

Six Sigma: A Fascinating Business Strategy and Its Contributions for Quality Innovation

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Abstract

Six Sigma was introduced into Korea in 1997, and it is regarded as a fascinating management strategy in many Korean companies. First of all, the reasons why Six Sigma is fascinating are given and a smart way to introduce Six Sigma is illustrated. Seven step procedures to introduce Six Sigma are explained. Next, the differences of problem-solving processes for project team activities for R&D, manufacturing, and service areas are compared. Third, a typical process for R&D Six Sigma is proposed, and major activities and scientific methods at each process step are suggested. Fourth, some differences between Six Sigma project team and quality circle team are presented. Finally, a Six Sigma model for e-business is proposed and briefly explained.

1. What is Six Sigma?

Sigma is a letter in the Greek alphabet that has become the statistical symbol and metric of process variation. The sigma scale of measure is perfectly correlated to such characteristics as defects-per-unit, parts-per million defective, and the probability of a failure. Six is the number of sigma measured in a process, when the variation around the target is such that only 3.4 outputs out of one million are defects under the assumption that the process average may

drift over the long term by as much as 1.5 standard deviations.

Six Sigma may be defined in several ways. Tomkins(1997) defines that Six Sigma is "a programme aimed at the near-elimination of defects from every product, process and transaction". Harry(1998) defines that Six Sigma is "a strategic initiative to boost profitability, increase market share and improve customer satisfaction through statistical tools that can lead to breakthrough quantum gains in quality".

Six Sigma was launched by Motorola in

1987. It was the result of a series of changes in the quality area starting in the late 1970s, with ambitious ten-fold improvement drives. The top management with CEO Robert Galvin developed a concept named Six Sigma. After some internal pilot implementations, Galvin, in 1987, formulated the goal of "achieving Six-Sigma capability by 1992" in a memo to all Motorola employees (Bhote, 1989). The results in terms of reduction in process variation were on-track and cost savings totalled US\$13 billion and improvement of labor productivity became 204% increase during 1987-1997 (Losianowycz, 1999).

In the wake of successes at Motorola, some leading electronic companies such as IBM, DEC, Texas Instruments launched Six Sigma initiatives in early 1990s. However, it was not until 1995 when GE and Allied Sigma launched Six Sigma as strategic initiatives that a rapid dissemination took place in non-electronic industries all over the world (Hendricks and Kelbaugh, 1998). In early 1997, Samsung and LG groups in Korea began to introduce Six Sigma under their companies. The results were amazingly good in those companies. For instance, Samsung SDI, which is a company under Samsung group, reported that the cost savings by Six Sigma projects totalled US\$150 million (Samsung SDI, 2000). At the present time, the numbers of big

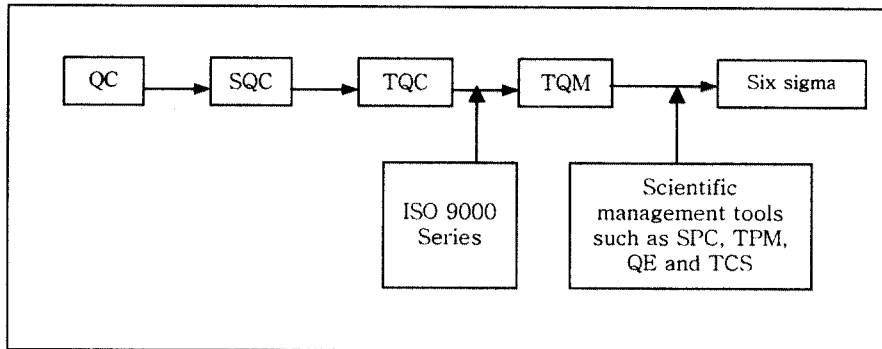
companies applying Six Sigma in Korea are exponentially growing, with a strong vertical deployment into many small and medium sized enterprises as well.

Through the consulting experiences of Six Sigma in Korea, the author believes that Six Sigma is a new strategic paradigm of management innovation for a company to survive in this 21st century (Park et. al, 2000). Six Sigma implies three things; statistical measurement, management strategy and quality culture. It tells us how good our products, services and processes really are through statistical measuring of quality level. It is a new management strategy under leadership of the top management to create quality innovation and total customer satisfaction. It is also a quality culture. It provides the way to do things right the first time and to work smarter by using data information. It also provides an atmosphere to solve many CTQ (critical-to-quality) problems through team efforts.

2. Why is Six Sigma fascinating?

Six Sigma is very popular in Korean industry. There are several reasons for this popularity. First, it is regarded as a fresh quality management strategy which can replace TQC, TQM and others. In a sense,

Figure 1. Development process of Six Sigma in quality management



QC : quality control
 SQC: statistical quality control
 TQC: total quality control
 TQM: total quality management
 ISO : International Organization for Standardization
 SPC: statistical process control
 TPM: total productive maintenance
 QE : quality engineering
 TCS: total customer satisfaction

we can view the development process of Six Sigma as shown in Figure 1. Many companies which were not quite successful in implementing the previous management strategies such as TQC and TQM, are eager to introduce Six Sigma.

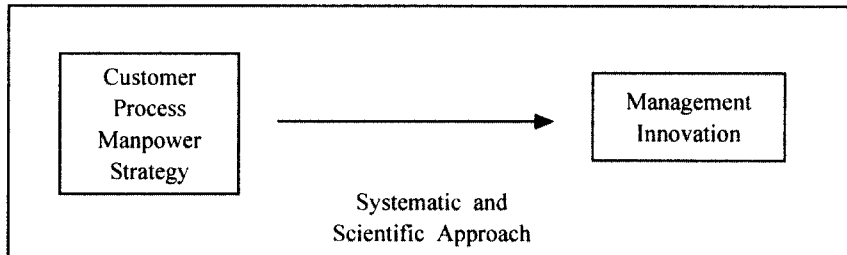
Six Sigma is viewed as a systematic and scientific approach for management innovation by the integration of four elements; customer, process, manpower and strategy as shown in Figure 2.

Second, Six Sigma provides a scientific and statistical basis for quality assessment for all processes through measurement of

quality level. The Six Sigma method allows to draw comparisons among all processes, and tells how good a process is. By this information, the top management knows what to do for process innovation and accordingly for customer satisfaction. Third, Six Sigma provides an efficient manpower cultivation and utilization. It has a belt system in which there are green belt, black belt, master black belt and champion. As a person in a company gets some education, he belongs to a belt. Usually, a black belt is the leader of a project team and several green belts work together for the project team.

Lastly, there are many successful stories of Six Sigma in well known world-class companies. Besides Motorola, GE, Allied Signal, IBM, DEC and Texas Instruments as mentioned above, Sony, Kodak, Nokia, Philips Electronics, Samsung Electronics, LG Electronics among others have been quite

Figure 2. Essence of Six Sigma



successful in Six Sigma.

3. A smart way to introduce Six Sigma

When a company wants to introduce Six Sigma for its management strategy, the author would like to recommend the following seven-step procedures.

- 1) Organize a Six Sigma team and set up the long-term Six Sigma management vision for the company.
- 2) Start Six Sigma education for Champions first.
- 3) Choose the area for which Six Sigma is introduced first.
- 4) Start the education for Green belts(GB) and Black belts(BB).
- 5) deploy CTQs for all areas concerned. Appoint a few or several BB as full time project leaders and ask them to solve some important CTQ problems.

- 6) Strengthen the infrastructure for Six Sigma such as statistical process control (SPC), knowledgement management (KM), database management system and so on.
- 7) Designate the Six Sigma day each month, and check the progress of Six Sigma from the top management. On this day, if necessary, presentation/reward of Six Sigma results can be implemented.

First of all, a few or several members should be appointed as a Six Sigma team to handle all kinds of Six Sigma jobs. And then the team should set up the long-term Six Sigma vision for the company. This is the first important task for the team to do. It is said that this is the century of 3Cs, which are Change, Customer and Competition for quality. The Six Sigma vision should match these 3Cs well. Most importantly, all employees in the company agree to and respect this vision.

Second, Six Sigma can begin from the proper education for all classes of the company. The education should begin from

the top management and directors, so called Champions. If Champions do not understand the real meaning of Six Sigma, there is no way for Six Sigma to go in the company. After Champion's education, GB→BB→MBB (Master Black belts) education in sequence. However, usually MBB education is practiced in professional organizations.

Third, we can divide Six Sigma into 3 parts according to its characteristics. They are R&D Six Sigma, Six Sigma for manufacturing processes, and Six Sigma for service areas. The R&D Six Sigma is often called DFSS(Design for Six Sigma). It is not easy to introduce Six Sigma to all areas at the same time. In this case, the CEO should decide the order of introduction to those 3 areas. Usually it is easy to introduce Six Sigma to manufacturing processes first, and then service areas and R&D areas. However, the order really depends on the current circumstances of the company.

Fourth, the GB and BB educations are the most important ingredients for Six Sigma. Usually, the GB education lasts one week, and the BB education lasts 4 months. The format of BB education is normally as the following. Each month consists of one week lecture and 3 weeks practice. During the 4 month period, each BB is requested to solve a project by himself.

Fifth, Deploy CTQs for all departments

concerned. These CTQs can be deployed by policy management or by management by objectives. When the BB are born, some of important CTQ problems should be given to these BB to solve. In principle, the BB should be the project leaders and work as full time workers for quality innovation.

Sixth, in order to introduce Six Sigma firmly, some basic infrastructure is necessary such as scientific management tools of SPC, MRP(material requirement planning), KM, DBMS and so on. In particular, efficient data acquisition, data storage, data analysis and information dissemination are necessary.

Lastly, one day each month should be declared as the Six Sigma day. On this day, the top management should check the progress of Six Sigma by himself.

On this day, all types of presentation of Six Sigma results can be done, and rewards can be awarded to the persons who did some excellent jobs for Six Sigma.

4. Problem-solving processes for project activities

The original problem-solving process for Six Sigma developed from Motorola is MAIC which means measurement, analysis, improvement and control. Later, DMAIC instead of MAIC is advocated from GE where D stands for definition. MAIC or

DMAIC is mostly used as the unique problem-solving process for manufacturing areas. However, for DFSS there are multiple proposed processes. They are as follows.

- 1) DMADV (Define - Measure - Analyse - Design - Verify). MADV was suggested by Motorola for DFSS, and D was added to it for definition. DMADV is similar to DMAIC.
- 2) IDOV (Identify - Design - suggested by GE and has been used most frequently in practice.
- 3) DIDES (Define - Initiate - Design - Execute - Sustain). This was suggested by Qualtec Consulting Company.

It seems that the above problem-solving processes for manufacturing and R&D areas are not quite suitable for service areas. The author believes that DMARI (Define - Measure - Analyse - Redesign - Implement) is an excellent problem-solving process for non-manufacturing service areas. Here, the phase 'redesign' means that the system for service works should be redesigned in order to improve the service function.

5. Design for Six Sigma, DFSS

From the author's consulting experiences,

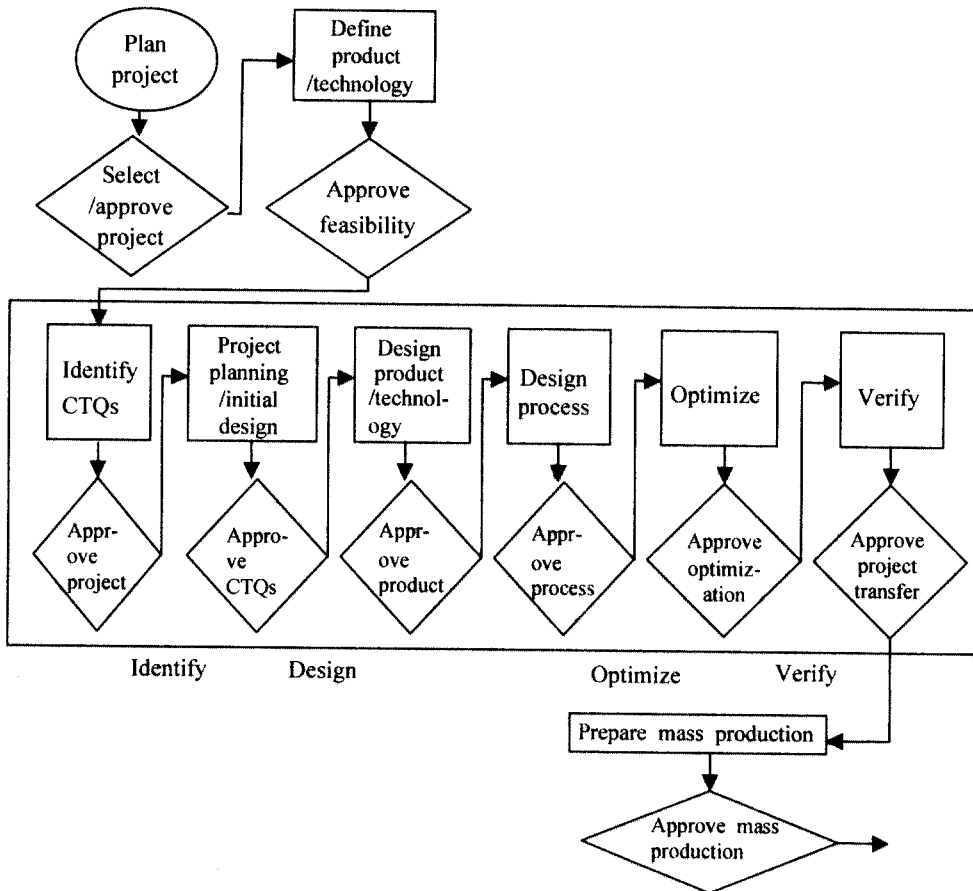
it is not easy for a company to adopt DFSS. However, once it is well adopted, the effect is tremendous and the cost savings is great. Figure 3 shows a DFSS process which is quite effective in a research institute. Samsung and LG Electronics are using this process.

In Figure 2, we saw a typical DFSS process, and the IDOV steps. The major activities and methodologies used in each step can be found in Figure 4.

There are several problems to be tackled for DFSS implementation. These problems must be solved for smooth introduction of DFSS. They are as follows.

- 1) Researchers tend to resist a new introduction of any scientific methodology into their research activities. Hence, their cooperation or approval should be sought before introducing DFSS into their works.
- 2) GB or BB education/training is especially necessary, since there are many scientific tools for R&D such as QFD, DOE, simulation techniques, robust designs, regression analysis and so on. For such education/training, textbooks which contain real and practical examples should be carefully prepared in order to make researchers understand why DFSS is a very useful tool.
- 3) Project team activities are not popular in R&D departments.

Figure 3. A typical DFSS process

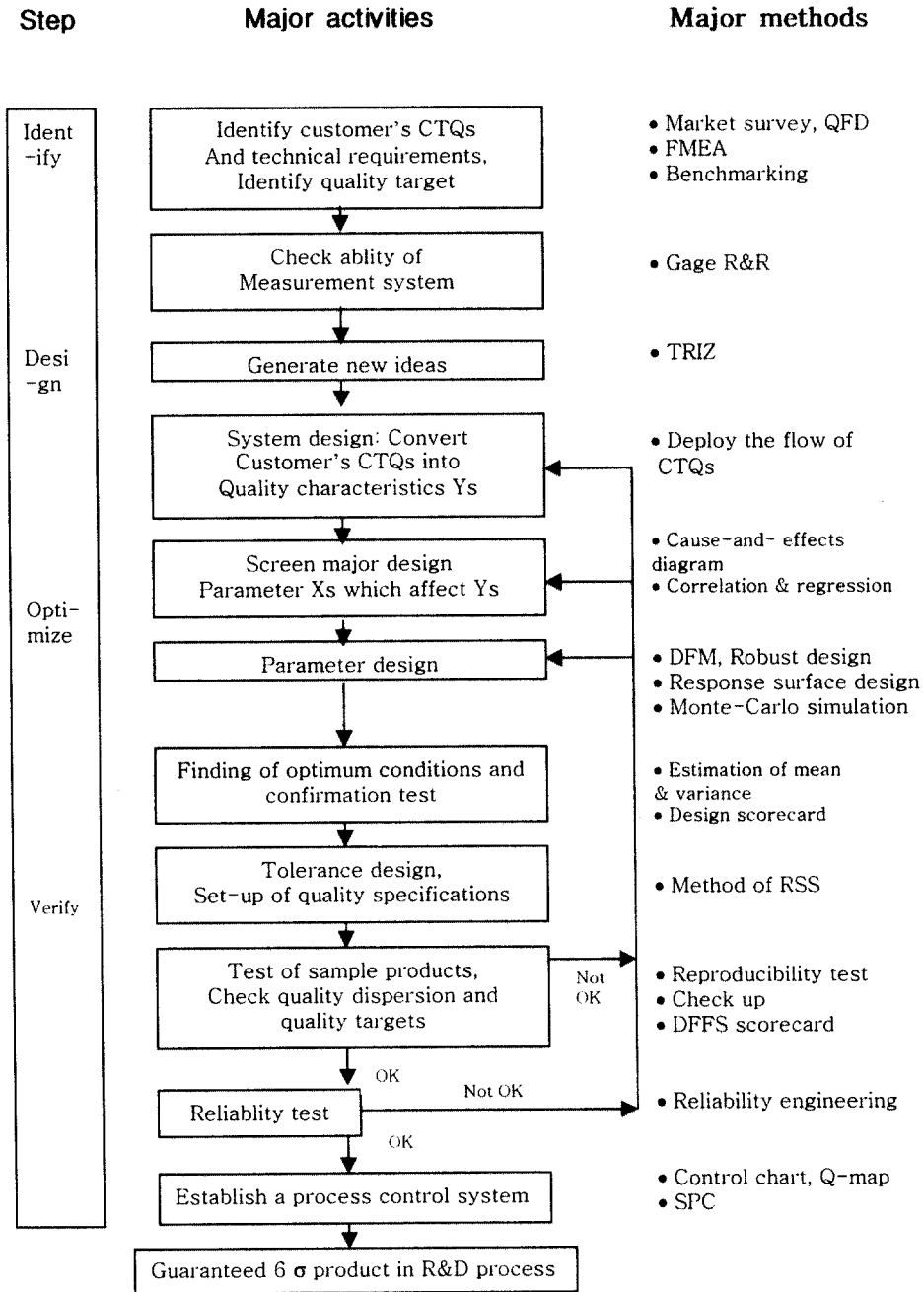


In this case, BB should be assigned as full time project leaders. It is desirable that the company gives time, space and necessary financial supports to BB to solve the projects.

al. (2001).

The author has been interested in DFSS, and his views and detailed explanation are given in Park and Kim(2000), and Park et.

Figure 4. Major activities and methods in each step of IDOV



6. Difference between project teams and quality circles

In Six Sigma the project teams leading by BB are the backbone of group activities. However, in TQC or TQM, quality circles are the backbone of group activities. There are some basic differences between these two teams as shown in Table 1. In the old management strategies TQC and TQM, there are usually two types of team efforts such as task-force-team and quality circle team. The task-force-team mainly consists of engineers and scientists, so called white colors, and the quality circle team consists of operators, so called blue colors. However, in Six Sigma, these two teams are merged into one, so called project team whose leader is usually a BB. For the theme selection and the problem-solving flow, the differences are also listed in Table 1.

Depending on the management policy, a company may have project teams and quality circle teams at the same time under the banner of Six Sigma. It looks all right. However, in this case careful control of two types of teams are necessary.

7. Six Sigma for e-business

Recently, e-business is rapidly increasing and it is of great interest to consider Six Sigma for e-business. The author would like to call Six Sigma for e-business as e-Sigma. It is clear that the ultimate management concept of e-sigma should be customer satisfaction. There are 4 ingredients for customer satisfaction management. They are CQCD which are convenience, quality, cost and delivery. To have an excellent e-Sigma system which provides convenient, high-quality, low-cost and accurate & speedy delivery, the following e-Sigma model should be established in e-business companies.

The voice of customer should be input into DFSS by using QFD, which converts VOC to technical requirements. These technical requirements are reflected in design aspects for Six Sigma. An efficient SCM is required for systematic acquisition, handling, storage and transportation of products. In all processes of e-business, each sigma level of each process should be evaluated and improved to assure high-quality performance

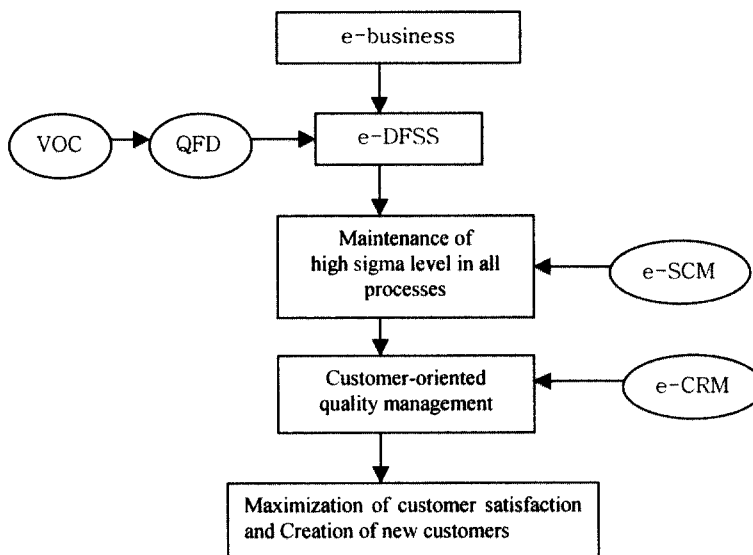
Table 1 Differences between project team and quality circle

Classification	Project team	Quality circle
organization	engineers(or scientists) + operators	operators
Theme selection	top-down, company CTQs	bottom-up, self-selection
problem-solving flow	DMAIC, DMADV, IDOV, DMARI	PDCA

of each process. For customer-oriented QM, e-CRM is required in e-business. Eventually, such e-Sigma flow will guarantee high-level customer satisfaction and creation of new customers.

some of them are not quite true for other countries. However, the author believes that the general trend is right. The author believes that Six Sigma is the best strategy for quality management so far in this new

Figure 5. e-Sigma model



VOC: voice of customer

QFD: quality function deployment

SCM: supply chain management

CRM: customer relationship management

8. Concluding remarks

This paper dealt with Six Sigma and its role in quality management. Since many aspects are based on Korean experiences,

millennium. Here e-Sigma is briefly explained. Since the concept of e-business is changing, the concept of e-Sigma may be changed soon. In this changing society, everything is changing. But, the concept of Six Sigma for e-business will emerge more as e-business steadily more prospers.

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