5s Project: introduction of lean manufacturing in a business unit with the aim of improving productivity

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Abstract

Lean manufacturing is centered on preserving value with less work. Lean manufacturing is a management philosophy derived mostly from the Toyota Production System and identified as “Lean” only in the 1990s. Lean manufacturing is a variation on the theme of efficiency based on optimizing flow; it is a present-day instance of the recurring theme in human history toward increasing efficiency, decreasing waste, and using empirical methods to decide what matters, rather than uncritically accepting pre-existing ideas. Lean manufacturing is often seen as a more refined version of earlier efficiency efforts, building upon the work of earlier leaders such as Taylor or Ford, and learning from their mistakes. However, the modern view takes a more holistic approach where the definition of waste is far more generic. Irregular production with ups and downs in production levels would be considered waste. The goal of Lean then becomes the creation and maintenance of a production system which runs repetitively, day after day, week after week in a manner identical to the previous time period.

In the last months I had the opportunity to do an internship to follow a project concerning the introduction of lean manufacturing. Some months before the group in charge of this Business Unit has given the directive to introduce Lean Production in the company with the objective to improve profitability. After a few months, the project has started with 2 sub-projects: 5S and Value Stream Mapping. When I arrived in the company, the project had already started, I went with an accurate analysis of society, of all the activities and the related sections of the previous project. After that I started “my real project,” especially on 5S, before other people had worked on this subject and this was the second step of the 5S for the company.

5S is the name of a workplace organization methodology that uses a list of five Japanese words which are Seiri, Seiton, Seiso, Seiketsu and Shitsuke. Translated into English, they all start with the letter “S”. The list describes how to organize a work space for efficiency and effectiveness by identifying and storing the items used, maintaining the area and items, and sustaining the new order. The decision-making process usually comes from a dialogue about standardization which builds a clear understanding among employees of how work should be done. It also instills ownership of the process in each employee.

During the work thesis after an introduction about lean manufacturing and 5S I described all the work made in the company. I tried to describe step by step the 5S before the theory parts and then the practical experience.

After that starts a section dedicated to change management.

Change management is a structured approach to shifting/transitioning individuals, teams, and organizations from a current state to a desired future state. It is an organizational process aimed at helping employees to accept and embrace changes in their current business environment. In project management, change management refers to a project management process where changes to a project are formally introduced and approved. The life of each is first proposed for change. Up close to daily life is a set of processes, consisting of thoughts, images, words and actions. These processes are developed and constantly changing. Each process brings with it changes that for the most part remain below our threshold of concern, semi-invisible. With the

help of two famous techniques, the Scott & Jaffe curve and the ADKAR model I helped to understand better the change from the workers point of view . After that there is the explanation of the importance of people motivation and how it is important for the company.
At the end of this I showed a dataset about the people that work in the department where 5S project has been implemented. In fact one of the pillars within a company is the individual. Understanding and managing human behavior is critical in the context of work.
The available information about the workers are: sex, age, number of working years into the company, the change behavior and the reasons.
With a thorough analysis of the dataset was created a model to be able to understand and explain the behavior of workers in the company during a project that leads to a change.
This analysis had been possible with the important help of human resources department and head department that gave me all the necessary information. The model was then applied and you were able to take the considerations of this project. In addition, the model will be a useful tool for the company and extensible to other departments.
Thanks to the model we can see at once that with increasing years of work in the company, the workers' behavior tends to be increasingly negative toward changing project. The structure of the model takes into account both the size of the company and the human behavior and can therefore be considered efficient and complete.
Finally this paper concludes with a detailed explanation of the outcome of the project that are very satisfactory both from a business perspective, with economic benefits, and from my personal point of view.
In addition there are a few tips for the company, the evaluation of certain problems, opportunities and the analysis of the main advantages and disadvantages.

Abstract in Italian language

Lean manufacturing è incentrata sulla conservazione di valore con meno lavoro. Lean manufacturing è una filosofia di gestione derivante soprattutto dal sistema di produzione Toyota ed è stata identificata come "Lean" solo nel 1990. Lean manufacturing è una variazione sul tema di efficienza sulla base di ottimizzazione del flusso, è un esempio attuale del tema ricorrente nella storia umana verso una maggiore efficienza, diminuendo i rifiuti e utilizzando dei metodi empirici per decidere ciò che conta, piuttosto che accettare acriticamente preesistenti idee. Questa filosofia è spesso vista come una versione più raffinata degli sforzi di efficienza, sulla base del lavoro dei leader precedenti, come Taylor e Ford, e sul come imparare dai propri errori. Tuttavia, la moderna visione richiede un approccio più olistico in cui la definizione di rifiuto è molto più generico. Produzione irregolare, con alti e bassi dei livelli di produzione sarebbero considerati rifiuti. L'obiettivo di Lean diventa allora la creazione e il mantenimento di un sistema produttivo che corre ripetutamente, giorno dopo giorno, settimana dopo settimana in modo identico al periodo di tempo precedente.

Negli ultimi mesi ho avuto l'opportunità di fare uno stage in un'azienda seguendo un progetto riguardante l'introduzione della Lean manufacturing. Alcuni mesi prima il gruppo responsabile di questa Business Unit ha dato la direttiva di introdurre Lean Production in azienda con l'obiettivo di migliorare la produttività. Dopo alcuni mesi, il progetto è iniziato con 2 sotto-progetti: 5S e Mappatura del Flusso di Valore. Quando sono arrivata in azienda, il progetto era già iniziato, ho cominciato con una accurata analisi della società, di tutte le attività e le relative sezioni del progetto precedente. Dopo di che ho iniziato "il mio progetto reale", soprattutto seguendo 5S, prima di me altre persone avevano lavorato su questo tema e questo era il secondo progetto legato a 5S.

5S è il nome di una metodologia di organizzazione del lavoro che utilizza una lista di cinque parole giapponesi: Seiri, Seiton, Seiso, Seiketsu e Shitsuke. Tradotto in inglese, tutti iniziano con la lettera "S". L'elenco descrive come organizzare uno spazio di lavoro in base all'efficienza ed all'efficacia attraverso l'individuazione e la memorizzazione degli elementi utilizzati, il mantenimento del settore e gli oggetti, e sostenere il nuovo ordine. Il processo decisionale di solito proviene da un dialogo di standardizzazione che costruisce una chiara comprensione tra i dipendenti di come il lavoro dovrebbe essere fatto. Essa infonde anche la titolarità del processo in ogni dipendente.

Durante il lavoro di tesi, dopo un'introduzione di lean manufacturing e 5S ho descritto tutto il lavoro fatto in azienda. Ho cercato di descrivere passo dopo passo le 5S, prima la parte teorica e poi l'esperienza pratica.

Dopo di che inizia una sezione dedicata alla gestione del cambiamento.

La gestione del cambiamento è un approccio strutturato per lo spostamento - transizione individui, team e organizzazioni da uno stato attuale ad uno stato futuro desiderato. Si tratta di un processo organizzativo volto ad aiutare i dipendenti ad accettare e ad abbracciare i cambiamenti nel loro ambiente di business attuale. In project management, change management si riferisce ad un processo di gestione del progetto in cui le modifiche vengono formalmente introdotte e approvate. La vita di ciascun individuo è prima proposta per il cambiamento. Da vicino la vita quotidiana è un insieme di processi, composto da pensieri, immagini, parole e azioni. Questi

processi sono sviluppati e in continua evoluzione. Ogni processo porta con sé cambiamenti che per la maggior parte restano al di sotto la nostra soglia di attenzione, semi-invisibile. Con l'aiuto di due tecniche famose, la curva di Scott e Jaffe e il modello ADKAR ho cercato di aiutare a capire meglio il cambiamento dal punto di vista dei lavoratori. Dopo di che c'è la spiegazione dell'importanza della motivazione delle persone e come sia importante per l'azienda.
Alla fine di questo ho mostrato un set di dati sulle persone che lavorano nel reparto in cui il progetto 5S è stato realizzato. In effetti uno dei pilastri all'interno di un'azienda è l'individuo. Capire e gestire il comportamento umano è un fattore critico nel contesto di lavoro.
Le informazioni che avevo a disposizione sui lavoratori erano: sesso, età, numero di anni di lavoro in azienda, il comportamento al cambiamento e le ragioni correlate.
Con un'accurata analisi del campione ho creato un modello capace di far capire e spiegare il comportamento dei lavoratori durante un progetto che porta a dei cambiamenti. L'analisi è stata resa possibile grazie all'importante aiuto dato dall'ufficio risorse umane e dal capo reparto che mi hanno fornito le informazioni necessarie.
Il modello è poi stato applicato e si sono potute fare alcune considerazioni riguardanti il progetto. Inoltre, il modello sarà uno strumento utile per l'azienda e sarà estensibile anche ad altri reparti aziendali.
Grazie al modello si può facilmente comprendere che con l'aumento degli anni di lavoro in azienda, il comportamento dei lavoratori tende ad essere negativo verso l'apertura a nuovi progetti legati al cambiamento. La struttura del modello prende in considerazione sia la dimensione aziendale che quella del comportamento umano e può quindi essere considerato efficiente e completo.
Infine questo lavoro si conclude con una spiegazione dettagliata dei risultati del progetto che sono stati molto soddisfacenti sia dal punto di vista aziendale, con i benefici economici, che dal mio punto di vista personale.
Inoltre ci sono alcuni consigli per l'azienda, la valutazione di alcuni problemi, alcune opportunità da cogliere e l'analisi dei principali vantaggi e svantaggi.

1. Theoretical introduction of the lean Manufacturing

Lean manufacturing, lean enterprise, or lean production, often simply, “Lean,” is a production practice that considers the expenditure of resources for any goal other than the creation of value for the end customer to be wasteful, and thus a target for elimination. Working from the perspective of the customer who consumes a product or service, “value” is defined as any action or process that a customer would be willing to pay for.

Essentially, lean is centered on preserving value with less work. Lean manufacturing is a management philosophy derived mostly from the Toyota Production System and identified as “Lean” only in the 1990s. Lean manufacturing is a variation on the theme of efficiency based on optimizing flow; it is a present-day instance of the recurring theme in human history toward increasing efficiency, decreasing waste, and using empirical methods to decide what matters, rather than uncritically accepting pre-existing ideas. Lean manufacturing is often seen as a more refined version of earlier efficiency efforts, building upon the work of earlier leaders such as Taylor or Ford, and learning from their mistakes. However, the modern view takes a more holistic approach where the definition of waste is far more generic. Irregular production with ups and downs in production levels would be considered waste. The goal of Lean then becomes the creation and maintenance of a production system which runs repetitively, day after day, week after week in a manner identical to the previous time period.

1.1 ORIGINS

After World War II Japanese Manufactures were faced with the dilemma of vast shortages of material, financial and human resources. The problem that Japanese Manufacturers were faced with differed from those Western counterparts. These conditions resulted in the birth of the “lean” manufacturing concept. Toyota Motor Company, led by its president Toyoda recognized that American automakers of that era were out-producing their Japanese counterparts; in the mid 1940’s American companies were outperforming their Japanese counterparts by a factor of ten. In order to make a move toward improvement early Japanese leaders such as Toyoda Kiichiro, Shigeo Shingo and Taiichi Ohno devised a new, disciplined process oriented system, which is known today as the “ Toyota Production System” or “ Lean Manufacturing”. Taiichi Ohno, who was given the task of developing a system that would enhance productivity at Toyota is generally considered to be the primary force behind this system. Ohno drew upon some ideas from the west, and particularly from Henry Ford’s book “Today and Tomorrow”. Ford’s moving assembly line of continuously flowing material formed the basis for the Toyota production System. After some experimentation, the Toyota production System was developed and refined between 1945 and 1970, and it still growing today all over the world. The basic underlying idea of this system is to minimize the consumption of resources that add no value to a product.

In order to complete in today's fiercely competitive market, Us manufacturers have come to realize that the traditional mass production concept has to be adapted the new ideas of lean manufacturing. A study that was done at the Massachusetts Institute of Technology of the movement from mass production toward lean manufacturing, as explained in the book "The Machine That Changed the World" awoke the Us manufacturers from their sleep. The study underscored the great success of Toyota at NUMMI (New United Motor Manufacturing Inc.) and brought out the huge gap that existed between the Japanese and Western automotive industry. The ideas came to be adopted in the US because the Japanese companies developed, produced and distributed products with half or less human effort, capital investment, floor space, tools, materials, time and overall expense.

1.2 WHAT IS LEAN?

The new uprising in the manufacturing goods and service sector has created great challenges for US industry. The customer driven and highly competitive market has rendered the old-fashioned managerial style an inadequate tool to cope with less challenges. These factors present a big challenge to companies to look for new tools to continue moving up the ladder in a global, competitive, growing market. While some companies struggle because of their lack of understanding of the change of customer mindsets and cost practices. To get out of this situation and to become more profitable, many manufacturers have started to turn to lean manufacturing principles to elevate the performance of their firms.
The basic ideas behind the lean manufacturing system, which have been practiced for many years in Japan, are waste elimination, cost reduction and employee empowerment. The Japanese philosophy of doing business is totally different than the philosophy that has been long prevalent in the US. The traditional belief in the west had been that the only way to make profit is to add it to the manufacturing cost in order to come up with a desired selling price. On the contrary, the Japanese approach believes that customers are the generator of selling price. The more quality one builds into the product and the more service one offers, the more the price that customers will pay. The difference between the cost of the product and this price is what determines the profit. The lean manufacturing discipline is to work in every facet of the value stream by eliminating waste in order to reduce cost, generate capital, bring in more sales and remain competitive in a growing global market. The value stream is defined as "the specific activities within a supply chain required to design order and provide a specific product or value".

The term "Lean" as Womack and his colleagues define it denotes a system that utilizes less, in term of all inputs, to create the same outputs as those created by a traditional mass production system, while contributing increased varieties for the end customer.

This business philosophy goes by different names. Agile manufacturing and continuous flow are all terms that are used in parallel with lean manufacturing. So the resounding principle of lean manufacturing is to reduce cost through continuous improvement that will eventually reduce the cost of service and products, thus growing more profits.

1.3 THE WASTE CONCEPT

“Lean” focuses on abolishing or reducing wastes (or “muda” the Japanese word for waste) and on a maximizing of fully utilizing activities that add value from the customer’s perspectives. From the customer’s perspective, value is equivalent to anything that the customer is willing to pay for in a product or the services that follows. So the elimination of waste is the basic principle of lean manufacturing.
For industrial company, this could involve any of the following:

- Material: convert all raw materials into end products. Try to avoid excess raw materials and scrap;
- Inventory: keep constant flow to the customer and to not have idle material;
- Overproduction: produce the exact quantity that customer need, and when they need it;
- Labor: get rid of unwarranted movement of people;
- Complexity: try to solve problems the uncomplicated way rather than the complex way. Complex solutions tend to produce more waste and harder for people to manage;
- Energy: utilize equipment and people in the most productive ways. Avoid unproductive operations and excess power utilization;
- Space: reorganize equipment, people and workstations to get a better space arrangement.
- Defects: make every effort to eliminate defects;
- Transportation: get rid of transportation of materials and information that does not add value to the product;
- Time; avoid long setups, delays and unexpected machine downtime;
- Unnecessary Motion: avoid excessive bending or stretching and frequently lost items.

Waste sources are all related to each other and getting rid of one source of waste can lead to either elimination of, or reduction in others. Perhaps the most significant source of waste is inventory. Work-in-process and finished parts inventory do not add value to a product and they should be eliminated or reduced. When inventory is reduced, hidden problems can appear and actions can be taken immediately. There are many ways to reduce the amount of inventory, one of which is reducing production lot sizes.
There is no question that the elimination of waste is an essential ingredient for survival in today’s manufacturing world. Company must strive to create high-quality and low cost products that can get to the customers in the shortest time possible. There are sets of tools that were developed and that can be utilized to eliminate or at least reduce the sources of waste; Some of them are: Value Stream Mapping, 5S, Kanban and Poka-Yoke.

1.4 LEAN GOALS AND STRATEGY

The espoused goals of Lean manufacturing systems differ between various authors. While some maintain an internal focus, e.g. to increase profit for the organization, others claim that improvements should be done for the sake of the customer.
Some commonly mentioned goals are:

- Improve quality: To stay competitive in today's marketplace, a company must understand its customers' wants and needs and design processes to meet their expectations and requirements.
- Eliminate waste: Waste is any activity that consumes time, resources, or space but does not add any value to the product or service. See Types of waste, above.
- Taking the first letter of each waste, the acronym "TIM WOOD" is formed. This is a common way to remember the wastes. The other alternative name that can used to remember is "DOT WIMP".
- Reduce time: Reducing the time it takes to finish an activity from start to finish is one of the most effective ways to eliminate waste and lower costs.
- Reduce total costs: To minimize cost, a company must produce only to customer demand. Overproduction increases a company's inventory costs because of storage needs.

The strategic elements of Lean can be quite complex, and comprise multiple elements. Four different notions of Lean have been identified:

- Lean as a fixed state or goal (Being Lean)
- Lean as a continuous change process (Becoming Lean)
- Lean as a set of tools or methods (Doing Lean/Toolbox Lean)
- Lean as a philosophy (Lean thinking)

1.5 BENEFITS AND MAINTENANCE

A fundamental principle of lean manufacturing is demand-based flow manufacturing. In this type of production setting, inventory is only pulled through each production center when it is needed to meet a customer's order. The main benefits of lean manufacturing include:

- decreased cycle time;
- less inventory;

- increased productivity;
- increased capital equipment utilization.

A continuous improvement mindset is essential to reach a company's goals. The term "continuous improvement" means incremental improvement of products, processes, or services over time, with the goal of reducing waste to improve workplace functionality, customer service, or product performance (Suzaki, 1987). Continuous improvement is another principle of lean manufacturing, Kaizen, which is the Japanese word for a continuous endeavor for perfection, has become popular as a paramount concept behind good management. One of the most effective tools of continuous improvement is 5S, which is the basis for an effective lean company.
Stephen Shortell (Professor of Health Services Management and Organizational Behaviors – Berkeley University, California) states: "For improvement to flourish it must be carefully cultivated in a rich soil bed (a receptive organization), given constant attention (sustained leadership), assured the right amounts of light (training and support) and water (measurement and data) and protected from damaging."

1.6 THE EXPERIENCE AND THE COMPANY

In the last 6 months I had the opportunity to do an internship to follow a project concerning the introduction of lean manufacturing. Some months before the group in charge of this Business Unit has given the directive to introduce Lean Production in the company with the objective to improve profitability. After a few months, the project has started with 2 sub-projects: 5S and Value Stream Mapping. When I arrived in the company, the project had already started, I went with an accurate analysis of society, of all the activities and the related sections of the previous project. After that I started "my real project," especially on 5S, before other people had worked on this subject and this was the second step of the 5S for the company.
This Business Unit is part of a group that is Europe's leading provider of reverse logistics for multimedia and telecommunication products. The group has:

- 5,700 employees
- Turnover € 350 million in 2007-2008
- 20 Centers of Excellence
- 3 lines of business:

  Telco: mobile phones, smartphones and PDAs

  Access: decoders, DSL modems, gateways

  Multimedia: flat displays, PCs, laptops, GPS, MP3

The Italy Business Unit, listed on the Paris stock exchange leaders in after-sales services and extended warranty products for IT and Telecom Videocom; present in Italy since December 1998

with a turnover of 27 million and 350 employees. The business areas in which it operates are as follows:

- IT;
- Videocom;
- Services On Site;
- Regeneration of used products;
- Telecom.

This Business Unit is able to apply their industrial processes with after-sales service, installation and integrated logistics.
The company operates in the digital technology and is able to offer advanced and innovative service solutions and is positioned as an integrated service partner.
The business has several departments, but this project has been applied on Videocom. Videocom area is the department that deals with the repair and renewal of the beauty of the Sky decoders.

2. 5S Methodology

5S is the name of a workplace organization methodology that uses a list of five Japanese words which are Seiri, Seiton, Seiso, Seiketsu and Shitsuke. Translated into English, they all start with the letter “S”. The list describes how to organize a work space for efficiency and effectiveness by identifying and storing the items used, maintaining the area and items, and sustaining the new order. The decision-making process usually comes from a dialogue about standardization which builds a clear understanding among employees of how work should be done. It also instills ownership of the process in each employee.

2.1 PHASES OF 5S

There are 5 primary phases of 5S: sorting, straightening, systematic cleaning, standardizing, and sustaining. Additionally, there are three other phases sometimes included: safety, security, and satisfaction.

- **Sorting (Seiri)**: Eliminate all unnecessary tools, parts, and instructions. Go through all tools, materials, and so forth in the plant and work area. Keep only essential items and eliminate what is not required, prioritizing things as per requirements and keeping them in easily-accessible places. Everything else is stored or discarded.

- **Straightening or setting in order / stabilize (Seiton)**: There should be a place for everything and everything should be in its place. The place for each item should be clearly labeled or demarcated. Items should be arranged in a manner that promotes efficient work flow, with equipment used most often being the most easily accessible. Workers should not have to bend repetitively to access materials. Each tool, part, supply, or piece of equipment should be kept close to where it will be used – in other words, straightening the flow path. Seiton is one of the features that distinguishes 5S from “standardized cleanup”. This phase can also be referred to as Simplifying.

- **Sweeping or shining or cleanliness / systematic cleaning (Seiso)**: Clean the workspace and all equipment, and keep it clean, tidy and organized. At the end of each shift, clean the work area and be sure everything is restored to its place. This makes it easy to know what goes where and ensures that everything is where it belongs. Spills, leaks, and other messes also then become a visual signal for equipment or process steps that need attention. A key point is that maintaining cleanliness should be part of the daily work – not an occasional activity initiated when things get too messy.

- **Standardizing (Seiketsu)**: Work practices should be consistent and standardized. All work stations for a particular job should be identical. All employees doing the same job should be able to work in any station with the same tools that are in the same location in every

station. Everyone should know exactly what his or her responsibilities are for adhering to the first 3 S's.

- **Sustaining the discipline or self-discipline (Shitsuke):** Maintain and review standards. Once the previous 4 S's have been established, they become the new way to operate. Maintain focus on this new way and do not allow a gradual decline back to the old ways. While thinking about the new way, also be thinking about yet better ways. When an issue arises such as a suggested improvement, a new way of working, a new tool or a new output requirement, review the first 4 S's and make changes as appropriate.

- **Safety**: A sixth phase, "Safety", is sometimes added. There is debate over whether including this sixth "S" promotes safety by stating this value explicitly, or if a comprehensive safety program is undermined when it is relegated to a single item in an efficiency-focused business methodology.

- **Security**: A seventh phase, "Security", can also be added. In order to leverage security as an investment rather than an expense, the seventh "S" identifies and addresses risks to key business categories including fixed assets (PP&E), material, human capital, brand equity, intellectual property, information technology, assets-in-transit and the extended supply chain.

- **Satisfaction**: An eighth phase, "Satisfaction", can be included. Employee Satisfaction and engagement in continuous improvement activities ensures the improvements will be sustained and improved upon. The Eighth waste – Non Utilized Intellect, Talent, and Resources can be the most damaging waste of all.

These last 3 phases aren't included in the project as the previous but are strictly correlated with all other phases.
It is important to have continuous education about maintaining standards. When there are changes that affect the 5S program such as new equipment, new products or new work rules, it is essential to make changes in the standards and provide training. Companies embracing 5S often use posters and signs as a way of educating employees and maintaining standards.

2.2 THE ORIGINS OF 5S

5S developed, as with so many of today's best practice tools, in Japan. We first heard of it as one of the techniques that enabled what we then termed 'Just in Time Manufacturing'. The Massachusetts Institute of Technology's 5-year study into the future of the automobile in the late 1980s identified that the term was inappropriate since the Japanese success was built upon far more than components arriving only at the time of requirement. John Krafcik, a researcher on the project, ascribed Lean to the collective techniques being used in Japanese automobile manufacturing; it reflected the focus on waste in all its forms that was central to the Japanese approach. Minimized inventory was only one aspect of performance levels in companies such as

Toyota and in itself only arose from progress in fields such as quality assurance and boards to highlight problems for immediate action.

5S was developed by Hiroyuki Hirano within his overall approach to production systems. Many Western managers coming across the approach for the first time found the experience one of enlightenment. They had perhaps always known the role of Housekeeping within optimized manufacturing performance and had always known the elements of best practice. However, Hirano provided a structure for improvement programs. He pointed out a series of clearly-identifiable steps, each building upon its predecessor. Western managers, for example, had always recognized the need to decide upon locations for materials and tools and upon the flow of work through a work area; central to this (but perhaps implicit) is the principle that items not essential to the process should be removed – stored elsewhere or eliminated completely. By differentiating between Seiri and Seiton, Hirano made the distinction explicit. He taught his audience that any effort to consider layout and flow before the removal of the unnecessary items was likely to lead to a sub-optimal solution.

Equally the Seiso, or cleanliness, phase is a distinct element of the change program that can transform a process area. Hirano's view is that the definition of a cleaning methodology (Seiso) is a discrete activity, not to be confused with the organization of the workplace and this clearly helps to structure any improvement program. It has to be recognized, however, that there is inevitably an overlap between Seiton and Seiso. Western managers understood that the opportunities for various cleanliness methodologies vary with the layout and storage mechanisms adopted but by breaking down the improvement activity in this way it is quite clear that the requirements for the cleanliness regime have to be understood as a factor in the design aspect of Seiton. Interestingly, as noted by John Bicheno, Toyota's adoption of the Hirano approach, is '4S', with Seiton and Seiso combined – presumably for this very reason. The improvement team must avoid the trap of designing the work area and then considering the cleanliness or tidiness mechanism.

Hirano also reminded the world of the Hawthorne Effect. We can all introduce change and while people in the business consider the change program to be under management focus the benefits of the change will continue, but when this focus has moved (as is inevitably the case) performance will once more slip. Western managers, in particular, may have benefitted from the distinction between the procedural or mechanical elements, Seiketsu, of keeping these matters in focus and the culture change, Shitsuke, which is most definitely a distinct approach to bringing about a new way of working. A number of publications on the subject in the West have questioned whether this culture can really be tackled as part of an exercise of relatively limited scope. The broader kaizen, or continuous improvement, approach is built, among other things, upon the company's valuation of all members of the workforce. If employees don't feel valued within the overall company culture, perhaps the change required falls outside the limits of a Housekeeping improvement program.

2.3 THE OBJECTIVES OF 5S

Hirano identified a range of benefits from improved housekeeping, all of which can be regarded as falling within the Lean portfolio – that is, they are all based around the elimination of waste in one form or another.

The most obvious benefit from **items being organized** in such a way (i.e. that they are always readily available) is that of improved productivity. Production workers being diverted from production to look for tools, gauges, production paperwork, fasteners, and so on is the most frustrating form of lost time in any plant. A key aspect of Hirano's organization approach is that the often-needed items are stored in the most accessible location and correct adoption of the standardization approach means that they are returned to the correct location after use. Another element of Hirano's improved housekeeping is improved plant maintenance – workers 'owning' a piece of plant, responsible for keeping it clean and tidy, can take ownership for highlighting potential problems before they have an impact on performance. (Of course, this brings with it the interface with preventive maintenance and the need for clarity in the 'assignment map', that is – who does what. The division of tasks between production workers and specialist maintenance engineers varies with the nature of the business, but ownership rests within the business unit rather than within the 'service provider').

The next aim is perhaps **Quality**. The degree of impact of dirt in a manufacturing environment, obviously, varies with the nature of the product and its process but there are few, if any, areas where dirt is welcome. Even if it is only in the form of soiled documentation accompanying the goods to the customer this can send a very negative message about the company and its culture. In other cases dirt can have a serious impact on product performance – either directly or indirectly, perhaps through compromising the integrity of test processes. Of course, 5S does more than address dirt; an inappropriate layout can result, for example, in product damaged through excessive movement or through the use of tooling other than that defined as the standard. Standardization is a theme of Hirano's approach, overlapping to a considerable extent with, for example, that of Ohno. A Standard Operating Procedure for tool certification is much easier to achieve if the tool to be certified is always in a clearly-marked location.

Another goal is improved **Health & Safety**. Clear pathways between workbenches and storage racks can minimize accidents, as can properly-swept floors. As with Quality, a well-organized, clean and tidy facility lends itself more readily to standard practice. Hirano also described how an environment in which the workforce has pride in their workplace can contribute to a considerable extent in a number of ways including customer service. Improving the layout of the facility merges with the concept of visual management; if workers can see the status of plant and of work in the facility, thus removing the need for complex tracking and communication systems, then benefits will accrue. 5S can also be a valuable sales tool when potential customers visit; a well-organized, clean and tidy facility sends a message of a professional and well-organized supplier.

One point made by all practitioners is that the adoption of 5S must be driven by goals. An article in the journal of the UK's Institute of Operations Management written by Mark Eaton and Keith Carpenter of the Engineering Employers' Federation noted that "the successful implementation of 5S requires that everyone understand why it is being used and what the expected results are. As

with all Lean techniques the aim is improvement in business performance; the adoption is not an end in itself.

2.4 THE EVOLUTION OF 5S

Many Western companies now promote Hirano's approach with a sixth 'S' added for Quality. Not unnaturally, there is some debate over this, with devotees on both sides of the argument. The sixth S serves a fundamental purpose – it reminds every one of the need for Quality. A key lesson taught by Japanese automobile manufacturers, and one central to the Toyota Production System, is that traditional levels of performance must be not only exceeded, but replaced by a completely different perception of the scale of what is acceptable. Rather than managing defects in percentage terms, Western managers heard of management in 'parts per millions', with single-figure levels of defects being the goal. Given that a 1% failure rate equates to 10,000 ppm the scale of improvement to be sought as part of the adoption of Lean was, to say the least, spectacular.

This improvement in quality levels could, of course, only be achieved with a complete re-definition of processes and culture within Western manufacturing. This includes issues such as 'Design for Manufacturing' and the fundamental change from Quality Control to Quality Assurance (that is, the Quality department role moving from inspecting and highlighting problems to guaranteeing methods and procedures to eliminate errors). Housekeeping, of course, is central to this and adding a sixth 'S' highlights this.

The contrasting view, and the one taken by Hirano in establishing this approach, is that each and every 'S' is a phase. As noted earlier, a major lesson for Westerners was Hirano's 5S methodology breaking the program down into a series of steps. The sixth 'S' does not add to this; Quality is not a phase, it is an objective – along with productivity and the others described above. Moreover, it is an objective of each and every phase. Adding the sixth 'S' might be perceived as recommending a program carrying out the sorting out, organizing, cleanliness, procedural and cultural steps and subsequently building in Quality, which of course is not possible. If all the objectives have not been built in throughout each element of the definition of the new way of working then they cannot be applied as an additional phase.

2.5 PRE START OF THE PROJECT

My project started at the end of February 2011 and I began with the help of a person a carefully analysis of the "AS-IS situation". Before my arrival, the project already existed and a team had implemented some modifications on the line with the aim of improving quality and productivity. During the initial phase of analysis it was possible to verify whether previous activities had produced good results and decide whether to continue with the next steps.

2.5.1 5S PLAN PROPOSAL

After that, (always with the help of some people) I started a study phase of the department Videocom to understand what were the areas that needed some changes (all assessed in order of priority) to try to improve productivity. At the end of this phase, in mid-April, I prepared a plan proposal with all activities emerged from the previous study.
The Videocom department has two main areas: the production line and the warehouse; Both of these areas have been subjected to the 5s project. The production line is divided into seven main areas: Unpacking, Test-in, Repair, Kit-Psu, Renew, Test-out and packing.
In the following figure is reported the plant of the project area.

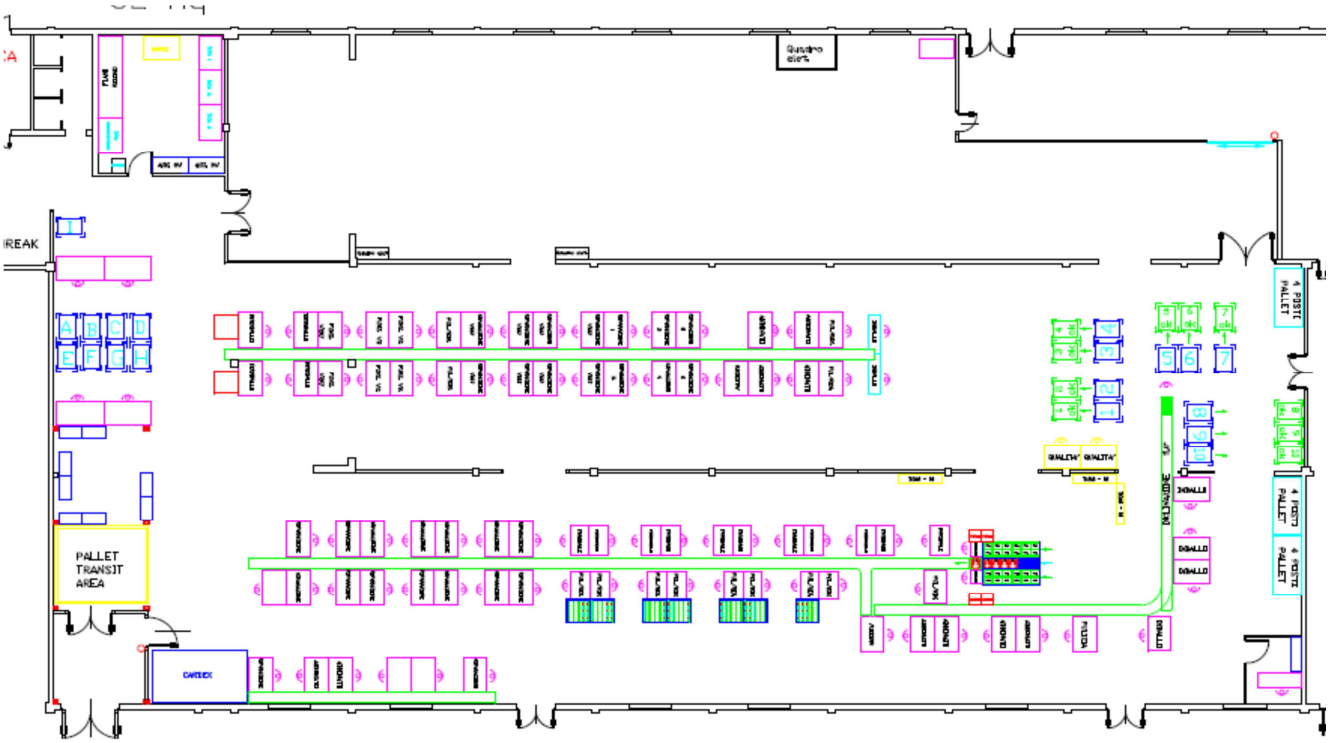

Fig. 2.5.1 Plant of project area.

In addition to the proposed plan, I also created a proposal for teams to carry out the project that would also be passed from Industrial Management, which was responsible for coordinating the project.

PLAN PROPOSAL

Warehouse:

- Reorganization of the floor and improving of the management;
- Brainstorming with the help of colored stickers;
- Elimination of obsolete pallets;
- Identification of stock areas for final products;

- Reorganization of the warehouse with evaluation of advantages and disadvantages (with hypothesis of layout change);
- Tracking of the new areas;
- Application of posters with photos;
- Reorganization of internal buffer shop;
- Creation of maintenance procedure.

Department Floor

- Vertical identification of the areas;
- verification of the areas outlined, with particular attention of:
  - Buffer shop
  - New pallet area
- Creation of daily cleaning procedure;
- Redefinition kit/Psu area;
- Move the scrap warehouse in the central warehouse.

Desks

- Check list equipment, in particular:
  - Repair Desks
  - Renew Desks
  - Test out Desks000
- move drawers in the right side;
- Evaluation if the drawers are necessary;
- Light check;
- Redefinition of kit/Psu Desks;
- Creation of daily cleaning procedure;
- Visual management to view information.

After this was done one day a meeting for discussion and approval of the plan and the team of 8 persons. The manager approved the totality of the business plan.

2.5.2 PROJECT CHARTER

At this point I created a project charter with a detailed explanation of the project
The project charter is a document divided into six parts: explanation of the project, opportunities, objectives, field, planning and team.

PROJECT	OPPORTUNITIES
Why is the project important? The productions line are disorderly, dirty disorganized and is possible to improve the quality manage. Is very important invest in a Lean project for increase the performance	**Main problems** Low productivity for the operator and for the line **Negative aspects** The principal negative aspects are: - Low business profitability - Big ibr esthetical and functional - Gap esthetical test whit real spare parts changed - No good impression with the customer - First approach with new customers no good **What is wrong?** Action areas: - Work benches - Production area - warehouse - file manage **Benefits** Increase quality and productivity.
OBJECTIVES	**FIELD**
Increase productivity Decrease of standard time **Ibr:** IBR decrease around 3% **Aesthetic presentation**	**Which process are important for the project?** The process areas important are: - work bench Layout - Production line Layout **Which process aren't important for the project** The process areas not important are - Time and method

<table>
<tr>
<td>Improvement of the aesthetic presentation

Gap aesthetic test – spare parts changed

Decrease of 10 % for this delta

Line staff involvement</td>
<td>- Line balancing

- Planning

Which are the constraints?
The constrains are:
- Is very important the production continuity
- Is very important avoid slow down the production

Which are the methods to be used?
The methods to be used are:
- Definition of what is useful and what is unnecessary.
- Delete the unnecessary, sort, clean, and identify the place for gear, parts, machinesStandardisations
- Train operator and apply the rules defined
- Construction of billboards and documentation for the production line</td>
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<tr>
<td>PLANNING</td>
<td>TEAM</td>
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</table>
</td>
<td>Champion – Industrial Manager
Team Leader – Process Eng
Team member
Team member – Mechanical Eng
Team member – Quality team
Team member
Team member</td>
</tr>
</table>

Tab. 2.5.2 Project charter table

2.5.3 PROJECT PRESENTATION AND PROJECT INFORMATION

One week before the start of the project, a meeting was convened for the official presentation 5S. During the meeting a presentation was screened with photos of the main areas of intervention. The meeting was attended by all team members. The team was formed from industrial manager, by some line operators and some people of the engineering division. To simplify understanding of

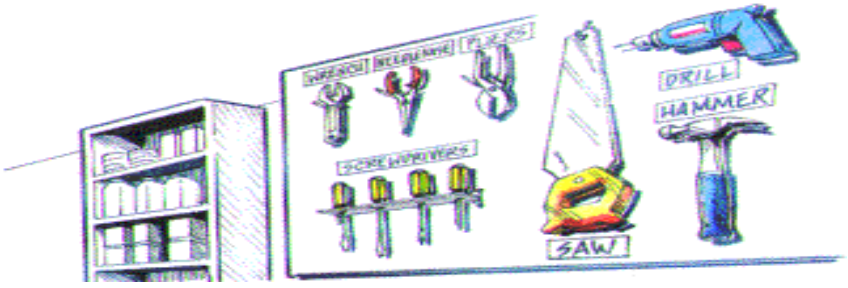
the project and its phases has also been given a small and funny project information to all members.

5S PROJECT INFORMATION

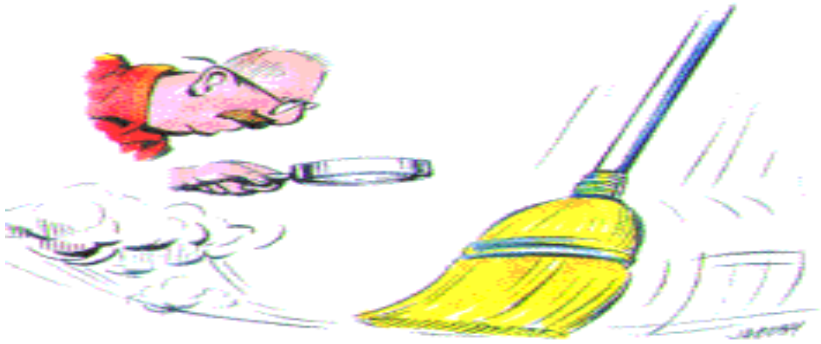
The project stands for 5 important pillars:

- 1) Seiri – Clearin up: remove what is not needed and keep what is needed

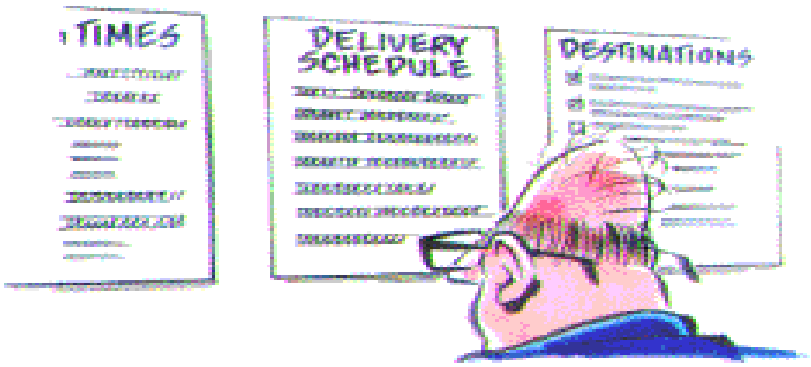
- 2) Seiton – Organizing: place things in such a way that they can be easily reached whenever they are needed



- 3)Seiso – Cleaning: keep thinks clean and polished; no trash or dirt in the workplace



- 4) Seiketsu - Standardizing:
  maintain cleanliness after cleaning – perpetual cleaning



- 5) Shitsuke – Self-Discipline:
  Commitment, a typical teaching and attitude towards any undertaking to inspire pride and adherence to standards established for the four components

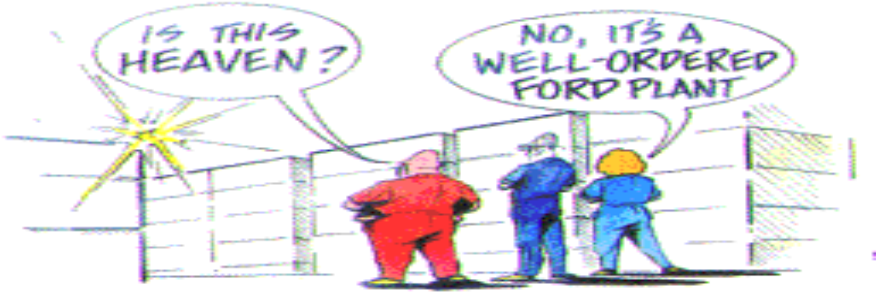


Fig. 2.5.3 Project information for workers

At this moment we were ready to start with the 5S project phase by phase.

3. Before S: Seiri

Often translated as sort, Seiri can also connote tidiness, cleaning, or separating.
Seiri is the first step in the 5S process and involves the meticulous examination of everything in the work environment. All extemporaneous materials or anything unrelated to the workplace are removed from the area. These items can be either stored for possible future use or discarded.
Not everything without an immediate use needs to be thrown out. A key to implementing Seiton effectively is the creation of a "red label" zone. Items with potential future use should be red-tagged and moved to a designated area.
By removing clutter and unnecessary debris, 5S eliminates hazards in the work space. A cleaner, better functioning workspace is left.
Productivity increases because Seiri has removed both distractions and obstructions to efficient and productive work. The separation of frequently used tools from rarely used items streamlines work to create faster, leaner, and safer working conditions.
Through the suitable sorting it can be identified the materials, tools, equipment and necessary information for realization the tasks. Sorting eliminates the waste material (raw materials and materials), nonconforming products, damaged tools. It help to maintain the clean workplace and improve the efficiency of searching and receiving thinks, shortens the time of running the operation.

3.1 THE 1S RULE'S PROCEEDINGS

The 1S rule's proceedings is divided into three stages:

On the first stage one should answer to so-called Control Questions:

- Are unnecessary things causing the mess in the workplace?
- Are unnecessary remainders of materials thrown anywhere in the workplace?
- Do tools of remainders of materials to production lie on the floor in the workplace?
- Are all necessary things sorted, classified, described and possess the own place?
- Are all measuring tools properly classified and kept?

On the basis of the answer to the above questions it is possible the estimation of the workplace in terms of the 1S rule so littering the workplace. If on any question answer is yes, it should execute sorting of thinks, which are in the workplace.

On the second stage one should execute the review of all thinks which are in the workplace and group them according to the definite system. According to carried out sorting it should execute the elimination from the workplace the things, which were found unnecessary.

To permanent usage the 1S rule 1S rule is so called The Program of the Red Label. It means giving the red label to things, which operator will recognize as useless within his workplace. This label will make possible not only the elimination of the given thing, but through its own formula will make possible the liquidation of the reasons of appearing on the workplace this given thing.

3.2 PRACTICAL EXPERIENCE

During the execution of the project every activity has been implemented following the 5s steps, even if not for all activities of proposal plan was needed to start of Seiri step. In fact in some of them wasn't necessary remove the materials and we started directly to the second step.
There are some activities that followed for hypothesis only three steps and others that followed all five steps.
In each practical experience I will illustrate the main areas and the main interventions that have been executed.

3.2.1 THE WAREHOUSE

The first area subjected of first phase 5S was the warehouse. Before the starting of the activities we made a general idea through a survey on the area. The situation in the warehouse was very difficult, in particular because during the first step of the project this area was not included. The store in question is located next to the production line and the area occupied is about 400 square meters. The warehouse is divided into some bays as you can see from the picture below.

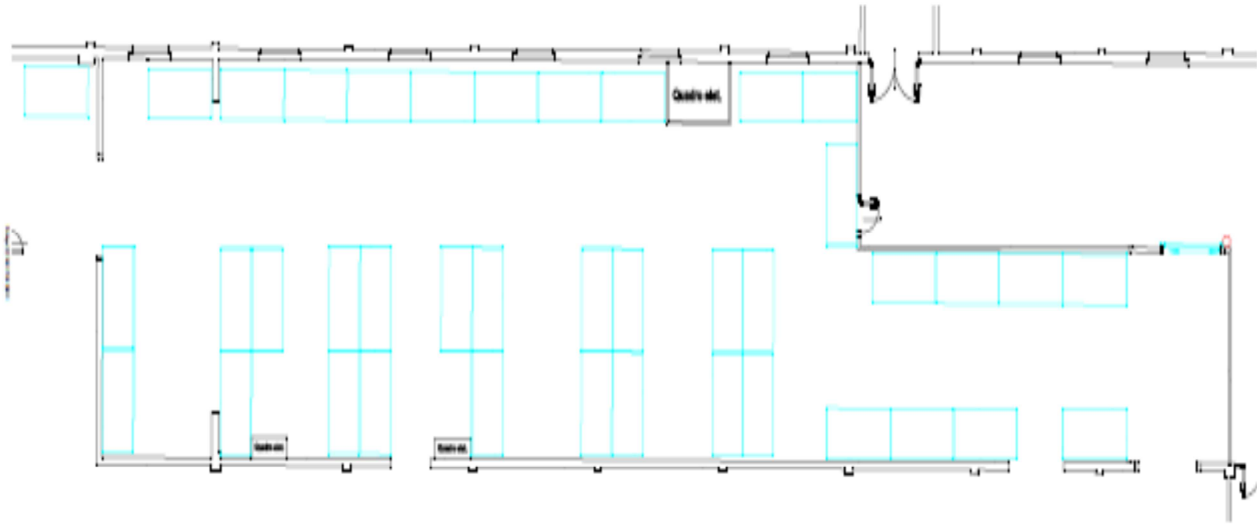


Fig. 3.2.1.1 Warehouse plant

The service area for the warehouse was in a rather critical situation, the spans were completely full of various pallets and even the aisles were overflowing with materials. The move, even walking was rather difficult. Each time that the warehouse manager had to retrieve a particular type of material was required to move many other pallets and this operations were really difficult. Besides being complicated, having to move other materials before retrieving the right pallet it will become a waste of time exaggerated. In addition, the materials stored in the warehouse were not distributed according to an exactly logical, but they were scattered more or less at random. In the following figure there is the initial situation of the store.

Fig.3.2.1.2 Initial warehouse situation

The problem was that there was too much stuff in the warehouse and much of this wasn't used: it was outdated material. To solve this unfortunate situation I kept colored stickers. Each color has a meaning, according to the legend below.

The utilized colored stickers are:

Fig. 3.2.1.3 Legend of colored stickers

With the help of some team members I went in the warehouse and began to label the various pallets until the entire area.

The pallets with red label had been classified as obsolete, some could be retrieved for use in another department, some could be sold and some could be thrown (e.g. cover of decoders not in production).
The pallets that we assigned the yellow label represented the unused materials at the moment but that needed further evaluation by competent staff in order to define the destination (e.g. cover of decoders of which the production was yet to be assessed).
The pallets with a green label instead represented the material currently used for production and was kept in the warehouse (e.g. cover of the decoders in production).
The pallets with a blue sticker represented material not used for production, but that could be reused for other purposes (e.g. bags).
Below are listed some images of pallets with posting stickers.

Fig. 3.2.1.4 Pallets with posting stickers

After that some members of the team worked for moving and eliminating the pallets with red labels. At this point the warehouse resulted less full and was ready for the second step of 5S.

3.2.2 KIT-PSU AREA

Another area subjected to Seiri step was the Kit-Psu area, where you carry out processing of remote controls, power supplies and the creation of bags containing the accessories to be added to the packing stage.
The Kit-Psu area looked very messy and even here the passage was extremely difficult, first it was necessary to divide the accumulated material between what was really needed and what was not. In the pictures below you can see the area as it appeared before the first step.

Fig. 3.2.2 Initial situation kit-psu area

To perform the work in this area has not been necessary to use the colorful stamps since we applied the first rule of 5s in the true sense of the word. In fact we have maintained on the area that was used effectively in the production and the rest have been eliminated. Even for the execution of this work the team members have participated and help me as a guideline to make the right decisions. At the end of this phase also the Kit-Psu area was ready to move to the second phase.

3.2.3 BUFFER SHOP AREA

The third macro-area incorporated in this step was the buffer shop zone that is located next to the Kit-Psu zone. The buffer Shop is a stock area of the parts needed for production. Parts stored in large quantities in the main warehouse, are unpacked and stored in smaller quantities in this small area that is next to the production line. The buffer shop stores material on shelves into plastic boxes with labels indicating what is inside. In this way, operators of the line must not waste time going to the main store, but found the required material directly from this area. The buffer shop works just like a real supermarket. The area was in a state of total confusion and it was necessary to restore order.

To restore order in this area was very important because this allows to production line the elimination of idle time to provide the necessary parts. In particular this allows a reduction of the time in the renew phase, a diminution of total production time and a correlated reduction of the production cost.

The figure below shows as the area appeared.

Fig. 3.2.3.1 Initial situation buffer shop area

Also in this area we have not accomplished through the use of colored stickers but we worked through a drastic separation between what was and what was not necessary for production. At the end of these operations also this area was ready to move to the second step.

To get a better idea of the spaces the image below shows the Kit-Psu and Buffer Shop area.

Fig. 3.2.3.2 Kit-psu and buffer shop plant

4. Second S: Seiton

Seiton is a concept that, loosely translated, means to set things in order. This second step in the 5S process is all about efficiency and can be summarized with one sentence:

A place for everything and everything in its place.

Seiton consists of putting everything in an assigned area so it can be used and returned as quickly and safely as possible. Commonly used tools should be easily accessible, saving both time and effort.

With color coding tools can easily be found, used, and returned to their proper places. Color coding and labeling eradicates confusion by making tools easily distinguishable by following standard color code guidelines.

The key to an efficient, safe, and adaptable organizational scheme is not only assigning everything a place, but knowing what that place is.

There are many ways to identify proper storage locations. A common method is to use color, pictograms, and shape identification, as they communicate much faster than text. A shadow outline of a tool to show its given location when accompanied by a text label is an effective method for showing tool storage location.

Without clear labeling, Seiton is wholly ineffective. While everything has its place, no one knows where that place is without clear visual indication. Labels can be used to organize space visually, as well as label individual objects to make their purposes clear and precise.

Because work requirements often change, Seiton organization should be flexible, capable of adapting to increases, decreases, and outright changes in production needs. Clear labeling is a must for adaptability because it allows for the arrangement of a clean, safe, and efficient workspace to meet any future demands.

4.1 THE 2S RULE'S PROCEEDINGS

It should execute the segregation of things and mark the place of their storing. Using things should always be divided on these which should be:

- In close access (1°degree sphere);
- Accessible 2nd degree sphere);
- In the range of hand (3nd degree sphere)

To the estimation of the workplace in terms of the second rule, that is setting in order things, serve the following Control Questions:

- Is position (location) of the main passages and places of storing clearly marked?
- Are tools segregated on these to regular uses and on specialist tools?

- Are all transport palettes storage on the proper heights?
- Is anything kept in the area of devices against the fire?
- Has the floor any irregularity, cracks or causes other difficulties for the operator's movement?

Things used occasionally and seldom should be on the workplace but outside the direct using sphere. Their distance and location from the place of work should depend on the frequency of using these materials or tools. Place of storage should be marked in the manner making possible their quick identification. It can be used colored lines, signs or tool boards. Once defined places and methods of storage should be invariable.

4.2 PRACTICAL EXPERIENCE

Seiton phase is, for my opinion, one of the most important during 5S process. Practically all activities subjected to this project crossed this step. (on the contrary of the before S that interested only a part of the total operations made.
Also during this stage the members of the team give me their contribution for achieving good results. This is also the most complicated activities because before the realization I had to make a carefully study of the interesting areas and make a good evaluation about advantages and disadvantages. In particular during the project I had to collaborate with engineering department that gave me an important technical support.
Now I show the main areas and the main interventions made during this phase.

4.2.1 WAREHOUSE

After first phase, implemented with the help of colored stickers and with a partial removal of obsolete pallets, started the second phase. During this passage have been made a lot of operations with the aim of achieving a drastic reorganization of the warehouse.
First of all we started from an accurate study about the change of layout (see picture..) with the evaluation of advantages and disadvantages. At the end of this study we decided to keep the previous layout and to make a reorganization of the existent structures.
The main problem in this store was that the stored components were not distributed according to an exactly logical, but they were scattered more or less at random. So, with the help in particularly from the warehouse manager, I started to classify the components with a specific logical. In this area in fact, there are a lot of components that are used for the construction of particular decoders and some that are used independently from the type of decoder.
The aim was to found a specific, convenient and adequate location for each pallet that contain the components. First step was to divide parts according to their original family and the remaining parts that are used for all products (like paper for packaging). After that we decided a specific

location for each of this group of selected pallets, according with the less distance between the storage location and the workplace. For example the paper used for packaging was put the nearest possible of packaging area and the components used for decoder type X were put the nearest possible at the workplace for decoder X and so on.
These operation are been made with the help of people and trans pallet for the transports.
In the following picture we can see a part of the warehouse during and after this work.

Fig. 4.2.1.1 Warehouse before Seiton phase

Fig. 4.2.1.2 Warehouse after pallet reorganization

Thanks to this reorganization at the end of this operation the store was more well managed, more presentable for external people that have access to the area, easier to research for what the operator needs for the production, easier for making inventory operations and easier the passage both for equipment and people.
In addition to these advantages in this way we can have an important time reduction for storing operation and so a connected saving in term of money.
I should point out, the fact of the inventory, always linked to the reduction of the time. When work began on the storekeeper told me that every time for taking stock, it took a lot of time, about 4 hours, because the situation was terrible in the store.
After this operation I spoke again with this person and was very happy because the time was drastically reduced. In this way he can use this time for other work for improving productivity.
After the reorganization of the entire area, we started with the organization of the floor, so the management has improved even more.
The organization of the floor is the study of areas to be traced. Each space according to its function is drawn with a specific color according to the following table.

AREAS IDENTIFICATION
Ways of passage
Different zone
Scraps
Work in progress
Finished products
Products on the line

Tab. 4.2.1.3 Colors of area identification

This table was already present into the company, because some areas were tracked. This table was created from the engineering department. I take the same colors table because in this way, we could continuous with the same modalities.
After the study, which concluded with the drafting of a bill, with the main areas that needed to be tracked, work began tracking the new areas.
The only color used in this area was yellow, because in the warehouse was important to identify the transition areas. This was done with the help of the warehouse manager and other players in rotation.
The following photos show the situation before and after tracking.

Fig. 4.2.1.4 Warehouse before tracking areas

Fig. 4.2.1.5 Warehouse after tracking areas

At this point the work was completed, but there was one more thing to do. Until now all operators have access to the warehouse, before taking a pallet of components had to watch and read on the box to see what was inside. This is a waste of time. I thought the smart way to avoid this problem would be to put a poster next to the pallet with the content. For this reason I started to open and know the contents of each box and take a photograph of each component. When I finished, I

printed the photos and I did do the plasticization with resistant material. Then I went in the store and started to put the pictures close to the same pallet. In this way each time a worker goes into the warehouse can immediately see where there is the position of the component. The plastic coating was applied with a special adhesive tape. In this figure we can see an example of identification posters.

Fig. 4.2.1.6 Warehouse with identification posters

It is important to note that until now, the warehouse was the only area of the department that hadn't identified the areas on the floor and for this reason was very important to draw.
The Seiton phase was completed in the warehouse and was ready to take the next step.

4.2.2 NEW UNPACKAGING AND NEW PACKAGING FLOOR

During my experience on the production line, further action, external to 5S project have been made. In particular in the area of unpacking and packing some of the old structures were replaced. So, when this work of replacement was done you must begin with the 5S project to complete the work. For this reason, on the basis of new forms of structures begun the reorganization of the floor. The new structure for these areas were always made with the aim of improving productivity (these were related to improve the quality of other projects).
Also according to the colors in the table the new lines were drawn on the floor. The only color used was yellow because the purpose was to create ways for the passage of people.
In the next photo you can see a significant intervention done.

Fig. 4.2.2 New unpack aging floor

4.2.3 BUFFER SHOP AREA

After the previous phase, even in this area has begun the second phase. It required a reorganization of the whole area, because all the boxes were scattered on the shelves in some way and it was difficult for operators to maintain order and find the right components. I started working with the help of the warehouse, a reorganization of space. We put everything in order and we applied the new labels with the name of the components contained in each box. After this buffer shop area was finally in order. In the next photo you can see a part of the buffer shop after the reorganization.

Fig. 4.2.3.1 Buffer shop after reorganization

Even in this area after the surgery before we moved the organization floor. Buffer shop was another area that hadn't lines on the floor and for making a good re-organization of space was important to do the lines. In this space must pass only the people and for this reason, the transition areas have been drawn much closer than the store. In addition, we organized the shelves in a way that the buffer shop has become a closed space (the entry has been left alone). In this way the space is even more neat and organized. Here too, the lines were made according to the table .. and the only color used is yellow (only the passage). The next image allows you to visualize the structure of the floor in the buffer shop.

Fig. 4.2.3.2 Buffer shop after tracking areas

4.2.4 STORAGE AREA FOR FINISHED PRODUCTS

Close to the packaging area and particularly at the end of this area there is a special area dedicated to the pallet stationary. This area is dedicated to the formation of pallets with the final products. At the end of the packing stage, the operator takes over the decoder contained in the box and puts it on the correspondent pallet. This is the final step before shipment of products. When a pallet is complete it is put in stock ready to ship.

Before the reorganization, this area was not messy or confusing, but the pallets were placed side by side and take a particular finished pallet was becoming very difficult. In fact, sometimes you had to move all pallets to take a close finish and put the new one. For this reason, with the help of a team member we have designed a new layout for pallet stop to avoid unnecessary movement of adjacent materials.

With this new provision, operators can take any of the other without moving the pallet.

Also missing in this area was a corridor for people and trans pallet passage and we could also create this .
The area has been reorganized with the colored line on the floor. But before that we had to remove the existing lines with some special tools. Here, too, were tracking the line according to the table .. The colors used were: yellow, always in the corridors of passage, and the green around the finished products. The areas of the pallets were plotted according to the actual size of a standard pallet.
In the photo below I show the area with all the changes mentioned.

Fig. 4.2.4 Storage area for finished products after reorganization

4.2.5 VISUAL MANAGEMENT AREA

Visual management area is a small zone where there are some message boards where you put some information for workers. It's actually very important that people who work within the production line are informed about projects and initiatives that affect the line. In particular, these boards are used to display the project related to lean manufacturing. During the phases of the project, it puts the progress and at the end of the project the analysis and the obtained results. Prior to my arrival at the company before the 5S project this area was forgotten and no one used these posters. In addition to one of these boards there is the most important poster in which the line operators can put post-it with their suggestions to improve the general and personal working

conditions. This is a very important thing because in this way can manage even more to understand what workers want and this is a way to make them an active part.
Seiton operation in this area was done through a reorganization of the provisions of the noticeboards. Was created a semi-closed area with the use of these message boards.
The idea is to show in a small space everything that happens in the production line in a particular period. Usually the information is not changed at regular period of time but according to the events that happen.
At the end of the reorganization was also drawn the floor always according to the above table ... The only color used is yellow, only for the walkways.
When I was in the company I was responsible for updating this information. During the project, every time a job was completed I did a report with the main activities implemented and I was going to put this in this area, to show the new status of the project 5S.

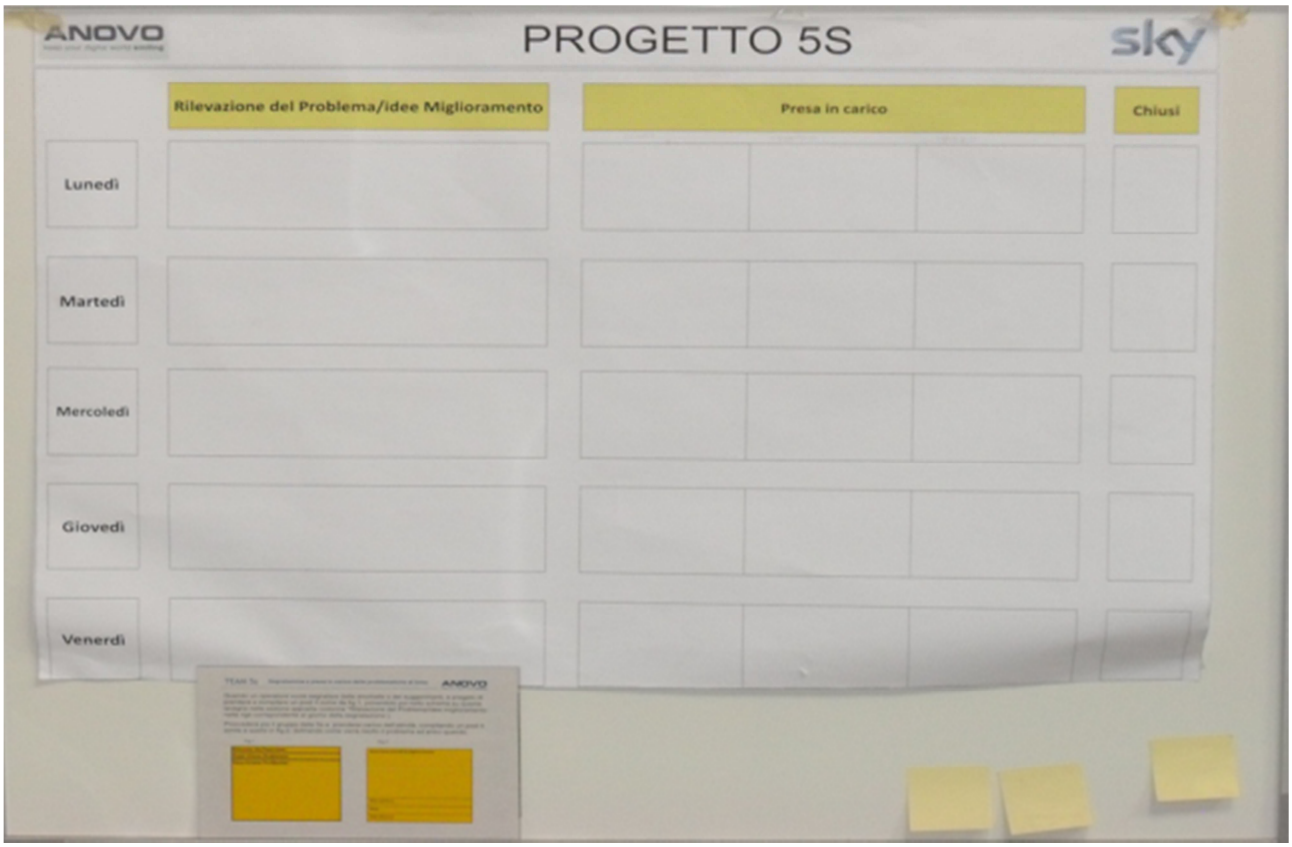


Fig. 4.2.5 Poster of visual management area

4.2.6 KIT-PSU AREA

After separation, kit-Psu area was ready for the second step. For the realization of Seiton I had the main collaboration from engineering department that studied with me the new layout of the entire area. This is an area in which worked four or five people and the space is divided into two main sub areas: one for pallets and components stationery and one for operators' desks. The zone was very confused and operators losses a lot of time for finding and providing the desks with the necessary components. With the study of new layout as output we created three possible space

reorganizations. The new layout were shown to industrial manager that chose with us the best option. In the following picture you can see the old and the new area layouts.

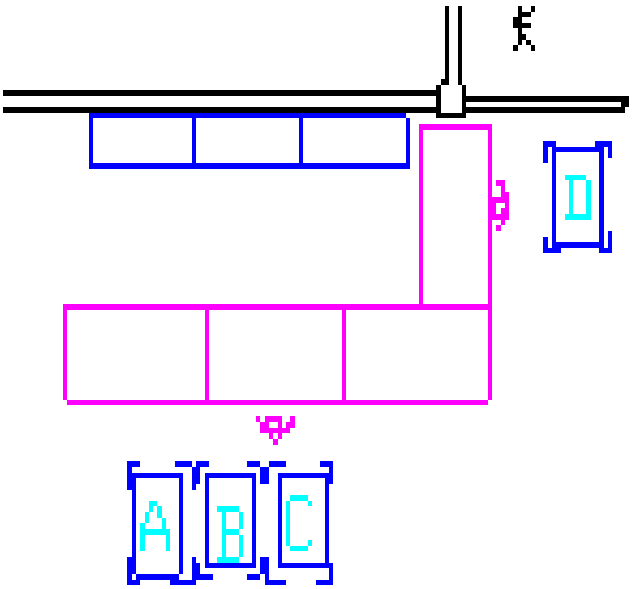
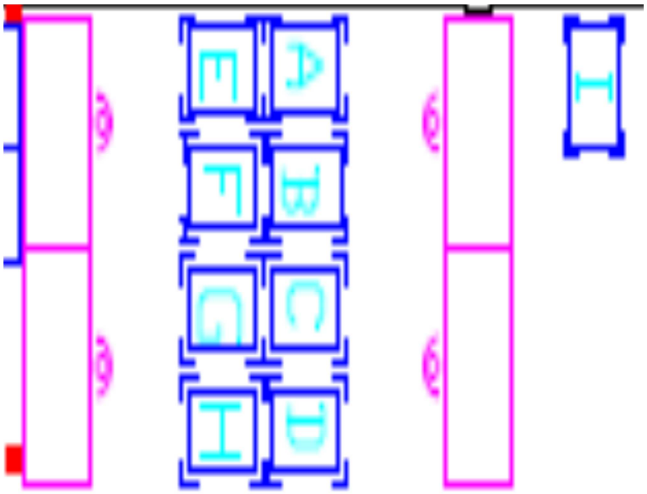


Fig. 4.2.6.1 Plant of old kit-psu area



4.2.6.2 Plant of new kit-psu area

As we can see from the photos the new area is completely changed. Before the benches were located behind the pallet with the components and was very uncomfortable for the workers to recover the materials necessary for production, now people can make the components more easily. In this way was recovered a lot of space, in fact, now there are nine places for pallets.
After the study and choice, some members of the project 5s out the work. After I studied the reorganization of the floor and there was the implementation of this too. The lines on the floor were made with the color yellow for the steps, blue for work in progress components and red for the waste materials (such as batteries). In this figure we can see the area at the end of Seiton phase.

Fig. 4.2.6.3 Kit-psu area after seiton phase

4.2.7 WORK BENCHES

Another field where Seiton had been applied are the desks. On the line each operator has his desk for the realization of their work. Each desk is provided from the necessary equipment. For some of these tools is a special place where to put them when no longer needed and for others, however, is missing.

Many times the working tools were placed in the most disordered possible and work space became very limited. Sometimes the instruments were so badly placed that the operators were forced to put something on the ground. In addition to work in a particularly messy also causes a loss of time in finding what you need. In addition, even for people outside who came and observed he was not particularly well. So we tried to arrange, with the same operators and with the help of the department head, the benches, so as to make it more orderly and to make easier the work phases.

During this activity, we tried to find a proper position for all instruments, especially for those who did not have a right location. Seiton stage is an operation that has been implemented on all the benches of the production line.

The figures below we can see an example of bench before the reorganization and an example of bench after the reorganization.

Fig. 4.2.7.1 Example of work bench before reorganization

Fig. 4.2.7.2 Example of work bench after reorganization

5. Third S: Seiso

Seiso means to clean or shine. Seiso, the third step in the 5S process, focuses on cleanliness of the working environment. Seiso champions creating a clean and neat work space. Maintenance and cleanliness become part of the everyday working routine to increase both workplace safety and longevity of tools and equipment.
Seiso focuses on not simply cleaning the working environment once, but keeping it clean every day to maintain the facility and equipment long term.
From operators to managers, making cleanliness a part of daily routine can drastically improve health, morale, and safety to a remarkable degree. There are rules that explain both how to clean something and when to do so, ensure communication and the maintenance of standard operating procedures. Regular cleaning permits to identify and to eliminate sources of disorder and to maintain the clean workplaces, During cleaning it is checked the cleanness of machine, workplace and floor, tightness of equipment, cleanness of lines, pipes, sources of light, current data, legibility and comprehensibility of delivered information etc. Indispensible is also taking care of and maintenance the personal tidiness of the operator.
In the complicated world of manufacturing, knowing how and when to clean equipment can be difficult. Through clearly printed signs and labels every worker can know their responsibilities, both for cleaning and operation.
Using a standard scheme can help increase efficiency of cleaning. By knowing where cleaning equipment is, and where it goes, workers can easily maintain the standards of the 5S methodology.

5.1 THE 3S RULE'S PROCEEDINGS

The first step of realization the 3S rule is renovation the workplace. It is assumed that, the first cleaning forces the exact checking of usage two of the previous rules. The usage of the 3S rules relies on everyday keeping in faultless cleanness the workplace. It is executed by the operator of the given workplace.
To the estimation of the workplace in terms of the 3S rule, that is cleaning the workplace, serve the following Control Question:

- Are the oil's stains, dust or remains of metal found around the position, machine, on the floor?
- Is machine clean?
- Are lines, pipes, etc. clean, will they demand repairing?
- Are pipe outlets of oils not clogged by some dirt?
- Are sources of light clean?

5.2 WHY IT IS IMPORTANT TO WORK IN A CLEAN ENVIRONMENT?

"People who work in a clean and orderly environment are less likely to have accidents or be exposed to other hazards. People tend to take more pride in their work and be more productive and more particular about safety."

No matter how much you love or hate your job, going to work every day can be taxing. Those who loathe their work will trudge off miserable day in and day out, hoping a change comes soon. If you love the job, you are still going to have days that are just too much. Regardless how you feel, the work environment plays a major role in how you feel about your job. Working in a clean, healthy environment will have a major effect on how you feel about doing something every day. Likewise, working in an unclean environment will have just as much of an effect, but in a negative way. This is why keeping the workplace clean is so important. It can have a major impact on how people feel and behave in the workplace. Occupational health and safety is all about providing a safe environment for employees to carry out their duties. The spin-off for employers is that there is a reduction in workplace injuries and a corresponding increase in productivity and staff morale.

Keeping a clean working space is a vital part of keeping employees happy. Though they might focus on issues like vacation and benefits and pay raises, a clean space will become a major issue if it slides. As long as things are clean and feel organized, there will not be problems. The moment you neglect cleaning, you are going to hear complaints. It could be a safety issue too. If you let cleaning issues go for too long, your employee's health and well-being might be at risk.

If you are working in an environment that services customers in person, it is even more important the work environment be kept clean and safe. You need to make sure customers feel confident working with you and entering your business. A bright, clean office area will make them feel welcome. They will also feel confident they can count on you to handle their issues. If you have an untidy workspace, it will feel cluttered and unwelcoming. Clients might assume if you do not care enough to keep the space clean, you might not care enough to take care of their needs.

There is a clear connection between hygiene and safety and you only have to look at washroom facilities to gain a better understanding of this. With the ever present danger of bacterial transference between workers, diseases like flu can easily spread it hygiene standards are not maintained at a high level. That's why commercial cleaning contractors should be obliged to meet high standards when it comes to sensitive areas like washrooms.

Keeping the space clean improves the air quality, which keeps everyone healthier. With improved air quality, you will cut down on absenteeism. As dirt, dust and grime accumulate bacteria start to breed and this can be catastrophic in any enclosed working space such as an office. Bacterial infections can lead to illness, a major contributor to staff absentee rates so, once again, a clean environment contributes to greater workplace safety. Workers will also have more energy and feel more creative. Just the simple task of cleaning will improve performance and boost business.

All of these things lead to better production from employees and from the company. If you feel good about your environment, you can make it through even the toughest days. Just as you would at home, keep your space clean and fresh and it will make you feel much happier. When people feel better about their environment, they get along better. If you are having issues with

communication in the workplace and people seem to be bickering with co-workers, try making the space cleaner. The fresh change may be just what everyone needs to feel better and try harder to get along with one another in the workplace.

WHERE IS IT BETTER?

HERE **OR** **HERE?**

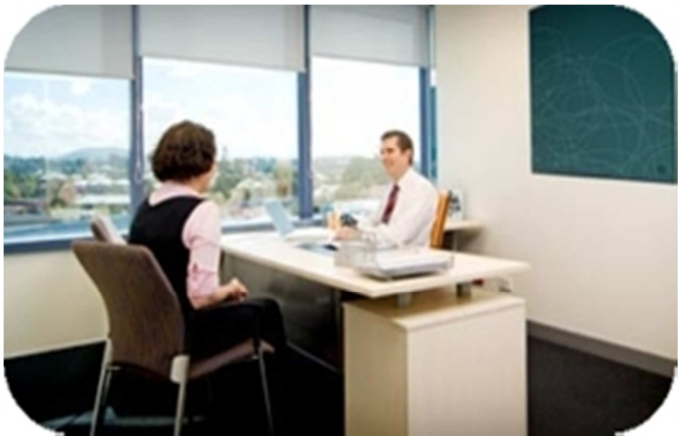


Fig. 5.2.1 Example of workplaces

5.3 PRACTICAL EXPERIENCE

Beyond the activities related to 5S, this is an activity that is always performed, even if in the course of the project was carried out with greater accuracy, it was a kind of extra cleaning.
Seiso was a very important activity during the project that occasionally has taken a long time.
I lived this phase in a "special" way, because I often did not participate directly, but it was implemented directly from other people.
Sometimes this phase was also carried out several times during the project, and sometimes did not happen at the end of phase Seiton, but also before.
In the following sections I will illustrate the various areas involved in the Seiso phase.

5.3.1 WORK BENCHES

During the project, some benches of the line were subjected to thorough cleaning. In fact, some benches were in not presentable condition, we found that operators did not care for them and with the important collaboration of the department head were able to give the appearance better. Cleaning is made possible through the use of a special degreaser. This occurred during the Seiton phase when we did the reorganization of the banks themselves.

5.3.2 KIT PSU AREA

Even in the kit-psu area has been a thorough cleaning. In this space was not possible to clean by the cleaning machine, because of the times when you have done the work, but they thought directly the operators. The cleaning of the area was carried out twice, the first time at the end of the first phase of 5S, when the area was almost completely released and the second half of the second phase, before the tracking of the floor.
In addition, the cleaning has also covered the benches. At a time when the reorganization took place and also the layout has changed significantly, has made a most careful cleaning of the work benches to remove the dirt accumulated in full over time.

5.3.3 WAREHOUSE

Seiso in the warehouse was a really important step which was held in conjunction with the second phase of 5S. In fact, after the reorganization and subsequent placement of pallets, this activity took place.
Of course it was an operation of type extraordinary, made possible with the help of purchasing office, that commissioned the cleaning company, which is responsible for maintenance of stable, thoroughly clean.
Cleaning was performed by means of a Particular machine that has permission to remove any dirt.
It was chosen to do this type of operation at this stage of the project, because the next step was to reorganize and draw lines on the floor to identify new areas. The tracing of the floor was made using very durable and colorful stickers, for this reason it was important that the floor was really clean, so that the stickers can attach very well.
In some areas, however, has not been possible to use the machine for cleaning and was done manually by operators. In the picture below you can see a picture of this activity.

Fig. 5.3.3 Warehouse cleaning operation

5.3.4 BUFFER SHOP AREA

The buffer shop area was subjected to cleaning process several times. The first cleaning was performed prior to Seiton step, when the area was partially released, and this cleanup has involved the removal of dirt on the floor. The second cleaning was carried out during the Seiton and concerned in particular the shelves, where he made a thorough cleaning.
Finally, even the floor has been retested for perfect cleaning of the floor before the reorganization. In this area it was not possible to clean the floor by means of the machine because of the limited size of aisles.
In the next photo we see one of the cleaning operation of an operator.

Fig. 5.3.4 Buffer shop cleaning operation

5.3.5 UNPACKAGING, PACKAGING, STORAGE AREA FOR FINISHED PRODUCTS AND VISUAL MANAGEMENT AREA

Even in all these areas seen previously (Seiton phase) was completed in an accurate and thorough cleaning. In particular, this was carried out during Seiton phase before the reorganization of the floor. Even in these cases was decided to carry out the cleaning at this point of the project because it was important to have a clean floor to do better adhere the tape. In fact you can see that more and more the surface is clean the tape lasts.
Moreover, in all these areas, the cleaning is done manually with some operators and even here it was not possible to use the specialist machine. As far as storage area for finished products before the cleaning, were removed the adhesive tape which already exists. This activity was made possible through a tool and an operator who had experience in these types of jobs.

6. Fourth S: Seiketsu

Seiketsu loosely translates to “standardized clean-up.” Seiketsu, a single step in a transforming process, is occasionally mistaken as the entirety of the 5S methodology because it encompasses all the previous steps of cleaning up, paring down, and sustaining order.

Fostering unity of purpose, Seiketsu ensures that all work operates in a consistent and precise manner. Through standardization and increased, clear explanation, workers can accomplish their responsibilities without hesitation.

Standardizing involves constructing a consistent approach for carrying out tasks and procedures. Constant order and function are the core goals of this step.

Efficiency is increased by visual cues. Organize the work environment with clear and understandable visual cues. Color coding and the use of shapes are very effective ways to quickly achieve visual communication and obvious organization.

Seiketsu allows for control and consistency. Basic housekeeping standards apply everywhere in the facility. Everyone knows exactly what his or her responsibilities are. Housekeeping duties are part of regular work routines.

6.1 THE 4S RULE’S PROCEEDINGS

Worked out and implemented standards in the form of procedures and instructions permits to keep the order on the workplaces.

Standards should be very communicative, clear and easy to understand. Regarding this during preparation and improving, it should be involved all participants of the process on the given workplaces, it means direct workers. The group knows the best specificity of its own activities, and process of elaboration and after that, usage gives them possibility of understanding the essence and each aspect of the operations. In the aim of assuring all the easy access, obligatory standards should be found in constant and visible places.

It is assumed that standards should not be implemented only in the typical operational processes e.g. production, movement, maintenance, storing, but also in the administrative processes, for example: book-keeping, customer service, human resources, management or secretariat service.

Fig. 6.1 4S rule’s proceedings

6.2 PRACTICAL EXPERIENCE

At the end of the stages outlined in the preceding chapters, was held a meeting during which we evaluated the actions previously performed. The assessment of each individual activity was very positive and useful for the purposes of quality improvement.
In almost all cases the results are very visible through the reduction of process time.
At this point in the process, it posed however a problem: it was necessary to think about some actions to try to maintain and monitor the areas subjected to various changes.
Indeed, human behavior is sometimes very strange. A person accustomed to act in a certain way for a long time, it tends to flow, after a short period of time, to return to the current state and begin to carry out inappropriate actions made before the introduction of changes.
So after all this we decided to introduce and create maintenance procedures. In particular, we have created two, which I will explain in the following paragraphs.

6.2.1 WEEKLY WAREHOUSE PROCEDURE

The warehouse was by far the area most subject to change. In fact, now entering in this place is almost the feeling of entering into a different place from the previous one.
The magazine in question is basically managed by one person and then there are other people who help occasionally. To keep the area in a way highly organized, clean and controlled isn't simple. To try to achieve this I created a procedure for maintaining weekly, so that the head during the week could monitor all the required parameters.
In theory, it would be better to create a daily procedure, but unfortunately seeing the limited staff, we thought that perhaps it would be better that way. The objective of this procedure is that at the end of the week the warehouse is in the requested conditions.
The created procedure is quite simple, there is a list of actions to be taken weekly.
During the week, the manager must ensure that these actions play correctly and when it is safe to have done so must sign off. Then will be the head of the department that will ensure that the actions and procedures are being applied correctly.
In addition to the signature and the actions to be performed, the procedure also shows the date and number of weeks where you are, so that, even if one week the department head does not do the routine check, he can still track the following week.
In the event that none of this was done, or was not done properly the head of department may take corrective action by the operator and ask for explanations to warehouse manager which shall bear the responsibility. Also when it emerges any kind of logistical problem or closely related to the procedure will try to resolve it immediately.
The following image is a facsimile of the procedure for maintaining stock weekly.

MAINTENANCE PROCEDURE FOR WAREHOUSE

Weekly activities to be performed:

A. Trash in the waste
B. Place the instruments in the proper place of work
C. Check the organization around the station and the shelves
D. Dust and clean the work bench
E. Place any empty boxes that will be reused
F. Check the condition of safety equipment (gloves, shoes and shirts)
G. Check that the pallets are in the right location
H. Check that the image next to the pallet identification is correct
I. Verify that the pallets can be removed obsolete
J. Check the materials that can be moved

Weekly Maintenance Procedure

Warehouse		**Department**	
Number of bench			
Week and Date	**Operator**		**Signature**

Fig.6.2.1 Weekly warehouse procedure

After the procedure was created, another meeting was held, where he attended the department head, the warehouse manager, the industrial manager and the head of engineering department and the procedure was approved.

Now my and the company hope is that the procedure is being used properly over time, is a useful tool for maintaining the inventory in a better and convenient as possible way and do not go back to the previous situation.

Finally, with the aim of maintaining full inventory management has created a network folder where you can find the picture of all components stored in a warehouse, so that every time something pallet changes position you can reprint and replace the photo in the right place. So it is also about maintaining the visual appearance of a warehouse.

6.2.2 DAILY BENCHES PROCEDURE

The second procedure was created to address the problem related to cleanliness and order on the benches. A line operator typically spends most of the time next to your workbench and must therefore take care and keep thinking about ordained to perform their jobs better. This discourse is closely related to chapter five, in fact work in a clean and tidy helps both in terms of health and mind.

Of course, the fact of the care of the bench depends from person to person, in fact, when we assessed the possibility to create these procedures, I went to see the situation. Passing the line between the benches, I realized that on all of the people, about 10% had a lot of care for the bench and for the tools to be used during production, 40% had a regular care (close to the required standard) and the remaining 50% did not care of all.

So after this careful observation was then decided to actually create a procedure that could help the industry to take better care for the workspace. Unfortunately, the factor is that today more and more people have a very uncaring attitude and tend to abuse everything that isn't proprietary. This reasoning is very wrong because people have to understand however that this is extremely important.

Here, as in the previous case, the procedure is very simple. It is actually a sheet, where the top shows the various actions to be taken daily and at the bottom there is a sort of table where you put the number of the bench, the phase of the process that carries that particular bench, the date, operator's name and signature. In this way you can monitor if the worker performs the required actions, and effectively control the order and cleaning on the work bench.

The actions to be performed are very simple and require little time in trivial them. Tend to be preferable that these actions were carried out at the end of the workday, in order to fix everything before you pull out the day. Also because in this way on the next working day is everything in order and that helps the mind.

Of course this is not exhaustive, it is just a tip, the operator is free to perform these activities when they want during the working day.

An important thing to note is that some operators had also a tendency to deposit tools and material useful to earth with this procedure is no longer allowed.

Moreover, with the introduction of this new technique to monitor we have sought to "invent" something new. Each operator during the process is equipped with a PC with which step by step see what needs the product and update the situation at the end of the activities required. This maintenance procedure will soon be made available digitally, so as to make everything computerized.

For the first time the sheet is placed next to the work bench, then both versions will follow to become digital only. In this way you will save in paper, into a space for play production and in time for inspections, which will be made partially automated. The figure below is an example of a sheet of daily cleaning of work benches.

CLEAN PROCEDURE

Daily activities to be performed:

A. Throw trash in the waste of the day
B. Place the instruments in the proper place of work
C. Check the organization around the station
D. Dust and clean the work bench
E. Place any empty boxes that will be reused
F. Check the condition of safety equipment (gloves, shoes and shirts)

Sheet for Dayly Cleaning

Phase of the process		Department	
Number of Bench			
Date	**Operator**		**Signature**

Fig. 6.2.2.1 Daily work benches procedure

The procedure was applied to each bank of the production process. Of course there are different stages on the line and each has its own specific workbenches. To try to customize every little step of the process it was decided to put in the back of each sheet, the picture of how the bench should be located at the end or the beginning of the workday.
The figure below is an example of bench clean and tidy.

Fig. 6.2.2.2 Work bench clean and tidy

7. Fifth S: Shitsuke

Shitsuke, the final step a 5S system requires, and translates to discipline.
Shitsuke denotes a commitment to maintaining the practices of the first four S steps. It is the commitment not just to 5S methodology, but to a process of continual improvement known as kaizen. 5S can only be effective if it is a continual daily process by which all work is conducted. All strategies and methods fail without commitment.
Reinforcing and maintaining the four steps through Shitsuke sustains positive growth and increased safety and efficiency.
The 5S system is a new way to operate, because of this it must be continually maintained.
Responsibilities and instructions must be assigned and reinforced in the 5S system. Color Coding can help everyone to understand their new, more efficient roles.
Shitsuke is the realization of above-mentioned rules and it refers to maintaining standards and keeping the facility in safe and efficient order day after day, year after year.

The main advantages connected with the 5S rule are:

- Increasing the awareness and morale;
- Decreasing of mistakes quantity resulting from the inattention;
- Proceedings according to decisions;
- Improvement of the internal communication processes;
- Improvement of the inter human relations.

7.1 THE 5S RULE'S PROCEEDINGS

Implementing the idea of the 5S will demand from workers the compact self-discipline connected with implementing and obeying the rules of regularity in cleaning and sorting. It leads to increasing the consciousness of staff and decreasing the number of non-conforming products and processes, improvements in the internal communication and through this to improvement in the human relations.
It is also important to understand the need of executing the routine inspections of usage the 5S rule. This inspection is executed by helping of so-called Check List and created on its basis the radar graph of the 5S, which serves to estimation of the workplace. The inspection of realization of the 5S rule is executed once a month by chosen team implementing the 5S rule, the control team.

7.2 PRACTICAL EXPERIENCE

After a series of practical activities, the last phase of 5Sproject is more of a mental task to try to spread among the operators of the line a positive attitude and respect for the rules of the preceding chapters. The fifth rule is by no means easy but it is essential for the maintenance of

changes. Often at the end of such projects you form a team to control, for the development of this final rule. In this case, however, we preferred not to form any type of team, but to entrust this task to the department head and his collaborators. In this way, each operator of the line that must take controlled an area will have more responsibility, and so this will help your motivation. Of course, every worker in the course of the project has been trained to do their jobs with self-discipline for the proper maintenance of the various areas. The department head periodically check the work done by the workers and will examine whether the mode of operation is correct.
It 'important to point out that after the efforts made for the accommodation of the various areas during the four rules above, will be task of the operators be able to maintain for taking advantage. Later in this chapter I will show the images of all areas at the end of the project and I will list the main benefits.

7.2.1 KIT PSU AREA

The kit-psu area however, was the only area of the department that has been completely revised and changed. Here too, the benefits obtained have been significant:

- More order;
- More space for the rest of the material being processed;
- More space and workstations for operators;
- Less time on non-value added for the recovery of products to work.

The following image is the kit-psu area at the end of 5S project.

Fig. 7.2.1 Kit-psu area at the end of 5S project

7.2.2 WAREHOUSE

The stock was the area most subject to the 5S project and where the work lasted longer.
The greatest benefits obtained are:

- Better organization of stored products;
- Increased identification of areas;
- Increased visual impact for the search of stored products;
- Increased cleaning;
- More order;
- Elimination of obsolete material.

In the picture below there is the image of a part of the warehouse at the end of the project.

Fig.7.2.2 Warehouse at the end of 5S project

7.2.3 WORK BENCHES

The work benches of the department underwent a complete overhaul during the project and also this has brought significant benefits:

- More order;

- More cleaning;
- Better organization;
- More available space.

In the picture below there is a work bench at the end of the 5S project.

Fig. 7.2.3 Work bench at the end of 5S project

7.2.4 STORAGE AREA FOR FINISHED PRODUCTS

Even the storage area for finished products has brought many advantages:

- More order;
- Increase the number of pallet parking;
- Intermediate way of passage;
- Improved ability to move pallets;
- Better organization.

In addition for this area the space has been used well and now there is more space available also for the transit of the goods.

The picture below there is the parking area of the pallet at the end of the 5S project

Fig. 7.2.4 Storage area for finished products at the end of 5S project

7.2.5 BUFFER SHOP AREA

The buffer area shop has also been subjected to the full project, which has brought several benefits:

- More order;
- More cleaning;
- Better organization;
- More available space.

Thanks to this new reorganization it is very easy also the reconnaissance of the good and as a consequence there is a big saving of time.
Now will be task of the operators try to maintain this area in that way.
The following photo shows the area at the end of the project.

Fig. 7.2.5 Buffer shop area at the end of 5S project

7.2.6 OTHER AREAS

In addition there are other areas that have been submitted to the 5S project for which have already been shown pictures of the finished works. These areas are:

- Visual management area;
- Unpackaging area;
- Packaging area.

Even in these areas as a result of the project have been found some advantages, such as better organization, increased cleanliness and order.

8. Change Management

Change management is a structured approach to shifting/transitioning individuals, teams, and organizations from a current state to a desired future state. It is an organizational process aimed at helping employees to accept and embrace changes in their current business environment. In project management, change management refers to a project management process where changes to a project are formally introduced and approved.

Change management is a systematic approach to dealing with change, both from the perspective of an organization and on the individual level. A somewhat ambiguous term, change management has at least three different aspects, including: adapting to change, controlling change, and effecting change. A proactive approach to dealing with change is at the core of all three aspects. For an organization, change management means defining and implementing procedures and/or technologies to deal with changes in the business environment and to profit from changing opportunities. Successful adaptation to change is as crucial within an organization as it is in the natural world. Just like plants and animals, organizations and the individuals in them inevitably encounter changing conditions that they are powerless to control. The more effectively you deal with change, the more likely you are to thrive. Adaptation might involve establishing a structured methodology for responding to changes in the business environment (such as a fluctuation in the economy, or a threat from a competitor) or establishing coping mechanisms for responding to changes in the workplace (such as new policies, or technologies).

Change Management processes may include creative marketing to enable communication between change audiences, but also deep social understanding about leadership's styles and group dynamics. As a visible track on transformation projects, Organizational Change Management aligns groups' expectations, communicates, integrates teams and manages people training. It makes use of performance metrics, such as financial results, operational efficiency, leadership commitment, communication effectiveness, and the perceived need for change to design appropriate strategies, in order to avoid change failures or solve troubled change projects.

Successful change management is more likely to occur if the following are included:

- Benefits management and realization to define measurable stakeholder aims, create a business case for their achievement (which should be continuously updated), and monitor assumptions, risks, dependencies, costs, return on investment, dis-benefits and cultural issues affecting the progress of the associated work.
- Effective Communications that informs various stakeholders of the reasons for the change, the benefits of successful implementation (what is in it for us, and you) as well as the details of the change (when? Where? Who is involved? How much will it cost? Etc.).
- Devise an effective education, training and/or skills upgrading scheme for the organization.
- Counter resistance from the employees of companies and align them to overall strategic direction of the organization.
- Provide personal counseling (if required) to alleviate any change related fears.
- Monitoring of the implementation and fine-tuning as required.

8.1 WHAT'S CHANGE?

The life of each is first proposed for change. Up close to daily life is a set of processes, consisting of thoughts, images, words and actions. These processes are developed and constantly changing. Each process brings with it changes that for the most part remain below our threshold of concern, semi-invisible.

Usually we find to be changed only when a long process coming to fruition shows us her fruits visible in this way for example our wrinkled face shows us one day the passage of time.

Other times we find these processes when unexpected burst onto the scene of the events of our lives, seemingly inexplicable. The breakup of a relationship, a dismissal or a sudden illness painfully reveal many threads interrupted. There is strength, patience and support to make these moments of rupture is a real opportunity.

Change is the process of creative destruction of previously earned achievements.

We must be willing to cannibalize what we do today in order to ensure our leadership in the future. And against human nature, but you have to kill his own business while still working.

Companies often to keep up with the times and innovation adopt 2 main types of change: radical change or the continuous.

For the radical change using business process re-engineering that results in a radical rethinking of business processes designed to make dramatic improvements in critical performance parameters such as cost, quality, service and speed.

At the heart of reengineering is the notion of discontinuous thinking: to recognize and break the existing rules and the basic assumptions underlying the company's operations.

Instead, the philosophy of continuous improvement and change explains the competitiveness of Japanese companies. In this case it is a long series of small changes in the middle between innovation and maintenance. The organization is seen as a lifelong learning system that involves all the roles.

The learning organization is one that encourages continuous learning and knowledge creation at all levels, one that defines processes for facilitating the circulation of knowledge about the organization and translate that knowledge in this rapidly changing.

There are different national styles of change in particular:

- Japanese prefer gradual processes of type;
- Americans favor re-engineering processes.

This is caused by:

- different organizational forms;
- different strategies;
- different roles of human resources;
- different management styles;
- different optical temporal;
- cultural orientations.

8.2 WHY CHANGE?

Changes within an organization might stem from internal or external factors. Efficient change management requires the ability to identify what causes structural change within an organization. The ability to identify the signs of oncoming organizational change can help you better prepare for the change and implement policies that will keep your company on a growth path. There are a lot of reasons that lead a company to changing. In the following explanation there are the major causes of change.

- Acquisitions

According to Organizational Change Management, acquiring or merging with another company has a profound effect on organizational structure. The deletion of duplicate departments manages cost, yet talent from both companies can be utilized in the resulting corporate structure. However, job functions will be altered to fit the business model of the company, and management positions may be eliminated as well.

- Job Duplication

Multiple managers or executives within an organization may create the need for change, according to JobDig.com. Employees can either become frustrated with trying to please more than one manager, or employees may find ways to use opposing views by multiple managers to get what the employee needs. When employees encounter duplicate management positions, the structure of the organization needs to be altered to eliminate the excess positions and bring departments into line with the proper individual manager.

- Marketplace Changes

As the marketplace changes, so do the structural needs of your organization. For example, as fuel prices rise, customers may begin to demand more fuel-efficient vehicles. If you own a car dealership known for selling large SUVs and vans, you may have to shift your focus to smaller and more fuel efficient cars. This requires bringing in sales people and service technicians accustomed to selling and working on these vehicles. Marketing then needs to change to target the car-buying public, and the old methods should be eliminated.

- Process Changes

Changes to the way the company does business can cause structural changes. If a company was used to allowing departments to be autonomous, then a change to a centralized way of doing business will create changes in company structure. If a new department has been created to address a company demand, the company structure must change to accommodate the new group. If a company want to became more profitable and improve their productivity with some modifications and the introduction of new work methods. For example, if the backlog of archived files becomes so large that an archiving department needs to be created, that can change the flow of information in your company and have a significant effect on corporate structure.

8.3 SCOTT & JAFFE CURVE

There are many change models available seeking to clarify and define the process of change at human behavior level. The change curve offers a clear and concise picture which has successfully helped many of my clients begin to understand and deal with change. It also provides an easy, clear language they can use to discuss change in a non-threatening, process-based manner.
This helps take personalities and personal biases out of the picture and reinforces that all the stages of change are normal. This model lets one frame change. It can be used to illustrate that people react differently to change based on:

- Personal change tolerance;
- The number of changes going on simultaneously in a person's life;
- How critical the person perceives each change to be;
- How much change has happened over the past twelve to twenty-four months.

This model is also effective in opening discussion on how one can help one's peers move through the phases, thus ensuring a successful change for the entire group. Getting the group to take responsibility for moving all the members through the change, respecting each person change parameters and understanding that no one really wants to be left behind.

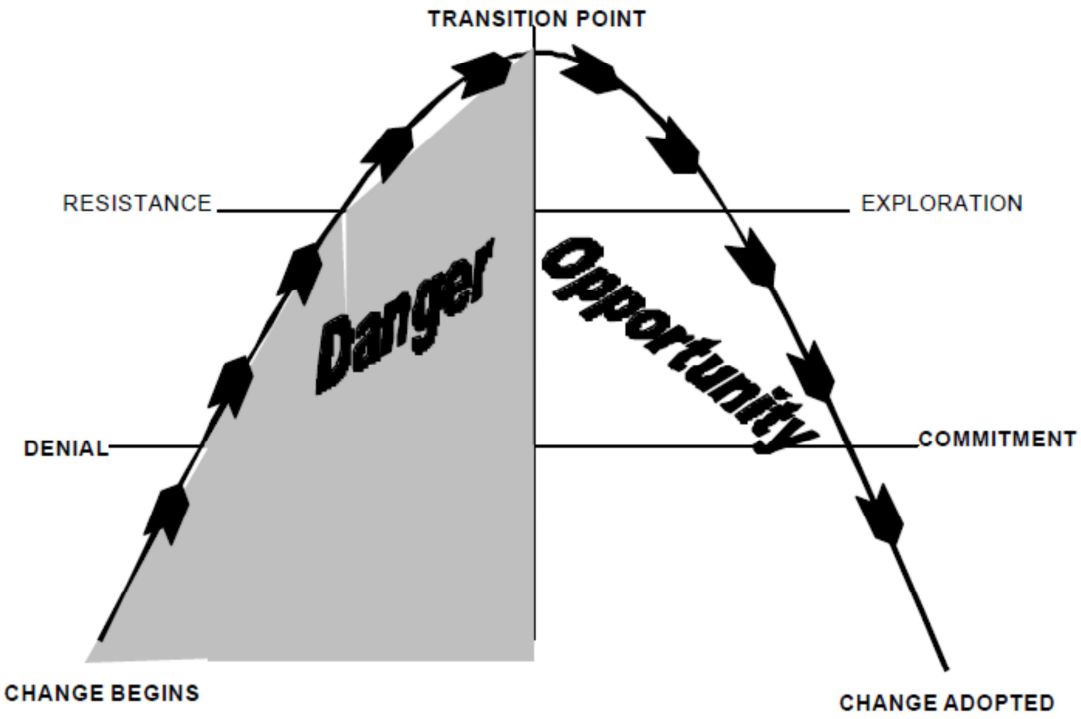


Fig. 8.3 Scott and Jaffe curve

As the picture shows, initial feelings of danger result from potential loss of control, competence, direction and territory. Once these issues are addressed people can move into the opportunity

phase and begin to see the potential for greater freedom, power, recognition, increased participation and reward.
During denial typical thoughts include:

- If I just ignore this it will go away;
- This must be a mistake;
- This must be going on in another department, my department is working well.

During denial, employees want to believe that the change is still optional, probably a mistake, that it will go away and life will get back to normal.
Communication and getting employees involved in the change will move them quickly out of denial. It is important to reinforce that the change is required for the business survival, explain what factors are causing the change, focus on a clear goal and institute robust two-way communication to deal with issues and move people out of the denial phase.
By the time people enter the resistance phase they are becoming angry and it is anger based on fear. Typical thoughts include:

- How could they do this to me;
- I'll show them. They can't make this work without me;
- I'm just not going to do it.

During this phase, if it is not managed well, sabotage of the process or even the plant can occur. Employees who do not move out of this phase remain angry and not-productive. They have a negative impact on those around them and often need to be removed from the organization. Resistance is a normal phase that everyone passes through, it may take a minute or months. If resistance is not dealt with, the organizational change will fail. During resistance managers are faced with increasing absenteeism, failing production and decreasing quality. The employees begin to coalasce into protective reinforcement groups, or worse, they surrender to their fears and become organizational dropouts.
In a healthy change initiative participants will move through resistance, reach a transitional point and begin to identify personal opportunities to flourish based on the change. First, employees become willing to explore the change and look for ways they can contribute. This is a very fragile period. Communication and personal reinforcement must be maintained and managed. Employees must be rewarded for even small increments of involvement. During exploration comfort zones are being rebuilt and existing skills are being applied to new and challenging tasks, relationships and processes. Any failure to support the employee during exploration will result in an immediate and final retreat into resistance or indifference.
A successful journey through exploration will lead employees to commitment and change adoption and integration into the organization. Commitment comes through transition.
Change is external, transition is the internal psychological reorientation employees experience which allows the change to work.

While these phases appear to be linear they are actually iterative with slight movement into and out of each phase as people put a tentative foot forward, retreat slightly, and make a larger foray. How the organization communicates, rewards, and supports the iterations will determine whether change is successful.

8.4 THE ADKAR MODEL

The ADKAR model of change is a practical answer to effective change management for individuals and organizations. Built on practical research conducted in more than 900 organizations the model is simple to learn, makes sense, and focuses on the actions and outcomes required for change.
While many change management projects focus on the steps necessary for organizational change, ADKAR emphasizes that successful organizational change occurs only when each person is able to transition successfully.
It makes sense then that this model, developed by Jeff Hiatt, first published in 2003, focuses on 5 actions and outcomes necessary for successful individual change, and therefore successful organizational change.
The ADKAR model consists of five sequential steps or actions:

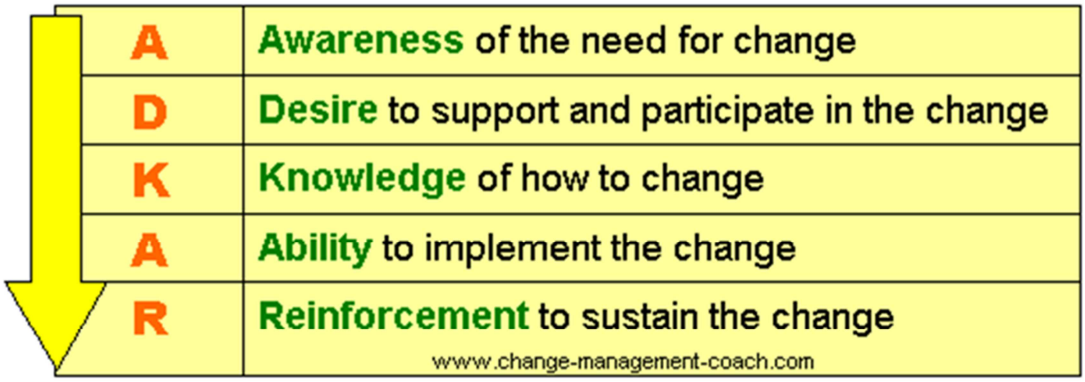


Fig. 8.4.1 Steps of ADKAR model

1.Awareness of the need for change.
Understanding why change is necessary is the first key aspect of successful change. This step explains the reasoning and thought that underlies a required change. Planned communication is essential. When this step is successfully completed the individual (employee) will fully understand why change is necessary.
2.Desire to participate in and support the change.
In this step the individual is able to reach a point where they make a personal decision to support the change and participate in the change. Naturally a desire to support and be part of the change can only happen after full awareness of the need for change is established. Building desire is partly achieved by addressing incentives for the individual and creating a desire to be a part of the change.
3.Knowledge on how to change.

The third building block of the model, providing knowledge about the change, can be achieved through normal training and education methods. Other methods of transferring knowledge, such as coaching, forums and mentoring, are equally useful, so don't limit this process to formal training. Two types of knowledge need to be addressed: knowledge on how to change (what to do during the transition) and knowledge on how to perform once the change is implemented.

4.Ability to implement required skills and behaviors.

In the ADKAR model Ability is the difference between theory and practice. Once knowledge on how to change is in place (theory) the practice, or actual performance of the individual, needs to be supported. This can take some time and can be achieved through practice, coaching and feedback.

5.Reinforcement to sustain the change.

This final stage of the model is an essential component in which efforts to sustain the change are emphasized. Ensuring that changes stay in place and that individuals do not revert to old ways can be achieved through positive feedback, rewards, recognition, measuring performance and taking corrective actions.

Hiatt refers to each of these five actions as building blocks for successful individual change, and therefore successful organizational change. As the graphic indicates the process is sequential. In other words each step must be completed before moving on to the next. Hiatt emphasizes that it is not possible to achieve success in one area unless the previous action has been addressed.

To use the ADKAR model effectively, you will need to understand the underlying framework for change initiative. In the diagram below, change happens on two dimension: the business dimension (vertical axis) and the people dimension (horizontal axis). Successful change happens when both dimensions of change occur simultaneously.

Fig. 8.4.2 Adkar model

This is often the part of change management that is most difficult as organizations are already moving towards the next change. However, for successful change, reinforcement is essential to ensure that changes are maintained and new outcomes can be measured.

The primary reason for choosing this model of change management is the focus on individual change and ensuring each person makes the transition. This is more than a 'soft' approach it has practical applications. Most importantly, when you're focusing on the individual you're able to measure where they are in the change process and what is required to assist them. You are not simply relying on running a certain number of training programs, or communicating a particular message, and expecting everyone to follow.

The ADKAR model directs change management activities. It's focused on outcomes, not tasks to be performed. Many change models describe what needs to be done; this model describes the outcomes (Awareness, Desire, Knowledge, Ability, Reinforcement).

The ADKAR model helps to measure the effectiveness of the change process. Progress can be measured down to the individual level, gaps diagnosed, and corrective action is directed.

Managers have a tool they can use. Each part of the model gives manager's a specific role. For example, an individual struggling with change may need knowledge on how to change or may lack the ability to implement necessary skills or behaviors. The manager is able to discern between the two and can provide training (knowledge and information) or work closely with the individual, coaching them to give them the confidence (and ability) to perform effectively.

This change management model can be used for both project and non-project change, and is effective as a model of individual change outside of the organizational setting as well.

Research shows that problem with people dimension of change is the most commonly cited for project failures.The power of the ADKAR model is that it creates focus on the first element that is the root cause of failure. When you approach change using this model, you can immediately identify where the process is breaking down and which elements are being overlooked, This avoids generic conversations about the change that rarely produce actionable steps. This results-oriented approach helps focus energy on the area that will produce the highest probability for success.

As demonstrated using the Change management process, there are two tasks that successful change programs have to achieve:

- The change management process, which focuses on the hard side of change – the process steps in the change management project plan.
- The transition of people – the softer side (and hardest part) providing successful change in individuals and changing their behaviors to a new state.

The ADKAR change management Model can be used throughout the change management process to ensure that the transition plan is successful and that the cultural change is happening successfully therefore can be used to support the change project as a tool to cultural change.

Bringing the two dimensions together in a logical format means that the business should be able to successfully close out its project objectives and tasks, whilst ensuring that cultural change is happening and transitioning well along its path. As one can see in the model above, ADKAR can go hand in hand with the change management process. It can be used to help prepare people for change, create a transition plan and also be used to gauge current change performance,

highlighting any gaps in and areas of improvement in real time, within the five phases of the model.

8.5 THE IMPORTANCE OF PEOPLE MOTIVATION

On the basis of a famous research 90% of time behaviors of the workers caused failure during change management. It is for this reason that the company must motivate well the workers. This is one of the most important key for the success.

Motivation, at the most basic level, refers to the inner urges that cause people to behave in certain ways. In the workplace, while some explore the issue of what motivates or demotivates individuals, we argue that a more accurate focus should be on understanding what motivates people in a specific direction. Since the firm's success, profitability, and sustainability are directly linked to individual performance and productivity, a central theme for managers is how to ensure that employees are performing at the highest possible level. A more careful-examination of the issue reveals that the answer to this critical question rest in the understanding of the mix of psychological, personal, and contextual forces.

Work motivation can be generally defined as "a set of energetic forces that originates both within as well as beyond an individual's being, to initiate work-related behavior, and to determine its form, direction, intensity and duration". The sustainability perspective would suggest emphasis on duration, that is, what would sustain motivated behavior in long term.

Other important things about human behaviors is work context, such as degree of involvement, participation, empowerment, and delegation are important elements of work motivation and performance. As managers get their subordinates more involved in decision making that is relevant to their work, as they provide them with more work autonomy, and as they delegate more responsibilities to them, employees are likely to put forth more effort and their job performance will improve. The act of delegating responsibilities to employees and providing them with the authority necessary to carry out the delegated responsibility are viewed as powerful forces in motivating employees. Employees want to have responsibility, they appreciate the implicit trust in their skills and abilities, delegation is an effective tool to develop employees, and employees want to participate in decision making that effects their working life experience.

Another way to motivate employees is rewards, assuming that the rewards are distributed fairly. Rewards seem to be a part of many different perspectives in motivation.

When defined as psychological energy directed toward goals, all behavior is motivated: goal are the direction for achieving of wants or avoidance of threats: All nonproductive behavior can be viewed as an attempt to avoid or counteract threats or alienation.

The aim of the company focused on understanding motivation dynamics at work. Demotivation and alienation at work can be combated by carefully thought out programs such as employee involvement programs and behavior modification.

Also during our project the employees motivation was one of the most important things that company provided an important attention. There were some phases of the project in which the workers were not very motivated and in these case the change process has been more difficult.

Fortunately during the project the managers gave the right attention to people motivation, with the help of carefully explanations about the change and the workers reacted sufficiently well.

8.6 SAMPLE FOR ANALYSIS

At the end of this chapter I show a sample of data about the people that work in the department where 5S project has been implemented. The information about the workers are: sex, age, number of working years into the company, the change behavior and the reasons. This sample will be analyzed in the following chapter and in particular will be discussed the trend behaviors during the project.

OPERATOR		SEX	AGE	YEAR IN THIS COMPANY	CHANGE BEHAVIOUR			IF UNFAVOURABLE WRITE AT LEAST A REASON
					FAVOURABLE	UNFAVOURABLE	INDIFFERENT	
Worker	1	F	30	1,5	X			
Worker	2	F	29	1,5	X			
Worker	3	F	28	1,5	X			
Worker	4	M	34	11,5		X		Different point of view
Worker	5	M	56	7,0	X			
Worker	6	M	59	4,5		X		Fear of the change
Worker	7	F	35	12,5	X			
Worker	8	F	31	6,5	X			
Worker	9	F	38	12,0			X	
Worker	10	M	54	11,5		X		Different point of view
Worker	11	M	47	13,0			X	
Worker	12	M	30	9,5	X			
Worker	13	M	32	11,5			X	
Worker	14	F	34	10,5	X			
Worker	15	M	45	21,5		X		Fear of the change
Worker	16	F	28	5,0	X			
Worker	17	F	30	3,5	X			
Worker	18	F	30	3,5	X			
Worker	19	F	37	5,0	X			
Worker	20	M	30	9,5	X			
Worker	21	F	38	12,0			X	
Worker	22	M	42	12,5	X			
Worker	23	M	36	4,0	X			
Worker	24	M	35	10,5		X		Different point of view
Worker	25	M	36	5,5	X			
Worker	26	M	32	11,0	X			
Worker	27	F	49	10,5	X			
Worker	28	M	35	14,5		X		Different custom
Worker	29	F	37	10,5	X			
Worker	30	F	34	10,5		X		Different point of view
Worker	31	M	26	5,5	X			
Worker	32	F	48	10,0		X		Fear of the change
Worker	33	M	32	5,0	X			
Worker	34	F	32	11,5			X	
Worker	35	F	35	6,5	X			
Worker	36	F	25	4,0	X			
Worker	37	F	28	3,5	X			
Worker	38	M	57	4,0	X			
Worker	39	M	27	5,5		X		Different customs
Worker	40	M	42	3,0			X	
Worker	41	M	49	6,5	X			
Worker	42	M	42	6,5	X			
Worker	43	M	40	4,0	X			
Worker	44	F	35	4,0	X			
Worker	45	F	30	4,5	X			
Worker	46	F	34	10,5			X	
Worker	47	F	42	20,5		X		Different point of view
Worker	48	F	34	12,0	X			
Worker	49	M	36	5,5	X			
Worker	50	M	54	11,0	X			
Worker	51	F	53	38,5		X		Different customs
Worker	52	F	36	6,5	X			
Worker	53	F	37	3,5	X			
Worker	54	F	37	12,0	X			
Worker	55	F	44	10,5		X		Fear of the change
Worker	56	F	24	3,5	X			
Worker	57	M	31	5,5	X			
Worker	58	M	45	4,0	X			
Worker	59	F	31	4,5		X		Different customs
Worker	60	F	30	5,0	X			
Worker	61	M	29	3,5	X			
Worker	62	F	32	12,0		X		Fear of the change
Worker	63	F	46	24,0		X		Fear of the change
Worker	64	M	34	11,5	X			
Worker	65	M	26	4,5	X			
Worker	66	M	35	6,5	X			

Tab. 8.7 Dataset for analysis

9. Human Behavior

One of the pillars within a company is the individual. Understanding and managing human behavior is critical in the context of work.
Sustain human development is dependent on the individual's ability to continuously learn and improve. The ability to perform well is the obvious focus for individual employees. But to go beyond that we must be concerned with the personal growth and development of all personnel. Skills in goal setting and interpersonal communication as well as attitudes toward failure and success are of prime relevance for the individual who must ever face a turbulent workplace that is always undergoing restructuring. Motivation to work is the driving force around which all other aspects of individual effectiveness can be viewed.
Understanding behavior in organizations can start with the total system and delve down into the subsystems or with the individual and work out into groups on up to the whole. The specific order of the learning journey itself can vary from individual to individual from situation to situation.
An integrated perspective on organizational behavior is designed to improve human and economic sustainability. We take human sustainability to mean the development and fulfillment of human needs. Understanding and managing individuals require a comprehensive holistic orientation that is embedded in continuous learning.
Individual behavior in the context of work varies. Any attempt to learn why people behave as they do in work settings requires some basic understanding of the factors that influence action. The scientific field that provides the most insight into human behavior is psychodynamics.
Another important aspect is that values and belief systems influence the work behavior of organizational members and trigger differences in people's perceptions.
Often managers, their subordinates, or co-workers perceive the same situation differently. The way individuals perceive their own competencies, skill and knowledge; the way they perceive their tasks; and the way their peers and their supervisors perceive them affect behavior and performance. As such, perceptual differences that are likely to occur in the complex web of relationships and perceptions are likely to have an impact on individuals and their performance. From a managerial point of view, understanding the perceptual process and the potential barriers for accurate perception is critical.
Perceptual differences between people and groups are a major problem area for many field of study, In management perceptual problems are pervasive and for this reason the recognition of their existence is of major importance in understanding organizational behavior. Perceptual differences are normal functions of the brain processes that help make life immediately meaningful.
In this chapter I will focus on investigating the nature of individual behaviors during 5S project. This analysis had been possible with the important help of human resources department and head department that gave me all the necessary information. The information are reported in the 8.7 table. The data reported are both quantitative and qualitative, in this way I can make an appropriate and complete analysis and we will understand better the human behavior that affected the entire 5S project.

9.1 FIRST ANALYSIS: EXPLANATION OF THE DATASET WITH CLUSTERS

I start the analysis of the data with the formation of some clusters on the basis of the gathered information. In this way we will discover additional information regarding the structure of the sample.

First of all the data set contains 66 people, all working in the concerned department. The analysis was made possible and led to results that are very realistic because the sample size is quite good, because usually the sample should be neither too large nor too small. The study was made possible thank you to clustering methods, based on the identification of homogeneous groups of records called clusters. The observations belonging to one group are similar to one another and dissimilar from observations included in other groups. Clustering models may provide a meaningful interpretation of the phenomenon. Based on the data that I had, I could divide the information into 3 main clusters. The first 2 clusters are derived from data obtained with the human resources department, while the third and last cluster is derived from an interview with the department manager, who has the best knowledge about the workers. The first cluster extracted from the data collected concerns the division between men and women.

Male	**31 people**	47%
Female	**35 People**	53%

Tab. 9.1.1 First cluster

From this cluster, you may notice that the sample is fairly balanced, of a total of 66 people, 31 (47%) are men and 35 women (53%).

The second cluster, however, is that regarding the age of people. The various ages from data were divided into 4 groups: from 18 to 28 years, from 29 to 39 years, from 40 to 50 years and aged 50 years and over

Age		
18-28 years	8	12%
29-39 years	39	59%
40-50 years	13	20%
51-… years	6	9%

Tab. 9.1.2 Second cluster

The analysis showed that age group in which there is the highest concentration of people is the second, from 29 to 39 years, a medium low age. The concentration percentage on the total is the 59%. In addition regarding this data has been calculated also the average age of the worker that is 37 years, confirming the age in which there is the highest concentration.

Closely correlated with age, there is another attribute: the number of years that a person works in this company. It isn't said that in all cases there is close correlation between age and years of work in the company, but usually if a person works with the company for many years in most cases the worker will have more years than people who work there from less time.

These data have also been divided into classes: until 5 years, from 5 to 10 years, from 10 to 15 years and more than 15 years.

Number of working years in the company		
Until 5 years	20	30%
From 5 to 10 years	18	27%
From 10 to 15 years	24	36%
From 15 …	4	6%

Tab. 9.1.3 Number of working years in the company

By placement of the data, it results that also here the sample is fairly balanced. In the first three groups there is a concentration of about 30%, while the last group (the one above 15 years) there is a low concentration of 6%. From this last group of data we can see that the average age of workers is not very high. This is confirmed by data on the age analyzed earlier. Even for this have been calculated the average, which is equal to 8,5 years, which always confirms the previous statement. This group of data is especially important for the analysis of human behavior, since according to the years of work a person will tend to have a certain kind of attitude rather than another.

The third and last cluster, derived from the interview conducted at the department head, reports the qualitative data. This is the behavior of workers during the change and so during the project 5S. The cluster contains three types of behavior: positive, negative and indifferent.

Change behavior		
Favourable	44	67%
Indifferent	15	23%
Unfavorable	7	11%

Tab. 9.1.4 Third cluster

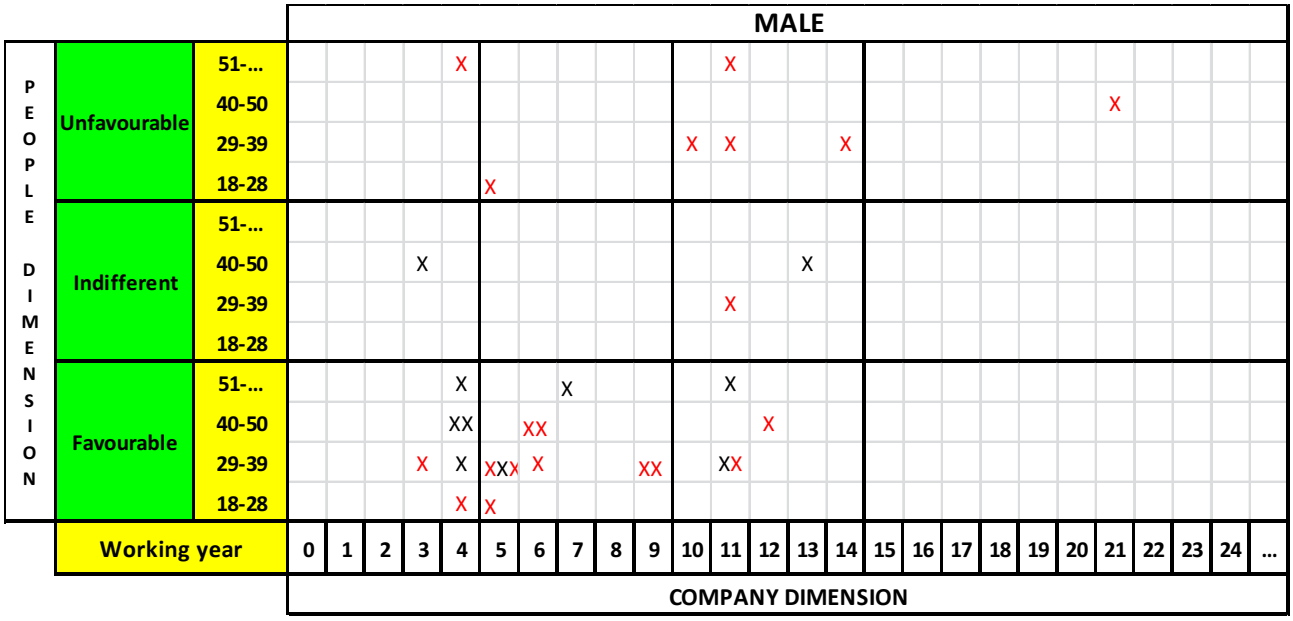
From the analysis of the data it is possible to understand that 67% of people had during the course of the project a favorable behavior, 23% had a behavior rather indifferent and the remainder, 11% unfavorable. This is very good, because the fact of having a very positive and motivated attitude towards the project is already a good starting point. Addressing a change with a favorable spirit helps to carry forward in the best way the possible situations that arise. In addition to having during the whole project, always a good attitude helps to achieve well the desired result with a particular level of success.

It is important to emphasize the fact that this information has been obtained by the person who generally know more well the workers and thus truly reflects reality. During my internship, I had the opportunity to interact often with the operators and in some cases I have had the opportunity to understand the attitude toward the change, but I have preferred to ask directly to the department head since for these type of data had much more experience.

For the moment we can say that the distribution of the sample appears to be fairly balanced and is not particularly abnormal. This is only the first part of the analysis, which has helped us better understand the structure of the sample with its main features. Following the study will become much more thorough interpolation of data seen recently. In fact, to study the behavior of people are needed a depth analysis and you could not stop at a level so low.

9.2 IN-DEPTH ANALYSIS

Starting from the previous analysis, now I show a second carefully study. I think that a graphical representation is the best way to visualize the relationship between the attributes. There are several types of graphical representation, but I think that the most intuitive is scatter plot. This is a two dimensional Cartesian chart obtained by placing the first attribute on the horizontal axis and the second attribute on the vertical axis. The points plotted thus correspond to the pair of values of the dataset. The scatter plot shows the intensity of the positive relationship between the attributes. Scatter plot is an easily imagine of the real situation and may prove confusing and ineffective when the number of data is very high.
On the basis of the data that I had, I tried to build the scatterplot. From the previous analysis I had four set of data, but the graphic has got only two axis. For this reason I thought to divide the data in two parts: people dimension and company dimension. The people dimension collects all the attributes strictly correlated with the people, hence sex, age and behavior. Instead the company dimension has as only attribute the number of working years. People dimension and company dimension represent respectively the vertical axis and the horizontal axis. During the construction of the scatter plot I saw that was better to make two graphical representations on the basis of the sex of the people, because the behavior changes a bit. This also important to maintain the structure of the previous clusters. In addition as I told before, for achieving an effective view of the data it is better to have a low number of data. For the building of these graphs further to the gathered data I was inspired from the ADKAR model and it is for this reason that I explained the model in the previous chapter. The graphs have as common points the same meaning of base for the axis. In effect also ADKAR model reflects the same two dimension: company and people, even if in the next graphs are situated in opposite way. In the following table we can see the obtained scatter plots.



Tab. 9.2.1 Scatter plot male

			FEMALE																									
PEOPLE DIMENSION	Unfavourable	51-...																										X
		40-50												XX								X				X		
		29-39					X							X			X											
		18-28																										
	Indifferent	51-...																										
		40-50																										
		29-39												X	X	XX												
		18-28																										
	Favourable	51-...																										
		40-50												X														
		29-39		XX		XXX	XX	XX	XXX					XX		XXX												
		18-28		X		XX	X	X																				
	Working years		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	...
			COMPANY DIMENSION																									

Tab. 9.2.2 Scatter plot female

As we can see from the scatter plots you have a different distribution between male and female. From the analysis of the previous paragraph I discovered that the favorable behavior is the majority both for men and women. The graphs confirm this statement but underline also a difference of distribution between the two scatter plots.

First of all there is a big difference for the age of favorable people. The favorable women have an age from 18 to 39, instead the favorable men have an age from 18 to over 51. The distribution age of the favorable is more low for women. In addition the females have a favorable attitude if they work in the company from few years. The males have an homogeneous distribution on the basis of the average of working years.

For the indifferent attitude there is a very low percentage as you can also note from the study before. The age of indifferent women is from 29 to 39 years, instead from men is distributed for all age. The fact to have a low percentage of indifferent people toward the project change it's very good because helps to understand that the workers have some interests about their work and workplace. As I said before the interest and the motivation within the work zone represent an important factor for the final success.

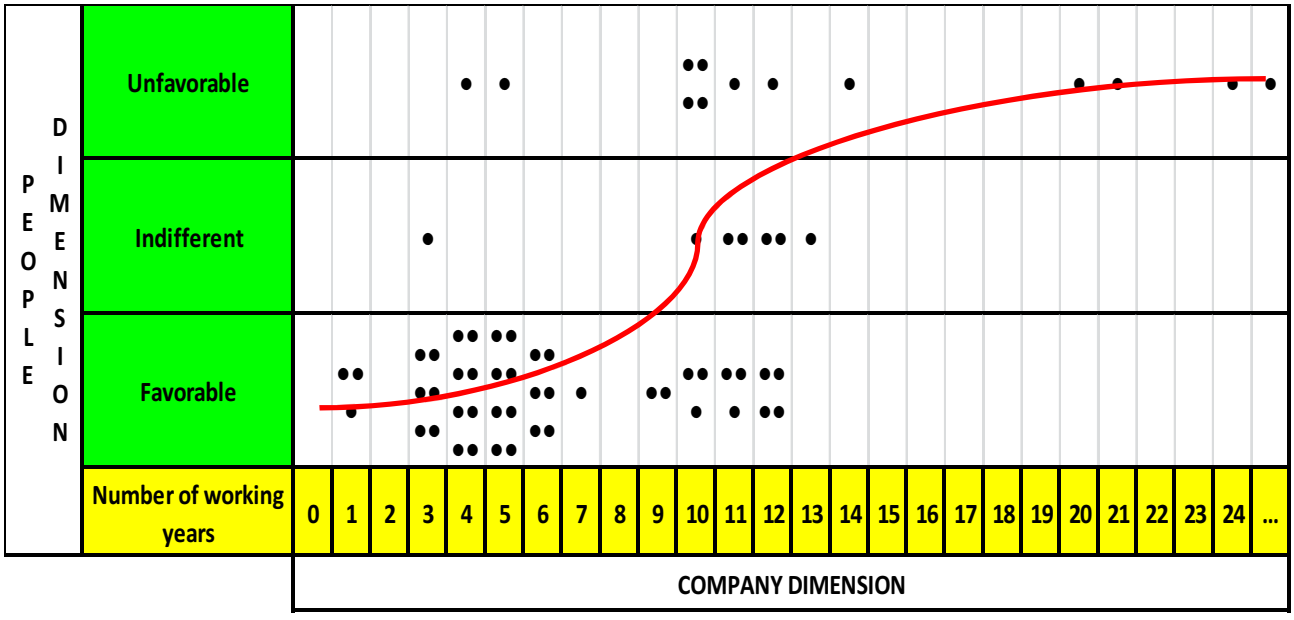
A very important fact is observable for the unfavorable behavior. As we can see from the plots the negative attitude increases with the growth of the working years both for male and female. This is a very good observation that helps us to understand better the trend behaviors. Furthermore the average age of unfavorable attitude is quite homogeneous , but for the women there isn't case from 18 to 28 years.

With regard to the years of work in the company and what we have seen above, there is not a large percentage of above 14 years, but this is something quite normal. In fact it is very rare that a person begins and ends his career in the same workplace.

Overall we can see that as a percentage of young people have a much more positive attitude than other people. This fact is also quite normal because a young person is generally more motivated and can be more open respect to new experiences.

9.3 CONSTRUCTION OF A MODEL

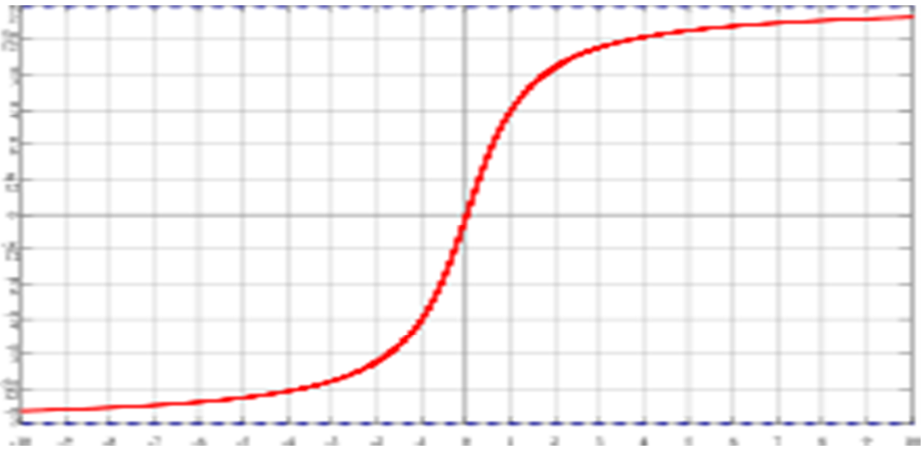
Regarding the analysis seen before and in particular on the basis of the two scatter plots I created a model that try to explain the observation that I think it is the most important and meaningful. The model is ever based on a graphical representation: the loess plot. The loess plot is built on scatter plots and can therefore be applied to attributes. Starting from a scatter plot, it is possible to add a trend curve to express the functional relationship between the attributes.
The built model has the same axes of the previous scatter plot: company dimension as horizontal axis and people dimension as vertical axis.
The model take only two attributes the behaviors as vertical axis and the number of working years as horizontal axis. This is because the previous analysis was used in order to understand the structure of the data and then interpolating all had, while a model is something innovative that assembles the most meaningful information. In addition, a person's age is closely correlated with the years of work and therefore did not need to represent it.
Contrary to the previous analysis, the model is built both for male and female, because observing the graphs separate there weren't differences as the study before.
In the following table there is the created model.



Tab. 9.3.1 Behavior model

The model shows the structure of behaviors of the dataset.
Thanks to the chart we can see at once that with **increasing years of work in the company, the workers' behavior tends to be increasingly negative**. As we have seen from the previous assertions the average age of the sample is low and we have for the most part a positive attitude, however, the trend is clearly visible.
The trend curve that was drawn helps us even more to assemble the data in order to arrive at a just conclusion. Furthermore, if we were to bring the curve to reality we can say that is similar to an inverse trigonometric function: the arctangent.

The following chart shows the arctangent function, where you can see the similarity with the curve of the model.



Tab 9.3.2 Arctangent function

Arctangent curve refers to an infinite interval and assumes this particular form due to the horizontal asymptotes (upper and lower)
Of course, the curve of the model refers to a finite interval and then a portion of the real function.
The model also assumes this similar shape because the boundaries of favorable and unfavorable behaviors perform the same function of the asymptotes
The creation of this model is very useful and important both for the purposes of this thesis and for the company where has been applied this project.
For the purpose of the thesis is useful to complete a thorough analysis of the collected data and obtained results.
For the purposes of the company is significant to know some aspects still hidden and for future projects. In fact at the end of this work will be given a copy of the thesis to the company with the goal of a useful learning, application and extension of the model to other departments. It is important to emphasize the fact that the model is designed to be applied both before and after the execution of a project related to a change.
The most important thing for the application of this model is the knowledge of the data. If you want to apply the model before the start of the project to make some considerations about the final outcome and make an accurate assessment, in addition to economic evaluation, whether proceed or not, it is useful to make some assumptions about the behavior of people with the help a competent and experienced person (eg. Department head). For the construction of the model to back your data are ever very important and requires careful observation of the people involved.
The advice is to apply the model both before and after the execution of a project, in order to verify the validity of information each time. In this case it was possible to apply it only after because it was created precisely for the purpose of the final analysis.
The model is in fact seen and evaluated as a tool to be delivered to the company to search the causes of corporate successes or failures. In any case, it's important to research the causes and analyze them.

9.4 ANALYSIS OF UNFAVORABLE BEHAVIOR

Data analysis, however, does not stop there, because there is still something to be analyzed carefully. At the end of Chapter 8, when the dataset was shown, there were also the reasons in case of bad behavior. The reasons for negative behavior can be grouped into three broad categories: different points of view, different habits and fear of change. These data was collected again thanks to the invaluable help given by the department head.
The table below gives an account of the causes.

Reasons	Number of times	Average Working Years
Different point of view	5	13 years
Different custom	4	16 years
Fear of the change	6	14 years

Tab 9.4.1 Causes of unfavorable behavior

The table also shows the number of times that a specific reason you submit and the average number of working years in the company of workers involved. The averages reported data higher than the general average, even if these data have little significance. So I decided to do more research to see if there was again a correlation between years of work and cause of the behavior.
The histograms below show the study.

	Different point of view			
Times				
5				
4				
3				
2				
1				
Years	Until 5	From 4 to 9	From 10 to 14	From 15 ...

Tab. 9.4.2 Histogram of different point of view

	Different customs			
Times				
5				
4				
3				
2				
1				
Years	Until 5	From 4 to 9	From 10 to 14	From 15 ...

Tab. 9.4.3 Histogram different customs

	Fear of the change			
Times				
5				
4				
3				
2				
1				
Years	Until 5	From 4 to 9	From 10 to 14	From 15 ...

Tab. 9.4.4 Histogram Fear of the change

From the study, each case taken separately shows again that negative behavior is symptomatic of a large number of years in the company. This reinforces what has been discovered in the previous section with the construction of company-years model.
From the first table you can see that the fear of change is the main cause of negative attitude.
The changes cause the breakdown of what you had created earlier and sometimes distort the human mind. In fact, sometimes a person who was accustomed to act in a certain way is forced to change and this can be problematic. Often a change provides an effort used to perform a working job in a different way. For a person of a certain age, maybe even close to retirement age, is difficult to be positive and get used to change and he is therefore less flexible toward adaptation. This is often dictated by the fact that a person beyond a certain age had more negative experiences and is less receptive to new things. A young person is instead better prepared for new experiences and can adapt to new situations, often with a motivated and very positive spirit.
The second cause of negative behavior concerns the different viewpoints. This case is not entirely related to age and then the working years with the company, because to have a different view with respect to another person or company you work, you may occur independently to the age in which you are . This statement is confirmed by the fact that the average years, visible from the first table is lower than the others.
The last cause concern the different ways that people have. It can be seen that the average years of work for this cause is the highest. This is quite understandable because as the years of work grows, you get used to work in certain ways and it is much more difficult to change. This third and final case is so closely correlated with the first, because the explanations can be given to motivate the negative attitudes are the same. A person beyond the age is not as motivated and open to change, but a young man who still has a long working life he can see changes in a way to improve and grow.
The change into a company it’s very important because we live in a continuous changing business environments. Being innovative and responsive to changing business environments requires great flexibility. The trend toward an elastic company affecting the human resources. The flexibility can be reached with a team of favorable and positive people toward the change. For this reason I took a lot of attention for the unfavorable behavior.
Having a negative attitude in the course of a business plan means not be agree with the measures to be applied.
During my experience in the company I was able to closely observe the workers, to interact with them and understand sometimes their ideas about change. Often there have been cases where the fact of having a negative attitude, did not stop there. In fact there have been some unpleasant situations, during which some operators have caused damage to create problems for the project implementation. The damage fortunately have not been large scale and they could easily solve, the fact remains that there were. An example of this type was the failure of a monitor on a work bench that had to be subjected to the phase Seiri.
Also during the project was posted on a poster mentioned in previous chapters, where you could write some tips, and people haven’t almost worked. Avoiding unfavorable behaviors can lead to better results.

9.5 TEAM ANALYSIS

In order to complete in the best way the analysis is very useful to analyze the sub-sample taken from the dataset of people who formed the 5S team. The people of the team as well as practical help in the work place had the important role of spokesman for the department for explaining to all of what the project is occupied. In the initial phase was also held a meeting to explain and was delivered to each member an information to better understand.
In the table below is visible the dataset of 5S team.

OPERATOR	SEX	AGE	YEAR IN THIS COMPANY	CHANGE BEHAVIOUR			IF UNFAVOURABLE WRITE AT LEAST A REASON
				FAVOURABLE	UNFAVOURABLE	INDIFFERENT	
Worker 1	M	30	9,5	X			
Worker 2	M	34	11,5	X			
Worker 3	F	31	4,5		X		Different custom
Worker 4	M	42	12,5	X			
Worker 5	M	54	11,5		X		Different point of view
Worker 6	F	28	5	X			

Tab. 9.5 Dataset 5S team

Recall that the sample was chosen more or less at random, but trying to incorporate people from almost all stages of the process, in order to have a broad view of everything.
Based on this data has been conducted an analysis more or less complete as that seen previously. The dataset results quite in equilibrium, there are more men, but the people with negative attitude are a man and a woman.
The results have led to understand that the behavior of this portion of the sample is closely related to that of the full dataset. Fact that the percentage of favorable behavior in this sample is equal to 67% and the percentage of unfavorable is 33%. This makes us to understand that the behavior of the spokesmen of the project was well amplified in the department.
The team members have done their job very well influenced the opinions of their colleagues. Even the analysis of the average age and years of work in the company lead to almost identical results. Do not think it necessary at this point to create the model for this sub-sample as the reduced number of attributes. It is still obvious at this point that the result is the same as above.
We also note that the sample of people with negative attitude has rather high age and high years of work in the company. The construction of the model was always brought to the confirmation that with the growth of the years of work also increases the negative behavior.
In this short and last study you can pick up a very important teaching for the development of projects that is the choice of the team. It is important the choice of the team but more importantly, the attitude of the team. For example, if this team was formed with only favorable people we might have had more cooperation and better results.
Be beneficial at times also means taking a project as a challenge which can be drawn particular opportunities, means to get involved, means work together to achieve common goals.

10. Conclusion

After explaining everything that happened during the project and after having done a thorough analysis is now time to draw conclusions.
During the conclusions I will make some evaluations about the outcome of the project, I will make a budget will highlight all the positive and negative things, I will try to give useful advice to the company for the future and comment on my personal experience in the company.
This last part is a kind of review, following the implementation of the project, a sort of monitoring results. This requires the measurement of the results obtained by the comparison with the objectives and constraints in the initial phase.
From this kind of analysis may well reveal any corrective actions, problems and opportunities arising from the project that can be used in future for the development of further new projects.
The conclusions will be divided into several parts. At the beginning I will show a detailed example of economic benefit, then you will learn the general result of the project, the main advantages and disadvantages, and finally the personal comments about the experience.

10.1 EXAMPLE OF ECONOMIC BENEFIT

Thanks to the project that was performed several benefits have been obtained, but the most important of all are the economic ones. Actually were performed in the department two cross-projects linked to lean production and it is therefore quite difficult to estimate the benefits of the single 5s project. The economic benefits have been estimated in general related to lean production and you cannot separate them. These were estimated with the findings in terms of time. The time saved is translated into money, because time has a specific hourly cost. To be able to get the savings were performed the time measurements before and after the project. The difference is the saving of time that has been reached. But there is one particular area of the department where there is the test out phase where we have been changes only related to the 5s project and was thus possible to calculate the specific economic benefits. So I thought it would be very interesting to get an idea of savings, which has been obtained.
In the table below you can see the times related to the test out phase.

Test Out Phase	Time Before	Time After
Actual Cycle Time	170,33 seconds	145,11 seconds
Added Value Time	163 seconds	141 seconds
Not Added Value Time	7,33 seconds	4,13 seconds
% Time	100%	85,19%

Tab. 10.1.1 Test out times

From the table we can see some indications related to time, the first is the actual cycle time that refers to the total time of this phase. The other two terms refer to the division of total time: the value added time and not value added time. The overall objective of the project during a 5S project is the reduction of the time, but primarily the added value time and then the other. The table clearly shows that it has gone from a work cycle of 170 seconds in one of 145, with a saving of time of 25 seconds (nearly half a minute) and a savings rate of around 15%. These data speak for themselves and see that the savings is substantial. Now, starting from the time saved is possible to calculate the economic benefits.

Test Out Phase	Reduction Time for each unit	Reduction Time for each unit	Savings for each unit of product
	25,23 seconds	0,42 minutes	0,14 €

Tab. 10.1.2 Economic benefits for test out phase

From the table above you can see what is the saving for each unit of economic product. It has been possible to make this calculation because I know that the hourly cost, that is about 20 €. Given this result so found does not say much, but you can give more sense knowing the number of products per year. For a company that produces small amounts, these savings per unit is irrelevant, but for a company like this that produces large quantities can be very significant and lead to a great economic advantage

The number of products per year is an information that I was given directly by the company. This data is based on some predictions based on the company's request.

Total Production Forecast 2012	130.000 units of product
Total savings per units	0,14 €
Total Savings for 2012	18.200 €

Tab. 10.1.3 Saving forecast test out phase for 2012

From the table above has been obtained the total savings of the test out phase due to the 5S project. The savings is given by multiplying the savings per unit produced for the production forecast for 2012. The result is € 18,200 for a single phase of the process is quite high.

From this example it is possible to understand that the economic results achieved through the development of this project are enough high and you can then say that the project was successful. For the reason explained above, it is not possible to estimate the total savings due to the 5S project, this is a real shame, although I hope I have given, however, a clear idea thanks to the numerical example mentioned above.

10.2 END OF THE PROJECT, COMMENTS ABOUT THE RESULTS AND FUTURE

To conclude this work really well, I thought it would be very useful and important, to actually see all the areas of intervention that were fixed at the beginning. These areas of intervention were seen specifically in the chapter 2, paragraph 2.5.1 called 5S Plan Proposal. To examine specifically I decided to build a table where you can see the progress percentage for each intervention.

Action Areas	% of completation	Status
Tracking new unpacking area	100%	Complete
Clean workbenches procedure	100%	Complete
Recovering visual management area	80%	On going
Redefinition kit-psu area	100%	Complete
Tracking new kit-psu area	100%	Complete
Reorganization new buffer shop area	100%	Complete
Check list equipment	50%	On going
New organization of the warehouse	100%	Complete
Tracking of the warehouse	100%	Complete
Application of photos	80%	On going
Maintenance Procedure for warehouse	100%	Complete
New storage area for finished products	100%	Complete
Elimination of posters with photos	50%	On going
Tracking of new packaging area	100%	Complete
Brainstorming with colored stickers	100%	Complete
Move the scrap warehouse in the central warehouse	20%	On going

Tab. 10.2.1 List of action areas

In the table above you can see the percentage of completion for each intervention action of the 5S project and based on this the progress status. From the Plan Proposal seen in the second chapter for the construction of this table was made a summary that encompasses all the actions. We note that almost all areas of intervention have been completed and this is a positive symptom and then of success. You can also note that all operations have been started with at least a minimum percentage of 20%. You can see that we have only the status of complete, in progress and none pending.
Based on this I have also created a summary table of the most important data.

Total Actions	Total % of Completion
16	86%
Status of Actions	**Number of Actions**
Complete	11
On going	5

Tab. 10.2.2. Summary of Actions

You may notice that on a total of 16 scheduled actions, the percentage of completion was 86%, a very high percentage. In addition of a total of 16 actions, 11 were completed and 5 instead are ongoing and will be then taken over in a future 5S project.

Following this analysis, I can say that the project has been highly satisfactory outcome. This is not only a personal opinion but that's what the company thinks and therefore it is a very rational statement. The greatest benefit obtained was the reduction of time in particular the substantial elimination of non-value added time resulting then in economic benefits.

From my point of view the strategic factors that have led to a satisfactory result was the definition of the initial objectives for the implementation of the strategy. The objectives were defined in a very simple and clear way from the beginning and this has made it possible to implement the right strategy to take forward the project in the best possible way.

Another very important point which has contributed greatly to the success of our plan was the collaboration found with the 5S team and other operators of the department. Although sometimes you have found some difficulties you can be said found that cooperation was pretty good. Of course if you had found the project would be full cooperation probably could have gone better. Even the 5S team taken separately behaved quite well and has helped in spreading the concept of the project. I council to the company for future projects to continue to work with a team and put special attention to his choice. It would be good that members of the team have a favorable attitude toward the plan to implement change, because as we have seen from the model created this has a certain influence on the final result.

Also working in teams is very important as teamwork produces better results than the work of the people taken separately. The group also appears to be a formalized organizational context in which the mutual adaptation is carried out better, through the management groups creates a sense of mobilization towards common goals and offers the opportunity to participate in at least partial processes like decision-making. The group also contributes to the socialization, that is a process by which members learn and internalize the values, culture and styles of their organization's behavior.

This also helps to develop a sense of belonging and identification of individuals in the organization. In addition for complex problems are best tackled with technical team decision and you have the opportunity to examine the problems according to different points of view, relying on a wider range of expertise to stimulate and generate innovative alternatives. During the project we tried to assemble a team of people from almost all areas of the department, in order to create a sort of cross functional teams, including such different people with different skills and responsibilities. All

this is particularly useful for dealing with change and balance the trend towards specialization of labor with the need to integrate locally fragmented activities and skills.
Another very important and should not be underestimated in view of a new project is the training. The company must give way and time to the resources to learn and consolidate the knowledge to better deal with the experience that you will present. In this case was decided (at least for members of the team) a kind of training on the job that is a type of training within the work environment and during the work experience which proved to be a combination of learning rather than actually winning. It would be good to implement some sort of life-long education of workers so that the knowledge and training are kept updated throughout the working period.
Furthermore, as we have seen previously is very useful that workers are motivated in what they do. The motivation can radically influence performance. At the base of the reasons there are conscious and unconscious forces that pushes individuals to particular types of behavior. These forces may be due to several factors: hedonism, past experiences and future expectations. To increase motivation recommend the company to carry feedback to evaluate retrospectively the outcome of a project based on the objectives that have been established. A sort of management by objectives (MBO). These are pay systems for individuals in which part of their salary (during the project) is variable and linked to the objectives to be achieved.
The objectives descended from the general objectives through a cascade mechanism that would involve various levels. In this way, individuals may be much more motivated and increase the likelihood of achieving good results.
The behavior of individuals can be so oriented with the encouragement of desired behaviors through positive reinforcement such as rewards, pay increases, positions of prestige through punishment or negative reinforcement.
Another important issue is procedural fairness, that was a vital part of the project, because operators need to hear that the processes are fair and transparent and that there are equal opportunities for all.
Other important factors relate to the ways in which individuals perceive the problems and changes. Two key levers are the development of intuition and instinct in dealing with experience. These qualities are formed over time and find their roots in the experience and knowledge of the situation. The experience also compensates for the lack of information and speed the resolution of a particular type of problem. I highly recommend the company to also keep in mind this factor when choosing a team.
Probably in the course of the project would take into account all these aspects we could get more satisfactory results, but the experience built up over time, is to learn new things to use in the future.
I'm sure that in any future plans the company will build on these important tips. It 'also very important to underline the fact that the company will also have the option of using the model created and explained in the ninth chapter both for the initial assessment of a project (or start) and for the subsequent evaluation of the achievements. I hope this can be used and extended to all other departments.

10.3 ADVANTAGES AND DISADVANTAGES MADE

At this point it is useful to take stock of everything that has led the project. As I explained before, the project has had a very positive outcome and then there are many advantages that have made. In addition however inevitably parallel there are also disadvantages.
I start with the list of main advantages:

- Decreasing time-of-cycle, the total production time has decreased significantly. This was made possible in particular thanks to the substantial reduction of non-value added time, this is the time that does not bring any benefit to the product.
- Waste elimination, it is indeed sought to substantially reduce waste, in particular the time that did not confer any value to the product.
- Reduction of the cost, reducing the time for the production also costs are considerably reduced. For example, just think of the costs for electricity, with the same amount of energy now can produce more.
- Improvement of the quality, that automatically occurs with cascade connection to other benefits listed are also improves the quality of units produced. The quality offered to customers is a paramount of maximum importance because it represents a competitive advantage.
- Increasing productivity, this advantage is closely linked with all others and it is a consequence.
- Line Involving staff, increase collaboration and mutual support of people in the department. In addition grow the experience and level of training.

In parallel, there are also disadvantages:

- Time for training, increases the time spent to train people in light of plans and objectives to be achieved;
- Time for maintenance procedures, increases the time spent for the maintenance and continuous improvement with the changes.

These disadvantages are transformed then in the long term benefits. Particularly in competitive advantages that can make a difference at the moment of sale of products.

10.4 PERSONAL COMMENT ABOUT THE EXPERIENCE AND THANKS

This experience has been extremely positive. It allowed me to enter in the world of work, I have allowed to apply what I learned during my studies at university, I joined an organization and I was able to cooperate with many other people. In the company the people with whom I cooperated formed a sort of team, each with their own tasks but with the same final common objectives. The activities of each individual must inevitably meet with that of others to achieve a common result. The experience taught me to understand the mechanisms of work group and especially the dynamics with which a large business is organized.

It was an experience that helped me grow and I still leaves an indelible memory. I had the opportunity to socialize with almost all company personnel, and I was able to meet the professionals who taught me to apply my theoretical knowledge. All the staff has always been available and open to dialogue, even though they found a company with a well-defined size internal structure, I have never been denied access to corporate data that I needed.

Finally I would like to thank all the people who have followed me and allowed me to make this work that concludes my training.

Special thanks to Prof. Alessandro Brun, who directed me to the company, which has been following the progress of the project, which allowed me to do this work of thesis and finally followed throughout the thesis process. I thank the professor for his openness, kindness and for his listening and support in achieving this final work. He has provided valuable insights and guidance ensuring this research provides a value in correct direction.

I thank all the corporate team, in particular the manager of production, the engineering department, the purchase department, the human resources department, the quality department that have always advised and guided me in the course of the internship. In addition, I also thank all the department Sky, in particular the department head, deputy head and all line operators in which I have always found a good collaboration.

A special thought goes to the Polytechnic and its impeccable internal organization, with particular attention to the detachment of Como where I have been following my course of study. The Politecnico of Milano is a famous name throughout the world and studying at this noble university made me realize that here working great professionals who are able to form complete engineers The master followed over the past two years, was in English and attended by students from all over the world. This wide variety of people has made possible a great cultural exchange and despite the diversity, the English language as a common medium has allowed us to interact together.

A big thanks also goes to my parents and my sister that have always supported me and helped even in difficult times, they have always pushed me to give the best and never give up.

Finally, a thought is addressed to fellow graduate students who over the years and in this final period we have always exchanged opinions and advice to our growth.

References

Bibliography

Joseph M.Juran, A. Blanton Godfrey, JURAN'S QUALITY HANDBOOK, Fifth edition, McGraw-Hill, International edition.

Richard Normann, LA GESTIONE STRATEGICA DEI SERVIZI, Etas

H.John Bernardin, HUMAN RESOURCES MANAGEMENT AN EXPERIMENTAL APPROACH, Fourth edition, McGraw-Hill, International edition.

Jerald Greenberg, Robert A.Baron, BEHAVIOR IN ORGANIZATION: UNDERSTANDING AND MANAGING THE HUMAN SIDE OF WORK, Eight edition,

Hugh Willmott, David Knights, INTRODUCING ORGANIZATIONAL BEHAVIOR MANAGEMENT, Thomson.

Jerald Greenberg, MANAGING BEHAVIOR IN ORGANIZATION, Fourth edition, International edition, Pearson Education International.

James R. Evans, William M. Linsday, THE MANAGEMENT AND CONTROL QUALITY, Sixth edition, Thomson South Western.

Douglas. C. Montgomery, Chery L. Jennings, INTRODUCTION TO STATISTICAL QUALITY CONTROL, Sixth edition,

Gianluca Spina, LA GESTIONE DELL'IMPRESA, Second edition, Etas.

M. Bramanti, C. D. Pagani, S. Salsa, MATEMATICA CALCOLO INFINITESIMALE E ALGEBRA LINEARE, Second edition, Zanichelli.

Carlo Vercellis, Business Intelligence: Data Mining and Optimization for decision making, Wiley.

Morgan, Gareth and Zohar, Asaf. (1996, October). Key Principles for managing Change

Murphy, John R. (1997, May). Change Second. Training & Development

Buchel, Mary, Accelerating Change, Training &Development, 1996

Larkin, Sandar and T.J. Larkin, Reaching and Changing Frontline Employees, Harvard Business Review, 1996

Taiichi Ohno, Lo Spirito Toyota, Einaudi 1993

Beer, M. and Eisenstat, R.A. (1996) "Developing an organization capable of implementing strategy and learning", Human Relations.

Goldstein, J. (1988) "A Far from-Equilibrium Systems Approach to resistance to change", Organizational Dynamics.

Morgan, Gareth and Zohar, Asaf (1996, October), key Principles for Managing Change.

Nickols, Fred. (2000). Change management 101 A Primer

Slobodnik, Alan J. And Slobodnik, Deborah. (1998, April). Change Management in a Human Systems Model: Four System Types.

Sutton, R.I., Eisenhardt, K.M., & Jucker, J.V. 2011. Managinig organizational decline. Organizational Dynamics.

Hendry, Chris, Understanding and Creating Whole Organizational Change Through Learning Theory, Human Relations, 1996.

Henderson – Loney, Jane, Tuckman and Tears: Developing Team During Profound Organizational Change, 1996.

Buchel, Mary, Accellerating Change, Training & Development, 1996

Websites

http://www.articlesbase.com/p-articles/4-reasons-why-a-clean-work-area-is-a-safe-work-area-2342562.html

http://5s.labelprinter.com/seiri.php

http://www.leanexpertise.com/

http://www.leancompany.it/

http://www.gearfire.net/category/general/

http://www.leanthinker.net/lean.html

http://www.educational-business-articles.com/index.html

http://www.change-management.com/articles.htm

http://www.managing-change.net/index.html

http://it.wikipedia.org/wiki/Change_management

http://humanresources.about.com/od/changemanagement/a/change_wisdom.htm?rd=1

http://businessballs.com

http://yorku.ca/faculty/academic/gmorgan/0695keys.html

http://www.strategy-business.com/briefs/96101.html

http://www.yorku.ca/faculty/academic/gmorgan/0695keys.html

http://www.home.snafu.de/h.nauheimer/intro.html

Papers

Journal of achievement in materials and manufacturing engineering, the 5S methodology as a tool for improving the organization, J. Michalska, D. Szewieczek

Managing Personal Change, Moving through personal transition, revised edition, Cynthia D.Scott, PH.D, M.P.H. and Dennis T. Jaffe, PH.D.

Lean manufacturing tools and techniques in the process industry with a focus on steel, by Fawaz Abdullah, Ms in industrial engineering, University of Pittsburgh

Il cambiamento strategico, Gerardo Patriotta

Leading Change Kotter's Best Practice Critical Success Factors

Failure Trends in a large Disk Drive population, Eduardo Pinheiro, Wolf-Dietrich Weber and luiz André Barroso, Google Inc.

John Fisher's Transition Curve 2003-7

How important is a safe and clean environment, does this affect you? Pauline Nunn, Adrian Dracup

Managing Organizational Change, Joanne Mowat, The Herridge Group

Scott C.D and Jaffe D.T (1995), Managing Change at Work. New Brunswidc Canadian Research Institute.

Managing Organizational Change, Michael W Durant CCE CPA

Resistance to change: a literature review and empirical study, Pardo del Val, Manuela & Martinez Fuentes, Clara, Universitat de Valencia, Spain

Organizational crisis: The logic of failure, Gilbert Probst and Sebastian Raisch

Schalk. R. Campbell, J.W. and Freese. C. (1998) “Change and employee behavior”, Leadership & Organizational Development Journal.

Pident. S. K (2000) “Rethinking resistance and recognizing ambivalence: a multidimensional view of attitudes toward an organizational change”, Academy of Management Review.

Barr. P.S., Stimpert, J.L. and Huff, A.S. (1992) “Cognitive Change, Strategic Action, and Organizational Renewal”, Strategic Management Journal, 13 (Special issue).

Boeker, W. (1997) “Strategic change: The influence of managerial characteristics and organizational growth”, Academy of Management Journal.

Child, J. And Smith, C. (1987) “The context and process of organizational transformation – Cadbury Limited in its sector”, Journal of Management Studies.

Galpin, Timothy, Connecting Culture to Organizational Change, HRMagazine, 1996

Arkin, Sandar and T.J. Larkin, Reaching and Changing Frontline Employees, Harvard Business Review, 1996.

Van de Ven, A.H. and Poole, M.S. (1995) “Explaining development and change in organizations”, Academy of Management Review.

Strebel, P. (1994) “Choosing the right change path”, California Management Review.

Maurer, R. (1996) “Using resistance to build support for change”, The Journal for Quality and Participation.

Morrison, E.W. and Milliken, F.J. (2000) “Organizational silence: a berrier to change and development in a pluralistic world”, Academy of Management Review.

Leana, C.R. and Barry, B. (2000) “Stability and Change as Simultaneous Experiences in Organizational Life”, Academy of Management Review.

Lawrence, P.R. (1954) “How to Deal with Resistance to Change”, Harvard Business Review.

Keck, S.L. and Tushman, M.L. (1993) “Environmental and Organizational Context and Executive Team Structure”, Academy of management Journal.

Hannan, M.T. and Freeman, J. (1984) “Structural Inertia and Organizational Change”. American Sociological Review.

Greiner, L.E. (1972) “Evolution and revolution as organizations grow”. Harvard Business Review.

Ghoshal, S. and Bartlett, C.A (1996) “Rebuilding Behavioral Context: A Blueprint for Corporate Renewal”, Sloan Management Review.