6 Sigma and ISO 9001:2000 Rivals or partners?

Quality was once the prerogative of engineers in white coats, employing specialized tools and techniques for measurement and analysis. With the arrival of the ISO 9000, quality was no longer a specialist function, but moved to the boardroom as a central management concern. Does 6 Sigma and its tools and techniques represent the revenge of the quality technicians, or does it add to the "what needs doing" of the ISO 9000 approach the necessary "how to do it"?

Companies large and small know ISO 9001:2000 because without it, they would soon stop getting calls from business partners. Apart from sector-specific requirements such as ISO/TS 16949:2002 for the automotive industry, and ISO 14001 for environmental management, the main alternative approaches available are the EFQM assessment model for Europe, Malcolm Baldrige for the US and Deming for Japan.

These approaches, all of which are equally interesting, are more managerial in that they involve a systems approach including the aspects of leadership, human resource management, customer satisfaction and measurement of overall results, not forgetting the social environment through relationships with local and national communities.

In Europe, ISO 9001:2000 and EFQM are the best known and most widely used for various reasons and are driven either by market forces or by corporate strategy.

Neither of these two approaches intrinsically contains a problem-solving method. They allow improvement of aspects that emerge at the tip of the cost iceberg, but not always of those lurking in the submerged part, which are usually the most significant in financial terms. When one knows that the visible part covers only 5 % of the costs of non-quality, while total losses can amount to as much as 25 %, one can only wonder about the choice of tools in relation to the economic stakes (*see **Figure 1** overleaf*). What is needed, therefore, is to apply the classic complementary problem-solving tools within a Plan-Do-Check-Act cycle of continual improvement.

6 Sigma is applicable to any process within the company

The 6 Sigma approach provides another vision of progress because it brings together:

– a rigorous problem-solving approach integrating methods and tools at each stage of the improvement cycle, and using statistical

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analysis to understand the phenomena involved;

– an organized management approach based on a "Champions, Black Belts and Green Belts" structure;

– a new approach for implementing improvement initiatives in the medium and long term.

Furthermore, it is applicable to any process within the company, from design to customer invoicing, through all stages of production, and not forgetting supporting services (human resources, logistics, purchasing, maintenance, etc.).

The ISO 9001:2000 approach, even if it represents a plus compared with the 1994 edition, does not actually specify methods – the *how* – to improve the processes.

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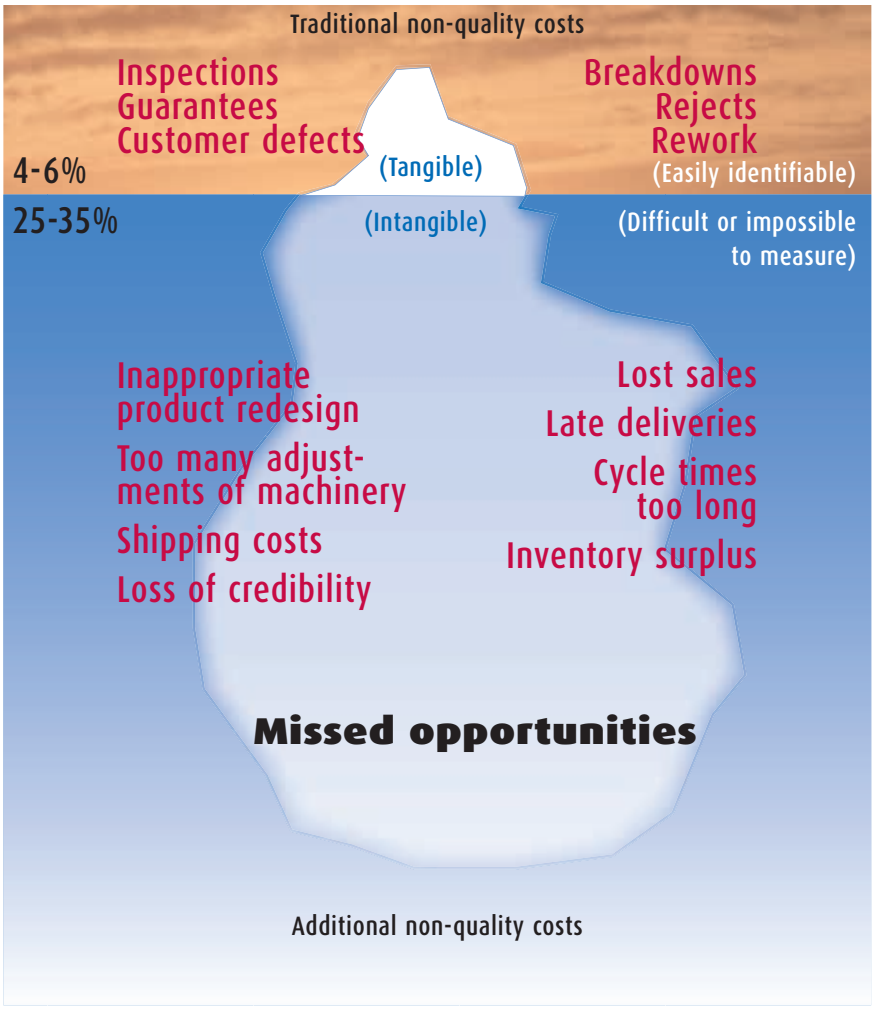
Figure 1: The iceberg of costs due to non-quality



It nonetheless provides the basis for a fresh start in optimizing the company because it is the first basic process-describing activity required for introducing an improvement approach. 6 Sigma, through the DMAIC (Define–Measure–Analyse-Implement-Check – *see* ***Figure 2***) cycle, provides a thorough and powerful methodology for optimizing not only the processes, but also for reducing their variability.

Strengths and limitations of ISO 9001:2000

Compared with the earlier version, ISO 9001:2000 reinforces the role of company leadership in the management of the quality system and introduces the process approach and measurement using indicators to demonstrate efficiency and effectiveness in achieving the intended results.

This significantly facilitates the subsequent implementation of 6 Sigma, even if one should not compare the ISO 9001:2000 process-definition requirement with the 6 Sigma road-mapping requirement, which is far more demanding. The 6 Sigma approach is more fundamental in that it involves defining the characteristics of the process, defining limit specifications and classifying the data – uncontrollable "noise", controllable variables, or procedures.

At each stage in a process, two types of variables need to be distinguished: "noise" variables (i.e. those incidental aspects that cannot be controlled in the same way as the environment and the operators can) and controllable variables, which can actually be measured. It is also necessary to determine whether there are any procedures to be considered at this stage.

The main strengths of ISO 9001:2000 are that it:

- provides evidence that the customers' requirements have been taken into account;

- shows that at a given moment (the certification audit) the company complies with the requirements;
- ensures quality from day to day;
- describes through procedures what is being done and how nonconformities are being remedied without waiting for customers to complain;
- relies on a PDCA continual improvement approach;
- is proactive with regard to customer expectations by means of satisfaction surveys.

However, the main weaknesses of ISO 9001:2000 are:

- it ignores indicators that are significant for the company with regard to internal (non-value adding) and external (commercial performance and strategic choices) results;
- it does not require a formalized classification of processes. In describing processes, it is not enough to describe the value-adding process alone, because in some cases there would not be much to report.

It is not uncommon to find ISO 9001:2000 certified companies showing a level of 35 000 parts per million (ppm) of deficiencies in production and hovering between 2,5 and 3 Sigma (see box, "6 Sigma in brief") with regard to their processes. In fact, it is the end customer who pays for the internal nonconformities because losses have to be financed in order to maintain margins.

ISO 9001:2000 reinforces the role of company leadership in the management of the quality system

The benefits of the 6 Sigma approach

The 6 Sigma approach goes to the very root of processes that generate losses by placing the emphasis on verified facts that have been statistically explained. The objective, therefore, is to optimize economic performance while satisfying the customers. It is based on the DMAIC cycle, linking the right tools and their application in the right place – which is its great strength.

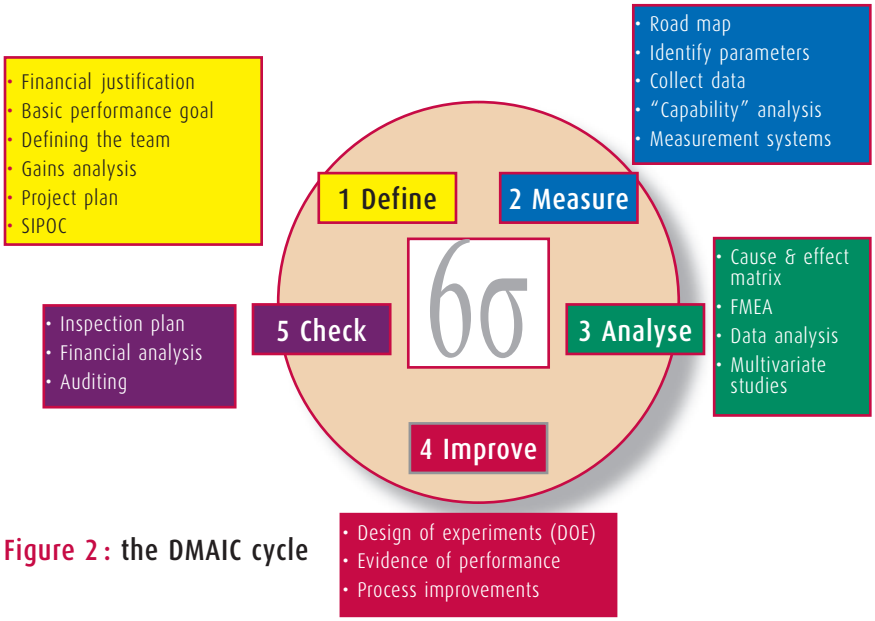


Figure 2: the DMAIC cycle

The features introduced by the 6 Sigma method are:

- Focus on customer expectations and the ability to meet market requirements as they evolve (in 6 Sigma, there are internal customers and end customers).
- A management approach that focuses on identifying problems induced by poorly performing processes that lead to internal losses in terms of rejects and rework, but also in terms of their non-value-adding cost. These are the aspects which heavily jeopardize the company's cost efficiency and, hence, its sustainability.
- An in-depth description of process activities by seeking potentially influential variables, categorizing them according to their nature, measurability, etc..
- Extensive use of practical tools and descriptive statistics based on verified facts, disregarding views and rumours that have not been verified in practice.

6 Sigma in brief

The 6 Sigma process improvement methodology makes extensive use of statistics. 6 Sigma projects focus on defining the key variables associated with a given process and then refining that process and removing the variation.

All processes behave according to a normal distribution law (known as the Gauss distribution or Laplace-Gauss distribution), which is characterized by its mean (centre of the distribution) and its Sigma (representing the standard deviation of a distribution) where 99,74 % of the data fall within the + or - 3 Sigma range. In such cases, it is unlikely that the customer's specifications are being met. A 6 Sigma process is one where there are six units of standard deviation between the distribution mean and the customer's specifications. (See Figure 3.)

- Strong participation of all players within the company, whatever their level, from the design office to the operator.
- Involvement suppliers who can be the source of disruptions through lack of control over supplied raw materials.
- Involvement in all company activities, often across functions (it is not uncommon to see projects that directly involve raw material suppliers in order to minimize the risk of disruptions due to non-quality surfacing during production.)
- A structured organization (Champions, Black Belts, Green Belts, etc.) in which staff permanently assigned to one or two projects systematically track down any losses identified by management without waiting for customers to complain.
- A change in company culture with regard to how it seeks to achieve profits.

6 Sigma is perfectly complementary with other approaches, particularly ISO 9001:2000

Another major difference compared with the traditional, managerial quality approaches is that 6 Sigma invests in individuals with potential, irrespective of their initial skills or degree of knowledge or position in the company, whether in production or in supporting services.

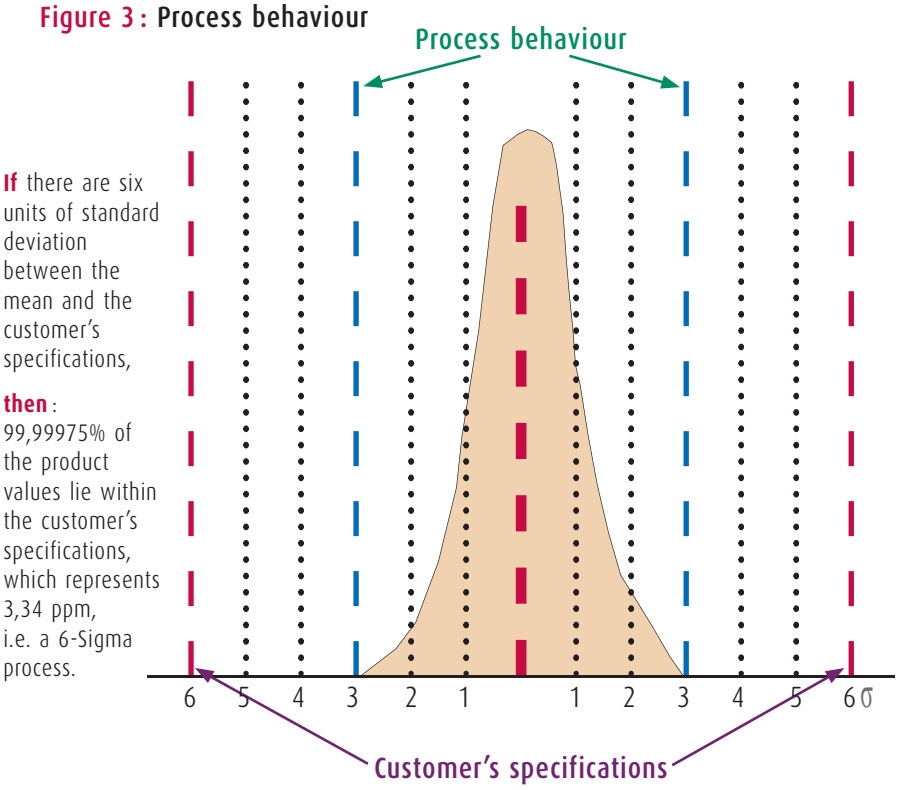
This investment in individuals is made once and for all and whoever has followed it will keep it even after leaving the company (provided this knowledge is used on a regular basis because of the need to proficiently master some particularly advanced tools). In addition, 6 Sigma fits in perfectly well with other approaches such as Supply Chain and Lean Manufacturing.

Results

Few companies publicize their results – for very understandable reasons! But General Electric did publish the following findings of its 6 Sigma programme:

- On average, non-6 Sigma companies are at a level of 35 000 defects per million opportunities for defects (one article may have several defects).
- Cost of going from 3 or 4 to 6 Sigma (see box '6 Sigma in brief'), USD 7-10 billion (equivalent to 10-15 % of turnover).
- First year:
  - 30 000 people trained in 6 Sigma
  - costs: USD 200 million
  - savings: USD 150 million the first year (USD 200 million in the second year)
- Operating margins up from 14,8 % in 1996 to 18,9 % in 2000
- Extension to immediate suppliers.
- By 2000, 15 % of managers were Black Belts.

Figure 3: Process behaviour



Conclusions

To conclude with a different view of the subject, it is worth noting that:

- Company certification or qualification approaches (ISO 9001:2000, EFQM, etc.) are broad management approaches that can be also be applied on the basis of self-evaluation according reference documents, but are often market driven.
- 6 Sigma is more of a structured management system, built on project management, for solving specific problems identified on the basis of a search for significant gains, based on the variability of processes and not on their description, however accurate that may be, and usually management driven!
- The DMAIC cycle, when properly implemented, leaves little room for error. Of course, it uses the classic quality tools, but only to initially measure and subsequently check at the inspection stage whether the actions undertaken have reduced the variability of the analysed process.

In fact, 6 Sigma is perfectly complementary with other approaches, particularly ISO 9001:2000, where process orientation and efficiency indicators are present at last. Moreover, the quality culture instilled by the traditional approaches sets the ground for understanding this new approach.

However, it introduces other dimensions: measurement, the role of questioning in the mental framework and attention given to problems through a permanent problem-solving organizational set-up.

If quality is everybody's business, then the 6 Sigma approach fits in perfectly well, since it does not attempt to codify quality in manuals and procedures, but rather to control all processes involved in the creation of variability, in line with corporate requirements and constraints.

To perform well, companies do not need to be certified, but in order to minimize the risk of disappearing because of poor financial results, they cannot overlook methods such as 6 Sigma. One should not wait for the market to decline before optimizing one's processes, for that could be too late!

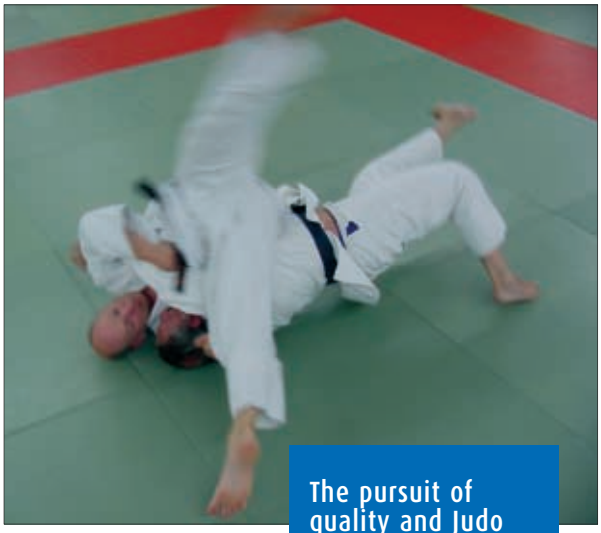
The battle, then, is clearly the same, but with other methods and with an often more tangible outcome in terms of operational and financial results, which has been demonstrated for more than 15 years – and not only in the US.

A great majority of quality managers do not have access to statistical analysis software, but the Black Belts, as a whole, do have such a tool in the form of the four following pieces of advice that need to be taken into account when seeking to control process variability:

- **Measure** nothing unless you **record** it.
- **Record** nothing unless you **represent** it in graphical form.
- **Represent** nothing unless you plan to **analyse** it.
- **Analyse** nothing if you do not intend to **act**.

For instance, Statistical Process Control (SPC) is a quality method widely used in companies to monitor fluctuations in the results of manufactured products using control charts – but most of these traditional methods do nothing to explain the process' variation – indeed, quantifying variation has no effect on the variation itself.

The classic quality tools are often used in very disparate ways. 6 Sigma reinstates them within a structured approach that restores them to their required efficiency while removing some of the myths surrounding them.



The pursuit of quality and Judo may seem far removed, yet in both contexts, opposing one force against another leads only to a blockage. However, focusing all energies in one direction achieves the optimal results.

IMS graphic artist Pascal Krieger, a 4th dan black belt in Judo, provides a demonstration of this principle: by a spiral movement, he combines his opponent's force with his own to achieve a spectacular overturn in a matwork technique.