PART 3

The Necessary Adaptation of the Company for the Future

Chapter 10

Japanese Methods

10.1. Japan from the Meiji era to now. The origin of the Japanese miracle

10.1.1. *A bit of geography*

The Japanese archipelago consists of thousands of islands and it stretches to about 3,000 km. Seventy percent of the 377,835 km^2 of the country is mountainous; less than a quarter of the total area is arable. Moreover, Japan has very few raw materials. On average, it has at least one earthquake per day, excluding the volcanic eruptions and tsunamis. About 117 million people, less than 2% of the global population, live on the equivalent of French Brittany in a not particularly hospitable country [DOB 95]. Japan, the second world power since 1968, has just been surpassed by China, which is 11 times more populated.

10.1.2. *A bit of history*

Japan was confronted with the West in 1542 with the arrival of European merchants followed by the Jesuits (St. Francis Xavier). It closed its doors to the West during the 17th Century.

It was in the mid-19th Century, after the mission of the American Commodore Perry in 1853, that Japan was forced to trade with the West. The ascension of Emperor Meiji (1852–1912) to the throne in 1867 marked the transition from a feudal state to a modern state. Japan sent its best students to study in Europe and in

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the United States. It had brought its modernization and industrialization to become a leading power with its own means!

In 1905, the destruction of the Russian fleet in the Tsushima Strait took the world by surprise. Japan was done with affronts by the West. The white people were no longer invincible!

After World War I, it became the sole Asian colonial power, it ruled over Korea and Taiwan, and participated in the Treaty of Versailles.

In 1942, it occupied a part of China and a large part of Asia Pacific (Philippines, Singapore, Malaysia, Burma (today Myanmar), Pacific islands, etc.).

The attack against Pearl Harbor on December 7, 1941 resulted in the entry of the United States into World War II.

In 1945, Japan was defeated and signed its surrender on the *Missouri*, anchored off Tokyo on September 2 of the same year. Japan was occupied for the first time in its history.

The country was devastated; the incendiary bombing by General LeMay using the *B-29* Superfortress flying at 1,500 m altitude caused massive destruction, especially in Tokyo. One-third of the capital was burnt; the wooden buildings had caused thermal effects which were previously unknown; the doors of houses went high up in the sky and hit the bombers. The atomic bombs dropped on Hiroshima and Nagasaki put an end to a terrible war.

General McArthur was appointed as governor of Japan. The United States decided to help the country to rise from the ashes fearing that poverty would lead the country toward communism.

In 1947, in order to put the telephone network back on track, McArthur made an appeal to W.E. Deming.

Deming met with the executives of Keindaren, one of the largest associations of Japanese private companies. The ideas of Deming, poorly received in his native country, were adopted by the Japanese.

From 1960, the results expected by the implementation of the Deming system materialized and Japan started to export its products to the West.

At the end of the 20th Century, more than half of American cars were of Japanese origin.

At the beginning of the 21st Century, Toyota was the premier car manufacturer in the world.

Gone are the days when the Japanese product was synonymous with "junk"; before World War II, did Japan not sell watches in kilos?

Human qualities and the intelligence of people accustomed to sacrifice are undoubtedly among the causes of this success. We are interested only in the technological aspects of the "Japanese system" the best illustration of which is the Toyota system.

Deming is inseparable from the Japanese miracle.

The disaster of the nuclear power plants of Fukushima in March 2011 caused by an unprecedented earthquake and tsunami tarnished the image of Japan and the nuclear industry throughout the world. This did not alter anything in the Japanese industrial system and the country's capacity to react in adversity.

10.2. W.E. Deming and Japan

During his stay in Japan, Deming exhibited his theories of management at popular conferences attended by employers, who put them into practice.

Starting in 1950, the Deming Prize was awarded to Japanese companies that were of the highest order in terms of management. In Japan, Deming was revered as a demigod and received the highest awards.

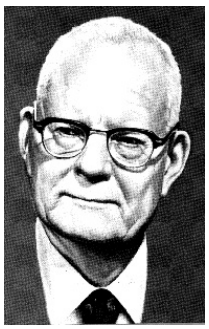
It was not until 1980 that his ideas started to establish themselves in the United States, due to the supportive collaboration with the journalist Claire Crawford Mason of NBC who hosted a TV show on the theme *"If Japan Can Why Can't We"*.

This program broadcast the principles of Deming through videotapes that reached university campuses.

10.2.1. *A brief account of the Deming system*

The Deming system deals with the management of the company, public administration, and education. It is based on process control, coordination of operations, and prediction. Its philosophy and "creed" are expressed in Deming's 14 points [BRE 99]. His method for continuous improvement is symbolized by the famous Deming wheel or the PDCA (*Plan, Do, Check, Act*) approach described in Chapter 13, " Change Management ".

W.E. Deming was born in 1900 in Sioux City, Iowa in the United States.



He obtained a PhD in theoretical physics from Yale University. He worked for 10 years on nitrogen fertilizers in a laboratory at the Ministry of Agriculture.

In 1938, he took up the post of statistician at the *Bureau of the Census* in Washington DC. From there, he developed statistical techniques from surveys by sampling, which was internationally acclaimed.

He implemented the concepts that Walter Shewhart (1891–1967) had executed right from 1924 in the Hawthorne plant of the Western Electric Co.

Shewhart was considered to be the father of Statistical Quality Control *(SQC) of which the* Shewhart Charts *represent the most famous element.*

During World War II, Deming assisted the arms industries. With Shewhart, he taught technicians a management system that aimed at improving the productivity and quality of war materials. Not many listened to him.

In 1946, he became Professor of statistics at New York University.

Box 10.1. *W.E. Deming (1900–1993)*

10.2.2. *The Japanese system from SQC to TQM*

Post-war Japan started to progress in heavy production (metallurgy, automobile industry, and so on), and set up a *QC Research Group* (QC–*Quality Control*) in order to be able to offer quality products.

This group sought the help of Deming, who was a world-renowned statistician [HOD 92], right from 1949. In fact, the Japanese engineers very quickly recognized the effectiveness of statistical methods in order to correlate manufacturing defects and operating conditions.

Japan moved on from SQC (Statistical Quality Control) toward TQM (Total Quality Management), thanks to J.M. Juran [JUR 98]. TQM included SQC by extending its field of investigation to the actual production, marketing, sales, and so on [JUR 98]. All the processes of the company were reviewed!

TQM aims for customer satisfaction. Japan took on value analysis, developed by Lawrence Miles (see Chapter 9, "Project management techniques: engineering") [PAR 99], and implemented QFD (Quality Function Deployment).

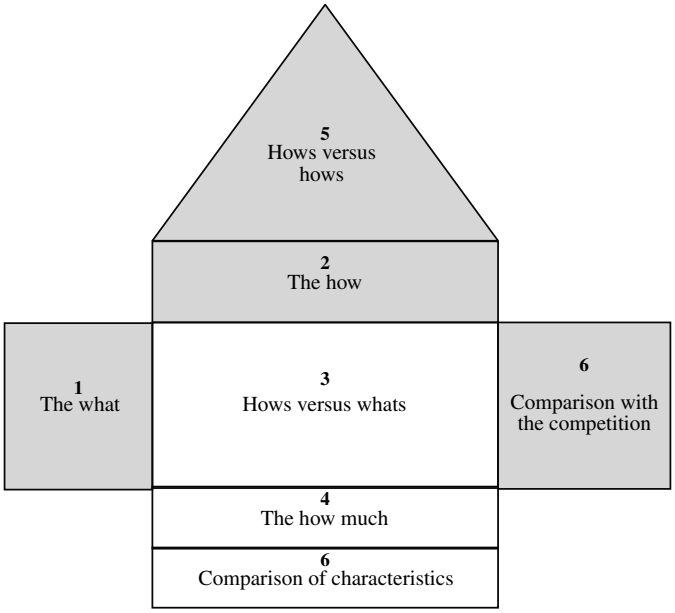


Figure 10.1. *The "house of quality"*

In 1972, this method was used by Mitsubishi in its Kobe shipyards. It is an accurate method that translates *customer* requirements into *technical objectives*. The basic tool is the "house of quality" (Figure 10.1) which enables integration of quality in the development of a new product at a very early stage. The method requires answers to the following four questions:

– what are the first and foremost expectations that need to be satisfied in order to ensure the commercial success of the product?

– what are the technical solutions that need to be worked on?

– what are the critical points to be examined?

– what are the risks that need to be controlled?

The method takes place in two phases: the construction and deployment of the house of quality. QFD "brings" the customer into the engineering and design department.

The construction of the house of quality includes the following six steps:

– identifying the customer's needs (Whats);

– defining the technical characteristics of the product to be offered (Hows);

– establishment of the relationship between the characteristics and needs of the customers (Hows versus Whats);

– setting the level of technical performance of the characteristics (How many);

– determining the connection between the characteristics (Hows versus Hows), and ensuring that there is no redundancy or conflict between two characteristics;

– comparing the product with those of the competitors (the comparison).

10.3. The Toyoda family – Taiichi Ohno – The Toyota Empire

Sakichi Toyoda (1867–1930) [APP 10] was the son of a carpenter. He took up the construction of looms. He sold the license of an automatic loom to an English company.

On his deathbed [APP 10], he urged his son Kiichiro (1894–1952) who had the same inventive genius to get into the automobile industry; the Toyota Motor Corporation was founded in 1937.

In 1949, Toyota was in great difficulty; a strike for 15 months had put the company close to bankruptcy. Kiichiro resigned in 1950.

Eiji Toyoda (1913–), nephew of Sakichi Toyoda, succeeded him after several years. He led Toyota for 25 years after starting as an engineer in the family loom business. He described himself as an engineer–manager. He visited the Ford plants in the United States. He reproduced their gigantism but incorporated quality as well. He was considered to be the father of the Toyota system assisted by a man of genius, Taiichi Ohno.

10.3.1. *Taiichi Ohno (1912–1990), the man of JIT (just in time)*

Taiichi Ohno began his career in the textile sector of the Toyoda family before joining its automotive sector in 1939. The story was that during a study visit in the United States, he observed that, in a supermarket, the shelves were not restocked with the products until the stock was almost gone.

This observation would be the cause of his flash of genius that led him to develop the Kanban system, also called just in time (*JIT*).

Box 10.2. *Taiichi Ohno (1912–1990)*

Kanban in Japanese means label; a label is attached to the container of machined parts at the upstream post that will supply a downstream production post. The upstream post will not start a new production cycle until the return of the kanban of the downstream post. This is the system of zero inventory; one produces only what one needs [LU 89].

This is control by downstream "flows". The customer's requirements launch the production process: it is not the company itself!

This *a priori* simple idea took about 10 years to be implemented, the labor unions opposed it initially. It was implemented starting from the 1960s.

For many authors, JIT is a synonym for "Toyota". Toyotism is actually a complex system which, in addition to JIT, includes a wide range of methods and tools that propelled Toyota to the forefront of the international scene.

10.4. Toyotism

It is difficult for a non-Japanese person to understand this system. Japan is a country whose culture and the type of relationships between people are very different from that of the other countries, especially Western countries. The language barrier makes it difficult to analyze!

The methods involved are numerous; it is not easy to find one's way around! We will try to highlight the salient features of the system.

10.4.1. *General philosophy – principles of management*

Figure 10.2. *A Toyota plant*

Toyotism seeks customer satisfaction by providing a quality product that meets his or her requirements [OZE 90].

It believes that wealth is created at the plant, at the *workplace*. The worker contributes to this creation of wealth by being effective, that is by not producing rubbish, while improving his productivity.

Toyotism is a system based on the philosophy of *Kaizen* or continuous improvement. The Japanese quickly adopted the PDCA (Plan, Do, Check, Act) approach of Deming which seeks the same goal. The PDCA approach is discussed in Chapter 13.

Toyotism is the kingdom of TQM (Total Quality Management). This total quality approach was performed without computers, robotics, and other words ending in "ics", and for a good reason!

Toyotism is also described as the system of five zeros: zero defects, zero breakdowns, zero setup time, zero inventory, and zero paper. Here, zero is synonymous with optimum!

Stock is synonymous with waste; products are manufactured but are not sold, inventories are accumulated because the machines do not work at the same pace. There are bottlenecks, poorly managed constraints, and a lack of synchronism. As mentioned above, *Kanban* or JIT reduces the stocks to the minimum and results in financial gain by reducing the costs associated with the inventory.

There is constant assessment.

Graphs of all kinds, histograms, bar charts (Gantt charts), pie charts, polar diagrams, or web charts; dashboards giving goals, standard deviations, performance indicators, projections for the future, and so on, with some explanations. These are the essential tools of management reports.

10.4.2. *Problem solving*

The most common method that the West uses easily is the cause-and-effect diagram. This diagram is also called as the Kaoru Ishikawa diagram, named after its promoter, or the fishbone diagram. It makes it possible to establish the connection between an effect (that is observed) and the causes that are likely to be its source [OZE 90].

To classify the causes into categories, one often uses the five M's, which cover: manpower, materials, machines, environment, and methods. But, the categories vary according to circumstances. By being very visual, the diagram clearly shows the structure of causes of the problem, generally put forward during a team *brainstorming*.

EXAMPLE 10.1.– Causes for the fall of a worker on a puddle of oil in the plant.

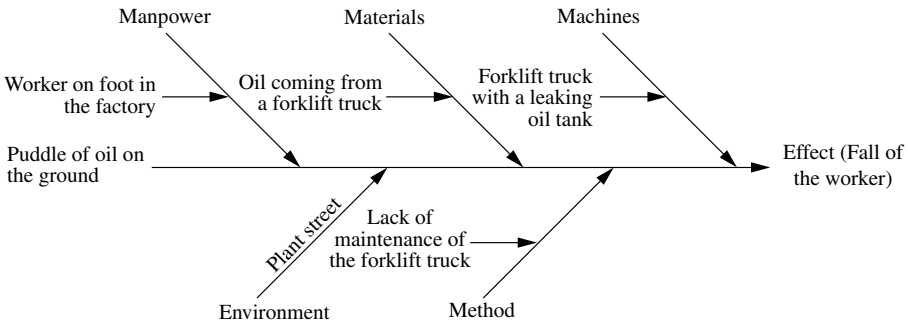


Figure 10.3. *Example of an Ishikawa diagram*

10.4.3. *The KJ method or affinity diagram*

This method, invented by Professor Kawakita Jiro (KJ), an anthropologist, uses Post-It notes. This is the basic tool for solving problems whatever their nature or complexity. The group works on a given theme; each participant formulates his or her idea in a sentence (subject, verb, complement). The sentence does not contain any negation. The leader gathers the Post-It notes on a board. This is a way to structure the brainstorming.

10.4.4. *Statistical process control*

Any process has a tendency to drift, either for unpredictable but identifiable causes (power failure, error of raw materials, control error), or for random or unknown causes, also known as unidentifiable causes, which depend on the process (slight variation of raw material, failure of a measuring device, etc.).

Let us recall that W.E. Deming was invited to Japan for his expertise in statistical process control; we have mentioned it above (from SQC to TQC). SQC is an essential tool for zero defects.

10.4.5. *Improvements at the workplace*

One of the characteristics that seems to differentiate Toyotism from Taylorism and Fordism is job enrichment, the involvement of workers in improving the working conditions and overall effectiveness.

In this section, we will discuss creating the work environment, quality of ambiance, and the tools that are available for the first level of supervisors.

10.4.5.1. *Visual management*

This is about making the workplace, particularly the plants, “transparent”, pleasant, welcoming, and a place for delivering positive messages. Cleanliness, orderliness, interior design, and display are key factors. Ground lighting, signs, reference points, and maps, so that visitors are not lost, are important and should not be underestimated.

The display of performance indicators related to the commitments of management and staff, and to quality, safety, and the environment helps show that there is dynamism, a desire in the system to move forward. The display of improvement objectives clearly indicates that an improvement plan has been established and is being followed.

10.4.5.1.1. The 5S method [HIR 95]

This Japanese method takes its name from the first letter of five Japanese verbs:

– *seiri* = removing (remove the unnecessary); organizing;

– *seiso* = cleaning;

– *seiton* = setting in order;

– *seiketsu* = standardizing;

– *shitsuke* = sustaining the discipline.

Many Western industrial managers have observed that this method is extremely effective in Japanese factories. It is not sweeping the floor; it is a state of mind that goes far beyond "everything in its place". It aims to take a fresh look at the workspace.

Fighting the dirt can be very difficult in a process unit that handles powders. In this case, having an immaculate workshop requires redesigning the equipment (no more leakages) and its mode of operation. Tags indicate defects. One part of the tag is attached on the equipment that has a problem; the other part of the tag is displayed on a board of the control room. While entering the control room everyone sees where the problems lie. They must be quickly remedied. This is Deming's wedge of the PDCA wheel (*shitsuke!*).

10.4.5.2. *SMED (Single Minute Exchange of Die)*

SMED is an organization method that tries to reduce the changeover time systematically, with a quantified objective and is the object of the AFNOR NF X50 – 310 standard. This Japanese method, conceived in 1970 by a Japanese engineer named Shigeo Shingo on behalf of Toyota and an emblematic figure of *lean manufacturing*, consists of finding ways to quickly adapt one machine to another job in batch processes and processes in series. This method is based on the differentiation between internal and external tasks:

– internal tasks are the tasks, whose implementation requires plant shutdown;

– external tasks are the tasks that are not directly dependent on the operating process of the plant.

Preparing for changes in "concurrent operation time" (during the operation of machines), organizing the operations, and adapting the equipment parts can provide significant time, productivity, and financial savings. The method is usually associated with "just in time" (JIT). It is carried out according to the following four steps:

– identification of the operations performed when changing the series;

– separation of internal and external operations;

– conversion of internal operations into external operations;

– rationalization of the internal operations as external operations.

10.4.5.3. *Poka Yoke [SHI 88]*

This other Japanese method consists of relieving the operator from excessive need for attention by using simple tools based on the senses (vision, hearing) in order to prevent breakdowns: it is an anti-error system. It involves defining the equipment items that avoid (*yoke*) unintentional errors (*poka*), organizing himself, being imaginative and studying the work center in detail. The objective of Poka Yoke is to achieve "zero defects". Poka Yoke was invented by Shigeo Shingo, the designer of the SMED system.

For example, Poka Yoke uses templates so that the worker positions his or her piece on the machining tool without having to take special measures; this saves him or her time and reduces the possibility of errors.

It may use specific fittings for fluid pipes to avoid contamination.

Alarms indicating the incorrect positioning of tools, work-pieces, and so on are put in place.

10.4.6. *Human aspects*

It is difficult to give the name "tools" to the things that involve human beings. However, nothing can be done without methods and without active involvement of the players of the company. It is pointless to discuss quality if employees are not motivated and trained. Training affects team work amongst other things. This is the group which needs to be convinced that progress is necessary and knowledge must be questioned by "foreign" people in the group.

There is no doubt that the Japanese "miracle" owes much to the ability of the Japanese to work in teams, to accept "quality circles", to progress and to fight for their workspace.

10.5. The American response

It was from the 1960s that America, which felt the upcoming Japanese threat, began to think about methods of production management. The APICS (American

Production and Inventory Control Society) was founded in 1957 in Cleveland [KER 89] and has more than 80,000 members today!

It is interesting to note that the word *Inventory* is included in its name. The American response would be at the source of management systems called MRP I and II (Material Requirements Planning and Manufacturing Resource Planning) respectively.

A similar method, the OPT (Optimized Production Technology) method, highly publicized by its inventor, develops the concept of constraints or bottlenecks.

Re-engineering was all the rage starting from the 1980s. We will discuss this in Chapter 13 "Change Management".

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