

Summary

This project's main objective is to study and develop management methods employed for more than half a century by the Japanese in terms of production management, human resources and everything related to the company stuff, placing them as leaders in the global market indeed in all sectors in terms of efficiency, reliability, quality and safety at work.

As a starting point a theoretical analysis of the history, culture and behaviour throughout Japanese history to understand why the concept of *Japanese Management* is famous throughout the world and is increasingly used by multinational companies of all sectors in the market.

The second part deal with everything related of *Lean Management* and all the concepts that the term carries on such as Just in Time, Kaizen, 5S, etc. Concerning the own experience applying 5S in a multinational.

The knowledge gained is then applied to a Spanish company in the sector of surface's treaters with has solvency problems, although it has an amazing projection in the close future. So it is applied the concept of lean manufacturing to reduce costs primarily through process redesign and time recovery of unnecessary daily tasks at work and it is applied to achieve working as a team and as a family.

It requires a long-term projection to achieve the *Lean Manufacturing* company so unfortunately it is not possible to quantify the results as regards efficiency because the lack of time, however, it is reflected how is studied the current situation, how it begins to act dramatically and all the pros and cons found, making a comparative between a Japanese and Spanish company.

Despite major drawbacks, it is expected that though the work done during this thesis the company will be able to reduce production costs by at least 10% and 20% structure costs as well.

Contents

Summary	1
Contents	3
1. Glossary	7
2. Preface	10
2.1. Motivation	10
2.2. Prerequisite	10
3. Introduction	11
3.1. Objectives	11
3.2. Scope	11
4. Japan's history, culture and behaviour	12
4.1. Japan's history	12
4.1.1. The country	12
4.1.2. Origin, evolution and influences	12
4.1.3. Main factors of economic growth between 60s and 80s	15
4.1.4. The economic recession in the 90s	17
4.1.5. Main points of the more than 10 years deflation	17
4.1.6. Japan nowadays, deflation still persists	17
4.2. Japanese behaviour	19
4.2.1. Education in Japan	19
4.2.2. Japanese behaviour at work	20
5. Lean Management (LM) as the basic idea	24

5.1. What is LM?	24
5.2. First concept: elimination of wastes	26
5.2.1. Eliminate the seven kind of wastes	27
5.3. Second concept: Just in time (JIT)	30
5.3.1. What is Just in Time?	30
5.3.2. The birth of Just in Time	30
5.3.3. How to implement the system "Just in Time"?	31
5.3.4. Principles of JIT	33
5.3.5. Cost – Benefit of the implementation of JIT	43
5.3.6. Provider – Customer relationship	43
5.3.7. Links to suppliers	44
5.3.8. Several vendors or a single provider	45
5.3.9. Short-term contracts or long-term.....	45
5.3.10. Local and distant suppliers	46
5.3.11. Customer links	47
5.4. Third concept: Kaizen	48
5.4.1. What is Kaizen?.....	48
5.4.2. The birth of Kaizen.....	48
5.4.3. When to use Kaizen.....	49
5.4.4. Reluctance to Kaizen.....	49
5.4.5. Kaizen Concepts in a wider sense.....	50
5.4.6. Kaizen is a process.....	53
5.4.7. Organization's implication of Kaizen.....	53
5.4.8. Quality Circle	55
5.4.9. Visual management	57

5.5. Fourth concept: 5S	59
5.5.1. What is 5S?	59
5.5.2. Who are the 5S for?	59
5.5.3. What is the goal of 5S?	59
5.5.4. Benefits of 5S	59
5.5.5. When to apply 5S	60
5.5.6. Definition of 5S	60
5.5.7. Paradigms that obstruct the 5S implementation	61
5.5.8. How to promote 5S.....	64
5.5.9. 5S in practice.....	67
5.5.10. Personal experience in JM	70
5.6. Toyota Production System	72
5.6.1. The origins and the future of <i>TPS</i>	73
5.6.2. <i>Jidoka</i> and <i>Just in Time</i>	74
6. Japanese Management Application	76
6.1. Company's description	76
6.2. Suppliers type	77
6.3. Detailed description of the activity	78
6.3.1. Service offered & final product	78
6.3.2. Production process.....	79
6.3.3. Advantages (Suppliers & Customers)	82
6.4. Actual situation	83
6.5. Lean Management for IVR	87
6.5.1. Objectives.....	87
6.5.2. Process followed as regards JM	87

6.5.3. Actions taken	90
6.5.4. Pros and Cons seen while LM application in IVR.....	93
6.5.5. Results obtained after the application	95
6.5.6. Future tasks to do as regards Lean Management.....	95
6.6. Economic benefits of applying JM in IVR	97
Conclusions and recommendations	99
Acknowledgements	100
Bibliography.....	101
Bibliographic references	101
Additional bibliography	102
Webgraphy	102

1. Glossary

To make the reading of that document easily to understand it has been considered interesting define some concepts and symbols used previously:

Concepts and abbreviations:

- **Andon:** Is a manufacturing term referring to a system to notify of a quality or process problem. The centrepiece is a signboard incorporating signal lights to indicate which workstation has the problem
- **Benchmarking:** It means to learn from the best.
- **BME (Budapest Műszaki és Gazdaságtudományi Egyetem):** It is the university where I have been doing my research for the thesis
- **BUTE (Budapest University of Technology and Economics):** It is BME but with English spelling
- **CEO (General Director or manager of a company):** managing director or chief executive in charge of total management of an organization
- **CRM (Customer Relationship Management):** It is a strategy for managing a company's interactions with customers, clients and sales prospects
- **Cycle time:** Time between operations in the chain production
- **FIFO (First in First Out):** describes the principle of queue processing technique by ordering process by first-come, first-served
- **GDP (Gross Domestic Product):** Is the market value of all final goods and services produced within a country in a given period of time, mostly in a year
- **Heijunka:** It is a technique for reducing waste and vital to the development of production efficiency in Lean Manufacturing.
- **IVR (Investigación y Valorización de Residuos):** It is the company which has been applied the Japanese management.
- **Jidoka:** it is an intelligent automation or automation with a human touch used in lean manufacturing, which permits that when a problem occurs it is detected, the machine stops, it is fixed the problem and then investigated the main cause of that problem.

- **JIT (*Just in Time*):** it is an inventory strategy that strives a business's return on investment by reducing in-process inventory and associated carrying costs. The precursor was Toyota.
- ***Kaizen*:** it is continuous improvement system and philosophy that can be applied in all the areas of a company.
- ***Kanban*:** it is a concept related to lean production, it is a scheduling system that tells what to produces, when to produce it and how much to produce.
- **Lead time:** It is the time since a product is started until it is finished
- **LM (*Lean Manufacturing*):** it is a management philosophy which 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.
- **MRP (*Material Requirements Planning*):** Is a production planning and inventory control system used to manage manufacturing processes. Most of MRP systems are software based.
- ***Muda*:** It is a Japanese term which means waste, it is widely related with Toyota Production System
- ***Pokayoke*:** it is a mechanism that avoids making mistakes to workers in lean manufacturing.
- **RC (*Recovery Centre*):** It is one of the company's process name explained later which basically add value to the wastes of customers enhancing sludge for raw materials
- **SWOT analysis (*Strengths, Weaknesses, Threats and Opportunities*):** it is a strategic planning method used to evaluate strengths, weaknesses, threats and opportunities involved in a project or in a business venture.
- **TMI (*Tractament Mediambiental Integral SL*):** The Company which create the idea of setting up IVR.
- **TQM (*Total Quality Management*):** ei
- **TPS (*Toyota Production System*):** is an integrated socio-technical system that organizes manufacturing and logistics for the automobile manufacturer closely related with the JIT and the LM.

- **UPC (*Universitat Politècnica de Catalunya*)**: University where I study in Spain.
- **WIP (*Work In Progress*)**: it is inventory that has been worked but it is not longer viable as raw materials not yet sellable as a finished product.
- **WTC (*Waste Transfer Centre*)**: It is the other company's process name which accumulates danger wastes to sell them in a bigger amount to bigger treaters.

2. Preface

2.1. Motivation

The thesis I have done has been primary motivated by my interest in business management. I was always watching and admiring people who in adverse and difficult situations were able to solve problems and take even knowledge from it.

During the years of study at the *Polytechnic University of Catalunya* (UPC) I learned and applied concepts and techniques used by the Japanese regarding corporate governance, either managing people or simply managing downturns.

I also learned to improve yourself you must always keep in mind two aims clearly identified, first what I want to reach and second, where I have to go.

For that reason, I have chosen the Japanese management as a topic for my thesis to delve into the concepts as I am aware of that, the Japanese are the best in terms of innovative management techniques.

2.2. Prerequisite

I have been studding several subjects and reading different books related to management tools for several years for that reason, the structure of my thesis project to understand Japanese management philosophy the history and background are to be studied.

The first part is dealing with the culture and behaviour of Japanese people, the second part begins by defining the key concepts of Japanese management. The third involves the application of Japanese methods in a Spanish company where I hope to help both sides, them with the management improvement and me for the increase of knowledge.

3. Introduction

The thesis has been undertaken during my stay in Hungary, working with the engineer Ms. Legeza and during the two weeks staying in the IVR business, the company because of privacy rights would prefer to remain anonymous.

3.1. Objectives

The main objectives of my thesis are to understand the Japanese Management philosophy, to analyze the key concepts and the ways of their success.

It is also important to explore ways to apply my knowledge got in a Spanish company with problems of survival. It is expected to improve internal communication process of the company following an improvement plan implemented with the idea of Japanese management. Specific objectives are the following:

- Understand and gain insight into the concepts of Japanese Management.
- Understand the company's culture and its objectives.
- Develop an improvement plan for the company future.

After the completion of the project will be achieved major goals:

- Implementing the improvement plan and monitored the first phases.
- Demonstrate the economic viability of the improvement plan.

3.2. Scope

The project considers the learning phase on Japanese Management concepts and study how it can contribute to improving a company with critical management and financial problems. For time constraints, it cannot include the monitoring, analysis and optimization of the improvement plan in JM.

4. Japan's history, culture and behaviour

4.1. Japan's history

4.1.1. The country

The State of Japan is an island nation in East Asia. It lies to the East of the Sea of Japan, China, North Korea, South Korea and Russia, stretching from the Sea of Okhotsk in the north to the East China Sea and Taiwan in the south. Japan is an archipelago of 6,852 islands. The four largest islands are Honshū, Hokkaidō, Kyūshū and Shikoku, together accounting for 97% of Japan's land area. It has the world's tenth-largest population, with over 127 million people. The Greater Tokyo Area, which includes the capital city of Tokyo and several surrounding prefectures, is the largest metropolitan area in the world, with over 30 million residents.

As regards the government, and since adopting its constitution in 1947, Japan has maintained a unitary constitutional monarchy with an emperor and an elected parliament called the Diet.

Economically speaking, Japan has the world's second-largest economy by nominal *GDP* and the third largest in purchasing power parity. It is also the world's fourth largest exporter and fifth largest importer and it is a developed country with very high living standards. Japan has the highest life expectancy of any country in the world and the third lowest infant mortality rate.

4.1.2. Origin, evolution and influences

In order to understand the Japanese people and their cultural behaviour it is necessary to know where they come from, so at least learn about the history of Japan. So, it can be separated into nine periods.

Japanese history is the succession of events that occurred within the Japanese islands, with the appearance of isolated influences by events in the first place, by the Empire of China, which defined its language, its writing and also its political culture. On the other hand, it was influenced by the West, which turned the country into an industrial nation, managed to exercise a sphere of influence and territorial expansion on the Pacific area, but after the Second World War stopped, maintaining a system of nation linking to industrial country's cultural tradition.

The emergence of the earliest human inhabitants in the Japanese archipelago dates from the Palaeolithic about 35,000 years ago. Between 11 000 and 500 BC these people developed a type of pottery, called "*Jomon*", considered the oldest in the world. Then came a culture known as "*Yayoi*", which used tools metal and cultivated rice. In it there were several chiefdoms, but excel that of *Yamato*. In later centuries the rulers of *Yamato* strengthened their position and began to spread through the archipelago under a centralized system, bowed to the various tribes existing ground of divine descent. At the same time, the central government began to assimilate customs of Korea and China. The fast imposition of foreign traditions place a strain on Japanese society and in the year 794 the imperial court established a new capital, *Heian-kyo* (now *Kyoto*), giving rise to a highly sophisticated culture of its own from the aristocracy. However, in the provinces the centralized system was a failure and began a process of land privatization, giving as result a collapse of public administration and the breakdown of public order. The aristocracy began to need the help of warriors to protect their properties, giving rise to the class samurai.

Minamoto no Yorimoto became in 1192 the leadership of Japan, setting up the figure of the *Shogunate*¹ as a military institution de facto permanent rule for almost 700 years. The outbreak of *Onin War* in 1467 triggered a chain of wars that swept through Japan, a period which culminated in 1573, when *Oda Nobunaga* began to unify the country, but could not finish the job because he was betrayed by one of its main General. *Toyotomi Hideyoshi* avenged his death and completed the unification in 1590. At his death, the country became divided into two camps, the supporters of his son *Hideyori* and those who endorsed one of the major daimyo², *Tokugawa Ieyasu*. Both sides clashed during the *Battle of Sekihagara*, which came with *Ieyasu* victory, to be officially named *Shogun* in 1603, establishing the *Tokugawa Shogunate*. The *Edo period* was characterized by peaceful, and the decision to close the borders to prevent contact with the outside which included urbanization, increased shipping of commodities and a diffusion of trade and handicraft industries. But the basement of the economy of that moment was the rice, through which the government collected taxes from the peasants and they were high, about 40% of the harvest. Until 1853 the isolation didn't end and it was because *Commodore Matthew Perry* forced Japan to open its doors and sign a series of treaties with foreign powers (called "*Unequal Treaties*"), which caused discomfort among some samurai, who supported the emperor to resume its role in politics.

¹ It was a military range and a historic title given directly by the Emperor and it gave power to lead the country.

² Is a generic term referring to the powerful territorial lords in Japan who ruled most of the country.

On the other hand, and parallel as those years, when renaissance Europeans reached the country in the 16th century they were quite admired of Japan because it was considered as a country immensely rich in lots of things, such as precious metals. So the first who started trading were the Portuguese but this was more and more **challenged by Chinese** at first, but later by Dutch, Spanish and English. After that competition for trading with Japan the only who could exchange their stuff were the Dutch until two centuries later.

The last *Tokugawa shogun* resigned in 1868, ushering in the *Meiji era*, named after the reigning emperor who assumed political power. He started leaving the country's modernization and the feudal system of the samurai, the capital was moved to Tokyo, started a strong process of Westernization and Japan would emerge as the first industrialized Asian country. He made a process of territorial expansion into neighbouring countries, which led to militarily confront the Russian Empire and the Chinese Empire. In **that period Japan send lot of people to see and learn from the world.**

To **promote industrialization**, the government decided that, while it should help private business to allocate resources and to plan, the **private sector was best equipped to stimulate economic growth**. The greatest role of government was to help provide the economic conditions in which business could flourish. In short, government was to be the guide and business the producer. In the early *Meiji period*, the **government built factories and shipyards** that were sold to entrepreneurs at a fraction of their value. Many of these businesses grew rapidly into the larger conglomerates. **Government emerged as chief promoter of private enterprise, enacting a series of pro-business policies.**

Upon the death of *Emperor Meiji*, Japan **had become a modern state, industrialized, with a central government and as a power in Asia, rivalling the West**. There was a social **explosion due to economic and population growth** and began to gain ground on political extremism and into the 1930s accelerated the military build-up, comparing it to China for the second time. After the outbreak of war in Europe, Japan took advantage of the situation for the annexation of other areas of Asia. During 1941 diplomatic relations between Japan and the United States were strained, as **U.S. President Franklin Delano Roosevelt had blocked oil supplies to Japan and froze all Japanese credits in the United States**. On December 7 of 1941 Japan attacked *Pearl Harbour*, which this country entered the World War II as part of the "Axis Powers". Despite a series of early victories, defeats the Allies in battles like Midway have changed the roles in the Pacific Theatre. After the horrific atomic bombings of Hiroshima and Nagasaki, Japan submitted its unconditional surrender, so he was busy by U.S. forces, which dismantled the army, liberated the occupied areas, the

political power of the Emperor was deleted and the prime minister would be elected by parliament.

World War II wiped out many of the gains Japan had made since 1868. About 40% of the nation's industrial plants and infrastructure were destroyed, and **production reverted to levels of about fifteen years earlier**. The people were shocked by the devastation and swung into action. **New factories were equipped with the best modern machines**, giving Japan an initial **competitive advantage** over the victor states, which now had older factories. **As Japan's second period of economic development began, millions of former soldiers joined a well-disciplined and highly educated work force to rebuild Japan.**

Japan's highly acclaimed post war education system contributed strongly to the **modernizing process**. **The world's highest literacy rate and high education standards** were major reasons for Japan's success in achieving a technologically advanced economy. Japanese schools also encouraged discipline, another benefit in forming an **effective work force**.

4.1.3. Main factors of economic growth between 60s and 80s

Complex economic and institutional factors affected Japan's post-war growth. First, the nation's pre-war experience provided several important legacies. The Tokugawa period (1600–1867) bequeathed **a vital commercial sector in burgeoning urban centres**, a **relatively well-educated elite** (although one with limited knowledge of European science), a **sophisticated government bureaucracy**, **productive agriculture**, **a closely unified nation with highly developed financial and marketing systems**, and **a national infrastructure of roads**. The build-up of industry during the *Meiji period* to the point where Japan could vie for world power was an important prelude to post-war growth and provided a pool of experienced labour following World War II.

Second, and more important, was the level and quality of investment that persisted through the 1980s. **Investment in capital equipment**, which averaged more than 11% of *GNP* during the pre-war period, rose to about 20% of *GNP* during the 1950s and to more than 30% in the late 1960s and 1970s. During the **economic boom of the late 1980s**, the rate still hovered around 20%. Japanese businesses **imported the latest technologies** to develop the industrial base. As a **latecomer to modernization**, **Japan was able to avoid some of the trial and error earlier needed by other nations to develop industrial processes**. In the 1970s and 1980s, **Japan improved its industrial base through technology licensing, patent purchases, and imitation and improvement of**

foreign inventions. In the 1980s, industry stepped up its **research and development**, and many firms became famous for their **innovations and creativity.**

Japan's **labour force** contributed significantly to economic growth, not only because of its availability and literacy but also because of its **reasonable wage demands.** Before and immediately after World War II, the **transfer of numerous agricultural workers to modern industry** resulted in **rising productivity** and only **moderate wage increases.** As **population growth slowed and the nation became increasingly industrialized in the mid-1960s,** wages rose significantly. However, **labour union cooperation generally kept salary increases within the range of gains in productivity.**

High productivity growth played a key role in post-war economic growth. The highly skilled and educated labour force, extraordinary savings rates and accompanying levels of investment the low growth of Japan's labour force were major factors in the high rate of productivity growth.

The nation has also benefited from **economies of scale.** Although medium-sized and small enterprises generated much of the nation's employment, **large facilities were the most productive.** Many industrial enterprises consolidated **to form larger, more efficient units.** Before World War II, large holding companies formed wealth groups, or **zaibatsu,** which dominated most industry. The **zaibatsu** were dissolved after the war, but **keiretsu** (large, modern industrial enterprise groupings) emerged. The coordination of activities within these groupings and the integration of smaller subcontractors into the groups **enhanced industrial efficiency.**

Japanese corporations developed strategies that contributed to their immense growth. Growth-oriented corporations that took chances competed successfully. Product diversification became an essential ingredient of the growth patterns of many keiretsu. Japanese companies added plant and human capacity ahead of demand. **Seeking market share** rather than quick profit was another powerful strategy.

Finally, circumstances beyond Japan's direct control contributed to its success. International conflicts tended to stimulate the Japanese economy until the devastation at the end of World War II. The Russo-Japanese War (1904-5), World War (1914–18), the Korean War (1950–53), and the Second Indochina War (1954–75) brought economic booms to Japan. In addition, **benign treatment from the United States after World War II facilitated the nation's reconstruction and growth. (1)**

In **1952 Japan regained its sovereignty** after the signing of the Treaty of San Francisco and grew up economically with the help of the international community. Politically,

the Liberal Democratic Party, a conservative, was ruling on an almost uninterrupted during the war.

4.1.4. The economic recession in the 90s

After **successful years of continuous growth** mainly based on the rapid expansion of heavy manufacturing in such areas as automobiles, steel, shipbuilding, chemicals, and electronics and with the start of the *Heisei era*, Japan suffered an economic recession in the 1990s because it suffered an economic bubble mainly caused by the increased quantity of money for investment so speculation was inevitable. There were also changes in socially faced a **declining birth rate and rapidly aging population**.

4.1.5. Main points of the more than 10 years deflation

The economic problem that mainly fits Japan within last years of financial crisis can be summarized in five points:

1. The big deflation the economy of the world is suffering and the difficulty to recuperate the loans from the banks.
2. The serious worsening as regards regional economies.
3. The stagnation of the business system.
4. The decrease of the expense for the costumers.
5. The low efficiency and the lack of transparency in the government politics.

So, we can see again that Japanese problem nowadays come mainly for the speculative process that made increase economy and enlarged the bubble that Japan suffered. So they must as all the capitalist system increase their economy with a strategic and safety way acting for the future instead of searching easy and fast money with speculation.

4.1.6. Japan nowadays, deflation still persists

Since more than one decade Japanese economy is living a hard way of recuperation, years of uncertainly, macro indicators suffering sometimes growths and sometimes deflations, and aggressive changes in their political axis. All the best practices that all the governments have tried haven't succeeded as they thought. So, low bank interests, expansive fiscal politic and yen's fluctuation in changing rate, despite this Japan has had a short economic growth.

To sum up, in the early twenty-first century, Japan has begun to reform practices governing post-war society, the government and the economy, which adds a major policy change in 2009 with the arrival of the government of centre-left government. After that, **deflation still persists**.

4.2. Japanese behaviour

Before understanding how Japanese people are as regards of culture and personal behaviour is necessary to know the main aspects of their education. A traditional and hard **way of education**, stimulating competitiveness between students but without forgetting **team work** is the way to **overcome problems** and the daily life of everyone. As we have already seen in Japan the strict education helped to gain objectives as regards enhancing economy problems.

4.2.1. Education in Japan

Japanese education is the result of his history aiming to be better each day, this is based in four points which contribute in the basement of the interaction to build enterprises, to make them bigger, to work as a group and **to be very loyal**, and those are the followings:

- **Control**

All the **students receive the same education in all the country** and it is controlled by the government.

- **Competitiveness**

This is such important, **to increase the level of the education**.

- **Efficiency**

The ministry of Education of Japan distributes its limited budget to teach human resources important, strategy speaking, to **promote modernization and industrialization**.

- **Equity**

The **best students** of each class **can continue studying at university**, because their system is based only in the capacity of the person.

So after that points, it is necessary to say that one of the reasons of such productivity in live for the **Japanese** people is the **attitude** they assume in front of work, profession and in the live in general.

They **thing in positive**, always in **positive aspects**, so they are guide after this kind of education by some premises in works ways and in live that let them gain whatever they want.

This is why, **Japan always enhance itself after crisis**. So the following are the basement of them behaviour at work and in live.

4.2.2. Japanese behaviour at work

The first stage is that **Labour and Management** accepts them because they have **interests interlinked**.

The second stage is the **investment in human resources**, such as job training and horizontal information structure which makes the work environment much relaxed and productive.

The **absence of resistance** to change is one of the main points in the Japanese behaviour, and perhaps one of the reasons is the relationships between labour and management because they work as a coalition. And also another good reason may be that labour is almost never fired. Thereby, if there is some financial tension people accept decrease their salaries. Therefore, it helps to enhance the enterprise way.

The **cooperation and work-group morale** is a fact that has been provided by the hard education that Japanese people have been received in their early years. Thereby, members of the organization feel that they have an obligation beyond the simple exchange of labour for salary.

Changing the incentive structure solves problems that big companies has. So first, it is necessary to encourage employees to **stay with the firm for the long-term**, in order for them to acquire the contextual skills necessary to become a part of the company culture. Second, Japanese firms need to promote **productive co-operative behaviour in team production**.

One of the main strengths of what the Japanese firm is that **normal size centralization** is made superfluous by localized problem solving. Somebody says "If **teamwork** is lacking in the middle management of a Japanese company, then all the disputes will be passed to the corporate office for resolution". This principle appears valid for **all levels of the organization**, and workers therefore expect to be informed and **involved in decision making**. If, on the other hand, management ignores them, passive and active resistance within the organization is likely to arise.

The **paternal organization** is the concept that Japanese people follow. The great majority of the workers of a company assure that if some other and more successful company give them

work they are not going to retire from the first company, because workers consider their company to be more than merely an employer. They also think that **the company is a part of them life** at least equal important to their personal life. So this way of act is brought from the Confucianism and their old culture.

After that short introduction of Japanese behaviour at work and gaining access to their mentality I am going to introduce 10 items that distinguish Japanese Management Practices, in the manufacturing way. It is important to see the difference between the Western view and the Eastern one.

4.2.2.1. Market first

- From the beginning, the Japanese are export minded
- They learn from their markets and their customer, and how the market is changing

4.2.2.2. Long term commitment

- Relationships are critical to good business. Trust is more important than contracts, receipts and law courts
- Learning information and know-how accumulation
- Stability and flexibility especially with customers, suppliers, employees and investors
- The Japanese spend much more time up front with a potential customer or supplier before making a commitment

4.2.2.3. Training and education

- Job training is really important in Japan because they spend much of the working live in the same company
- There are meetings with all the parts of the organization in different levels and between them just to know more about the knowledge of each other
- It is believed that when they have a job, then it starts their education

4.2.2.4. Get in touch, learning from facts

- They accept a mix between employees and managers. So engineers do not make too much distinction wearing fancy clothes. An insight in Japan is that neighbourhoods are less stratified in terms of economic class
- They learn from facts, because engineers are well communicated because they live the production problems as the workers because they are close to the problems

- There is something that makes Japanese special. They are world class at copying and improving upon an idea, but would be smart to develop their creativity

4.2.2.5. Effort evaluation

- They are focused on process improving, consequently on results. So once they know how to do something, they work on small improvements, they evaluate the effort not results
- The best way is to improve the process, which leads to results
- In time, Japan will become more results focuses, and more creative. But they will not change the focus on a human organization

4.2.2.6. Customer first and shareholder last

- This is a huge different between the Western and Japanese concepts because the priority order of a Western company to make the shareholders happy, to satisfy the customer and the employee and so on until shareholder in the last position
- The Japanese firm is organized for the employee. It is a more human orientation

4.2.2.7. Team work

- It means to help others, in every case. It means as well that the processes are designed to implicate more than two people working together
- In Japan team leader is always asking team members to help more, instead of being the responsible for the company results

4.2.2.8. Flexibility

- The idea is to transfer the knowledge of management and the know-how of the company to the employees aiming a bit of knowledge in everyone which it may be useful if the worker change its working place
- Japanese take the long range view, and ask how long can you wait. Though, which sometimes it takes too much time to make decisions

4.2.2.9. Quality first, cost last

- Profit is the result of the pursuit of quality as quality improves, costs go down
 - Quality includes products, services, machines, layout, policy, planning and organization
- (2)

4.2.2.10. Learn from the best (Benchmarking)

- They always look at someone better. The only problem is that when you are the best you must be creative and this is a problem for Japan, it is their challenge
- They must learn the following things:
 - i. Improve their lack of decisiveness. They are not transparent and decisions can take too much time
 - ii. They ignore individual ability; as a result, they obtain lack of creativity
 - iii. Strategic opportunities: too much delay and time

Meanings of several basic terms in management

First, it is important to clarify some terms that are used indiscriminately to define ideas similar but not identical. We refer to the terms Method, Methodology, Project, and even System Plan. It is curious that we all know clearly discern their meanings and differences between them from a linguistic point of view, but as we use in business jargon, the mix, trade and substitute as true synonyms, so we should stop at least once to review their meanings³:

- **Management** means, in all business areas and organizational activities are the acts of getting people together to accomplish desired goals and objectives efficiently and effectively. Management comprises planning, organizing, staffing, leading and or directing, and controlling and organization (a group of one or more people or entities) or effort for the purpose of accomplishing a goal
- **Method** means an ordered set of operations with which we want to get a result
- **Methodology** is the study of the methods considered in them
- **Project** is the intention of achieving a goal and the plan is devised to achieve this
- **System** is a set of rules and procedures on a particular matter
- **Plan** means the action to regulate and manage the aspects of a project
- **Effectiveness** means to do things right
- **Efficiency** means to do right things.

³ According to the *Laurosse encyclopaedia*

5. Lean Management (LM) as the basic idea

5.1. What is LM?

Lean Management especially focused in Manufacturing is a comprehensive concept one of the biggest concepts that JM has brought to the world of management and business. The main idea is to produce just what's need and to produce it with the maximum of benefit possible. It is directly related with aiming to eliminate waste. Basically it means, obtaining the correct things in the right place, in the needed time, minimizing waste, being flexible and being prepared for change. But the aim of lean management is to change the current situation of a company, to make it more competitive, reducing costs and adding value at the same time. (3)

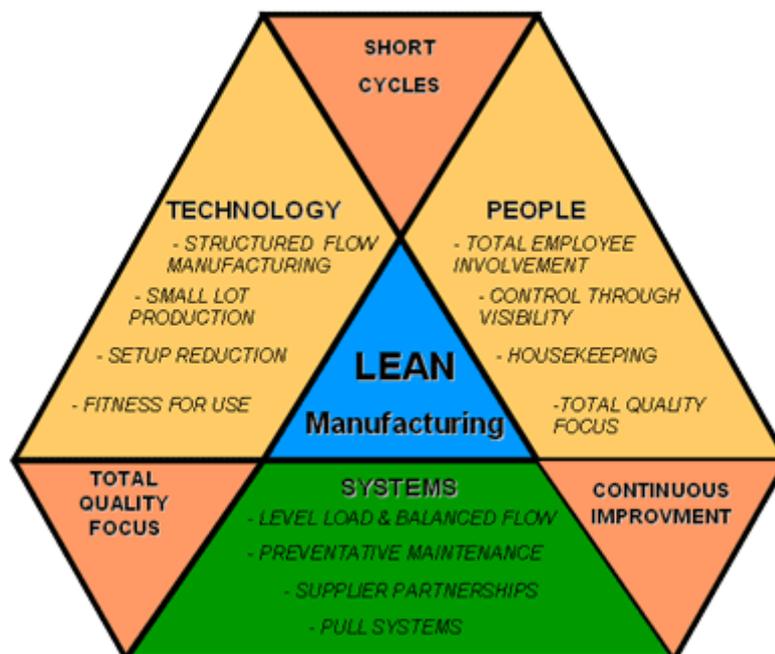


Figure 5.1: Lean management connections and main issues

Source: Buker, Inc Management Education and Consulting (*Buker.com*)

It is to be seen that Lean Manufacturing is a management philosophy of work that believes eliminating waste, quality improves, and production time and cost decrease as we can see in the (Figure 5.1) it's related the major concepts of it. By the way, it is not easy to show all the tools this philosophy use but most of them are going to be mentioned in the following chapters, but to make some known reference, those are Kaizen (continuous improvement),

pull production system instead of push production, *Kanban*, Just In Time, TQM, 'Pokayoke' which means that systems and process in the company are mistake resistant and so on. (4)

The main points of Lean Manufacturing (LM) are:

1. **Minimizing waste** basically eliminate everything that doesn't add profit to the final product, and optimize the use of limited resources such as people, money, space, and so on.
2. **Pull system (JIT)**, it means that all the supply chain must be prepared to produced at the time what clients want when they want it. It is much easier because you do not need forecast if you produced what clients want. Zero inventory (raw material, finished products).
3. **Continuous improvement (Kaizen)**, reducing costs, increasing quality and production and also sharing information.
4. **Quality at the first time**, searching zero defects, finding the reasons and solving the problem in its origin.
5. Building and maintaining a good and **long relationship with the suppliers** getting agreements to share risks, costs and information. Sometimes common development.

From now and over it is explained how it is easier to implement the Lean Manufacturing system in every company. First of all, we are going to talk about the elimination of waste, which is in my opinion the easiest thing to do, after that we are going to show how Just In Time works and what are the main points of it, and we will see that most of all the concepts are closely related, third we will see Kaizen and then 5S but let's think before about that point, because It is believed that by reducing waste directly enterprise's areas become much better and provide more benefits. But, what do we have to reduce?

5.2. First concept: elimination of wastes

Muda is a Japanese term which means waste, everything that doesn't add value to the final product. And the Japanese has organized in seven wastes.

As I am going to explain later, Toyota, one of the precursors of those concepts explain that use three “Mu-” words as part of the Toyota Production System⁴ (TPS), *Muda*, *Mura*, and *Muri*. Each of these is a type of waste and instantly recognized by the Japanese as part of a business improvement initiative.

Eliminating waste is the way to reduce the costs and hence improving profit, this is the aim of lean manufacturing, and the benefits of lean manufacturing can be very significant if implemented correctly and sustainably. It is also say that typically, less than 5% of activity is value adding.

The following are shown in the (Figure 5.2):

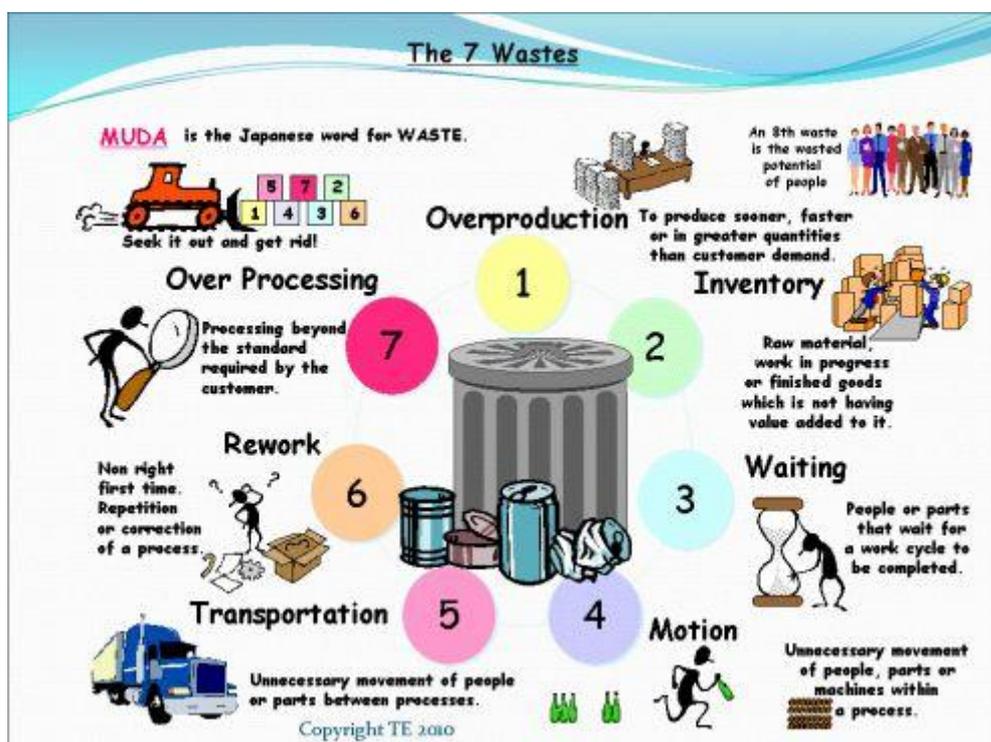


Figure 5.2: The 7 Wastes

Source: *HubPages.com*

⁴ This is explained in the section 5.6 Toyota Production System (TPS).

5.2.1. Eliminate the seven kind of wastes

5.2.1.1. Overproduction

Overproduction happens each time engaged more resources than needed to deliver to customer. For instance, large batch production, because of long change over time, exceeds the strict quantity ordered by the customer. For productivity improvement, operators are required to produce more than the customer needs. Extra parts will be stored and not sold. Overproduction is the worst kind of waste because it hides or generates all others, especially inventory. Overproduction increases the amount of space needed for storing raw material as well as finished goods. It also requires a preservation system.

Mainly it is caused by:

- Large batch sizes
- Unreliable process
- Unstable schedules
- Unbalanced cells or departments
- Forecast on inaccurate information which means work without actual demand

5.2.1.2. Inventory

Inventory, can be either in raw materials form, *work-in-progress* (WIP), or finished goods, and it represents a capital outlay that has not yet produced an income either by the producer or for the consumer. Any of these three items not being actively processed to add value is waste.

Excess of inventory is caused by:

- Unreliable supplier/s
- Lack of balance in work flow, forcing inventory build-up between process
- Large batch sizes
- Failure to observe *First In First Out* (FIFO) stagnant materials
- Incapable process
- Long changeover time
- Not adhering to procedures

5.2.1.3. Waiting

Whenever goods are not in transport or being processed, they are waiting. In traditional processes, a large part of an individual product's life is spent waiting to be worked on.

Waiting results from:

- Poor coordination between man and machine
- Long changeovers
- Unreliable process affecting quality
- Batch completion, not single piece transfer between operations
- Time required to perform rework

5.2.1.4. Motion

As compared to Transportation, Motion refers to the producer, worker or equipment. This has significance to damage, wear and safety. It also includes the fixed assets and expenses incurred in the production.

Wasteful motion is caused by:

- Poor workstation layout excessive walking, bending reaching
- Poor method design such as too much transferring parts from one to another
- Poor workplace organization
- Large batch sizes
- Reorientation of materials

5.2.1.5. Unnecessary transportation

Each time a product is moved it stands the risk of being damaged, lost, delayed, and so on and it is as well a cost which is no added value. Transportation does not make any transformation to the product that the consumer is supposed to pay for.

Excess transportation may be caused by:

- Poor layouts → large distance between operations
- Lengthy, or complex material handling systems
- Large batch sizes
- Working to faster rate than customer demand (overproduction)

- Multiple storage locations

5.2.1.6. Defects

Whenever defects occur, extra costs are incurred reworking the part, rescheduling production, and so on. By the way, exists tools to avoid defects having, such as 6-Sigma.

Defects are caused by:

- Hidden failure of raw material
- Inadequate training
- Poor choice of skills
- Incapable process (general; special machines, tools)
- Incapable suppliers
- Operator error
- Excessive stock
- Transportation (damage, pilferage)

5.2.1.7. Over-processing

Over-processing occurs any time more work is done on a piece than what is required by the customer. This also includes using tools that are more precise, complex, or expensive than absolutely required.

Is caused by:

- No standardization of best techniques
- Unclear specification and unclear quality acceptance standards
- No optimization between production and customer demand (such us stricter tolerance than necessary)

An easy way to remember the 7 wastes is **TIMWOOD**.

T: Transportation, I: Inventory, M: Motion, W: Wait, O: Over-processing, O: Over-production, D: Defect.

After the 7 wastes or *Mudas* it is necessary to talk about JIT (*Just In Time*) because it has been one of the most powerful tool implemented in Japan.

5.3. Second concept: Just in time (JIT)

5.3.1. What is Just in Time?

Just in time, is a system which allows arise productivity in factories. It allows reducing costs in management and keeping too many stocks in warehouses. So, in that way factories don't produce by forecasts, but they produce by real purchase order. *Just in Time* means making only "*what is needed, when it is needed, and in the amount needed.*"

Just in time indicates a work philosophy which means that raw materials and the products arrive just in time, either for manufacturing or customer service.

The JIT approach explains much of the current success of Japanese companies, large precursor. Their bases are the reduction of wastage, and everything that is not needed at the precise moment capacity mattresses, large batches stored in inventory, and so on. Thus, the first thing we notice is the substantial reduction in inventory costs, leading to better production, better quality and greater ease of management. As I have explained the point before.

However, we can't study the JIT system as a package, but we must study it as a philosophy, as it not only affects the production process, but also directly over the staff, working methods, suppliers, etc. This philosophy is mainly based on two phrases that sum up their goals, "**the habit of getting better**" and the "**elimination of costs consuming practices.**"

5.3.2. The birth of Just in Time

Just in time was born in Japan, where it was charged by the car manufacturer Toyota who started to use in the early 50's and the main purpose of this system was to eliminate all unnecessary items in the area of production (including from the department purchases of raw materials to customer service, through human resources, finance, etc..) and was used to achieve cost reductions and never imagined meeting the needs of customers the lowest possible costs as discussed in the chapter before. In a small nation like Japan, one of the greatest assets is undoubtedly the physical space. Therefore, one of the pillars of the new philosophy was precisely the space-saving, waste disposal and, in conclusion, removing the burden of the existence of inventory. It means costs saving at the same time.

From the eighties and due to favourable economic conditions and labour many companies are developing similar products manufactured by different companies, thus reducing the

market share and, therefore, profits. The companies would be larger than its competitors, and what should be on those aspects that no one before had thought. Japanese companies were the first to focus its products and innovations in this direction. To do this, they must be the best in innovation of new products, but also had to be the fastest, to prevent competition reduced profit margins. But impeded technological advancement to increase the time difference since launching the new product until the competitors "reproduced." Therefore, they should find a new method to continue to innovate but increasing the profit margin. And precisely this is the philosophy of innovation that we are dealing with: The JIT. Quickly, the companies that implemented, all Japanese, were able to solve two problems at once: the lack of physical space and maximizing profit, **"Inventory reduction and elimination of cost consuming practices."**

Many Western companies have not yet implemented the JIT system yet. The reason is that the different lifestyles of both blocks, methodical life traditional Japanese life against liberal Western countries. And above all, the difference is that in Europe, the company is the workplace for most, losing ties after work hours. In Japan, however, the company is a part of life very important in Japan worker's life, going so far as to identify fully with the problems of the company, making them as their own and trying to resolve for the benefit of all before the benefit. If we take this as a starting point, we can appreciate the reasons for the difficulties of implementing a Japanese production system in a Western country. We are going to see them in the JM application⁵.

5.3.3. How to implement the system "Just in Time"?

We must start from the premise that the JIT is not only a productive method, but a philosophy, and therefore should not be implanted, but must be taught and who should show their strengths and weaknesses, so that the workers learn this philosophy on its own initiative, and taxation.

It is successful, and the views are the results, the adoption of JIT in a company involves a radical change in the way of seeing the company so as to understand it. All rules and routines and set raisins to obsolescence, since, for instance, JIT requires the elimination of excessive costs characteristic of large installations. And this becomes a factor in the rejection of the JIT, because not all firms are flexible enough to embrace the changes that the JIT needs. Therefore, there are many excuses that Western companies alleged to reject the JIT.

⁵ Difficulties found with the JM application, section (6. *Japanese Management Application*)

But they all have a coherent explanation and it may come to clarify the ideas for many companies.

Getting a good rate of return depends on good implementation of five phases which are essential for this are:

- 1. Put the system into production**
- 2. Education**
- 3. Process improvements**
- 4. Control improvements**
- 5. Expanding the supplier and customer relationship**

1. The first phase involves setting up a base on which to build the implementation. Since the implementation of JIT involves changing attitudes within a company, the first phase establishes the overall tone of the application. It includes some initial education, the cost-benefit analysis, and identification of a pilot plant. But perhaps the most important factor for implementation is to get commitment from top management. Without this commitment, the implementation to be much more difficult, as it inevitably will have specific points to make difficult decisions
2. Once the first phase it is done it can begins the task of education. The fact that this phase is called the point at which it is or leaves, it indicates its importance. A good implementation of JIT requires changing attitudes often deeply rooted
3. After running the education program, you can change the processes
4. The fourth is to achieve improvements in production control. These improvements include the use of mini mills with flow lines to simplify control problems and the use of pull systems such as *Kanban*⁶ to pull work through the production system
5. The final phase, which could be the first to find reliable suppliers. To create a reliable supplier chain is the basic of JIT. The suppliers have to be ready to deliver the ordered volume any time, such a system ensures to satisfy the changing demand of the market. It means a flexible production method. Workers sometimes have not to work if the market actually does not need their company products. However workers will not be fired. Managers reduce their own salary during the recession. In case the market needs again their products the works make overtime without deliberately. The expansion of supplier and customer relationship completes the implementation of JIT. This phase includes

⁶ It is explained in the glossary

suppliers and customers in a JIT system covering the entire production process, from suppliers, through the company until customers. This last phase will be discussed later.

These five stages form the basis of the implementation of JIT have been tested many times in practice and form the core of the implementation plan.

5.3.4. Principles of JIT

5.3.4.1. Attack the fundamental problems

Japanese culture love to use images to represent concepts. To describe the first goal of the JIT philosophy, attacking the fundamental problems, the Japanese used the analogy of the river of the stockpiles and it is reflected in (Figure 5.3). (5)

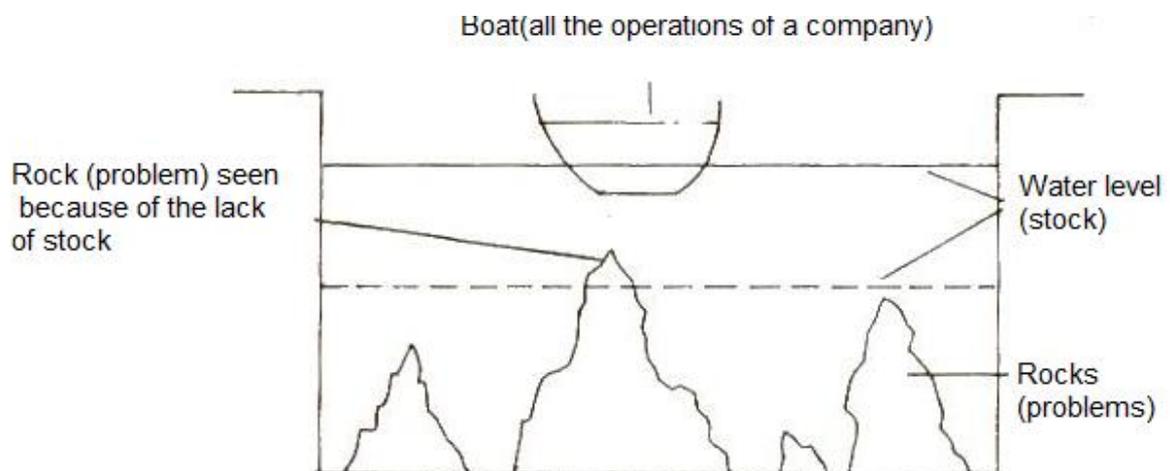


Figure 5.3: River of the stockpiles

Source: Own source

The river level is the stock and the company's operations are displayed as a boat sailing upstream and downstream. When a company tries to lower the river level (in other words, reduce inventory levels) discovers rock, it means, problems. Until quite recently, when these problems arose in companies in Western countries the response was to increase the stock to cover the problem.

A typical example of this type of problem would be that of a plant that had an unreliable machine to supply parts to other, more reliable, and the typical response to the West would maintain a large safety stock between the two machines to ensure that the second machine did not lack work. Instead, the **JIT philosophy states that when there are problems we must face and resolve them, the rocks must be removed from river bed**. The level of inventories can then be reduced gradually to discover another problem and this problem would also be resolved, and so on. For unreliable machine, the JIT philosophy tell us that we had **to solve the problem**, either with a preventive maintenance program that will improve the reliability of the machine or, if it fails, buying a more reliable machine, the (Figure 5.4) illustrates the difference between the traditional Western approach and the JIT.

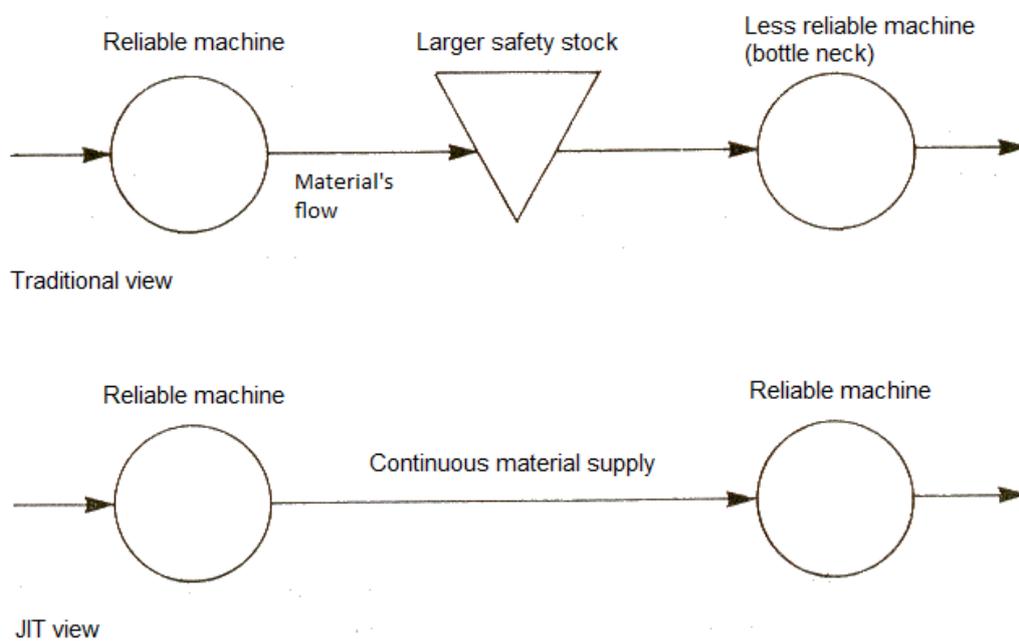


Figure 5.4: Non reliable machine's view and difference between Western and JIT

Source: Own source

When a machine or process which forms a bottleneck, one of the traditional Western approaches has been trying to get a better and more complex programming (using, for example, the MRP II) to ensure they never run out of work, reducing and the effect of the bottleneck. The consequences of these policies have often been disappointing, the objectives in terms of stock turnover, which is a good measure of efficiency, were lower in Western countries in Japan, and what is more, these objectives regarding the rotation of stocks have been rising faster in Japan than in Western countries. The JIT approach to a

machine or process which constitutes a bottleneck is, however, reduce the preparation time for higher capacity machines or find alternative processes, purchase additional capacity or outsource the work too much. A JIT management acknowledges that neither increased security nor a stock of more complex programming solve the fundamental problem, all it do is hide the problems temporarily.

When a manager JIT notes that cycle times are so long, trying to identify the main problems that cause them. Not content with trying to speed up some orders, but you will want to find out why the manufacturing lead times are so long. In my experience⁷, long production times are the result of several factors, including machines or processes that cause bottlenecks, lack of reliability of machines, poor quality control (which requires the reprocessing of items that do not meet the levels quality - a very expensive activity), and lack of control at the factory. Resolving these problems can gradually reduce production times.

5.3.4.2. Waste disposal

The second goal of the JIT philosophy can be expressed by a sentence frequently used in Japanese factories more efficient, **eliminate waste**, in this context means anything that does not add value to the product. Examples of operations that add values are the processes how to cut metal, welding, insert electronic components, etc. Examples of non-value adding operations are inspection, transportation, storage, preparation. Let's take the case of inspection and quality control as examples. The traditional Western approach is to have inspectors strategically placed to examine the parts and, if necessary, intercept. This entails certain disadvantages, including the time it takes to inspect parts and the fact that inspectors often find bugs when you have already made a whole lot, which is to reprocess the entire batch or disposal, too very expensive solutions. The JIT approach is to eliminate the need for independent inspection phase, focusing on two issues:

First, **doing it right the first time**. Since getting high quality products not normally more expensive to manufacture low-quality products, all you need is a concerted effort to purge the trends that favour the appearance of defects.

Secondly, **ensuring that the operator assumes the responsibility for controlling the process** and carry out the necessary corrective measures, providing some guidelines that you should try to achieve. There are many check points along the productions process.

⁷ I have been working in *Schneider Electric* during 6 months: (Section 5.5.6. Personal experience)

If we compare the traditional Western approach of inspection and quality control with the JIT method, we see that the Western approach is to determine upper and lower limits (tolerances) and whether the measures fall outside these two limits, the product is discarded or reprocessed. Instead, the JIT approach is to reduce the deviation from the ideal nominal, not tolerate any deviation from nominal⁸. In addition, the JIT transfers the responsibility to detect and correct deviations from the operators to carry out the processes. They are expected to do it right the first time and prevent products that deviate too much from the nominal. These are the essential features of statistical quality control⁹. The storage of stocks is another example of an inefficient activity. The real cost of inventory is twofold. The first cost is, of course, the direct cost in terms of capital and storage costs and the risk that stocks will become obsolete, as I have explain before. Many companies in the West have assumed that the cost of inventory is between 20 and 30 per cent a year. The second cost, which in the traditional Western companies have overlooked is that hidden stocks problems, linked to the JIT philosophy of gradually reducing inventory levels and present problems.

At first, some managers contemplating this idea with some concern because they thought it was good that the problem remained hidden, and that once exposed the problem had to do something about it. If providers do not provide the components or raw materials on time and with good quality, large safety stock of components or raw materials will keep the problem hidden. This is not a satisfactory solution. The safety stock is expensive, takes up space and may become obsolete. In addition, there are costs associated with the return form (if the quality is bad) or claim the order (if not delivered on time). More frequent and reliable supply can reduce safety stocks and costs.

Eliminate all activities that add no value to the product reduces costs, improves quality, reduces production times and increases the level of customer service. Indirectly, of course, it can also increase sales. Eliminate wasteful involves much more than a single effort once and for all. Requires a constant struggle to gradually increase the efficiency of the organization and requires the collaboration of a large proportion of the workforce of the company. If we want the policy to be effective cannot be left to a “committee” for the elimination of wastage, but it has to reach every corner of operations of the company, and it will only be effective if employees fully understand concepts and if they carried out any measures to implement the strategy for elimination of waste. But the way to

⁸ 6-Sigma philosophy

⁹ TQM (*Total Quality Management*)

do it, is to involve full participation of the majority of employees and in this way and with supervisors and managers training in JIT, this system will receive unconditional support.

Not to forget a Japanese worker do not start with work if not all conditions are ready to produce correct work piece.

5.3.4.3. Simple solutions

The third objective of the JIT philosophy is to seek **simple solutions**. Approaches to manufacturing management, part of the lean management, that were fashionable during the seventies and early eighties were based on the premise that the complexity was inevitable. And at first glance seems to be true. A typical batch manufacturer may have several hundred lots in the different processes simultaneously. Probably every item involves a certain amount of independent operations and likely will go through most of the departments of the factory. Operate a system of this kind is extremely complex because the interactions between different jobs and the need for other resources, often overwhelming to most managers. The JIT puts much emphasis on the search for simplicity, on the grounds that it is very likely to involve simple approaches more effective management. The first leg of the journey towards simplicity covers two areas: **material flow and control**.

A simple approach to the flow of material is to **eliminate complex routes** and seek more direct flow lines, if possible unidirectional. Most manufacturing plants based on lots are organized by what might be called a provision processes. (Figure 5.5) is an example. Such a factory is very flexible to satisfy the varying market demand (storage and volume) even in small lots.

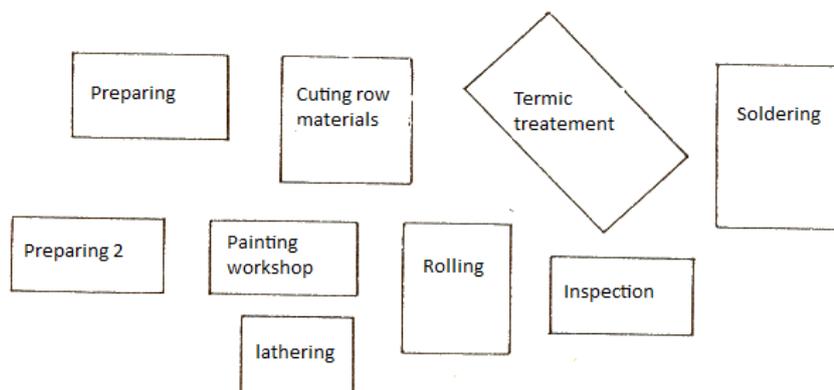


Figure 5.5: Typical layout approached in process (called process layout)

Source: Own source

Most of the articles produced in this factory instance follow a circuitous route from, for example, cutting raw materials to the lathe, then the boring, welding, rolling, heat treatment, grinding and the workshop paint. Normally, each process involves a considerable amount of time expected to be added to the time spent in transporting items from one process to another. The consequences are well known, a lot of work in progress and manufacturing lead times. The problems involved in trying to plan and control a plant of this type are enormous, and the typical symptoms are that the overdue items hastily passed by the factory while others that are not needed immediately because of the cancellation of an order or a change in estimates, stop and get stuck in the factory. These symptoms have little to do with the effectiveness of management. No matter how good a director, have trouble controlling this system. The philosophy of simplicity of JIT factory examines the complex and start building on that very little can be achieved by placing a complex control over a factory complex. Instead, the JIT emphasizes the need to simplify the complexity of the factory and take a simple set of controls.

The main method of getting a single flow of material in the factory is to group products into families, using the ideas behind the group technology and reorganizing the processes so that each family of products are manufactured in a flow line. (Figure 5.6) shows an ideal case, but generally, the flow line often takes the form of U. Thus, the elements of each product family can move from one process to another more easily, since the processes are located adjacently. This can reduce the amount of work in progress and the lead time of manufacture.

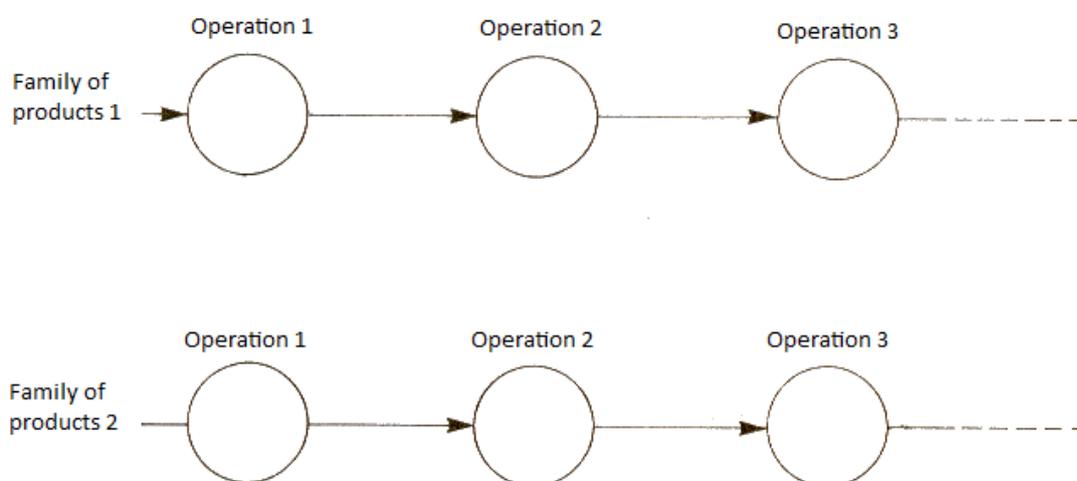


Figure 5.6: Workplace situated using flow lines (called Product Layout)

Source: Own source

With these small flow lines already laid, there is also other advantages. For example, management is much easier than in the case of the provision process, as each line of flow is largely independent. There may be a deputy head of each flow line. Furthermore, the quality tends to improve, given the decline in the panic because there is less urgent requests, you can spend more time solving the problems of quality.

The simplicity of JIT philosophy also applied to the flow of goods, it also applies to controlling these flow lines. Instead of using a complex control, the JIT puts more emphasis on a **simple control**. An example is the system drive called *Kanban*. Far from conventional control approaches, as the driving systems *Kanban* trail work.

Complex control systems are systems that push in the sense that what is planned to manufacture, which is then pushed through the factory. It is assumed that bottlenecks and other problems are detected in advance and are installed complexes control systems to report the changes so they can take corrective measures. Instead, the JIT approach that using the drive system *Kanban* eliminates the complex set of data flows, since it is essentially in its original form, a manual system. After completing the work of the last operation, a signal is sent to the above operation to inform you that should make more items, when this process is without work, in turn, sends the signal to its predecessor, and so on. This process continues to shrink the entire flow line as shown in (Figure 5.7).

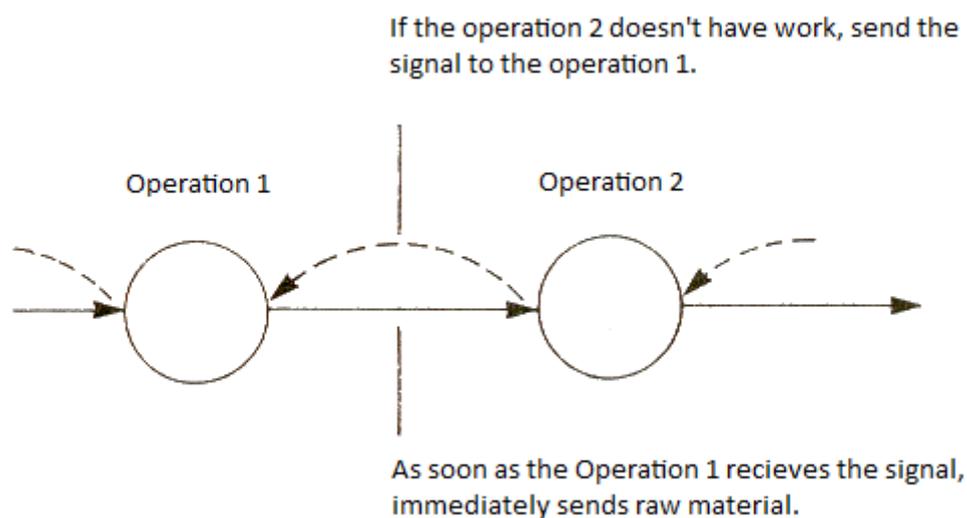


Figure 5.7: Pull system's diagram (assembly line)

Source: Own source

Thus, the work is dragged through the factory. It failure to work out the final operation not send signals to the preceding operations and therefore do not work. This is the main

difference from previous approaches to control of materials. If demand decreases, staff and machinery do not produce goods. JIT advocates suggest that perform other tasks such as cleaning the machinery, make adjustments and see if they require maintenance, etc. In fact, the traditional view that the main priority was to keep the machines and personnel in service, even at the cost of manufacturing items that only help increase a stock and inflated and increase the percentage of waste. The JIT approach, based on the use of drag-type systems, ensures that production does not exceed the immediate needs, reducing the current product and inventory levels while decreasing production times. And the time that would otherwise be spent on unproductive eliminate sources of potential problems through a preventive maintenance program. Getting the right environment for this to happen requires a comprehensive program of education, training and communication.

The complete assembly line developed from these product systems in case of big lots. Assembly lines are typical in Japan; they are less flexible than in process layout. The changeover time is high but Toyota needs just 30 minutes.

Evidence from Western manufacturers have carried out a program of this type shows encouraging results in reducing production times and unproductive periods of machinery. It also increases the morale. The main advantages to be gained from the use of JIT type drag systems (*Kanban*) are:

Main advantages:

- Reducing the amount of work in progress
- Reducing inventory levels
- Reduced manufacturing lead times
- Identifying areas that create bottlenecks
- Identification of quality problems
- Simple management
- Finding the reasons of problems

We have already spoken about the first three advantages, which include **reducing the amount of work in progress, inventory levels and production deadlines**. The original *Kanban* system in Toyota factory in Japan get a stock turnover of 80 compared with the average of Western companies is 3-4. Although one must be careful when comparing the Toyota line to other companies, they showed the amazing benefits that such systems can provide. One of the main advantages is that they **simplify the management of manufacturing system**. The driving systems work by themselves and need a complex

computer control is much lower. The workflow is determined by the limitations of the system and not what comes out of a computer. If, for example, creates a bottleneck in one area will also decrease the activity of the above processes to prevent the accumulation of work before bottleneck. The improvements associated with a drive system appear gradually. It seems to work better if the system is first applied to very long queues in front of each process and the level of the river (in progress) decreases slowly to reduce production times. Probably the improvements will be slow, but will also be continuous.

It is often assumed that the driving systems *Kanban* can be used only when there is little variety of products and little change in demand. However, many companies are using drive systems *Kanban* adapted when there are no such conditions. The fact that drag systems *Kanban* identify bottlenecks and other problems in the West was considered at first as a disadvantage. Well, as noted above, the aim of JIT is to solve the fundamental problems and this can only be achieved if problems are identified.

On the other hand, as regards to my experience in JM (*section 6.*) I have not tried to apply this pulling system yet, because implementing lean manufacturing tools such as JIT needs time so as it is discussed later the enterprise's implementing plan it is already in the primary phase.

5.3.4.4. Establish systems to identify problems

The fourth point of the philosophy of JIT is to establish systems to identify problems. We have seen how the driving systems *Kanban* take the problems to light. Another example is the use of *total quality control (TQM)* to help identify the source of the problem. With JIT, any system that identifies problems are considered beneficial and any system that mask pernicious. Drive systems *Kanban* identify problems and therefore beneficial. Traditional previous approaches tended to hide fundamental problems and thereby delay or prevent the solution. Most manufacturing systems had other problems: unreliable suppliers, lack of quality and bottleneck processes, etc.

Systems designed with the implementation of JIT should think of ways that trigger some sort of warning when a problem arises. The line operates with a certain efficiency level, a problem occurs, the line stops and the problem is identified, corrective action is taken and put back up the line. As we faced with the problem has been solved partially or completely, it is unlikely that this line has the same problem again, thus increasing efficiency. This is reflected on the diagram (Figure 5.8) where one can easily see that the approach works through the gradual accumulation of a series of small increases in efficiency. We can use any of these ideas in

any JIT system we design. The goal is not only decrease the amount of work in progress and manufacturing lead times but also to identify problems as soon as possible to force managers to take corrective action.

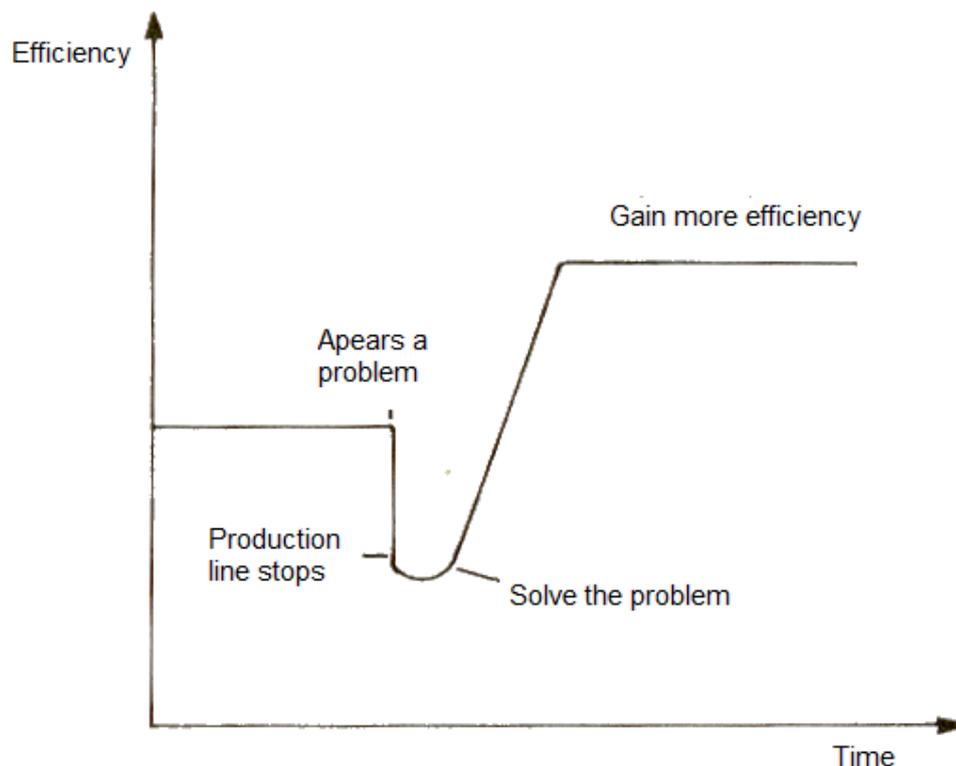


Figure 5.8: Gradual efficiency increase by solving problems as soon as they appear.

Source: Own source

For example, if we have a process with a bottleneck, clever programming can alleviate the symptoms, but will never solve the problem. In fact, a more complex programming simply takes a detour at the expense of, for example, rescheduling works with other processes that are less profitable. And what is worse, it serves to hide the problem, since a manager may be able to schedule a factory with several bottlenecks without having acknowledged that their operation has several inherent problems that should be identified and resolved. To identify a problem in an appropriate manner, a manager should be willing to pay the price in the form of small setbacks. If you really want to seriously implement JIT have to do two things:

- **Establish mechanisms to identify problems**
- **Be willing to accept a reduction in short-term efficiency in order to obtain a long-term advantage**

The difference between a traditional and typical JIT application is great. The low level of work in progress in the successful implementation of JIT factory gives a tidy appearance, almost deserted. You can also see an increase of moral and dedicated atmosphere. It is possible that many managers consider in principle the need to develop systems to identify problems is a potential disadvantage. However, experience shows that if these systems are created and if problems are solved (the first aspect of the JIT philosophy) can significantly improve the performance of the company.

5.3.5. Cost – Benefit of the implementation of JIT

Conventional approaches to control the manufacture and *MRP I* require large capital investments. In contrast, JIT requires very little capital investment. What is needed is a reorientation of individuals with regard to their tasks.

With the implementation of JIT, all expenses are mainly involved training costs. The staff of a company must be aware of the philosophy behind JIT and how it affects this philosophy in its own function. We must also remember that the JIT should **not be considered a short term** concept. The JIT is a progressive campaign that seeks continuous improvement. We must also bear in mind that the JIT not only reduces the stock, it increases the quality, customer service and general morale of the company. Everything shows that the JIT can be very profitable, with the only condition that the application is well planned.

5.3.6. Provider – Customer relationship

Relationships with both suppliers and customers are important because they expand the scope of reducing costs and give greater impetus to quality improvement. First of all suppliers should have the responsibility to deliver raw material of components of high quality in time. This way the final product will be of better quality.

The savings can be large. Recent research indicates the material costs are 51 per cent of total costs, while labour costs represent only 15 per cent at Western companies. The cost of labour as a percentage of the total cost tends to decrease (in many sectors, the labour costs are below 10 per cent), while material costs are increasing. Technologies such as automation and robotics have reduced labour costs and many companies are making major investments that will further reduce.

Instead, companies are only beginning to examine what can significantly reduce material costs. Researchers want to find replacing cheaper material or man or manmade material or

with new technology reduce the needed material volume or cut wastes. And zero inventories reduce significantly the material costs.

5.3.7. Links to suppliers

Suppliers should have the willing to deliver any time raw materials or elements to ensure the possibility of continuous manufacturing of the product choice the assembling company

In the relationship to suppliers, a way to eliminate waste, in the form of surplus stocks is to **reduce the quantities of orders** and this will reduce the time spent in the stores and at the same time the tied capital. Reducing the quantities of orders is an aspect of JIT applies to suppliers, but you have to make some changes to make it possible: Minimize the bureaucracy, exact delivery and simple inventory management.

By reducing the quantity of orders they increase, so can only be profitable if we change some of the mechanism of supply. Less paperwork is possible by each supplier delivers directly to the plant. It is often said, that the stock instead of in a warehouse is rolling on road or on railways.

When the items arrive at the plant, is to simplify the management of stock items to arrive so quickly to production areas. This means reducing the inspection and inventory of inputs. These important changes in procedure are offset by quality improvements. For example, eliminate the need for incoming inspection. The simplification of bureaucracy and management of stocks, together with the supply chain are some of the changes necessary to facilitate linkages with the JIT supplier. The main requirements for links with JIT suppliers are:

- **High quality from the supplier (cooperation with the assembly company)**
- **Optimum quantities of orders**
- **Shorter cycle times and more reliable delivery**

Thus, it helps to decrease inventory levels and uncertainty on the source of cycle times. If we can be sure that the provider will deliver high quality products on time, we can reduce the safety stock, coupled with the need to inspect the products received, and there will be no interruption of production due to poor quality items or delays in deliveries. But this way of thinking is mainly focused in enterprisers which make products not services.

5.3.8. Several vendors or a single provider

Until now, normally most of the major manufacturers do have buying components from several vendors. This means that several vendors make the same piece, this way they complete with each other. The advantages are increased reliable supply (the failure of one supplier does not interrupt the supply) and reduced cost (to have more bargaining power). However, those who believe it is better to have several suppliers forget three critical points. First, they can ignore the economies of scale. If a supplier can deliver a greater amount, the cost will be lower because much of the fixed costs remain the same. Second, each supplier handles smaller volumes than if it were a single supplier and this volume may not be sufficient to justify a future investment in process improvement. Third, there are more problems of management having to deal with multiple vendors.

The JIT approach highlights the need to seek a single source. In fact, it continually stressed the need for a single supplier to provide several pieces of a "family", thereby increasing the volume by supplier and reducing the number of suppliers. In this way, it will encourage the supplier to make the necessary investment to improve their manufacturing processes. Often, large companies that are implementing the JIT will send a team of suppliers (especially small suppliers) to study their manufacturing processes and recommend changes. Even they may have a mutual exchange of workers.

The assembly company has to create a good relationship with suppliers, providing technical assistance when necessary and checking that the chosen suppliers are financially sound and well managed. If not, you must choose another provider.

5.3.9. Short-term contracts or long-term

Traditionally, purchasing departments have always looked askance at the long-term contracts. Means to commit the company to a particular supplier over a long period of time with very little opportunity to renegotiate or find alternative suppliers. Buyers have always preferred short-term contracts because it provides greater flexibility and more competitive prices. After a short-term contract can be further negotiations with various vendors, and sign the contract that bid the lowest price.

From the standpoint of the supplier, are preferable to long-term contracts because they involve less risk. The short-term contracts may be more expensive because they offer the supplier any incentive to invest in improving processes and reduce costs.

The JIT promotes **long-term contracts with a few carefully selected** suppliers for the following reasons: More reliable deliveries, increased investment opportunities, better quality products and lower cost.

Is considered a long-term contract is more likely that the supplier keeps its delivery promises, often at the expense of short-term contracts with other companies. The company became a major customer (especially if purchased from the same source a product family) and meet their needs first. It is also considered a long-term contract provides the supplier with a greater sense of safety. Therefore, should the supplier make some investment to facilitate the production of the product family, investing in machinery, control systems or staff training. Somewhere in this long-term contract, specifying the date's delivery and quality levels. Before applying the JIT, when contracts are based almost solely on price, there was perhaps little incentive for providers to improve the quality of their products. Some even gave up trying to deliver products of acceptable quality. The long-term contract specifies the quality levels required (usually one level higher and higher), and suppliers have no doubt about the importance of maintaining product quality. These investments along with increased production volume for each program leading to reduced supplier costs, part of which benefits the provider and part of the buyer.

However, to implement the JIT is advisable not to get immediately to sign long term contracts. It takes time to identify appropriate suppliers and establish a good relationship to them. One cannot go from overnight to maintain a traditional relationship, sometimes antagonistic, with suppliers, the ideal environment of trust and cooperation JIT. It takes time, and should be a gradual shift towards long-term contracts. Such contracts can be signed only after a long period of reflection and analysis. Companies that have successfully implemented JIT approach with their suppliers have gradually extended the duration of the contract and have gradually consolidated a unique supplier network.

5.3.10. Local and distant suppliers

The fact that transport costs rise much faster than other costs is an increasingly powerful argument in favour of local suppliers. In addition, long cycle times associated with distant suppliers reduce flexibility. Each day adds to production time due to transportation planning horizon expands. Thus, providers can eliminate wastage by inventory associated with the delivery time and reduce the risk of delivering large quantities of defective products. Furthermore, the risk and uncertainty associated with long cycle times also decrease, making the system more flexible to lower costs.

5.3.11. Customer links

It can be useful a meeting or workshop for one day with major customers, to explain the JIT and why it is necessary to have information in advance about the needs of customers. From the standpoint of the client, a provider who is applying the JIT can reduce cycle times (giving a good response to changes in demand) and improve quality. A company without any late delivery is the kind of benefits that customer's value, but must realize that they must provide a strong program. Again, a long-term contract may help the company. The overall objective of creating links with customers is to improve the JIT system response to changing market demands. In turn, this can reduce customer costs.

5.4. Third concept: Kaizen

5.4.1. What is Kaizen?

In a globalized and competitive economy, it requires deep strategic thinking and ability to continually improve standards in business processes. Make feasible the continuous improvement requires a system that harmoniously allows the company to increase their quality levels, reduce costs, increase productivity, reduce delivery times and increase the flexibility of its production capacity.

The system of continuous improvement that best addresses these corporate needs is imperative Kaizen. Kaizen is a Japanese word meaning "continuous improvement, gradual and orderly." Adopting the Kaizen is to assume a culture of sustained continuous improvement, which focuses on eliminating waste and waste in the systems and processes of an organization.

Kaizen literally means continuous improvement. It can be either in your personal life, your spiritual life or your working life or even in the three of them. Lean Manufacturing means it is important to keep improving what you have already implemented so when a company adopts the Kaizen model, it strives to improve its processes in small but meaningful ways. And not just a onetime improvement, but a commitment to excellence by constantly testing and improving the work flow, day in and day out. (6)

5.4.2. The birth of Kaizen

Kaizen was first introduced in the Toyota Manufacturing Plant in Japan in the early 1950s, and it has since become one of the country's main reasons for its success. In Japan, Kaizen is a way of life in the workplace, from the office of the *CEO* all the way down to shop apprentice. They take it very seriously, and for good reason.

But the best thing about Kaizen and the biggest reason that every company should adopt it is that it does not rely on expensive innovative solutions. Just the opposite is true. The core principal of Kaizen is to make small, immediate improvements in the processes and standards of the workplace. But not just one improvement looking for ways to make small improvements should be part of everyone's job, every day of the week. And after a period of time, all of these small improvements will add up to better working conditions, a higher degree of safety, more efficiency and ultimately, greater profits, even costs savings.

5.4.3. When to use Kaizen

One thing is essential and is learning to see the company, its systems, processes and activities in a different way, by rediscovering and reinventing them constantly.

The secret of Kaizen is to be continually developed, with an open mind to review and rethink what we do, as we do when we do, who and where they do, that is done and why and as the saying goes: "If you keep doing what you have always done you will continue getting what you have always gotten."

There is a strategic need to systematically review our paradigms, as well as those of our competitors and our current and potential customers.

To move from a traditional organization to a highly competitive re-engineering is required to allow the leap from which you will be able to systematically apply continuous improvement.

It should simplify both the products and processes, making a smoother process, which is essential to stop the implementation of restrictions (such as minimum inventory) are intended to force management processes flawlessly, so as to achieve better use of resources.

The waste removal process requires that there be interaction between people, activities, technology and opportunity. These four elements must be carefully coordinated so that appropriate people are doing the right things (activities) as appropriate (technology) at the right time (timeliness). All items are focused on one goal: eliminate waste.

As a result of the systematic application of Kaizen is achieved major reductions in cost, levels of faults and defects, processing times, response times, areas occupied, and response times, while achieving the increased levels of productivity, inventory turnover, customer satisfaction, greater product variety and return on investment.

However, if the results are so satisfactory, why there is reluctance to your application?

5.4.4. Reluctance to Kaizen

Firstly, it is usually identified with a culture different from the company and its environment.

These problems are being solved by a correct diagnosis of the socio-cultural organization and its environment, in order to verify that tools and systems are most useful, and can be applied

more easily and cost advantages. It is a question of adapting the various methods and systems to the particularities of each organization.

Secondly, it identifies the fear of change, something that is logical and humane, but the awareness of the need and the training and coaching, can overcome them.

The third factor is that many see the change but fail to understand. Everyone talks about mobile telephony, Internet and the robot, but few understand the impact they have on the economy and in particular in their companies.

Finally and fourthly we have those who remain wedded to paradigms no longer valid. If paradigms are mindsets that help us understand what is happening to our environment, a change in the real technological, scientific, cultural, social, political and economic, makes these paradigms that allow us to understand and make decisions under the above circumstances apply today is no longer eligible.

The successful implementation of Kaizen is the result of:

- Achieving the full support of the senior managers and leaders
- Taking due account of the psychosocial and cultural environment of the company and its sectors
- Implement the various systems, methods and tools as a process with strategic objectives
- Awareness on all components of the organization about the need for change, and its benefits
- Apply the various methods and systems to each company according to an order of priorities, needs, capacities, capabilities and constraints
- Effect real cultural change
- Discover and change the paradigms no longer valid
- Implement a participatory and socio-technical
- Possessing a clear understanding of the Kaizen philosophy
- Achieve optimal planning and training

5.4.5. Kaizen Concepts in a wider sense

5.4.5.1. Management

Kaizen management has two functions: Maintenance and Improvement. Setting standards and keeping them is an important part of Kaizen. One of management's primary roles is to maintain the technological and operating standards that have been put into place. They

make sure that everyone performs his/her assigned tasks according to explicitly outlined standards and performs them on a daily basis. (7)

Management's other role is improvement. They must be constantly looking for ways to raise the current operating standards at the same time to increase the productivity. This is an ongoing effort and must be a daily part of the manager's job.

5.4.5.2. Process versus Results

Process is the holy grail of Kaizen. Managers often concentrate on results too much and pay too little attention to the process. Kaizen will change that behaviour. Kaizen manager realizes that improving the process will improve the result. This is why Kaizen is mainly focused on the process.

5.4.5.3. PDCA Cycle

The PDCA cycle (Figure 5.9) is a system to ensure the continuation of Kaizen principles. It is a vital part of the process because it is vital to make the diagnosis, plan, train, implement, evaluate and then standardize.

- Plan refers to establishing a target and a strategy for improvement. This is a must. Without a target, how do you know if you have achieved success?
- Do refer to the implementation of your plan
- Check is when you determine if your plan actually improved the process
- Act is the process of standardizing the improved procedure so that it can be continued and so that the problem will not return. By following the PDCA cycle, you will ensure that your process improves and does not degrade.

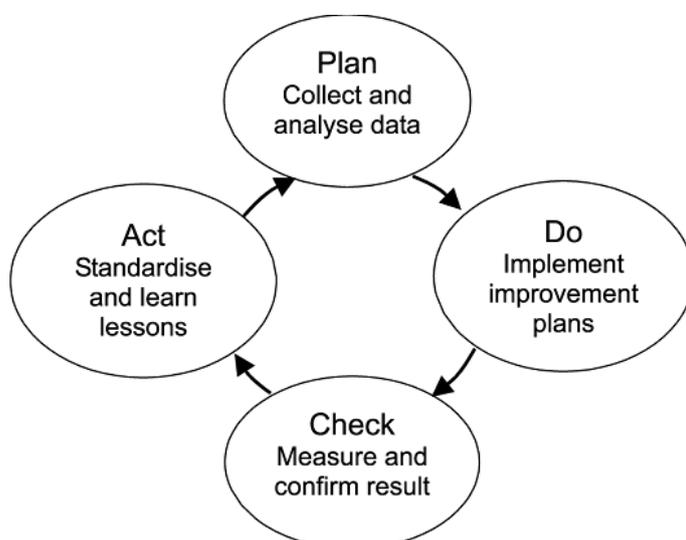


Figure 5.9: PDCA cycle

Source: emeraldinsight.com

5.4.5.4. Quality first

Improving the quality and cost reduction goals are fully compatible. Moreover, it is based on a higher quality than can be achieved higher levels of productivity and consequently lower costs, while they managed to decrease delivery times. Without building a strong system of quality there is little hope of achieving efficiency in cost and delivery. Not only can improve quality and reduce cost, but must carry out both to meet customer requirements today.

Quality is always the highest priority in Kaizen system of the *LM* part. But quality does not only refer to the finished product, it also refers to the processes and standards that create the product. It runs through all phases of company activity such us design, production, management, sales and service. It is both the goal and the method of the production cycle.

5.4.5.5. Speak with Data

One of Kaizen's biggest strengths is problem solving methods. But in order the model to work, you must gather relevant data to be analyzed. Without this data you will be flying blind. You will never be able to tell what is working and what needs to be improved. Data is the life blood of the Kaizen system.

So the first thing to implement is to creat a system of measurement, control and analysis of statistical data, relating them to different processes, activities, industries, products and services, both for physical units, and temporal, monetary, financial and others. Implementation will begin by the most important or urgent items given the conditions and needs of each company, with others being continued consistently.

5.4.5.6. The next process is the customer

Each product is made by a series of processes, one coming before the next. The Kaizen model stresses the importance of quality in each stage of manufacturing. The worker is responsible for each stage and should never pass a defective part (or inaccurate information) to the next stage. This is what is meant by the next process is the customer.

If every worker embraces this philosophy, the end result will be a dramatic drop in defective products.

5.4.6. Kaizen is a process

To understand what Kaizen is, it may be helpful to look at the differences between the traditional Western methods of improvement and the traditional use of Kaizen Eastern countries such as Japan.

In the West, innovation is king. When management wants to get better results from their workers, they introduce the latest technology, or incorporate the newest management technique from the latest marketing guru. Big changes equal big results and that's the mantra that is traditionally chanted in the West. The result is often a big expenditure of money, and time and at the end, the results are not always great.

Kaizen is different. Kaizen is the tortoise compared to the Western hare. It relies on long-term, long lasting and no dramatic changes. "Small steps done any times" is the method that they rely on. It is a group effort where everyone is involved and contributing. It requires a small investment of money, but a large investment in effort, cooperation and training. If done correctly, the results are often amazing.

Kaizen is a process. It is not a onetime adjustment. It must become a daily part of every worker's routine. It must become part of the company's culture so managers and employees are constantly looking for small ways to improve the work flow. When that happens, you will have an organization that has become lean and efficient. This is the essence of Kaizen. This is its greatest strength. (8)

5.4.7. Organization's implication of Kaizen

At its core, Kaizen is a group effort. Only when the entire organization embraces the ideals of Kaizen will you see its benefits. The dedication to Kaizen must start at the highest level of management and must infect middle management and the general workforce like a virus. Kaizen will forever change the manager-worker relationship. Traditionally, the manager's role was to plan, implement and supervise the workers. But by using the small group model in Kaizen, the responsibility to plan and control falls to the worker. The manager's job is now to motivate and supervise the workers.

Small groups are formed to carry out various specific tasks in the workplace such as quality control, suggestion groups, and way to minimize movements, safety, or any other necessary

task. Together they utilize the PDCA cycle to make small but continuous improvements to their areas.

Following the PDCA cycle:

1. Identify the problem or the process to improve
2. Identify the causes of the problem
3. Define the overall objectives of the company
4. Identifying projects and actions to do to improve
5. Plan to follow up actions

After a while using Kaizen the effects of it on workers are the following:

- Better morale
- Increased sense of teamwork
- Better communication between employees and management
- New skill development
- Workers feel valued and enjoy coming to work
- Removes the drudgery of the job

This small group model is a win-win for both management and workers. Workers begin to enjoy coming to work and management sees the level of quality in their products rise.

5.4.8. Quality Circle

5.4.8.1. Introduction of the concept

A Quality Circle is a small, voluntary group of employees and their supervisor(s), comprising a team of about 8 to 10 members from the same work area or department. Quality circles were first developed in the 1960s by a man named *Kaoru Ishikawa* in Japan. The Union of Japanese Scientists and Engineers (JUSE) were the ones who paid for the research that put the theories about behaviour science and quality control together.

Quality Circles are useful because the members of the team are from the same workplace and face similar problems. This concept is a management tool that has many benefits for their own work environment. Some examples of those benefits are control and improvement of quality, more effective company communication, using employee problem solving capabilities, and more job involvement. (9)

5.4.8.2. How to use Quality Circle (QC)

In using the Quality Circles concept there are three main parts to go through. The steps are identifying, analyzing, and solving quality-related issues. After the Quality Circle is set up the next step would be to train the group. The training is to make sure all the voluntaries understand the order and meaning of the steps and how to go through them.

Following training is the first real step in the Quality Circle process-problem identifying. At this step the members of the group are free to brainstorm about the problems they face in the workplace. Within this brainstorming session there are no bad ideas. After the members have some up with everything they can think of they go through the list and analyze each problem individually.

This step of problem analysis is to look closer at one problem at a time and having everyone's input on how to solve it. This step involves opinions from the members and research. The opinions are important because the members in this group are the ones who are faced with the problems at hand. The research can help to show the member what the result or effect will be with the way they may choose to solve a problem. After they are done with the analysis and come up with the solution they have entered the next step.

The last step in quality circles is the solution. The members prepare how they intend to solve the problem that was first presented in the brainstorming. The solution is explained in how it works and what the solution results should be. Those results are then showed to the mangers and group as a whole in a presentation type of meeting. The three steps of

identifying, analyzing, and solving are all very important in completing the process of a Quality Circle.

5.4.8.3. Examples Where QC are used

Quality Circles can be used by large business and small groups. One example of a large firm using this concept is Xerox. Xerox has an annual teamwork day and because of a past teamwork day they were able to prevent 6500 tons of waste from going to a landfill. Their solution at the time of seeing the problem with the amount of waste they were producing was a recycling program-which worked.

United Airlines used Quality Circles to look at the problem of no-shows and sick leave problems. As a result of the employees analysis of the problem sick leave was cut by 17 per cent which saved United Airlines \$18.2 million in the first year.

Quality circles have been used to help smaller group of people like *Kimberly Oshiro*. Kimberly used this concept to try and find out what caused road rage among her and her friends. From that Quality Circle they learned that speeding and tailgating were causes of road rage. As a group they learned to calm themselves while driving.

This concept has been shown to improve work productivity, save money and even to save lives. Xerox did a good thing by improving the world by making less waste. United Airlines increased productivity and saved money, which in the long run could have lowered fares. From Kimberly her life and the life's of her friends could be preventing road rage. Quality Circles are a very powerful concept in the real world.

One of the most publicized aspects of the Japanese approach to quality management is the idea of Quality Circles or Kaizen teams.

Professor *John Oakland* (a leading authority on quality) defines a Quality Circle or a Kaizen Team as a group of workers who do similar work and who meet:

- Voluntarily
- Regularly
- After normal working time
- Under the leadership of their supervisor
- To identify, analyze and solve “work-related” problems
- To recommend solutions to management

Evidence of successful Quality Circles suggests that there are no formal rules about how to organize them. However, the following guidelines are often suggested:

- The circle should not get too large, otherwise it becomes difficult for some circle team member to contribute effectively
- Meetings should be away from the working area, so that the team members are free from distraction
- The length and frequency of Quality Circle meetings will vary, but when a new circle is formed, it is advised to meet for about one hour, once per week
- Thereafter, the nature of the quality problems to be solved should determine how often the circle needs to meet
- Quality circles should make sure that each meeting has a clear agenda and objective
- The circle should not be afraid to call on outside or expert help if needed

5.4.9. Visual management

Another major concept of Kaizen is visual management. The opportunities for improvement may present themselves on a daily basis, but if you are not able to see them, they will be missed. One of primary methods used in Kaizen is to create an environment where tools, supplies and processes that out of place or out of sync can be seen right away, such as the example below (Figure 5.10.). There are two systems that are used to achieve this: 5S and 5M.



Figure 5.10: A bookshelves where the concept of visual management has been applied.

Source: Google images

To sum up what is Kaizen it is needed to know the most important idea is to put your mind in the way of making changes for achieving profit and not only for yourself, otherwise to achieving the company goals. The following picture shows exactly perfect the way how to apply Kaizen.

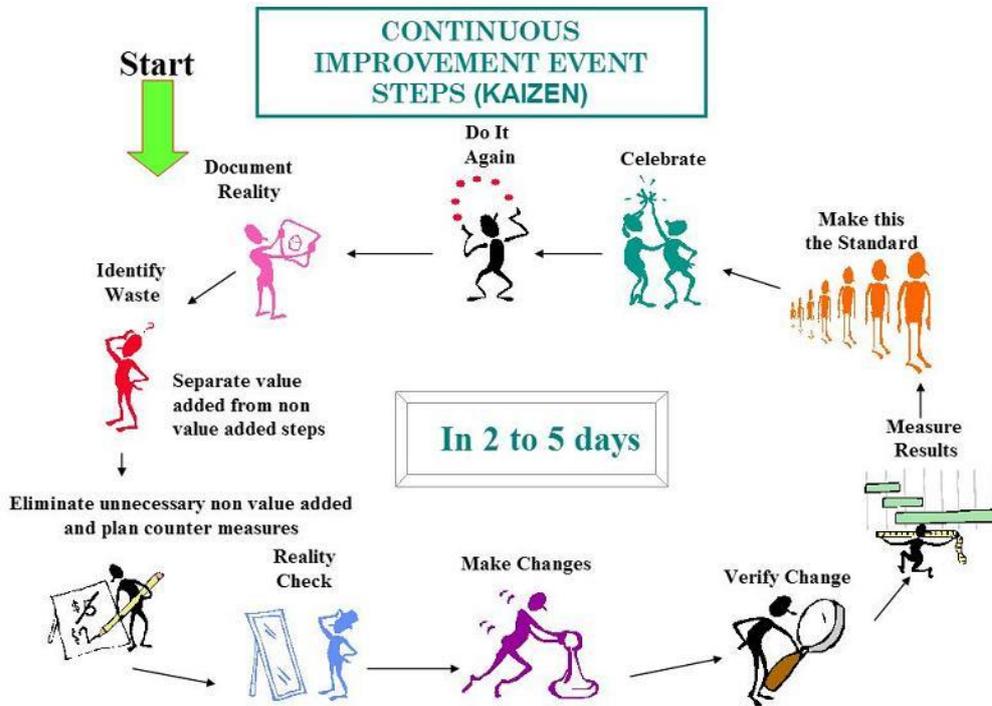


Figure 5.11: Continuous improvement process diagram

Source: Google images

5.5. Fourth concept: 5S

5.5.1. What is 5S?

Another big concept of the JM and one of the most visual concepts is the following called 5S.

The heart and soul of visual management is 5S. It is systematic approach to workplace organization and cleaning that will transform a disorganized workplace into an efficient running machine. 5S is a part of Lean Management that is very visual because it involves the workshop floor and the working place, is it focused to improve the conditions in the working area, aiming to improve the following.

5.5.2. Who are the 5S for?

For any organization, whether industrial or services, you want to start the path of continuous improvement. The 5S are universal, can be applied to all types of companies and organizations, both in workshops and in offices, even those who apparently are sufficiently clean and tidy.

"Whenever you can avoid inefficiencies, prevent movement, and eliminate waste of time and space."

5.5.3. What is the goal of 5S?

Improve and maintain the conditions of organization, order and cleanliness in the workplace. It is not just a matter of aesthetics. It aims to improve working conditions, safety, the working environment, staff morale and efficiency and therefore the quality, productivity and competitiveness of the organization.

5.5.4. Benefits of 5S

A company which implements correct 5S usually has high productivity (P), good quality (Q), low cost (C), exact delivery (D), high Safety (S) and high morale (M). Those six benefits are known with the following abbreviation *PQCDSM*. But the main question is, when we have to implement 5S, as far as it is known 5S is part of Lean Manufacturing, so to gain the leanness in production the first symptoms observed in low-level-management workshop floors will be the following.

5.5.5. When to apply 5S

- There are a lot of useless things and things are put in confusion
- It takes time to find out necessary things
- The distance of carrying paths are long and no clear distinction between working area and walking path
- There are many wastes in worker's motion
- There are many operation mistakes and defect ratio is high
- Many repairs for products, delivery delay and over time work exists
- A lot of raw material, work in process and product stock can be seen and handling time is long
- Office and production machines and equipment are dirty and their break-down ratio is high
- Floors, walls, windows, and lighting appliances are dirty and it dark in rooms
- Working condition is unsafe and many injuries and accidents take place
- Facilities for common use (canteen, locker room and toilet, etc.) are unsanitary
- Morale of worker is low
- Nobody takes pride in his job

5.5.6. Definition of 5S

In that point defining 5S might be useful, thus 5S means five Japanese words which each one has a meaning and the best thing is that each word has its own time to be applied.

- **Sort (*Seiri*):** The first step in 5S is to eliminate all the things in the workspace that are not being used and store them away. If a material tool is not used on a daily basis, eliminate it from the workstation. Basically is to identify and separate the materials needed for the unnecessary and discard the latter.
- **Set in Order (*Seiton*):** The second step is to arrange the items used on a daily basis so that they can be easily accessed and quickly stored. Your goal is to eliminate any unnecessary movements and actions by the worker to make the process as efficient as

possible. By establishing how they should be located and identified the necessary materials, so quick and easy to find, use and replace them.

- **Shine (Seiso):** Next is to get everything cleaned and functioning properly. The goal is to remove all the dirt and the grime and to keep it that way on daily basis. You want to get it clean and keep it clean by identifying and eliminating sources of contamination, ensuring that all media are always in perfect health.
- **Standardize (Seiketsu):** The fourth step is to develop a routine for sorting, setting and shining. Standardizing you create a system of tasks and procedures that will ensure that the principles of 5S are performed on a daily basis.

Easily is to distinguish normal from another abnormal situation, using simple rules and visible to everyone.

- **Sustain (Shitsuke):** In the last step, you want to create a culture that will follow the steps on a daily basis. The chief objective of sustain is to give your staff the commitment and motivation to follow each step, day in and day out.

The support is to establish a new "status quo" and a new set of rules or standards in the organization of work area.

5.5.7. Paradigms that obstruct the 5S implementation

In a business paradigms have existed and will exist preventing the full development of 5S. 5S strategy requires a commitment of management to promote their activities, such as by supervisors and ongoing support of the heads of the workplace. The management support to its permanent watchful eye of the performance of its employees, encouragement and recognition is essential to perpetuate the improvement process. The importance that managers and supervisors give the actions to be performed by operators will be key to creating a culture of order, discipline and personal growth.

However, there are common paradigms for 5S not develop successfully in the companies are:

5.5.7.1. Management paradigms

- Paradigm 1.

“Equipment must be maintained continuously”

The direction under pressure to deliver timely and sufficient quantities of products manufactured, does not easily accept that a job is more productive when kept clean, safe, tidy and clean. It is considered that cleanliness is a productive time-consuming work, but not appreciated to help eliminate the causes of faults such as dust, excess lubrication and sources of pollution.

- Paradigm 2.

“Workers do not care for the site, it takes too much time”

Management believes that grooming and cleaning is a problem unique to the operational levels. If managers do not have the resources or do not set goals to improve methods it will be difficult for the operator to take the lead. It is certain that workers will appreciate the benefits because they are the ones who are directly affected by the lack of 5S.

- Paradigm 3.

“There are many urgent orders we cannot spend time cleaning”

Often, the housekeeping is put aside when it comes to make a rush job. It is true that production priorities often push so that other activities need to wait, however, the 5S activities should be viewed as an investment to make all future orders available and not just point to the time required.

- Paradigm 4.

“I believe that the order is appropriate. Producing doesn’t take so long”

Some people believe that only the visible aspects and aesthetics of equipment sufficient. 5S should be used in order to identify deep problems in the team, as is contact with the machine operator that can identify faults or problems that may develop into serious failure for the team. Cleaning should be considered as a first step in preventive maintenance inspection on the ground.

- Paradigm 5.

“Hire an unskilled worker to perform the cleaning, it is cheaper!”

The worker who cannot operate a computer and who is hired only for cleaning, prevents the knowledge of the state of the equipment is used by the company and miss. Daily contact with

the machinery to help prevent problems, improve information to the technical experts of heavy maintenance and increases the operator's knowledge about the behaviour of processes.

5.5.7.2. Operators paradigms

- Paradigm 1.

"I get paid to work not for cleaning"

Sometimes, the staff accepts the inevitable dirt as a condition of your workstation. The worker does not realize the negative effect of a dirty job has on their safety, quality of work and productivity of the company.

- Paradigm 2.

"I have 10 years in the business, why should I clean?"

The worker believes that he is veteran so he must not clean because this is a task for people with less experience. On the contrary, the experience should help him to understand more about the negative effect of dirt and contamination in the workplace. Production workers sometimes assume that their job is to do things, not cleaning and organizing. However, it is an attitude that must change when workers begin to understand the importance of good housekeeping to improve quality, productivity and safety.

- Paradigm 3.

"We need more space to store everything you have"

This happens when explaining the 5S to the workers, their first reaction before the need to improve the order is asking for more space to store the items they have. The frequent comment is "... boss, we need a new wardrobe to store all this ..."

It is possible that once performing the classification and ordering elements most of them are unnecessary.

- Paradigm 4.

"I do not see the need to implement 5S"

It can be very difficult to implement 5S in companies that are very efficient and very clean as in the case of personal products factory or pharmacist. However, not everything is related with the removal of dust or contamination. 5S helps to improve visual control of equipment, modifying obstacles which avoid seeing the internal mechanisms of machines and allow performance monitoring of equipment, or even the application of 5S in the care of our workshops and desks.

5.5.8. How to promote 5S

The basis of 5S is the first three S which include making order of the working place the 4th one means to keep it and the last one is to continue it with a standardized process (Figure 5.12.).



Figure 5.12: The process that is must be followed to implement 5S.

Source: *epa.gov*

5.5.8.1. *Seiri* implementation (ordering or arrangement)

The first S focuses on eliminating the workspace everything that is not necessary. An effective way to identify these elements must be eliminated is called red tagging.

Red tagging involves placing a tag on any item where the need is still to be determined. The tag itself isn't important and can be either self made or purchased from a specialized company. The card should carry a range of information including the department the item relates too, why it's been tagged and a contact name.

- **The red tag process**

The process involved for red tagging can vary between companies but usually follows the following steps:

1. Items are sorted as part of the usual 5s process
2. Items of indeterminate need are tagged and placed in a holding area
3. After the sort process all red tagged items are reviewed
4. Items not needed are discarded
5. Items needed are then processed to the next stage of the 5s process

In fact a red card (expulsion) is placed on all items which are considered not necessary for the operation. Then, these items are taken to a holding area. Later, if it was confirmed that they were unnecessary, they are divided into two classes, which are used for another operation and will be discarded useless. The Sorting is an excellent way to free floor space and eliminate such things as broken tools, obsolete jigs and fixtures, scrap and excess raw material. This step also helps eliminate the mentality of "just in case".

Preparation for Seiri → Setting up standard for Seiri → Clearance operation of unnecessary goods → Judgment of unnecessary goods → Disposal of unnecessary goods.

5.5.8.2. Seiton implementation (everything in place)

Seiton is the second "S" and focuses on saving systems efficient and effective.

1. What do I need to do my job?
2. Where do I need?
3. How many pieces of it need?

Some strategies for this process of everything in place are: painting floors clearly defining work areas and locations, tables with silhouettes, and modular shelving and cabinets to have in place things like a trash can, a broom, mop, bucket, etc. Imagine how time is wasted looking for a broom which is not in its place. The broom should have a place where anyone who needs it, find it. *"A place for everything and everything in its place."*

Seiton is the heart of 5S because it results affects the total result of 5S indeed. In that phase everyone takes part of the new environment, and the location becomes fixed, things are placed neatly and the indications are corrects. We can say that the three elements of *Seiton*

are: Location, Arrangement and Indication. With that everything is under control and everyone understands the situation.

Selection of object for Seiton → Define a final place to keep it easily → Designing Indications → Prepare and supply indications → Post up the indication.

5.5.8.3. Seiso implementation (shine)

Once we have eliminated much clutter and even garbage, and relocated what we need, it comes a super cleaning of the area. When this is achieved for the first time, there should be a daily cleaning to maintain good appearance and comfort of this improvement. Workers will develop a pride in how clean and orderly they have their own working area.

This cleanup step really develops a sense of ownership in employees. In that point it starts being obvious some problems that were previously hidden by clutter and dirt. Thus, they find oil leaks, air, coolant, parts of excessive vibration or temperature, contamination risks, fatigued parts, bent, broken, misalignment. These elements, if left unattended, could lead to equipment failure and loss of production, factors affecting the company's profits.

The main points of Seiso are:

To find out the cause and origin of dirt and dust → remove and decrease dirt by the origin → think out easy ways of Seiso.

Because the Seiso mind is to make the own activity as one's own duty and it is for oneself, the mind to love one's workshop and one's machine and the mind of act autonomously which is one of the main reasons of why people usually avoids Seiso because people think that Seiso does not immediately contribute to the efficiency of their jobs compares with Seiri and Seiton.

5.5.8.4. Seiketsu implementation (standardize)

In implementing the 5S's, we should concentrate on standardizing best practice of our working area. Allow your employees to participate in the development of these standards or norms. They are very valuable sources of information as regards to their work, but often they are not taken into account.

When 3S is implemented correctly the workshop floor becomes beautiful. So the main purpose of Seiketsu is to standardize the 3S.

Once you have fixed how to do something → check the standards of the company → standardize the process of doing something or standardize the way of keeping things →

check (check list) and clean every day and give points → keep data and make trending graphs of the results obtained every day.

5.5.8.5. Shitsuke implementation (hold)

This is by far the "most difficult S to implement and achieve. Human nature is to resist change and not a few organizations have found themselves with a dirty cluttered shop a few months following their attempt to implement the 5S's. There is a tendency to return to the tranquility of "Status Quo" and "old" way of doing things. The support is to establish a new "status quo" and a new set of rules or standards in the organization of work area.

This is the final goal of 5S and the main point is to train people to follow good housekeeping disciplines autonomously. Then, people get into the habit of keeping rules correctly.

Role of management is important → Mutual audit by groups of workshop floor is effective → Individual 5S is the point of Shitsuke.

So once people can reach the goal they behave as follows.

- People deal with others with smile always
- They listen to others well
- They devote themselves to others and become Kaizen oriented people
- They have team spirit
- They have good manner as a member of the enterprise
- They are always punctual
- They are always sensible of 4S

5.5.9. 5S in practice

5.5.9.1. Security

To achieve "zero accidents" in a plant is necessary to pay attention to minor defects and this is the basis of 5S. This mental model of action is intended to eliminate any defects, in a production process or plant. We cannot guarantee safety at work if not able to clear all the little problems.

When we cut the grass, you can identify the hidden rocks that were covered by tall grass. These rocks are hidden serious problems remain hidden. When applying 5S in a

disciplined manner we eliminate many sources of trouble. Plants that do not eliminate small problems are more likely to suffer the loss of overall effectiveness. These productivity losses reduce the interest in the work fatigue accumulates in trying to maintain the highest standards of productivity declines and appears the accident care.

The accidents are caused by a combination of three factors:

- Personal factors (unsafe acts)
- Management factors (deficiency in the management)
- Mechanical and environmental factors

As part of the 5S activities and make business cards identify areas of potential risk. Some companies prepare lists which have the problems identified.

To achieve a better result in the implementation of safety-5S is advisable to separately identify the following defects of equipment:

- Inaccessible areas
- Pollution sources
- Potential areas of risk
- Equipment failure
- Doubts or questions about the operation of equipment

Some companies use red cards or other colours to identify these problems. However, I believe that working lists help to keep under control the actions to be developed to eliminate defects. Have specific lists or cards to mark or highlight areas of potential help to strengthen the monitoring capacity of potential safety problems. Mix the security problems of equipment defects that have nothing to do with security "hidden" security operations for this reason, it is suggested to differentiate the cards related to safety or health issues.

5.5.9.2. 5S display pictures

One of the purposes of 5S is to show photos before and after the organization that operates under this philosophy, giving a visual way and waste problems within the organization and maintaining the concept: everything enters through eye.

5.5.9.3. Maps and posters of 5S

In the process of work under the 5S found 5S maps or posters, which show the distribution of each workshop and / or employment at the plant. With these distributions are checked every workplace. As the sign is usually placed at strategic locations visible to the worker, this allows you to participate in the improvement of the section and your business in general.

The map allows operators 5S join the memos that they believe about what they see is wrong in any section of the organization.

Japanese Management consists of a lot of concepts (Figure 5.13.) which can be joined as a *puzzle*¹⁰ with the aim of improve the actual situation of a company as regards safety, efficiency, reliability and productivity in a company.

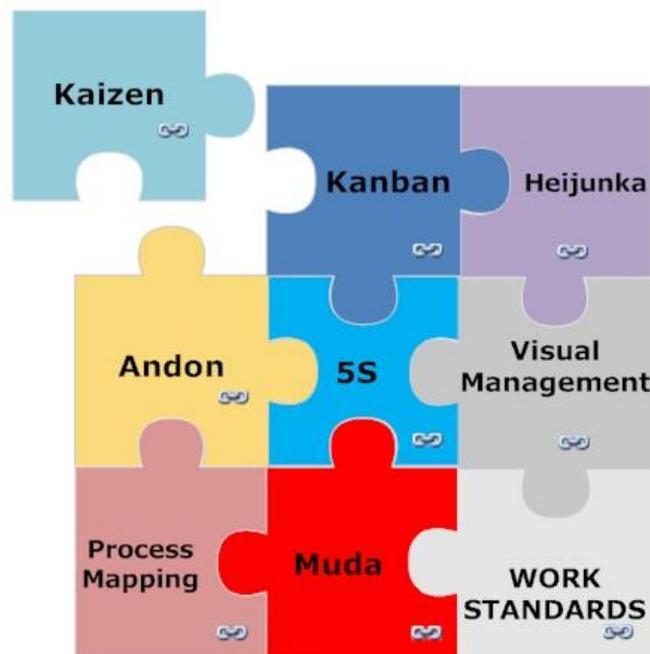


Figure 5.13: Management tools explained before

Source: Google images

¹⁰ It is a metaphor to fix the idea that all the concepts already seen approach the same goal, improve the efficiency of all the company's area.

5.5.10. Personal experience in JM

I was working as an assistant at an industrial engineering whose responsibility is to manage the logistic operations inside the centre, in this case a warehouse. I started working the 17th of March, 2010. And I finished the 27th of August, 2010. The aim of the company as regards me was to help the operation's manager in improving some processes to achieve the ambitious goals of the company in quality, and the global turnover expected for the company. My duties there were:

- Thinking in flow lines reorganization, to reduce the time of storing the materials.
- Starting up the automation of a modern warehouse, called *Megalift*, and teaching workers how to use it.
- Daily small improves.
- And teaching and leading the implementation of the 5S of the storehouse with a young work team specially the first points of 5S deciding what must be there, what was not needed and painting the working floors as regard the company's standards.

My experience there was really good. I decided to finish my degree as an industrial engineer abroad. But to make the reader a short view about the numbers of this company. I have build up my knowledge in experiencing JM application in a Multinational with a lot of economic resources so my aim was to use my own experience to get better a small company which do not have enough economic resources to invest in good goods. But before that I want to show in which kind of company I have learned those concepts. Mainly 5S application and Kaizen, basically daily small improvements with the idea or the core was: "*ONE IMPROVE PER DAY BUT EVERY DAY*"

5.5.10.1. Enterprise's information

The company is a global specialist in energy management, it operates in 5 markets, 17,3 billion of Euros in revenue in 2007, 120000 people in more than 100 countries, more than 200 factories around the world. But where I worked is the logistic centre located in Barcelona, in a 33.000 square meter building and which it distribute their products to more than 50 countries.

In the logistic centre we were working 330 people, 10500 different types of materials, organized by rotation and by size, there were 150 workers. And the rest of the people stuff (supply chain, engineer department, financial department, maintenance department, human resources department and purchase department). The organization chart of the company in

Spain was complicated. But the technology and management concepts I was used to apply were:

- Operational SAP
- ABC analysis
- Posters with indicators of 5S results of the daily test, quality, time delivery, efficiency and reliability

What I have learned:

- Deal with people who was in above position and who was below me at work.
- Lead small groups to achieve small objectives, objectives which the deadline was in less than a week.
- How to follow a forecast and deal with the fact that is difficult to make forecast depending on what happened the same month one year ago.
- Work in group.

By the way, Toyota was the pioneer of Japanese Management Methods so it is needed to dedicate an especial section in that project.

5.6. Toyota Production System

I have been describing Japanese Management methods and after understanding some of them it is needed to learn one of the best inventions of Japanese people performed by Toyota, as regards management involving all the multinational company.

So, first of all, Toyota Production System (TPS) is a production system that is steeped in the philosophy of the complete **elimination of all wastes** as I have explained before and it affects in all the production chain in pursuit of one of the most efficient production method.
(10)

There are five main principles¹¹ of Toyota and those are the following:

- Always be faithful to your duties, thereby contributing to the company and to overall good
- Always be studious and creative, striving to stay ahead of the times
- Always be practical and avoid frivolousness
- Always strive to build a homelike atmosphere at work that is warm and friendly
- Always have respect for God, and remember to be grateful all the time

There are seven guiding principles at Toyota:

- Honour the language and spirit of the law of every nation and undertake open and fair corporate activities to be a good corporate citizen of the world
- Respect the culture and customs of every nation and contribute to economic and social development through corporate activities in the communities
- Dedicate ourselves to providing clean and safe products and to enhancing the quality of life everywhere through all our activities
- Create and develop advanced technologies and provide outstanding products and services that fulfil the needs of customers worldwide
- Foster a corporate culture that enhances individual creativity and teamwork value, while honouring mutual trust and respect between labour and management
- Pursue growth in harmony with the global community through innovative management
- Work with business partners in research and creation to achieve stable, long-term growth and mutual benefits, while keeping ourselves open to new partnerships

¹¹ Source: *Toyota.com*

After these statements, Toyota Motor Corporation's vehicle production system is a way of "making things" that is sometimes referred to as a "Lean Manufacturing System" or a "Just in Time (JIT) system," and has come to be well known and studied worldwide.

This production control system has been established based on many years of continuous improvements, with the objective of "making the vehicles ordered by customers in the quickest and most efficient way, in order to deliver the vehicles as quickly as possible."

The Toyota Production System (TPS) was established based on two concepts: The first is called "*Jidoka*" (which can be loosely translated as "automation with a human touch") which means that when a problem occurs, the equipment stops immediately, preventing defective products from being produced; The second is the concept of "*Just in Time*," in which each process produces only what is needed by the next process in a continuous flow.

Based on the basic philosophies of *Jidoka* and *Just In Time*, the *TPS* can efficiently and quickly produce vehicles of sound quality, one at a time, that fully satisfy customer requirements. But where does TPS come from?

5.6.1. The origins and the future of *TPS*

The Toyota Production System, which is steeped in the philosophy of the complete elimination of all wastes and imbues all aspects of production with this philosophy in pursuit of the most efficient production method, traces its roots to *Sakichi Toyoda's* automatic loom. The TPS has evolved through many years of trial and error to improve efficiency based on the Just in Time concept developed by *Kiichiro Toyoda*, the founder and second president of Toyota Motor Corporation.

Central to the TPS is the philosophy of "the complete elimination of all wastes." As I have said before. Waste can manifest as inventory in some cases, processing steps in other cases, and defective products in yet other cases. All these "waste" elements intertwine with each other to create more waste, eventually impacting the management of the corporation itself.

Kiichiro Toyoda, who inherited this philosophy, set out to realize his belief that "the ideal conditions for making things are created when machines, facilities, and people work together to add value without generating any waste." He conceived methodologies and techniques for eliminating waste between operations, between lines, and between processes. The result was the so-called Just in Time method. (11)

5.6.2. *Jidoka* and *Just in Time*

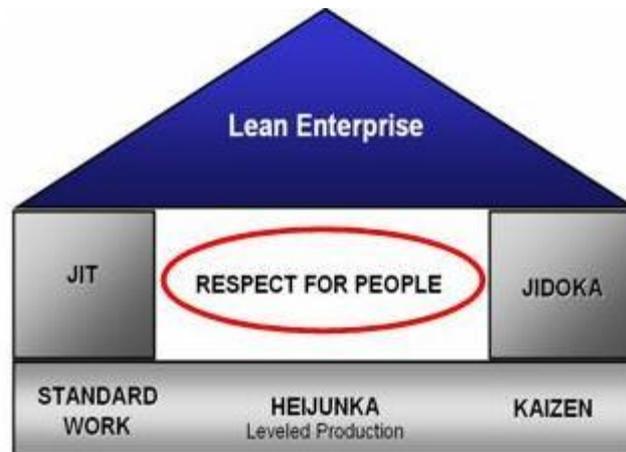


Figure 5.14: Basis of TPS's system

Source: Issacademy.com

As we can see in the (figure 5.14) the two pillars of the Toyota production system are *Just in time* and *Jidoka*. So, this is the mentality of people working for Toyota, but anything works if it is not counted the people and the respect for them. Then we know what *Just in Time* is, but what about *Jidoka*?

5.6.2.1. *Jidoka*, "Automation with a human touch"

The term *Jidoka* used in the TPS can be defined as "automation with a human touch." The word *Jidoka* traces its roots to the automatic loom which could change the operation without stopping the line, invented by *Sakichi Toyoda*, founder of the Toyota Group. The automatic loom is a machine that spins thread for cloth and weaves textiles automatically.

The Toyota term "Jido" is applied to a machine with a built-in device for making judgments, whereas the regular Japanese term "Jido" (automation) is simply applied to a machine that moves on its own. *Jidoka* refers to "automation with a human touch," as opposed to a machine that simply moves under the monitoring and supervision of an operator.

Since the machine stopped when a problem arose, no defective products were produced. This meant that a single operator could be put in charge of numerous machines, resulting in a tremendous improvement in productivity.

The (Figure 5.15.) reflects exactly well the concept of *Jidoka*. When something happened the system is able to stop the production, and improve the process to avoid future defects in production.

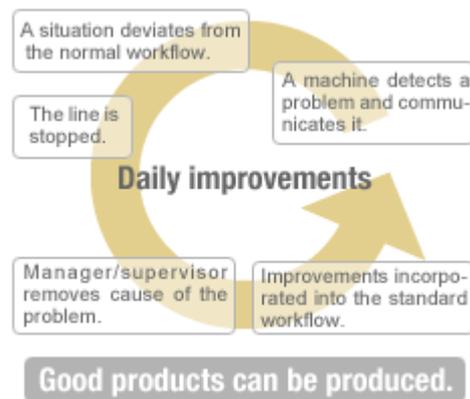


Figure 5.15: *Jidoka* concept's diagram

Source: Toyota-global.com

5.6.2.2. *Jidoka* and visual control (*Andon*)

Toyota has invented an important tool to control the line and to know how everything is going by "visual control", this invention is called "*Andon*" and it allows identifying problems at a glance. This system is typically used to alert all production management and support staff for non-conformances in the production process.

The point is that, time is a huge waste and producing too many defect pieces, it is also a waste, so it means that if line stoppage for any reason reduces the operational efficiency and leads to waste of production time which increases the overall costs to manufacture the component. The objective of *Andon* is to **minimize the time the process is stopped**.

The aim of this thesis is to understand Japanese methods and learn as much as possible to use those in the improving of economic conditions in a small company. I will try to show the first manager of Schneider Electric which was formed three years ago, the Japanese way of act and basically the Kaizen philosophy to reach the continuous improvement. And gain one thing better, each day.

6. Japanese Management Application

6.1. Company's description

“*Investigación y Valorización de Residuos SL*”, hereinafter IVR, arises from the segregation of the company in the waste section “*Tractament Mediambiental Integral*” SL, hereinafter TMI. TMI has been operating for 11 year in the environmental sector, and has three departments: sludge treatment, environmental engineering research and consulting-waste (collecting and sorting). Due to the difficulty of operating in the waste sector **without being an authorized agent**, and the difference of structures finally, it was decided to **create IVR**, with the same ownership structure as TMI and it settled down in Gerona because the lack of waste treaters in the zone.

IVR has the European authorization of waste treatment which allows enhancing waste coming from any country in Europe. For that reason it offers a full service waste removal to its suppliers (companies in the metal industry which their process's waste is mainly sludge formed by a mixture of metals, water and remains).

Basically its major suppliers are all companies mostly in the metallurgical sector with different sorts of waste as paper, glass, plastic and organic. Thus IVR receives two kinds of wastes; the first one consists of sludge with high metal content such as nickel and copper, and the second type is hazardous waste. For that reason, IVR has two main processes depending on which waste has to be treated, the recovery of metal-containing sludge which is done in the Recovery Centre (RC), and the collection of small quantities of hazardous waste in the Waste Transfer Centre (WTC).

So the main service offered by IVR, is the removal of waste from the suppliers for further appreciation of it, watching out to obtain as much margin as possible by researching to find the relevant technical and economic feasibility in the R & D department.

Moreover IVR is a micro-SME. However the main idea of organizational structure has been defined as a manager which is the owner at the same time and afterwards the workers, two engineers and two ground workers.

In the (Figure 6.1) is the IVR concept as a company with its suppliers and customers:

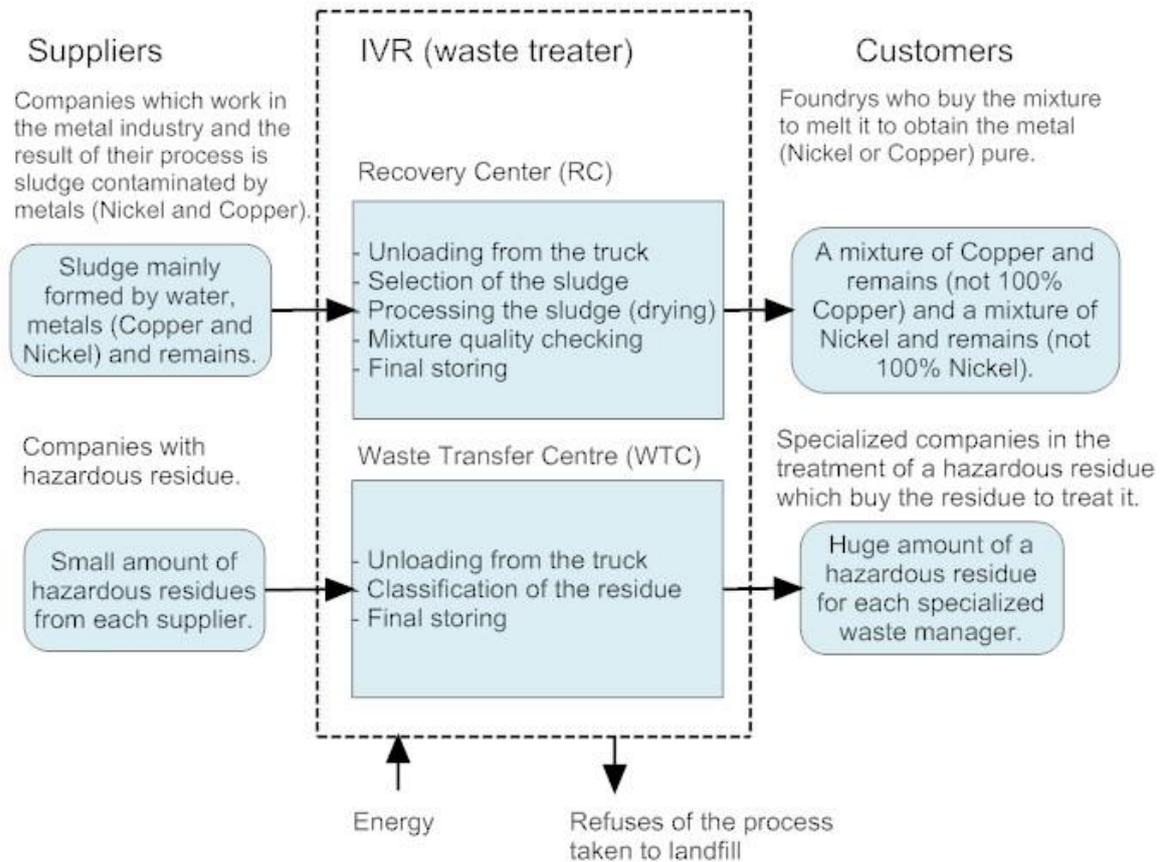


Figure 6.1: IVR concept as a company

Source: Own source

6.2. Suppliers type

In Europe it is mandatory that all companies pay for the removal of waste to a waste handler (like IVR) who is authorized to treat the waste to turn them back into raw material, because it is not possible to through away any type of waste which comes as a result of an industrial process. IVR is one of those waste handlers.

The main difference with conventional companies is the concept of waste management, in this case IVR receives money for the material (provider's waste), due to the nature of the activity performed by IVR. So hereinafter we will call the providers, *suppliers*.

Thus IVR gets money aside for waste removal (*suppliers*) and on the other hand, by selling the recovered metal waste such as Nickel or Copper or by selling the product as a result from the WTC process¹².

¹² Explained in the section 6.3.2.2

6.3. Detailed description of the activity

6.3.1. Service offered & final product

IVR performs two types of activities, in the Recovery Centre (RC) and in the Waste Transfer Centre (WTC).

6.3.1.1. Recovery Centre (RC)

Their main activity (which brings more profit to IVR) is the treatment of the residue (sludge) in the Recovery Centre (RC), in which basically the main operations are: receiving the waste, selecting depending on which kind of metal sludge is it, treated, processed and then sold.

As a final product RC obtains three products according to their composition called mainstream middle, Nickel-Chromium, Nickel and Copper.

The differentiating factor of their service is the R & D department (two engineers), which is dedicated to find the ways increasing efficiency.

This activity is targeted two types of partners. The first partner (supplier) is offered the service of sludge removal (IVR receives money) and the second partner (customer) is offered a product (the treated waste, Nickel and Copper). Basically, in the RC the main activity is to treat waste in order to transform them into Nickel and Copper.

6.3.1.2. Waste Transfer Centre (WTC)

The IVR second activity is taking place in the Waste Transfer Centre (WTC), so that IVR mainly acts as an intermediary between companies which have hazardous waste¹³ and waste treaters which are specialised on treating one kind of hazardous waste. The grace of this activity is that IVR charge to the customers and the suppliers.

6.3.1.3. The advantages of IVR's service

- Enables compliance with waste legislation, which requires to prioritize the recovery of waste by the treatment and landfill deposition
- The waste management costs are lower, and it will grow less in the future
- Improving the environmental performance of the company
- Decreases the degree of damage to the environment by the company

¹³ There can be a huge variety of hazardous waste.

6.3.2. Production process

6.3.2.1. Recovery Centre process

In the RC (Recovery Centre) is collected and treated waste (sludge).

Basically, the plant gets two types of residues, which have an average composition majority of Nickel (Ni) or Copper (Cu) (but they contain other metals as well, because they are waste and usually suppliers mix all their waste as a result from their production process). As I have said before IVR charges for receiving these wastes.

Once on the ground those muds are mixed in specific ratios, previously studied (by the R & D department), and the amount of water removed by drying, which decrease of about 50 per cent the weight of production. This process of drying dehydrates the sludge by heating it to over 200 °C, so in order to perform this operation the company has a machine technologically prepared. By the way IVR has made an investment into a new drying machine to change it for a more efficient and with more capacity machine.

For instance, the sludge is a mixture of water and solid waste, which weighs two kilograms, then the mixture, becomes dried and as the water evaporates, the resulting mixture weighs one kilo. There is some negligible residue of the process which is taken to landfill though.

Subsequently the final product which is mostly a mixture of Nickel or Copper with some remains are just prepared to be sold to a foundry which will obtain later the pure metal.

By the way, it is planned next year IVR will invest in a smelting furnace.

RC diagram (Figure 6.2.):

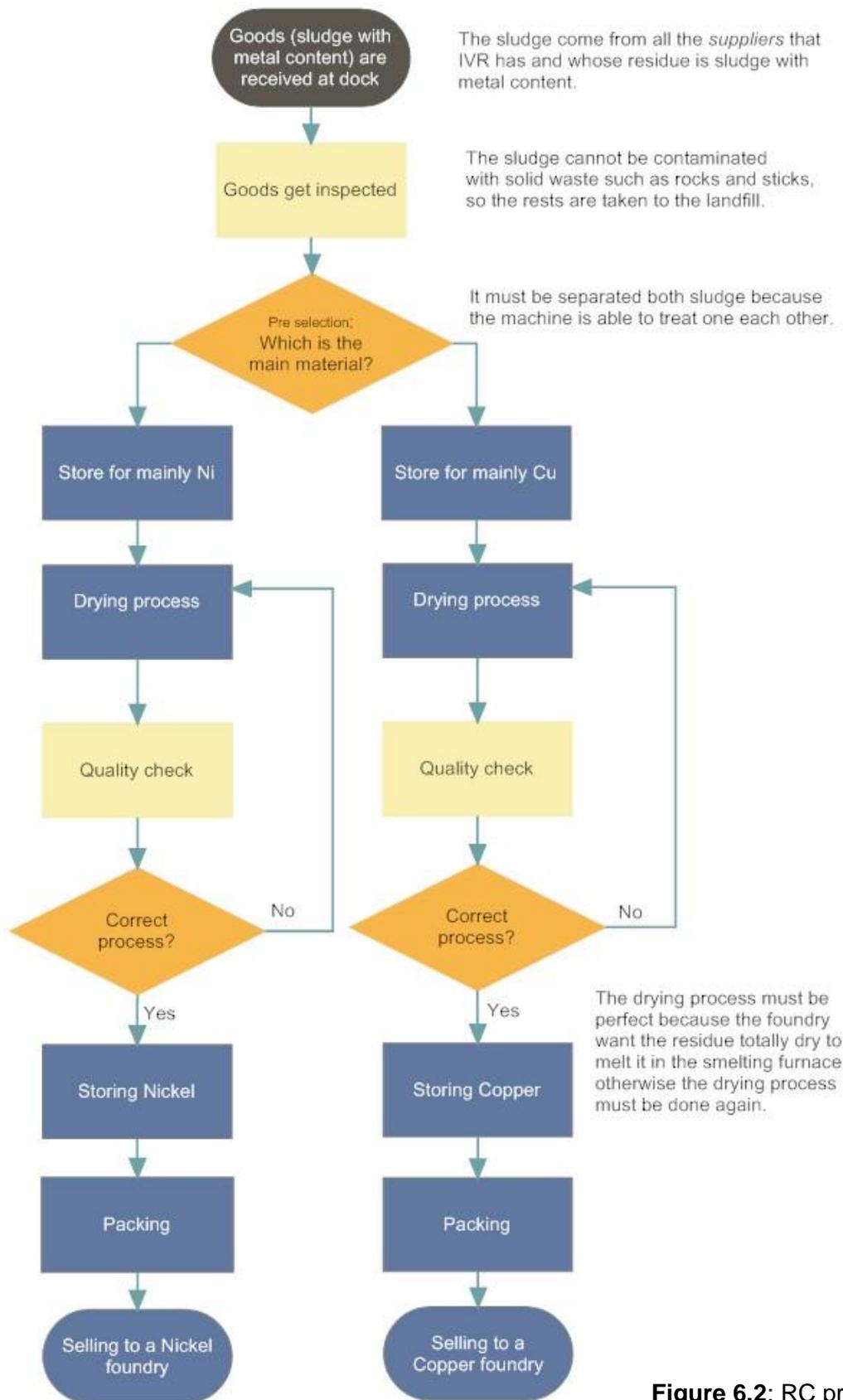


Figure 6.2: RC process

Source: Own source

6.3.2.2. Waste Transfer Centre process

In WTC, the hazardous waste is collected in small amounts, it is stored, classified and when the amounts are significant, will be sold. In this activity IVR receives revenue for companies needing to dispose of their small amount of waste, IVR accumulate the hazardous waste and then it sells them to a specialized waste treater.

By the way both activities (RC & WTC) are performed on the same floor.

WTC diagram (Figure 6.3.):

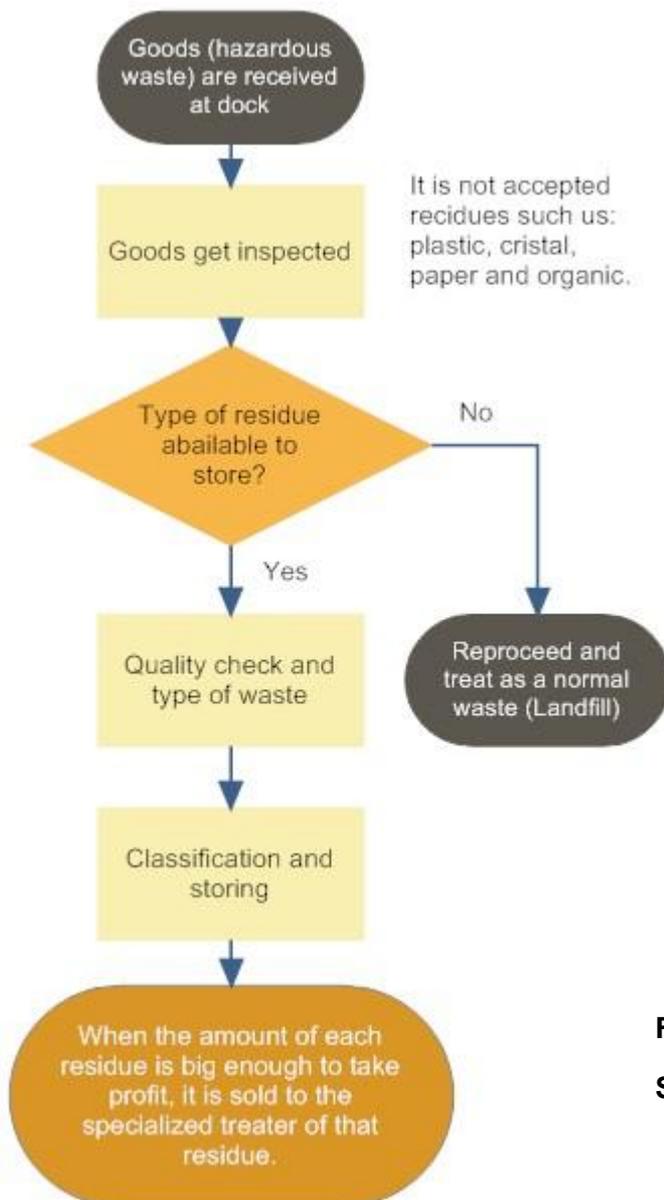


Figure 6.3: WTC process

Source: Own source

6.3.3. Advantages (Suppliers & Customers)

IVR's activity is in business of waste management.

The company's partners are of all types which produce waste, but most favoured partners are those that belong to the metal industry and they have dangerous residues.

As recovery centre (RC), suppliers are those that generate certain waste (sludge) wherever they are located. In this case the competitive advantage lies in the possibility of converting their waste into Nickel and Copper.

Potential clients of the waste are currently being investigated in many cases are already customers of TMI¹⁴. The strategy followed in this instance to enter the market is to offer the service to each supplier individually by offering the removal of waste, having a certificate of appreciation to be according with the law.

As regards the Waste Transfer Centre, suppliers are small businesses, SMEs and micro-SMEs that currently do not properly manage their waste in violation of the law, but in the coming years they must do.

For the philosophy of the service, the company has connections in many sectors. IVR is a waste manager and sells its final products to further manufacturers.

The sector is dedicated to the removal, processing (revalue) and sale of waste. IVR in the RC removes the waste from their suppliers to deal with in order to transform them into Nickel and Copper. On the other hand, in the WTC IVR works as an intermediate which just collects, classifies and then sells the hazardous residues to specialised waste treaters.

¹⁴ It is the company from whom IVR was founded.

6.4. Actual situation

IVR is having a clear case of sub-activity. The country, even the whole market had an economic crisis with increasing unemployment. That is why the company perform various tasks. Despite all the concepts learned during lectures of Production Management focused on daily improving without investment, and all the examples seen so far were based on improving the production efficiency, I conducted first a SWOT analysis (strengths, weaknesses, threats and opportunities) hence to draw a line to follow, one for each area analyzing, as well, how to talk to people using psycho economic¹⁵ theory, which recommends how to communicate with each worker to obtain the best results from him. (12)

It is known that for a company to respond to the changes introduced by its environment and to achieve the own objectives, it must implement an improvement plan in order to detect weaknesses in the company, and propose possible solutions to them.

The improvement plan is not an astonishing solution; it is simply a mechanism for identifying risks and uncertainties within the company and being aware of them allow working on solutions that deliver better results for the company.

To generate an improvement plan to be in line with the needs of an enterprise is necessary to involve any person involved in the process of creating the product or service provision offered by the company.

It is important for IVR to improve the efficiency for a long period of time, starting with a SWOT analysis, examining both the external environment and internal environment to know on which areas is possible the implementation of JM methods.

STRENGTHS (Internal positive) analysis:

- Competitive advantages: They treat directly with the client
- Most satisfied customers
- Safety waste removal from the suppliers
- USP's (unique selling points) in Spain
- Managers and engineers well qualified (University degree)
- Workers and engineers are young and active people

¹⁵ Check the bibliography

- Large experience in the metal sector for the main manager and 10 years of experience in waste treatment for the engineers
- Marketing: Catalan industry market and most of Spain as well
- Innovative aspects: the 30% of the earnings are designated in R & D
- Location and geographical: Unique manufactures of this kind in Spain and situated very close to the border with France
- Direct deliver capability
- Margin very high
- Manager with good business ideas
- Fix price of the final product (metals) because they are fixed by the London's exchange stock market
- Promotes environmental care
- They offer a unique service to their suppliers, a certification which makes them compromised with the environment

WEAKNESSES (internal negative) analysis:

- Weak brand without good market position
- Inability for making new customers
- People is not motivated
- Weak leadership
- Huge disorder in the offices and in the factory
- Repeated tasks
- Bad internal communication
- Customer lists not tested
- Need more sales people
- Staff needs training in many aspects
- Management cover insufficient: too many things to do, not enough capable people
- Disadvantages of proposition: High dependence on the suppliers; if the suppliers close or produce less, less residue IVR can revalue
- Low quality of the final product (not 100% pure) now around 30 %
- Highly dependent on economic aid
- Weak main manager as a leader
- Lack of awareness (which type of sludge is incoming) by the workers
- IVR is really new then it is not well situated in the market
- Financial difficulties to make investments

- Not enough cash flow and difficulties in the starting-up
- Not a continue supply chain. IVR depends on the suppliers
- Some work distraction which affect the core activity
- No process data storing and no reliable forecast
- Bad morale and increasingly worse commitment
- Low self-financing capacity
- Lack of standardized process
- No efficient management system
- Lack of manager cover, no succession

OPORTUNITIES (external positive) analysis:

- IVR can grow easily if the economic resources arrive
- Continuous resource and development (searching how to reevaluate new residues) studding new methods of waste treatment
- Competitors' vulnerabilities: Direct competitors in Germany
- The waste treater is a new market which is growing
- Could develop new products and services
- Could extend to overseas
- Profit margins will be better
- Can surprise competitors
- Huge possibility in gain new markets, horizontal (joining new process to revalue new residues) and vertical (joining smelters to get the 90-95% of the purity in Ni and Cu)
- Niche target markets: to revalue all the residues
- Geographical, export, import: France and Germany are the most advanced but IVR can expand to Spain
- New USP's: Selling new residues revaluated
- Can integrate Information Technologies to communicate with the Suppliers and the Customers to grow in efficiency by reducing bureaucracy
- New drying machine will increase the production and the efficiency of the process
- Global awareness of the environment
- Integration of Lean Management as a philosophy of work

THREATS (external negative) analysis:

- Decreasing the metallurgical companies in Spain
- Legislative effects: Strict legislation could impact
- Environmental effects would favour larger competitors
- Vulnerable to reactive attack by major competitors
- Lack of IT developments
- Market demand: Variability in the prices of the final product (Ni and Cu) depending on London exchange stock market
- Vital contracts and partners decreasing
- Difficult sustaining internal capabilities as regards employees. The best tend to leave the company
- Lack of key staff
- No sustainable financial backing from 2012 (need of external investment)
- Economy - home, abroad: Huge global economic crisis and worse in the metal sector (suppliers and customers are closing)
- Financial dependence on economic resources.

So after doing the analysis it was detected that IVR has more weaknesses than strengths but most of them are based on the bad attitude of employees and the bad morale. On the other hand IVR has more opportunities than threats what means that in the future IVR can be very competitive in European market. It is also clear that most of the weaknesses depend on bad morale, low motivation of the people and lack of training. IVR has a problem with selling but it is permitted to negotiate the price with customers and suppliers.

It is clear as well that after the acquisition of the new drying machine most of the problems will end, but meanwhile betting for the application of JM as regards LM will situate IVR in the top market position overseas and European market.

Even so the result of 2010 was positive. The forecast says that in two years relying on the seamless integration of the new more efficient drier is expected that turnover will increase to 3 million Euros in 2012 if the process is well guided. So I have tried to see what to do and where to go using JM management concepts by implementing in a management plan. (13)

6.5. Lean Management for IVR

6.5.1. Objectives

The main objective is to solve most of the weaknesses such as bad morale. Furthermore to gain specific goals and achieve the state of a lean manufacturing company by applying LM methods.

- Educate and train people in JM concepts (Waste elimination, JIT, Kaizen and 5S)
- Activation and morale-up of the organization
- Improve the quality of the product and the service offered
- Reduce all costs, especially production costs and structure costs¹⁶
- Improve the image and reputation of the company
- Improve the efficiency of the production process reducing wasted time
- Reduce the inventory
- Increase the incoming waste for treatment (sludge & hazardous waste)
- Improve the quality¹⁷ of the final product (Nickel and Copper) by the R&D
- Increase safety in the working place despite no accidents have already occurred
- Reduce the producing time
- Keep accurate delivery time
- Keep data of the activities which add value to the final product
- Control and analyse this data

6.5.2. Process followed as regards JM

One of the most important things in any implementation is to be methodical and systematic. By the way, it should be noted that one cannot encompass everything pertaining to JM at once, but it must be a continuous process of improvement. (14)

First I had a long interview with the CEO, talking about everything related to the company and its environment, then I had to persuade him by the idea I was trying to perform.

¹⁶All costs not directly related to production: manufacturing overhead costs, general business and administrative expenses, financial expenses, amortization of offices, etc.

¹⁷ Quality as regards recuperation of Nickel and Copper refers to the purity of the metal.

Secondly I started explaining people what is JM (Kaizen, JIT, 5S, etc.) and persuading them to start with drastic measures and actions.

Third, and to introduce deeply the concepts in IVR as regards JM it is needed to do the following actions after achieving the leader commitment:

- Quick education on the basics of JM and LM (Mudas, JIT, Kaizen and 5S)
- Applying the first 3 phases of the 5S (and eliminate the waste)
- Use Kaizen and Quality Circles
- Thoroughly educate people in JM by training weekly
- Consider all costs of IVR, separated by department and analyze them deeply to see which is the main cause of the high waste
- Complete the 5S by standardizing and holding the situation
- Improve the communication with the partners by increasing the website use o and net facilities

IVR is in the 2nd phase of the process (Figure 6.4.) to follow:

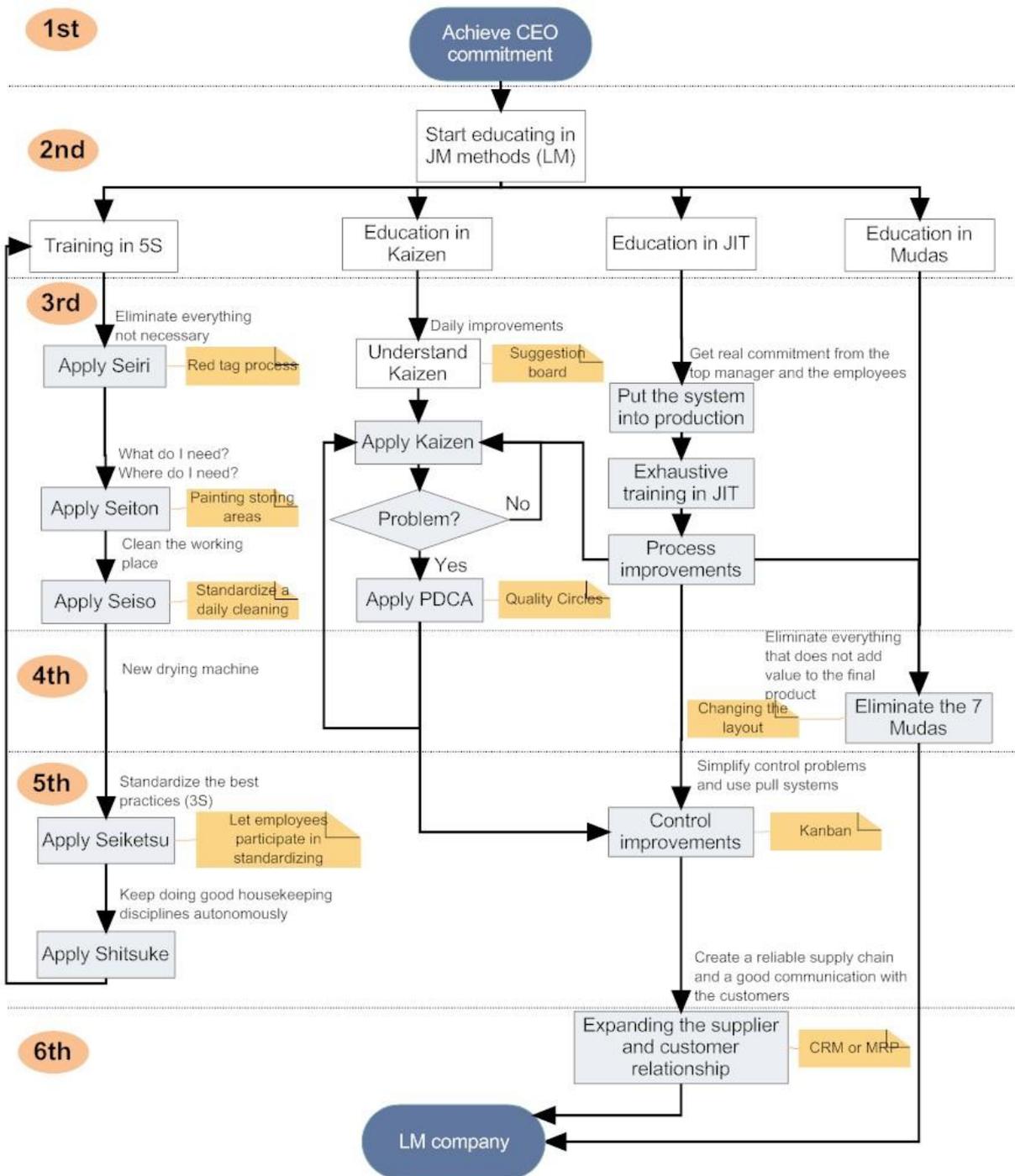


Figure 6.4: Process of the implementation of JM (LM) in IVR

Source: Own source

6.5.3. Actions taken

After observing the lack of IVR as regards management methods and following the structure of the project I am going to write the actions IVR must do as regards JM and in which phase IVR is today.

IVR wants to be leader in its sector starting with Lean Management. As a processing plant, it wants to produce just what is need and producing it with the maximum benefit possible, obtaining the correct things in the right place, in the needed time, minimizing waste, being flexible and being prepared for change.

6.5.3.1. How to eliminate the seven wastes in IVR under the concept of LM

Eliminating waste of time producing and carrying out the operations needed in the factory, the best thing is to change the layout. By changing the layout most of the seven Mudass would find a solution because at the beginning nobody thought in flowing production lines.

- **Eliminating overproduction:** In this case IVR does not produce more than the demand needs because it is living a clear case of underproduction, however it is needed to improve the reliability of the process and to accurate the information needed to work with an actual demand. But there are things to do before the new drying machine will be operative. Things such as improve the actual layout (old one) to absorb the future increase in production.
- **Reduce inventory:** Inventory, can be either in raw material form, *Work-In-Progress* (WIP), or finished goods, represents a capital outlay that has not yet produced an income. In IVR is possible to reduce the final inventory, because nowadays the company is waiting to sell the final product when the Nickel and Copper increase their value in London's stock exchange. But as there are two different processes in the RC, it is a problem the long changeover time of the machine, but it is expected that with the new drying machine this problem will be solved.
- **Reduce waiting time:** Whenever goods are not in transport or being processed, they are waiting. In the RC the final product is waiting to be sold and the sludge before treating is waiting as well most of time, because the changeover between products (Nickel or Cooper). It is better to work in process system not in product system, and then probably IVR will add a second new drying machine in the future, so it will be eliminated the wasting time before the treatment. On the other hand, it is important to mention if the final product is not dry enough needs reprocessing. This way wasted time occurs. Now if the final product is not dry enough, it is mixed again with the sludge of the same kind of metal

(Nickel or Copper). With that operation, the sludge coming to the machine is dryer than normal.

- **Reduce motion:** Transportation, motion should be minimized. The main problem to solve is the layout of the factory, because since now nobody has thought about it. Then it is possible to avoid excessive walking and bending by reorganizing the workplace and layout. So it was thought a new layout¹⁸ focused in flow lines to avoid excessive walks and excessive movement of work in process.
- **Avoid unnecessary transportation:** The only unnecessary transportation is because there is no fix place for each thing, so each time people left things when there is enough space. As I have mentioned before it is important to improve the layout, to avoid the multiple storage locations.
- **Eliminate defects:** Whenever defects occur, extra costs are incurred reworking the part, rescheduling production, and so on. Defects in IVR come from a bad selection of the incoming waste (sludge or hazardous waste). Thus the main thing is to train the workers to avoid the low awareness of incoming waste (sludge and hazardous waste), because the people who analyze the incoming waste (sludge) are the engineers, because they are afraid of that workers will not see the mistakes. To produce as fast as possible the person who leads the machine must be the same who decides about the sort of sludge.
- **Eliminate over-processing:** IVR does not suffer from over-processing, although it must standardize the best techniques, and make clear the quality acceptance standards.

6.5.3.2. Turning IVR to a “Just in Time” company

Just in Time has five phases to achieve a clean factory, without wastes and with a pull system. IVR is not still able to achieve these states but they can start working in JIT education, and improving on controlling the process following the five phases. But first it is needed a commitment from the main manager.

Put the system into production; educate employees, process improvements, set up control improvements and at the end expanding the supplier and customer relationship.

The first step started with the beginning education in JM (JIT, Kaizen and 5S). This phase is very important. Thus a good implementation of Lean Management requires changing attitudes often deeply rooted.

¹⁸ IVR will use the new layout when the new drying machine arrives.

Moreover it is important to study the process which adds value to the final product so it is needed data. Starting **keeping process time** (section 6.5.6.1.) of every repeated action that employees (workers) does, with the main idea to calculate exactly the time needed since the wastage arrives until delivering it.

It is needed to know where different (production, administration, management and so on) costs come from. Analysing the source of separated kinds of costs will be possible to reduce or eliminate them.

6.5.3.3. Using Kaizen in IVR

To apply Kaizen the main thing is to make employees understand the concept and act with Kaizen philosophy:

- Implement TQM, to achieve zero defects
- It is needed a real cultural change and people must be committed with the system and the company, thus every Wednesdays there is a participatory and socio-technical meeting at one hour to get people involved in the company as a family
- Training to get clear understanding of Kaizen philosophy

The idea is to fix in people's mind that every day is needed a new improvement which must be done the same day and it might come from all the workers. To make it real it is **installed a white metallic board** to keep the control of some indicators, to have white place to write down actions and responsible and with a suggestion zone to pose problems as well, so people every day (Kaizen) can pose and obtain daily solutions involving all levels.

This seemed to be achieved by the more motivated people. As a result the environment noticed a small change but there is a need of keeping on doing that because nothing is less useful than starting new things and stopping them after a while.

IVR started using Quality Circles because employees are **meeting every Wednesday morning (one hour)**, not only just to propose new ideas besides the suggestion's board but to share people's problems even private. Because the management wants to fix in people's mind that they are a team and even a family so everybody must care about the others.

6.5.3.4. 5S application process

The best thing of 5S is that it may be applied in all the companies because it has five phases which are clearly defined. Following the phases in IVR it is easy to apply the first three

because IVR has a complete disorder as regards finding things, the lack of needed things and the things doubled.

After that and to develop the idea of continuously improving daily IVR began carrying out the first three Ss of 5S, described above in section 5.5. Since the idea is to have in the area of work only the necessities.

Actually I mixed the elimination of waste (Mudas), Kaizen (Red Tagging) and eliminating the unnecessary things in 5S. Everything must have a place, even in the offices. IVR began with the “**red tag operation**¹⁹” just to **eliminate whatever not needed**. Every object which was not used yet got a red tag glued. To make working place cleaner because it is easier to find things when there is only one place to find it. Employees were deciding where to keep every tool to use in the best way possible.

The feeling in the company was something like fresh air. But it is needed to keep working hard every day without leaving 5S and Kaizen for daily busy work, because Lean Manufacturing is a system that must be fixed in the brain of people without taking productive time from them.

Despite QC in Japan are after working time in IVR will be during the working time because the employees have time enough owing to the sub-activity of IVR.

6.5.4. Pros and Cons seen while LM application in IVR

6.5.4.1. Cons

The most important problem that I found was to **convince the CEO** to try something new regarding Japanese Management companies. He gave special attention, but he did not trust he could perform it. He didn't know how to do it because he had **total ignorance** of all the concepts related to Japanese Management.

For a long time they have just focused on making money without taking care of their own process and their own daily life. Because they are too much focused on short term benefits and they have also **lost the idea of a working team** which is the best way to solve problems and to reach long-term benefit as Japanese companies have already shown.

¹⁹ It is explained in the section 5.5.8.1

Another big problem is that **employees are not taking responsibilities**. When a company is small, everyone should strive to grow, because employees **are just looking for personal gain**. They could combine the personal and company's target.

As regards the marketing, the idea of **brand and corporate image are nowadays weakened**, but this position is expected to improve increasing business through internet by completing the company's website. For example they can add English language to their webpage²⁰ to reach new markets.

Every engineer knows to make decisions it is necessary to base them on data. IVR has not collected data because it has **only focused on making partners**. Without thinking of their process reliability, how to reduce cost, how to be faster or at least how to deliver the final product as it is required.

Moreover, the current situation has sufficient capacity but low production due to the crisis. For this reason to focus on productivity is unnecessary. It was focused on improving internal and external communication, as it is explained before. Employees' opinion was commonly: **"it's not my problem, someone else will do that, I am very busy, and so on..."** all clear signs of discouragement.

6.5.4.2. Pros

On the other hand, there are strengths like it's full of courageous and young people who are **highly trained** and who are theoretically completely involved in the company's philosophy.

It is good as well that the **company is rather new** so **employees do not have old strong habits** even if they are good or not.

²⁰ This idea appeared in the blank board of suggestions from one of the workers of the company. It is an obvious prove that they just have not thought before.

6.5.5. Results obtained after the application

After that month of changes I have had another call conference with the CEO and he told me that the situation has changed a bit and those are the main points which have changed:

- People seem more involved in the company's targets because it cares about them
- The factory now is clean because almost everything (inventory, tools, papers, and office stuff) has its place to be stored
- There is still inventory of the waste for treatment because the new drying machine is not working yet, but as soon as drying operation it is expected to eliminate it
- The workers when they do not know what to do because of the sub-activity in production they use their time in 5S (cleaning, checking and standardizing) and thinking of small improvements because the idea of Kaizen is introduced
- The process has not changed yet, but IVR is still in the phase of cleaning, painting and deciding where to put everything
- Despite the workers are still working more or less with the same habits, when they have a lot of work they do not forget JM.

6.5.6. Future tasks to do as regards Lean Management

It is planned by the 31 of March 2011 the new dryer machine will be able to work, thus way the capacity of the system is going to increase by 30%, without making so many mistakes, and with less break downs.

After those bad months of sells the first of April 2011 it is going to be revised the staffing requirements. It means IVR must reduce their costs because the needs of cash flow.

On the other hand and as I have written before, once you have started with the accommodation of the situation to apply Lean Management in a company after the first strong steps one of the most important things is to **invest in people's education**, so that it is planned in the following months people will assist to a small daily courses about marketing, selling, bench-marking and JM as well.

One of the ideas of a QC is to invest in the webpage of IVR, first to translate it into English, and then, into German to open the company to the world market.

In the SWOT analysis was revealed the need of an integrated management system as CRM which will help to coordinate the incomes and the outcomes of the company making easily

the storing data and the task of analyzing it. It is planned for the 1st of July 2011 depending on the performance of the new machine the integration of one of those systems in IVR.

Meanwhile those months a regular training system will be introduced as a standard because educating is the best investment.

On the other hand workers will be standardizing actions and process in idling time.

6.5.6.1. Stored data by IVR

IVR is storing data from everything which is important to study following the chain value of both processes. Such as, the operation time of every worker adding value to the product or the evaluation of people's work. They are the following:

- Individual performance of each task every day in a standardized²¹ table
- In order to reach new clients IVR stores the data of partner visits, such as time needed, sales success, etc
- How many times the quality supervision has to rework the sludge to dry it better
- Truck unload at the dock
- Charging time machine depending on which sludge (mainly Nickel or Copper)
- Treatment time, depending on the sludge to be treated
- Collection time
- Quality supervision time
- Storage time for each Big Bag (the container in which the final product is stored)
- Truck loading time before dispatching

²¹ It is the same table for everybody.

6.6. Economic benefits of applying JM in IVR

IVR must make an economic forecast to know if their business is growing. It is shown (Figure 6.5.) their forecast for the next three years. After it is carried out some calculations based on the benefits of JM implementation, with expected increase of sales, decreases of common costs, increase of management costs (JM) and increase of incoming wastes because the production capacity increase.

In the table there is: bank interests because IVR had to take bank loans, and Personal allowance which means diets that IVR pays to the employees.

Concept	2011	2012	2013
Incoming Sludge	64.184,22 €	487.021,06 €	820.794,03 €
Incoming Hazardous wastes	42.789,48 €	324.680,71 €	547.196,02 €
Sales of RC	213.947,40 €	1.623.403,53 €	2.735.980,09 €
Sales of WTC	106.973,70 €	811.701,77 €	1.367.990,04 €
Total income	427.894,80 €	3.246.807,06 €	5.471.960,17 €
Bank interests	10.048,00 €	11.450,00 €	11.790,00 €
Production costs	96.848,71 €	131.100,00 €	258.700,00 €
Wages	148.212,40 €	648.244,22 €	1.002.152,39 €
Personal allowance	21.600,00 €	28.000,00 €	35.000,00 €
Machine's depreciation	125.900,00 €	760.800,00 €	760.800,00 €
Total costs	402.609,11 €	1.579.594,22 €	2.068.442,39 €
Benefit	25.285,68 €	1.667.212,84 €	3.403.517,79 €

Figure 6.5: IVR's economic forecast

Source: IVR top manager calculations

The table indicates increasing profit forecast without JM implementation, but the table below (Figure 6.6.), shows a forecast with JM. Applying JM takes the 5% of the people's working time which will not affect the production.

With the investment in education, the first year higher than the others, is expected that the common costs (production) can be reduced by 10% the first year and by 5% the second and the third. The sales (incoming sludge and hazardous waste) will increase as the efficiency of the company increase as well, so at least they will enhance by 5% each year in both activities (RC and WTC).

At the same time if the company's image gets better with the JM implementation, the sales of the final product (RC and WTC) will increase at least 1% in 2011, 3% in 2012 and 5 % in 2013, so taking all the rest as fix the benefit in 2013 is the following:

Concept	2011	2012	2013
Incoming Sludge	67.393,43 €	511.372,11 €	861.833,73 €
Incoming Hazardous wastes	44.928,95 €	340.914,74 €	574.555,82 €
Sales RC	216.086,87 €	1.672.105,64 €	2.872.779,09 €
Sales WTC	108.043,44 €	836.052,82 €	1.436.389,55 €
Sales	436.452,69 €	3.360.445,31 €	5.745.558,18 €
Bank interests	10.048,00 €	11.450,00 €	11.790,00 €
Production costs	87.163,84 €	124.545,00 €	245.765,00 €
JM training investment	25.000,00 €	15.000,00 €	15.000,00 €
Wages	148.212,40 €	648.244,22 €	1.002.152,39 €
Personal allowance	21.600,00 €	28.000,00 €	35.000,00 €
Machine's depreciation	125.900,00 €	760.800,00 €	760.800,00 €
Total costs	417.924,24 €	1.588.039,22 €	2.070.507,39 €
Benefit with JM	18.528,45 €	1.772.406,09 €	3.675.050,80 €
Improvement	73,28%	106,31%	107,98%

Figure 6.6: IVR's economic forecast with JM (LM) application

Source: Own source

Economically talking it is obvious that introducing JM methods in IVR has increasing tangible benefit although not the first year, but this is not everything. It is needed to count the intangible benefits as regards good morale and the new face of the company through the market world. In the table is shown that the payback investment in JM is in one year which indicates that investing in applying JM methods is a good idea to improve IVR efficiency.

Conclusions and recommendations

First, it is important to note that it has complied with the main objective of the project because I have learned and delved into the concepts of Japanese Management, and what is more I was able to apply these concepts at a Spanish company. But, despite the short period implementation, the results of JM observed were clarity process focused, working area clean and commitment of the staff.

At the stage of theoretical study, it was observed that the Japanese have created a new way of managing companies basically through its history and its behaviour in front of life, based on fundamental pillars such as family, honour, respect, responsibility and humility. And not surprisingly, precisely those in which is based the well-known term of JM.

As regards the JM application at a Spanish company, I have noted that any change is difficult at the first time, but if is it possible to manage the situation clearly and systematically, gaining the involvement of everybody, the specific objectives are achieved. It is even more clear the benefits of applying JM in a company because the increases of benefits are substantial after the first year of the application.

But it is vitally important to emphasize that the implementation of enterprise JM system in Western countries is totally different and more difficult than Japanese companies due to differences in education, work attitude, and especially individualistic and selfish mentality of people from West unlike the collective mentality of the Japanese.

Finally, I believe that from all the methods studied in this project the easiest is to implement the 5S, since the steps are clearly defined and its objectives are easily accessible and visible in a short period of time. Bet for JM in any company is a right decision due to its global success and low monetary investment, but it requires much management effort though.

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