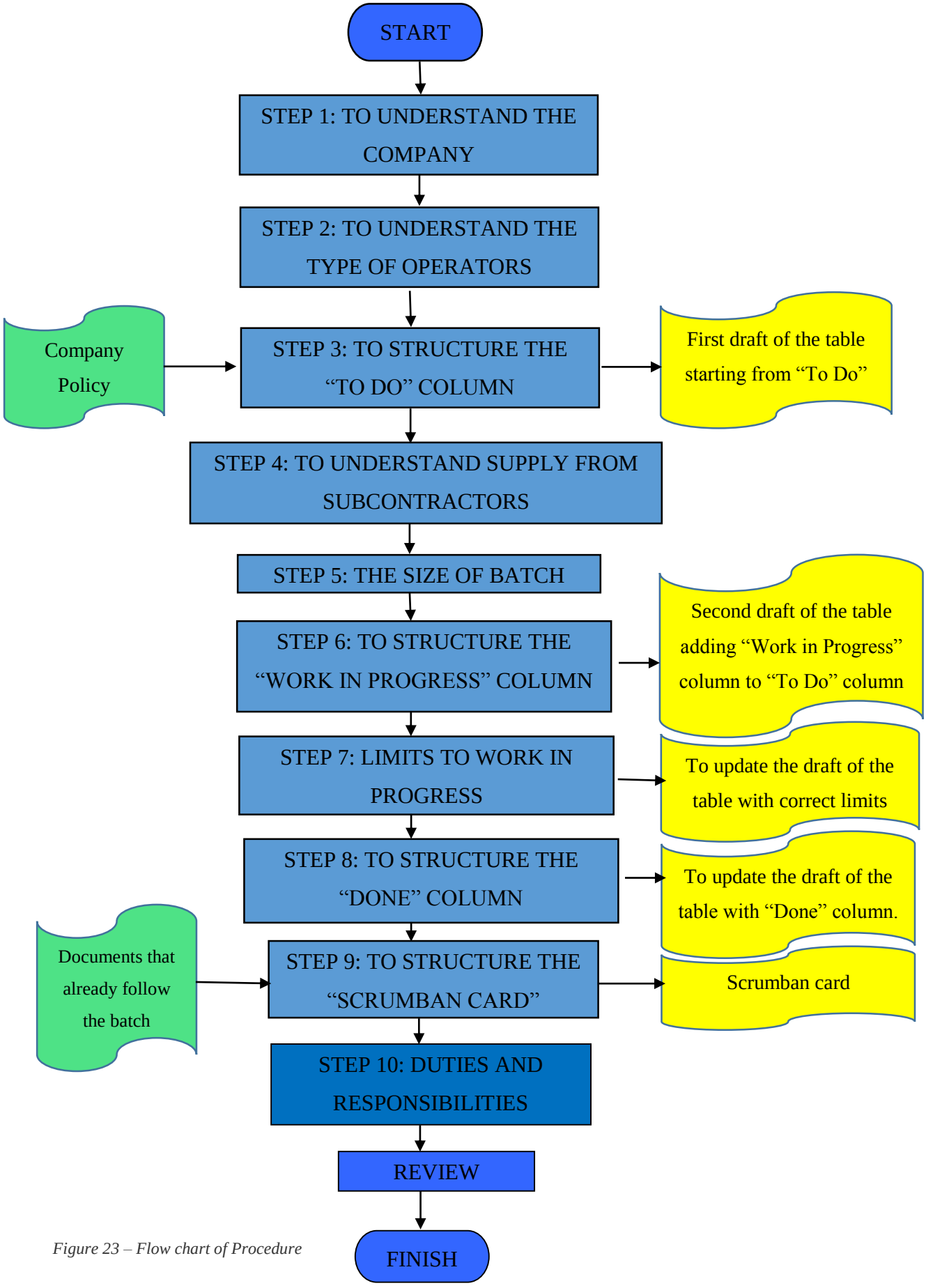


Figure 23 – Flow chart of Procedure

- **Step 1**: ***To Understand the Company***

The main point here is to understand the company: understanding which the product manufactures are and having a clear idea of the business layout (departments, warehouse, and production line).

Knowing product portfolio and production flow of each item, it allows to divide monoproduct industry from multiproduct industry and within multiproduction, job from process production.

The assistance of a person who is familiar with the company's structure and with its processes, will be very helpful during the implementation phase.

- **Step 2**: ***To Understand the Type of Operators***

Now the attention goes to the operators. There could be companies with multifunctional operators that are generally familiar with most of the process that affect a product from the beginning until the end of production. If this is the case then, implementing Srumban technique is easier because each operator is in charge of a single item along the whole process, form the beginning to the end, like in software industry.

In the opposite case, each operator performs only one elementary operation of a specific production phase, therefore the entire process, which is composed by many productive phases, is carried out by several operators.

- **Step 3:** ***To Structure the "To Do" column***

The "To Do" column must be organised by asking to the person responsible for the planning of production how they make decisions on production orders and which documents are used to keep production flow under control.

At this point, it is important to understand the company policy in use to choose the first batch to be sent to production; in this way, we are able to split the batch between backlog and priority. "Priority" sub-column is fixed but "Backlog "sub-column" could be customized to suit business needs. Once this information has been obtained, it needs to be drawn a first draft of the "To Do" column.

- **Step 4:*****To Understand Supply from Subcontractors***

At this point, it is essential to know if the company uses any sub supplier that performs parts of the production process outside.

If suppliers work on different stages of the process than the once of the company, the appropriate columns must be inserted in series; if the outsourced processes are similar from the ones performed by the company, the columns will be in parallel.

It needs to be considered the scales intended to be used to build the table.

- **Step 5:** ***The size of the Batch***

This step is about understanding how big is the unit sent to production; e.g. batch size. Generally, the production batch is part of a bigger order that the company schedules in smaller units to balance the production flow.

- **Step 6:** ***To structure the "Work in Progress" Column***

After the "To Do" column has been structured, now is the turn of the column "Work In Progress" column. The difficult here is to understand what are the process steps performed inside the company and which are outsourced outside; this is a key point in building the Scrumban Board, specially the "Work in Progress" column. Once this information has been obtained, it needs to be drawn a second draft of the table subdivided in three main columns "To Do" "Work in progress" and "Done". After that the column "work in progress" will be divided in sub columns. It must be carefully considered which scale is intended to use in building the table.

- **Step 7:** ***Limits to Work In Progress***

This step is the most difficult one because is about the limits of the work in progress.

The Scrumban theory limits the "To Do" column and the "Work in Progress" column, but in manufacturing we need to make some changes especially for the "Work in Progress" column.

Concerning the "To Do" Limit, we must insert the number of batch that the company produce from Monday to Friday (by adding 1 to 3 batches called "Share of Flexibility" in case of Overproduction) and we must consider all of the batch produced, also those that

then will be processed outside, for example those batches which will be sent to suppliers. This is crucial for balancing of productions lines.

The limit to work in progress of the “Priority” column, as the theory explains, is the same as the “Work in Progress” column.

The logic to determinate limits to the “Work in Progress” column, it is different from software application because in that case, the limit corresponds exactly to the number of operators; each operator performs an assigned software project, through the beginning till the end of the process following the whole WIP “production”.

In manufacturing the Limit to Work in Progress is not represented by the operators but by the batches as in the "To Do" column; so the limit corresponds the max number of batches that will go through the production cycle both internally and externally during the week.

The definition of limits can be done during step 3 and step 6; it depends on how you prefer.

- **Step 8:** ***To Structure the “Done” Column***

Finally the “Done” column has to be structured; it has no limits. This column includes the final steps in the manufacturing flow; an advice is to divide the “Done” column into "Packaging" and "Ready" which stands for "Goods ready for withdrawal by the carrier".

- **Step 9:** ***To Structure The “Scrumban Card”***

This passage is about the structure of the “Scrumban card”; this could be done even during steps before, not necessary at the end.

The main question here is about which information do we need to identify a batch.

The advice is to ask to the person responsible for production or to an operator in case there is already a document that follows the batch; this is the starting point for customizing the "Scrumban Card". In addition to information already present on that document, nothing prevents us to add other on the card.

However, on the card should be inserted a figure that assign the Priority to three different levels: High, Medium and Low.

In addition, tags should have different colours depending on the type of product and defects.

- **Step 10:** ***Duties and Repsonsabilities***

Downstream of the construction process of the table you need to determine who should compile the cards at the beginning of the process, who should move the badges, who must update the table every Friday etc.

My advice is to discuss about that with the responsible of production because he knows how much is the current workload of the operators, if operators are reliable etc.

The idea behind this tool is also to give responsibility to the operators; each one is responsible for the phase that is doing.

- **Step 11:** ***Review***

It is very important, at the end, to review the table; it must be paid a particular attention to the limits of the work in progress and check that the flow is balanced.

Doing the review, for balancing reasons, we realize if we must insert some column as "Stopped Area" for batches.

5 CASE STUDY

In order to demonstrate that the Scrumban Lean Tool technique perfectly fits the needs of manufacturing industry, I used as example the Luxury fashion company: "Fendi".

Fendi is an Italian luxury fashion company renowned for its creations on hand crafted fur and top quality leather accessories. Following the increasing competitiveness of the market, Fendi has lately opened the doors to Lean projects and innovation in terms of tools used and design; it is with this background in mind that Fendi accepted my project proposal.

The responsible for Fendi's production planning was interested in me implementing Scrumban tools on one of their suppliers; so I started my project focusing on a company called "Le Iene" which supply leather goods to Fendi based in the Industrial Area of Scandicci.

5.1 LE IENE

Le Iene is a Leather Goods Company head quartered in Scandicci, which produces leather goods of small/medium size like wallets, purses, small bags, etc. Fendi is one of their main

clients but it also serves many other famous luxury brands like Chanel, Dior, Balenciaga, etc.

The Map below (Figure 24) shows the planimetry of the company; the main departments are Preparation and Production where the main production flow happens.

Le Iene is composed by:

- n° 2 Offices
- n° 1 Warehouse
- n° 1 Control Area for Incoming Raw Materials
- n° 1 Preparation Department
- n°1 Area for Incoming/Out coming Leather from/for Sub-Suppliers
- n° 1 Control Area for Incoming Skived Leather from Sub-suppliers
- n° 1 Downstream Control Area of the Preparation Department
- n° 1 Production Department
- n° 1 Final Touches and Test Area
- n°1 Packaging Area
- n°1 Shipping Area

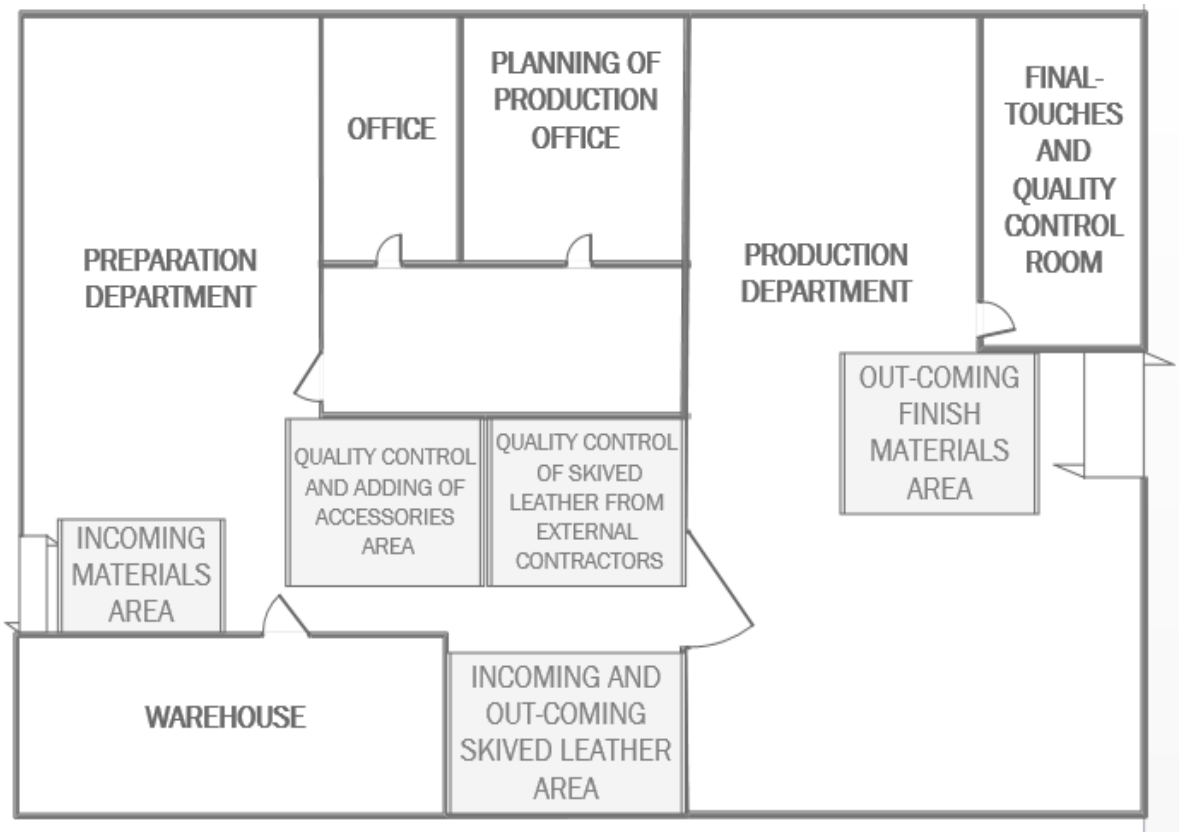


Figure 24 - Plan of Le Iene

1) When the raw material supplied by Fendi arrives, ”Le Iene” makes a first check to ensure the incoming material complies with the packing list in the appropriate area; the authorised personnel analyses a sample of the batch (typically 20%) and then counts the number of items received. After this check, the material is placed and stored in the warehouse. The same check is applied on all the other rough leather parts coming from different suppliers in the appropriate area (Figure 25) and then stored in the warehouse.

Figure 25 - Area of Sub-Supplier control

At this point the operator responsible, considering the "Document of the Order" which contains the Bills of Material (BOM) (Enclosure 1), accepts or rejects the incoming products and depending on that the production starts. In case of reject, ("Not completed WIP" state) the pending orders are shelved in appropriate boxes. Based on Fendi's order and their feasibility, the office produces a document called "Planning Orders" (Enclosure 2) which includes the identification of the "Must be" articles (that will be included in the Priority column with limits).

This schedule is updated whenever materials from Fendi arrive; so many orders change their state into "Completed WIP" so, they could be processed when the time comes considering the schedule.

2) Le Iene processes in general BATCH from 50 to 80 sku ("stock keeping unit" which means: distinct type of item for sale) second of time to Preparation in order to

balance production flow. Batch can be the entire order or part of it because the entire "Partita" as seen in the "Document of the Order" (Enclosure 1) may be too large and therefore it is broken down into smaller batches of production.

So, as can be seen in the document just mentioned (Enclosure 1), the Document of Order is composed of three rows of order; the first two rows relate to the usual product 8M0359-QZY-F022W (model-combination-colour) were combined in a single "Partita" (P107),while, Raw 3 is a single "Partita". The "Partita 107" being as a whole composed of 57 sku, very probably it will belong to the usual batch, as well as the "Partita 108"; if the amount of the "Partita" were more, probably would have been broken up into multiple batches.

The warehouse' employees prepare the batch following the "Document of the Order" and then each batch is collected on a shelf of the trolley (Figure 26).

Figure 26 – Batches on Cart

Each batch is accompanied along its entire production process by two type of document: the “Document of the Order” (Enclosure 1) where we can find the corresponding row of the batch order and a "Processing Document" (Enclosure 3) which is divided into four areas: General Data of the batch, Skiving (external), Preparation & Production. The documentation attached must be filled up at any phase. In the department are also collected, in a suitable container, all “Paper Pattern” (Figure 27) which represents the specifications of articles that can be tracked at any time.

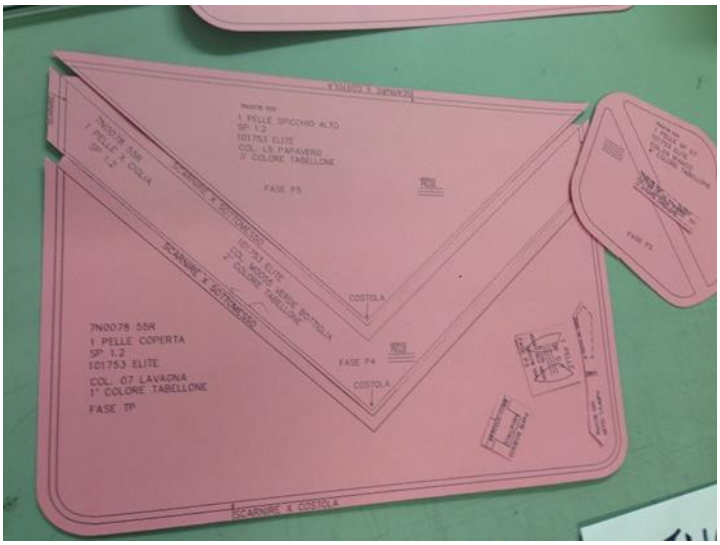


Figure 27 – “Paper Pattern”

3) When the batch has been composed, it is moved from the warehouse to the first station of “Preparation Department”; each batch does not follow the same path because the production flow is “Job shop” type.

“Preparation Department” is organised in many stations but as said, there is not a single unique path for it; to be precise, it does exist a “standard” path but it could be changed depending on product’s needs.

The following operations are carried out in the “Preparation Department”:

- Reinforcement Cutting
- Soppannatura
- Operations of Form
- Plating
- Stamping
- Turning edge and Grooving
- Spaccapelle
- Skiving

Generally, each operator performs only one operation because there are not multi-purpose operators in this department; so, on average there are seven operators at work.

4) When the batch comes to the end of the “Preparation Department”, it is moved to “Control Area” where it is analysed; after, always in this area, the responsible operators add the necessary accessories.
This Area has another function because it works as a “Stopped Area”; this characteristic is very important for balance of production because carts wait here before going to Production Department when it’s their turn.

5) The “Production Department” is organised in to two lines with three stations each one (Figure 28); one line is for normal production and the other is only for set of samples collection production; for this reason I consider only the line of normal production.

Batches moves from the first station to the next station when all pieces are processed.

Figure 28 - Line of Production Department

6) When the batch finishes its path along the line of "Production Department", we get the Finish Products. The cart containing the finish products of the batch moves to "Final touches and Test Department" (Figure 29 and 30); in this area, while operators make final touches operations, they do a Pre-Test too and block not conformity products. Later, an Inspector for the Quality Control from Fendi, analyses all finished products and he decides if products are in keeping with the specific or not.

Figure 29– Final-touches area

Figure 30- Test Area

If some products are not in conformity with the specific, the Inspector blocks them.

7) After "Test", good products proceed to "Package Area"; after that, lots are ready for shipment by road to Central Fendi Warehouse.

5.2 MODELING THE SCRUMBAN TABLE

How to model Scrumban table upon "Le Iene" business reality is shown in the procedure described in Chapter 4; the model is the result of observations of the production process, constant reviews, discussions with the management and test.

To show my work I proceed gradually. Scrumban table is composed of three maxi columns: "To Do", "Work in Progress" and "Done"; so I will go through the way I interpreted each column by using the procedure shown in Chapter 4.

5.2.1 To Understand the Company and the Type of Operators

On my first day at “Le Iene”, I got an idea about company operations. I had the chance of meeting the employees with a focus on management area. I needed to know the company organisation and in this way the production manager helped me to understand the production flow, the products portfolio, the layout and the path of carts through the stations. The production manager was fundamental, he was my key contact and at each step he checked if my project was on track and consistent with the reality of the company. Reviewing the project with the management is the starting point of a successful project.

5.2.2 “To Do” column

External Split and Skiving	Batching	To do (15) +3		
		Not Workable	Workable	Priority (10)
	Batch 1			
	Batch 2			
	Batch 3			
	Batch 4			
	Batch 5			
	Batch 6			
	Batch 7			
	Batch 8			
	Batch 9			
	Batch 10			
	Batch 11			
	Batch 12			
	Batch 13			
	Batch 14			
	Batch 15			
	Batch 16			
	Batch 17			
	Batch 18			

Figure 31 – “To Do” column

As we can see from Figure 31 above, I inserted an additional column called "External Split and Skiving" associated with the column “To Do” because, as previously described, “Le Iene” sends the leather to be skived and spitted to their sub suppliers. When the leather comes back to the company is ready to be introduced into the production flow. This column is important because the leather is the main component of the products and only after its arrival the Preparation can starts.

In this column it is not possible to enter the batch yet, but it is possible to write the identification code of the batches from sub-suppliers. “Le Iene” can now process the articles with the finished leather by following the order plan (Enclosure 2). Next to the column just described, there is the “Batching” column where the batches with “complete WIP” are inserted. These are the batches which have all the necessary elements (all elements of Order Raw) to start the production process.

A card should be representative of each batch as described below:

• The column “To Do” is divided into “Not Workable”, “Workable” and “Priority”

• Each Friday the person responsible of Production updates the Scrumban table, in specific he updates the “To Do” column with the related tags taking into account the Planning Document of the starting week (Enclosure 2).

• In “Priority” , tags must be inserted corresponding to batches of “Tassativi” articles which can be found in the “Planning Orders” document (Enclosure 2); tags must be ordered from top to bottom with increasing delivery due date; therefore the first tag at the top must have the closest delivery due date.

• In order to keep the balance between internal and external production, it is necessary to rank the batches in the Priority column according to the priority but also considering the proportions of 1: 2 between batch intended for outside and for inside.

For example ranks like: the first batch for internal, the second for external contractors and the third for internal; then, the fourth for internal, the fifth for external and so on until the column is complete.

• In “Workable” tags must be inserted corresponding to batches of the remaining articles in the Doc. “Planning Order”. Also here, tags must be ordered from top to bottom with growing delivery date; so, the first tag at the top must have the closest delivery date to the current time.

• In “Not Workable” column batches with “not complete WIP” of the starting week must be inserted; but it is rare that the “Planning Order” contains articles “Not complete WIP” in the week that is about to begin. “Not Workable” is a column for unforeseen events.

5.2.2.1 Limit to work in progress of “To Do” column

As we can see in the Figure 31, the “To Do” and “Priority” columns have limits to work in progress.

(15) +3 ➔ is the limit to work in progress of “To Do”; it is estimated based on “Le Iene” weekly production capacity.

“Le Iene” sends in “Preparation” 15 batches a week; then, after the “Decoupling point” (see below), 10 batches continue internally till the end of production flow and the others 5 batches go to external suppliers. I added 3 batches called “Share of Flexibility” because sometimes the number of weekly batches may be higher in case of “Overproduction”.

These 3 batches are an estimation of the maximum amount that can be produced within 9 hours of overtime (1 hour daily for 5 working days + 4 hours on Saturday) considering that to complete a batch in the Preparation Department should take on average 2.45 hrs.

10 ➔ is the limit to the work in progress in “Priority”; theoretically it should match the limit of the “Work in Progress” column (it should be 15) but this doesn’t apply well to manufacturing. As described before, there are not multi –purpose operators therefore each operator does not follow the same batch from the start till the end of production; for this reason the maximum limit does not correspond to the number of operators.

In manufacturing companies, a minor misalignment with the theory of Scrumban instrument is needed: the maximum limit of 10 corresponds to the minimum limit of Preparation (read next chapter for further explanations). Those 10 batches must be ready for Preparation so the warehousemen must keep under control the preparation of the trucks especially the 10 batches in Priority.

When the first batch of Priority goes into Preparation, a responsible moves the first tag of “Workable” to Priority in the last position.

5.2.3 To Understand the Supply from Subcontractors and the Size of Batches

At this point, it is essential to know if the entire production of "Le Iene" is done internally or if it depends on the external contractors. “Le Iene” in fact, uses groups of external contractors to outsource the production of finished products after the internal preparation in “Preparation Department”; then the batches come back to the company to have “Final-adjustments”, “Test” and “Packaging”. In addition, “Le Iene” has an internal “Production Department” where the same operations are performed for external contractors.

Finally, to have a clear picture of the situation “Le Iene” processes batches of materials for about 50 to 80 sku; the time within the range can vary depending on the balance of the line.

5.2.4 "Preparation" and "Point of Control and Addition of Accessories" columns

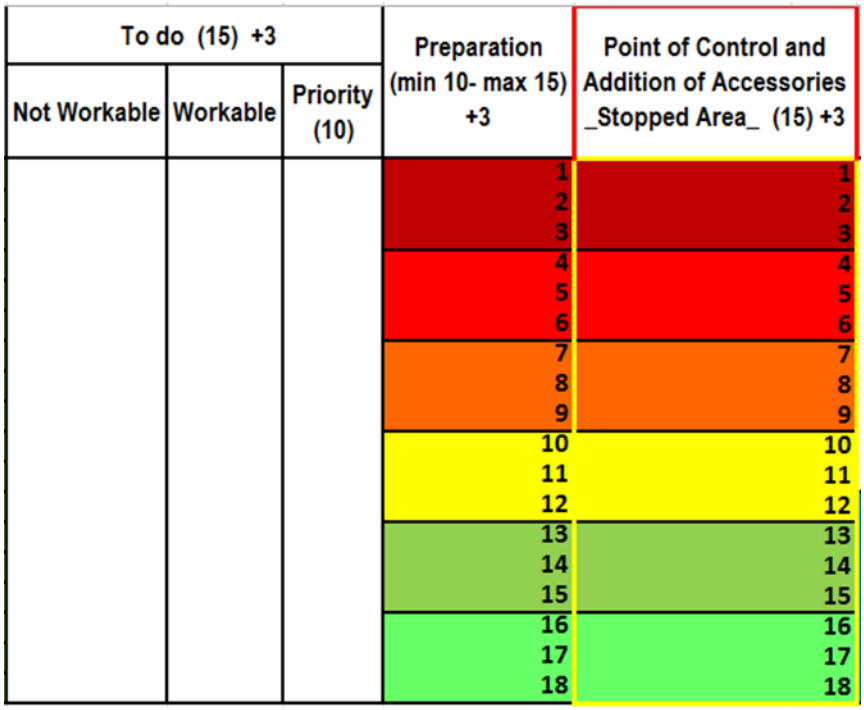


Figure 32 – "Preparation" column and "Point of control" column

Following the theory, after the "To Do" column, we should find the "Work in Progress" column but in this case there are two columns before that: "Preparation", "Point of Control and Addition of Accessories" column (Figure 32).

The reason for that is that "Le Iene" processes in "Preparation Department" batches both for internal and external production. In fact, after all the operations in Preparation, "Le Iene" makes a quality control check and adds the accessories when needed; then, it sends batches to suppliers destined to the external production. The important aspect is that "Preparation

Department" processes more batches than the "Production Department" because it is responsible for processing batches for suppliers too; for balancing reasons I divided "Preparation column" from "Work in Progress column".

The responsible operators move tags from "Priority"; they must insert tags in "Preparation Column" following the same rules of "Priority" column; the first tag on the top corresponds to the batch with the most recent delivery date and so on (as the numbers in the cells on show on the right).

In the "Preparation" column, the tag stays until the batch has been processed in the "Preparation Department". After that, the tag is moved to the "Point of Control and Adding accessories" column; the tag stays here until the corresponding batch is checked and the accessories are added; this phase serves also as a "Decoupling Point", because here "Le Iene" divides batches into internal and external path.

5.2.4.1 Limit to work in progress of "Preparation" column

"Preparation" column has a particular characteristic in regard to limit to work in progress because it presents both the minimum and the maximum limit. A minimum limit of 10 batches means that to have a continuous flow in Production Department, a minimum of 10 batches should be processed in "Preparation" every week; in this case10 tags must be in the "Production" column.

The maximum limit of **15 +3** batches means that at the same time, in Preparation there cannot be more than 15 batches plus eventually 3 batches in case of Overproduction, otherwise there is a bottleneck and the "Production Department" is blocked.

15 will be the limit of “Work in Progress” column too as explained below.

5.2.4.2 Limit to work in progress of “Point of Control and Addition of Accessories”

The limit to work in progress of “Point of Control and Addition of Accessories” is the same as what described for the column before. If in the Control Area there are more than 15 batches plus 3 batches in case of Overproduction at the same time, it means that there is a bottleneck. Anyway, even if there are many batches in this area could mean that something does not perform well.

This control area works as a “Stopped area” and “Decoupling point” as well; in fact, this area allows to balance the production flow between the internal “Production Department” and external suppliers.

5.2.5 “Work In Progress” column

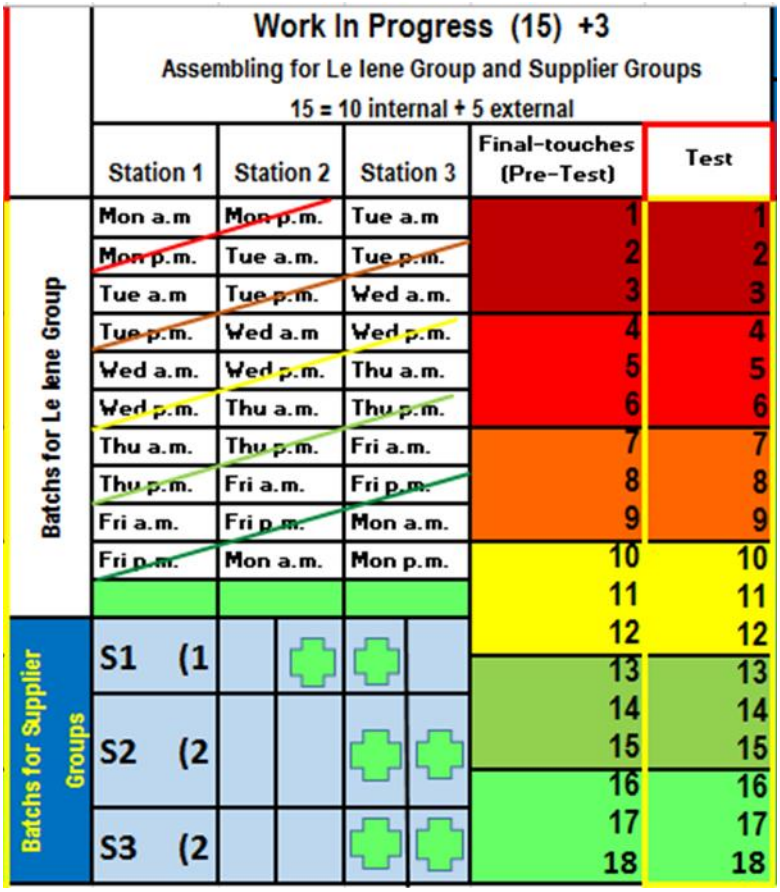


Figure 33 – “Work In Progress” column

As we can see in Figure 33, I divided horizontally the column “Work in Progress” to show two possible paths the batches can take: internal or external.

The light blue area shows which phases are carried out by external contractors; these phases correspond to the same operations performed at Station 1, 2 and 3 in the Company.

“Le Iene” has many suppliers, in this example we consider three suppliers (indicated by the symbol S1, S2, S3) which together absorb a total production of 5 weeks.

As we can see in the figure above, in the Scrumban table, each supplier has its productive capacity in brackets and the empty cells on right, where the cards of batches will be inserted; in addition, there are others cells with a symbol like this  which means that in case of overproduction each supplier can accept a maximum of 2 batches more.

When all batches comes from "Preparation Department" are dived into two groups, the ones performed inside and the ones processed outside. The cards related to the batches sent to suppliers stay in a specific cell in the light blue area until they return to "Le Iene"; once back, the batches follow the rest of internal phases of process which are "Final-adjustments", "Test" and "Packaging".

The cards are moved through the table depending on their position in the production flow.

For what concerns the "Batch for Le Iene Group" area, in the Station 1, Station 2 and Station 3 columns, the cells horizontally identify the daily path of the batches from Monday morning to Friday evening for 10 consecutive batches, which corresponds to the ones processed inside.

In this area there is also an extra light green raw to absorb at least batch in the case of overproduction by exploiting the overtime hours and trying to accelerate the line.

The "Production Department" is composed of a line with three stations; the line completes a batch of 80 sku every day and a half considering a working day of 8 h, as explained in the pattern below (Table 2).

	Monday morning	Monday evening	Tuesday morning
Station 1 (2 Operators)	Busy Station with batch 1 for 4 h	Busy Station With batch 2 for 4h	Busy Station With batch 3 For 4 h
Station 2 (2 Operators)		Busy Station with batch 1 for 4h	Busy Station With Batch 2 for 4 h
Station 3 (2 Operators) (END)			Busy Station With batch 1 for 4h

Table 2 – Day Parting of Operations on Stations

In the Scrumban table we can find a similar structure.

5.2.5.1 Limit to work in progress of "Work In Progress" column

The limit to "Work In Progress" column (considering all sub columns: "Station 1", "Station 2", "Station 3", "Final-adjustments" and "Test") is **15 +3** batches, which is the sum of 10 batches processed in the internal "Production Department", 5 batches processed outside and 3 batches which is the "Share of Flexibility". The meaning of this limit is that during the entire week in this column there can be a maximum of 15 cards (or 18 cards in case of overproduction) representative of the relative batches. If cards are more than 15 it means that there can be a bottleneck. The reason of 15 batches as limit is the same of "Preparation" column.

5.2.6 “Done” column

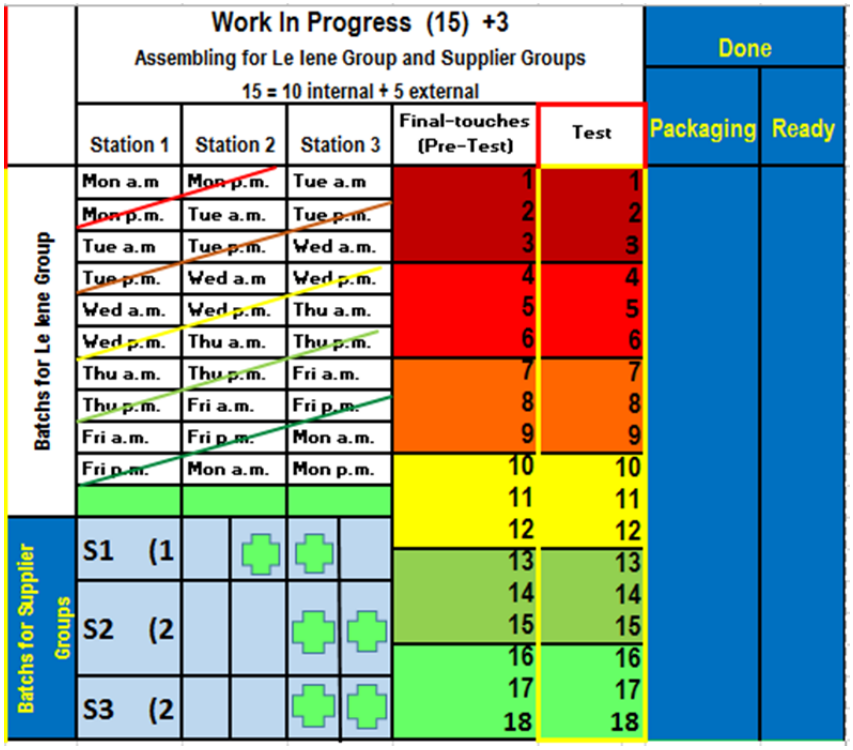


Figure 34 – “Done” Column

The “Done” column has not limit to work in progress and it is divided into two sub-columns: “Packaging” column and “Ready” column (Figure 34).

The “Done” column, in this case, is not different from the software table.

In the “Packaging” column, as the name shows, there are the cards of batches engaged in the operations of packaging. In the “Ready” column, there are the cards of the batches ready for shipping.

Once the batches are shipped, the relative cards can be removed from the table.

5.2.7 The Scrumban Card

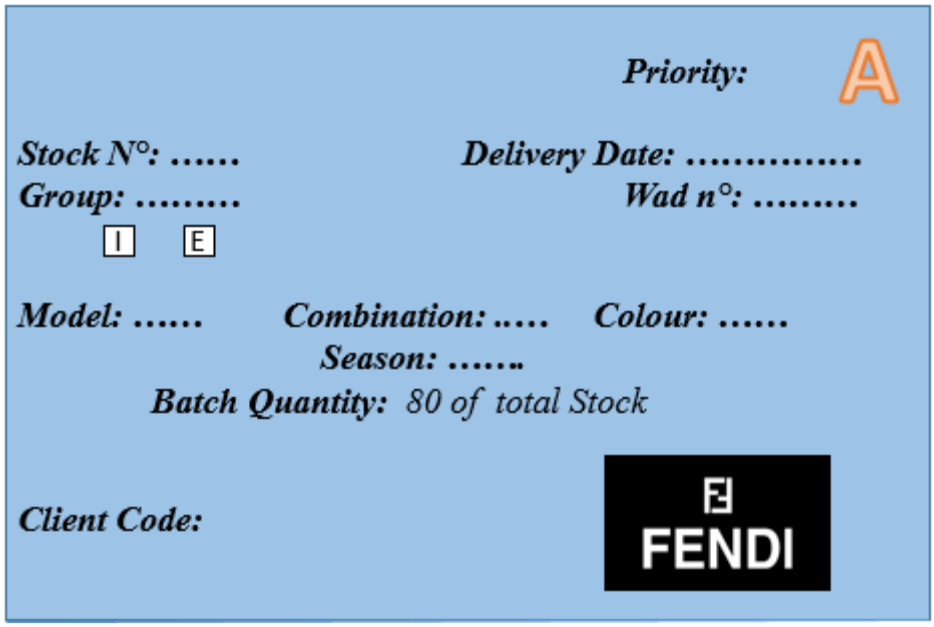


Figure 35 – The Card

To structure the card associated to each batch, I needed to know which information the company considers as critical; so I asked to the person responsible for production if there are already documents which follow the batch across all production process. "Le Iene" already uses a document called "Documento di Lavorazione" (Enclosure 3) which follows each batch; this doc. was my starting point so I transferred in the card the part called "Dati Generali" of "Documento di lavorazione" by adding something new. The Figure 35 shows the card.

The *"Priority*" is defined by three letters:

A: high priority,

B: Medium priority,

C: Low priority.

At the same priority, the batch with the closest delivery date has the priority and it will be written under the Priority information on the card.

"*Stock N°*" means "Partita N°" referred to the "Document of the Order" (Enclosure 1); the stock is a group of batches composed of order rows of the same product joined together which is broken down into smaller batches (50-80 sku) to have a better control on the production process. Therefore, in the card there must be a reference of the original "Stock" of the batch.

In the card there should be also a reference to the *"Group"* which is targeted for the batch:

I = if the batch is total processed inside

E= if the batch is sent to external contractors;

In case of external production, it is required to write in the provided space the extended name of the external contractor.

The information about *"Model", "Combination" "Colour", "Season"* and *"Wad N°"* is the same that we find in "Document of the Order" and "Documento di Lavorazione", related to the *Stock* of the card.

In "*Batch Quantity*", it must be written the precise amount of batch's sku; this information it can be obtained in the warehouse when the Stock splits in smaller batches.

Finally the code of the client must be written in the space allocated to *"Client Code*"; if possible the company logo can be inserted as showed in the Figure above.

5.2.7.1 The Card colour

The card colour is determined according to the type of content; e.g. the colour of the batch's card composed of wallets will be different from a batch composed of small purses or belts.

The decision about colour is up to the company, it can be any colour but RED.

The RED colour is used for the cards associated to "NOT CONFORMED PRODUCTS".

When batches are controlled downstream of the "Preparation" process or after the internal "Production" process, if people responsible find non conformed parts in the batch, they must separate them from the other parts (which continue its path along the production process) and assign a RED card.

This RED card has the same structure of the other ones apart from the compilation of the space "*Batch Quantity*". In the case of not conformed semi-finished, after "Preparation" process, it must be written the exact number and type of parts and the sku in case of non-conform of finished products.

These non-conforming products probably will be reworked; so the RED card will follow, on the Scrumban table, the same path of the batch in the production process.

5.2.8 The System of Colours of the Scrumban table

As you can seen in the full “Scrumban Table” in Table 3, the colours have an important function; in fact the table, is not only black and white, but its columns have something particular.

LEGENDA SCATOLE REPARTO	
	MATERIALE SOSPESO
	MATERIALE DIFETTATO/ DA SCARTARE
	MATERIALE IN ECCESSO O NECESSARIO
LEGENDA PERCORSO A TERRA REPARTO	
	SOSTA CARRELLI IN LAVORAZIONE/ NON COMPLETI
	SOSTA CARRELLO PRONTO PER LAVORAZIONE SUCCESSSIVA
	ZONA MAGAZZINO IN INGRESSO/ USCITA MATERIALI
	ZONA DI CONTROLLO
	POSTAZIONI FISSE
	CARRELLO PRONTO PER PULITURA E COLLAUDO

Figure 36– System of colors of ground path at Le Iene

“Le Iene” already has a system of colours, which uses for the ground path of the carts in their departments; so, to structure the table I referred to it because these colours and their meaning were already known by operators.

The Figure 36 shows this system of colours; pay attention to the part “Legenda Percorso a terra Reparto”.

The columns “External Spaccatura and Skaving”, “Done” and "Batches for supplier Groups" are blue because the company uses this colour on the ground floor to show the area for incoming and out coming of materials. Besides, “Point of Control and Additions of Accessories” and “Test” columns have red and yellow edges; these colours are already used in the departments of “Le Iene” to show control areas. In addition to these colours I also utilized a colour scale from dark red to light green in some column as you can see in Figure 34 or in Table 3.

Because “Scrumban” is an instrument of Visual Management it needs to be structured in such a way that it is immediately understandable by operators; so, I used this scale of colours to show “the ideal number of batches to be processed daily”. In fact, considering the weekly limits to work in progress of 15 batches, ”Le Iene” must process 3 batches daily, to work in a correct way. Starting from Monday, each working day has its coloured blocks of 3 batches each for a total of 6 blocks (5 working days and 3 batches for overproduction).

The cards are moved horizontally along the Table and the free cells are kept empty until the following week; in this way operators can easily understand if the process is under control. To have a perfect production trend there shouldn’t be more than 3 batches simultaneously in “Preparation”, “Point of Control”, “Final-adjustments” and “Test” column.

The correct progress of production considering “Station 1”, “Station 2 “ and “Station 3” is showed in another way; the position of the 10 batches processed internally is marked day by day on three stations of the production line. Finally, five coloured lines with a colour scale from red to green indicate the stations occupied daily and which batches are occupied with. For example, if on Friday afternoon “Le Iene” processes the eighth batch on Station 3, the ninth batch on Station 2 and the tenth batch on Station 1, it means that everything during the entire week went well. The colour blocks and the coloured lines are two types of Indicators; they show the correct trend of production across all phases by using a highly intuitive way. You can see the complete Scrumban Table below.

5.2.9 Duties and Responsibilities

Using the Scrumban tool also implies defining duties and responsibilities for the staff involved; an “Interfunctional Flow Chart” has been produced to describe that (Table 4). It must be read from left to right and it is structured in a similar way of Scrumban Table.

This Diagram has the same column of the Scrumban Table with a flow chart inside that explains which kind of operations takes place and who is responsible for them.

The purpose of this Lean Instrument is to empower the staff and consequently achieve an improvement on the quality of the processes.

5.2.10 Meetings

The document “Planning Orders” (Enclosure 2) released by the Planning office at “Le Iene”, corresponds to “Planning on demand” the new tasks and the Scrumban table which visualize the work in progress; to maximise the effectiveness of “Scrumban”, my advice is to schedule daily meetings earlier on the day. During these meetings, the responsible of Production can show rapidly the work that must be completed during the day and collect any update from the operators. This can help to solve current problems quickly and promptly.

5.2.11 Review

To get feedback on my work at each step, I presented the project to the production manager of “Le Iene” and by following his suggestions I introduced the necessary changes.

The ongoing confrontation with the management was essential to the project success.

6 HOW TO IMPLEMENT

The Scrumban instrument can be implemented through different forms; the company will choose the one that better suits the organization complexity, the willingness toward improvements, the budget available and the return on investment.

I suggested four potential forms below:

1)Implementation using magnetic board with magnetic cards; the board should be visible and accessible by any operator on the line. Each operator has duties and responsibilities assigned.

MAGNETIC WHITE BOARD http://www.lavagneluminose.info	
9 blocks of 100 pieces of CUSTOMIZABLE CARDS with magnetic back 67X150 mm (stock for 1 year considering 15 cards compiled daily and 52 weeks in 1 year) http://www.seton.it	€ 27,19 /block *9 = € 245,00
5 hours used for TRAINING the employees (25 users) considering an hourly rate equal to MDO/h cost.	5h*10€/h*25 users= € 1250,00
TRAINING COURSE by the PM	€30* 5h= € 150
TOTAL	€ 2035,00

Table 5- Costs of the first implementation form.

2) Implementation with customized Scrumban Visual Management Software based on workflow and Company's needs. This implementation form shows advanced characteristic compared to the simple white magnetic board just mentioned.

Software providers keep the production flow under control with programs like Scrumban, which can be customized based on customer's needs.

These programs are different depending on the number of users and different program functionalities.

The Scrumban Table can be visualized on many different devices like maxi monitor, laptop, tablet and smartphone.

My advice is to use a main screen that can be seen by anyone in the department and to allow a restricted number of people to update the software though personal devices; this is the first difference with the previous form where any operator could interfere with the tool.

Considering for example the portfolio of products of a software company with costs and functionalities like this (www.targetprocess.com) (Figure 37):

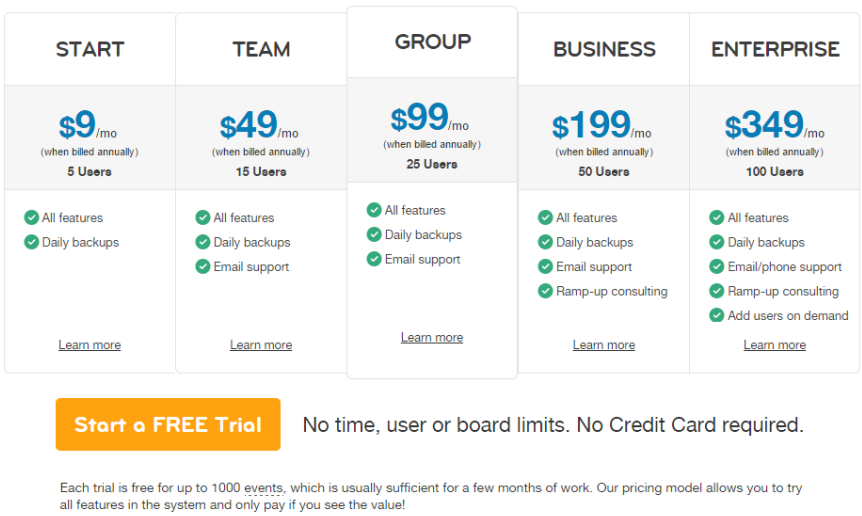


Figure 37 – Products Portfolio of a Software house

Considering the current change USD/EUR equal to 0.8779; if we decided to purchase the "GROUP" PACK, the company should support € 86.8772/month ($ 99.)	€ 1050.00 (for 1 year)
TRAINING for 5 employees for a period of 15 hours, I consider the hourly rate equal to the cost of MDO/h for the raison that this course is conducted during working hours.	15h*10€/h*5= € 750,00
TRAINING COURSE	€ 600,00
MAXI MONITOR	€ 1500, 00
TABLET	€ 500,00
TOTALE	€ 4400,00

Table 6 – Costs of the second implementation form

I assumed that smartphones and computers were already available in house.

3) Implementation with Scrumban Visual Management Software on a maxi touch screen; in this case the operators can move the cards on the touch screen as on a magnetic board. Duties and responsibilities are assigned.

The Scrumban table can be also visualized on smartphones and tablets but the update can be carried only through the screen.

Considering the current change USD/EUR equal to 0.8779; if we decided to purchase the "GROUP" PACK, the company should support € 86.8772/month ($ 99.)	€ 1050.00 (for 1 year)
TRAINING COURSE	€ 600,00
MAXI MONITOR TOUCH FROM 50" TO 69"	€ 4000,00
TRAINING for 25 employees for a period of 5 hours, I consider the hourly rate equal to the cost of MDO/h for the raison that this course is conducted during working hours.	5h*10€/h*25= € 1250,00
TOTALE	€ 6900,00

Table 7 – Costs of the third implementation form

4) Implementation with customised Scrumban Visual Management Software using Easy System. This system consists in a software and hardware solution with a touch technology, associated with the management system of "Fendi S.r.l." called "Stelth 3000" used by all Fendi's suppliers.

With Easy System, each batch is identified by a barcode and each working station has a small touch screen. The operators track the position of the batch by scanning the barcode when the batch passes through their station.

When the first batch of the series arrives on the production line, the operator on the first Operation is in charge of "LOGGING IN" while the operator assigned to buyoff is in charge of "LOGGING OUT".

This Procedure allows to move the cards automatically on the electronic Scrumban Table visualized on the maxi screen thanks to the Scrumban software of Easy System.

All operators are also identified with a barcode and every time that they change station, they have to scan the barcode on the touch screen; in this way it is possible to know who works on which the batch in each station.

Considering the current change USD/EUR equal to 0.8779; if we decided to purchase the "GROUP" PACK, the company should support € 86.8772/month ($ 99.)	€ 1050.00 (for 1 year)
TRAINING for 25 employees for a period of 20 hours, I consider the hourly rate equal to the cost of MDO/h for the raison that this course is conducted during working hours.	20h*10€/h*25= € 5000,00
TRAINING COURSE	€ 700,00
MAXI MONITOR	€ 1500, 00
EASY SYSTEM www.easysystem.it	€ 5000,00
TOTALE	€ 13250,00

Table 8 – Costs of the forth implementation form

My advice is to start always with the first implementation form because it could be used as a trial to prove if Scrumban works well in the business reality considered. After that, if Scrumban reflected the expectations, the company will evaluate the implementation of Scrumban with further implementation forms.

7 CONCLUSIONS

The work presents the potentialities of the application of a particular Lean technique called "Scrumban" with a focus on Software and Manufacturing industries.

In manufacturing, it is very difficult to define a standard structure of this instrument, while in software industry, Scrumban is frequently used as Visual Management tool and it presents a recursive structure.

In this work, a case study of a SME Company working in Luxury industry is used to show how Scrumban fits the manufacturing industry and the procedure used to implement the tool is described.

This paper aims to fill the gap in literature by presenting a standard procedure, which has the peculiarity of being flexible as it can be customised according to the characteristics of the company in exam.

The methodology applied, allowed to achieve three main objectives:

- To constantly track the state of the work in progress on the line and the performances of the production line.

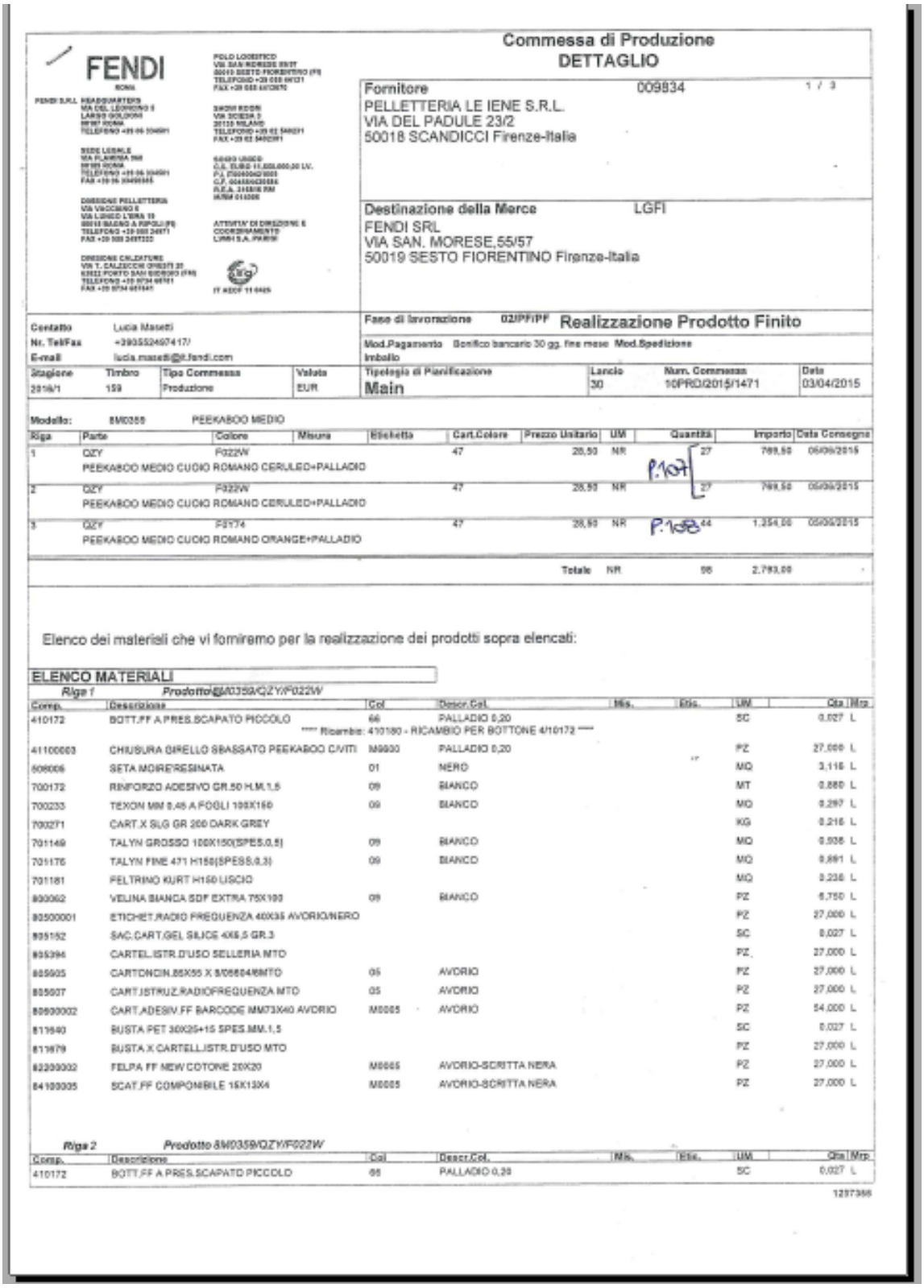
- To identify possible bottlenecks or inefficiencies and consequently eliminate them within a continuous improvement prospective.

- To continuously evaluate the quality of the work of the employees.

In fact, as any Lean techniques, Scrumban aims to eliminate wastes, reducing costs and production times and improving quality with a continuous improvement mind-set; but in addition to the others, it has the characteristic of being strongly focused on people. Therefore for the tool to be used there is the need of identifying duties and responsibilities of the employees involved in the production process.

This work aims to promote the usage of Scrumban technique in Manufacturing Industry in different sectors other than Fashion Luxury Industry such as Automotive, Naval and Industrial Production and to develop a better understanding of its pros and cons.

ENCLOSURE 1



FENDI

Commessa di Produzione
DETTAGLIO

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PELLETTERIA LE IENE S.R.L.
VIA DEL PADULE 23/2
50018 SCANDICCI Firenze-Italia

Destinazione della Merce LGFI
FENDI SRL
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E-mail lucia.masetti@it.fendi.com

Fase di lavorazione 02/PF/PF Realizzazione Prodotto Finito
Mod.Pagamento Bonifico bancario 30 gg. fine mese Mod.Spedizione
Imballo

Stagione	Timbro	Tipo Commessa	Valuta	Tipologia di Pianificazione	Lancio	Num. Commessa	Data
2016/1	159	Produzione	EUR	Main	30	10PROD/2015/1471	03/04/2015

Modello: 8M0359 PEEKABOO MEDIO

Riga	Parte	Colore	Misura	Etichetta	Cart.Colore	Prezzo Unitario	UM	Quantità	Importo	Data Consegna
1	QZY	F022W			47	28,50	NR	27	769,50	06/09/2015
	PEEKABOO MEDIO CUOIO ROMANO CERULEO+PALLADIO							P.107		
2	QZY	F022W			47	28,50	NR	27	769,50	06/09/2015
	PEEKABOO MEDIO CUOIO ROMANO CERULEO+PALLADIO									
3	QZY	F0174			47	28,50	NR	P.108 44	1.254,00	06/09/2015
	PEEKABOO MEDIO CUOIO ROMANO ORANGE+PALLADIO									
							Totale	NR	98	2.793,00

Elenco dei materiali che vi forniremo per la realizzazione dei prodotti sopra elencati:

ELENCO MATERIALI

Riga 1 *Prodotto 8M0359/QZY/F022W*

Comp.	Descrizione	Col	Descr.Col.	Mis.	Etic.	UM	Qta	Mrp
410172	BOTT.FF A PRES.SCAPATO PICCOLO	66	PALLADIO 0,20			SC	0,027	L
	***** Ricambio: 410180 - RICAMBIO PER BOTTONE 4/10172 *****							
41100003	CHIUSURA GIRELLO SBASSATO PEEKABOO C/VITI	M9930	PALLADIO 0,20			PZ	27,000	L
506006	SETA MOIRE'RESINATA	01	NERO			MQ	3,116	L
700172	RINFORZO ADESIVO GR.50 H.M.1,5	09	BIANCO			MT	0,880	L
700233	TEXON MM 0,45 A FOGLI 100X150	09	BIANCO			MQ	0,297	L
700271	CART.X SLG GR 200 DARK GREY					KG	0,216	L
701149	TALYN GROSSO 100X150(SPES.0,5)	09	BIANCO			MQ	0,936	L
701176	TALYN FINE 471 H150(SPESS.0,3)	09	BIANCO			MQ	0,891	L
701181	FELTRINO KURT H150 LISCIO					MQ	0,236	L
800062	VELINA BIANCA SDF EXTRA 75X100	09	BIANCO			PZ	6,750	L
82500001	ETICHET.RADIO FREQUENZA 40X35 AVORIO/NERO					PZ	27,000	L
835152	SAC.CART.GEL SILICE 4X6,5 GR.3					SC	0,027	L
835394	CARTEL.ISTR.D'USO SELLERIA MTD					PZ	27,000	L
835905	CARTONCIN.85X55 X S/06604/MTD	05	AVORIO			PZ	27,000	L
835907	CART.ISTRUZ.RADIOFREQUENZA MTD	05	AVORIO			PZ	27,000	L
82600002	CART.ADESIV.FF BARCODE MM73X40 AVORIO	M0005	AVORIO			PZ	54,000	L
811640	BUSTA PET 30X25+15 SPES.MM.1,5					SC	0,027	L
811679	BUSTA X CARTELL.ISTR.D'USO MTD					PZ	27,000	L
82200002	FELPA FF NEW COTONE 20X20	M0005	AVORIO-SCRITTA NERA			PZ	27,000	L
84100005	SCAT.FF COMPONIBILE 15X13X4	M0005	AVORIO-SCRITTA NERA			PZ	27,000	L

Riga 2 *Prodotto 8M0359/QZY/F022W*

Comp.	Descrizione	Col	Descr.Col.	Mis.	Etic.	UM	Qta	Mrp
410172	BOTT.FF A PRES.SCAPATO PICCOLO	66	PALLADIO 0,20			SC	0,027	L

1297366

ENCLOSURE 2

8 magg

SCADENZA 8 MAGGIO ultimo collaudo merc 08/05/15

STEALTH

ARTICOLI	COMM.	PEZZI
7M0193-E21-F048R	1158/1	110
7M0193-E21-F048R	1158/2	122
7M0193-E21-F048R	1221/1	13
7M0198-X4U-F0CRD	1159/3	46
7M0198-X4U-F0GXN	1159/4	49
8M0339-GRP-F0A73	785/1	37
8M0339-GRP-F0A73	887/1	33
8M0339-W2F-F034P	1165/1	18
8M0339-W2F-F034P	1165/2	4
8M0340-48U-F044M	737/1	5
8M0358-4CF-F044Z	1226/1	39
	TOTALE	476

Pagina 1

The Production Planning's Office points out the orders "Tassativi", based on Fendi's needs.

SCADENZA 15 MAGGIO ultimo collaudo merc 15/05/15

STEALTH

ARTICOLI	COMM.	PEZZI
7M0193-E21-F048T	1158/3	47
7M0193-E21-F048T	1158/4	55
7M0193-E21-F048T	1221/2	8
7M0193-E21-FOL6B	884/1	6
7M0193-E21-FOL6B	884/2	3
7M0193-E21-FOL6B	884/3	3
7M0193-E21-FOL6B	884/4	3
7M0193-E21-FOL6B	884/5	1
7M0193-E21-FOL6B	884/6	2
7M0193-E21-FOL6B	884/7	1
7M0198-X4U-F051E	1159/1	2
7M0198-X4U-F051E	1159/2	33
7M0210-E21-FOL6B	886/1	9
7M0210-E21-FOL6B	886/2	4
7M0210-E21-FOL6B	886/3	4
7M0210-E21-FOL6B	886/4	4
7M0210-E21-FOL6B	886/5	4
7M0210-E21-FOL6B	886/6	4
8M0313-4CF-F044Z	1162/1	42
8M0340-48U-F044M	709/1	197
8M0340-48U-F044M	709/2	179
8M0340-48U-F044M	709/3	119
8M0341-4CK-F049K	1166/1	157
8M0341-4CK-F049K	1166/2	87
8M0341-4CK-F049K	1166/3	88
8M0341-4CK-F049K	1224/1	105

22 magg

SCADENZA 22 MAGGIO ultimo collaudo merc 22/05/15

STEALTH

ARTICOLI	COMM.	PEZZI
7M0210-E21-F048R	1160/1	119
7M0210-E21-F048R	1160/2	119
7N0078-55R-F0K8A	1546/1	2
8M0251-F09-FONDK	1161/1	12
8M0251-F09-FONDK	1161/2	34
8M0251-F09-FONDK	1161/3	32
8M0313-4CK-F049K	1163/1	34
8M0313-4CK-F049K	1163/2	16
8M0339-4CK-F049K	1164/1	37
8M0339-4CK-F049K	1164/2	2
8M0339-4CK-F049K	1222/1	8
8M0341-4CF-F044Z	1223/1	87
8M0341-4CF-F044Z	1223/2	87
8M0346-3ZH-F022E	924/1	46
8M0346-U9H-F049A	889/1	89
8M0346-U9H-F049A	889/2	94
8M0346-U9H-F0MK5	1031/1	45
8M0346-U9H-F0MK5	1052/1	4
8M0346-U9H-F0MK5	1167/1	55
8M0346-U9H-F0MK5	1225/1	1
	TOTALE	923

8M0346-U9H-F0W51	1035/1	18
8M0358-W2F-F010Z	1168/1	45
8M0358-W2F-F034P	1168/2	19
8M0358-W2F-F034P	1168/3	2
8M0358-W2F-F034P	1168/4	4
8M0359-QZY-F022W	1169/1	58
8M0359-QZY-F022W	1227/1	22
	TOTALE	1335

29 MAGG

SCADENZA 29 MAGGIO ultimo collaudo merc 27/05/15

STEALTH

ARTICOLI	COMM.	PEZZI
7AR406-3EJ-F016Q	1460/1	206
7AR406-3EJ-F016Q	1523/1	20
7AR406-3EJ-F016R	1460/2	153
7AR431-52B-F0541	1461/1	76
7AR431-52B-F0541	1461/2	74
7AR431-52B-F0541	1524/1	34
7N0078-55R-F0K8A	1464/1	155
7N0078-55R-F0K8A	1526/1	92
8AP151-GRP-F0A73	1465/1	11
8AP151-GRP-F0A73	1465/2	46
8M0299-F09-FOPXB	1466/1	33
8M0299-F09-FOPXB	1466/2	28
8M0339-W2F-F010Y	1468/1	17
8M0339-W2F-F010Y	1468/1	60
8M0346-U9H-F0W51	1527/1	31
	TOTALE	1036

SCADENZA 05 GIUGNO ultimo collaudo merc 03/06/15

STEALTH

ARTICOLI	COMM.	PEZZI
7M0210-E21-F048T	1463/1	44
7M0210-E21-F048T	1463/2	59
7M0210-E21-F048T	1525/1	15
7N0078-51Y-F021Z	1808/1	64
7N0078-51Y-F021Z	1857/1	7
7N0078-51Y-F034B	1808/2	50
7N0078-51Y-F034B	1857/2	14
7N0078-55R-F0K8A	1464/2	249
7N0078-55R-F0K8A	1464/3	373
7N0078-55R-F0K8A	1464/4	372
7N0078-55R-F0K8A	1540/1	3
8AP151-48U-F044M	1809/1	54
8M0339-QZY-FOY74	1467/1	42
8M0339-W2F-F010Z	1468/3	27
8M0339-W2F-F010Z	1468/4	10
8M0348-G9Y-FONVJ	1814/1	14
8M0348-U9H-F0W51	1469/1	5
8M0348-U9H-F0W51	1469/2	31
8M0348-U9H-F0W51	1527/2	41
8M0358-F09-FOPXB	1470/1	12
8M0358-F09-FOPXB	1470/2	5
8M0359-QZY-F022W	1471/1	27
8M0359-QZY-F022W	1471/2	27
8M0359-QZY-FOY74	1471/3	44
	TOTALE	1589

SCADENZA 12 GIUGNO ultimo collaudo merc 10/06/15

STEALTH

ARTICOLI	COMM.	PEZZI
8M0358-F09-FOKUR	1817/1	7
8M0358-F09-FOKUR	1817/2	14
	TOTALE	21

SCADENZA 19 GIUGNO ultimo collaudo merc 17/06/15

STEALTH

ARTICOLI	COMM.	PEZZI
7M0193-E21-F0571	1807/1	30
8AP151-4CF-F044Z	1810/1	61
8M0313-4CF-F044Z	1811/1	127
8M0313-4CF-F044Z	1811/2	7
8M0313-4CF-F044Z	1811/3	78
8M0339-48U-F044M	1812/1	53
8M0339-48U-F044M	1858/1	9
8M0339-4CK-F049K	1813/1	57
8M0358-48U-F044M	1815/1	36
8M0358-48U-F044M	1859/1	7
8M0358-4CF-F044Z	1816/1	102
8M0358-4CF-F044Z	1816/2	109
	TOTALE	676

ENCLOSURE 3

raccomandazioni di lavorazione						
Destinatario	data inizio	data fine	problemi di lavorazione riscontrati	quantità analizzata	controllo non superato	difetti
INTERNO(responsabile)						
ESTERNO:						
Assemblaggio 2						
raccomandazioni di lavorazione						
Destinatario	data inizio	data fine	problemi di lavorazione riscontrati	quantità analizzata	controllo non superato	difetti
INTERNO(responsabile)						
Assemblaggio 3						
raccomandazioni di lavorazione						

DOC. LAVORAZIONE				
Partita N°	ODL N°	Data di consegna	Mazzetta n°	Cliente
Modello	combinazione	colore	Quantita'	Stagione

Scarnitura
raccomandazioni di lavorazione

Destinatario	data inizio	data fine	problemi di lavorazione riscontrati	quantità analizzata	controllo non superato	difetti
ESTERNO:						

Preparazione
raccomandazioni di lavorazione

Destinatario	data inizio	data fine	problemi di lavorazione riscontrati	quantità analizzata	controllo non superato	difetti
INTERNO(responsabile)						

Assemblaggio 1

Destinatario	data inizio	data fine	problemi di lavorazione riscontrati	quantità analizzata	controllo non superato	difetti
INTERNO(responsabile)						
finitura (fili e rifilatura)						
raccomandazioni di lavorazione						
Destinatario	data inizio	data fine	problemi di lavorazione riscontrati	quantità analizzata	controllo non superato	difetti
INTERNO(responsabile)						

Index of Figures and Tables

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