Data Technology and Knowledge-based Six Sigma

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Abstract

A new term Data Technology (DT) is defined, and its roles in modern technology are explained. Next, knowledge-based Six Sigma (KBSS) is proposed, and how the methodologies how it can be implemented in industry are suggested. Also the relationship between DT and KBSS is commented.

Key Words : Data Technology, Six Sigma.

1. Data Technology

It is well known that the modern technology for the 21st century is regarded as based on the following 6Ts. They are

IT: information technology
BT: bio-technology
NT: nano-technology
ET: environment technology
ST: space technology
CT: culture technology.

We believe that one more T should be added to these 6Ts, which is DT, data technology.

Definition of DT (data technology): DT is a scientific methodology which deals with

- Measurement, collection, storage and retrieval techniques of data,
- Statistical analysis of data and data refinement,
- Generation of information and inference from data,

- Statistical/computational modeling from data,
- Creation of necessary knowledge from data information,
- Diagnosis and control of current events from statistical models,
- Prediction of unforseen events from statistical models for the future.

DT is an essential element for Six Sigma, and in general for national competitiveness. The importance of DT will rapidly expand in this knowledge-based information society.

Many believe that DT is a subset of information technology (IT). This is not true. Generally speaking, IT is defined as follows.

Definition of IT (information technology): IT is an engineering methodology which deals with

- Presentation and control of raw data and information created by DT,
- Efficient data/information and image transmission and communication,
- Manufacturing technology of electronic devices for data/information transmission and communication,
- Production technology of computer-related machines and software,
- Engineering tools and support for knowledge management.

Korea is very strong in IT industries such as the internet, e-business, mobile phones, communication equipment and computer-related semi-conductors.

The difference between DT and IT can be seen in the information flow as shown in Figure 1.

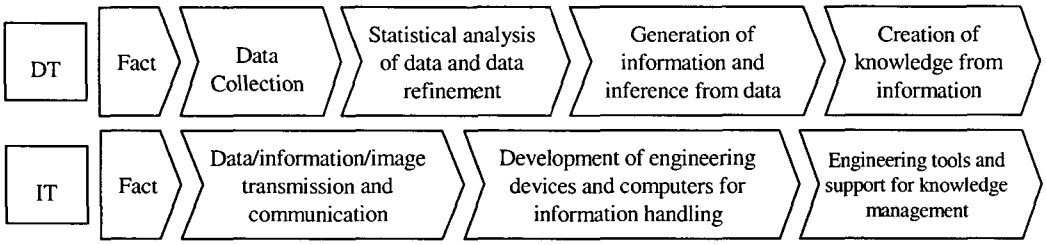

Figure 1. Information flow of DT and IT

DT is mainly concerned with data collection, statistical analysis of data, generation of information, and creation of necessary knowledge from information. However, IT is mainly concerned with data/information/image transmission and communication, and development of

engineering devices and computers for information handling. Also IT is concerned with engineering tools for knowledge management. Generally speaking, DT forms the infra-structure of IT. Without DT, IT would have limitations in growth. DT is software-oriented, but IT is hardware-oriented and systems-oriented. Without IT, DT cannot be well visualized. IT is the vehicle for DT development.

2. Knowledge triangle

It is said that the 21st century is the knowledge-based information society. We can think about the knowledge triangle as shown in Figure 2 in which DT and IT play important roles.

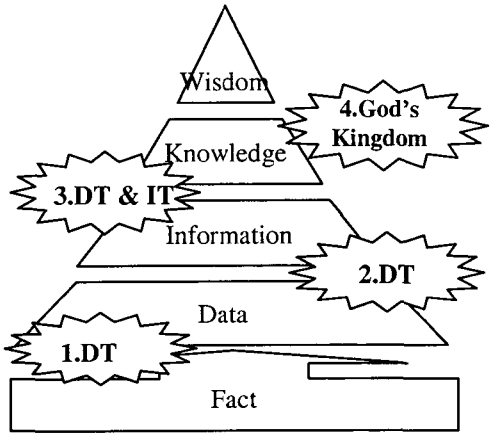

Figure 2. Knowledge triangle

In each step, the following activities are usually implemented.

Table 1. Major activities in each step of knowledge triangle

Step	Major activities
Step1	Measurement, Data refinement, Sampling design, Design of experiments, Meta data management, Gage R&R test
Step2	Data analysis and modeling, Data-mining, Data redefinement for application, Diagnosis and control, Prediction modeling
Step3	Output summary, Valuation, Remodeling, Information clustering
Step4	Knowledge generation from Information clustering

3. Knowledge-based Six Sigma

We think that Knowledge Management (KM) is very important in this knowledge-based information society. If Six Sigma and KM are combined, it could become a very powerful management strategy. We want to propose the so-called Knowledge Based Six Sigma (KBSS) as the combination of Six Sigma and KM. Since Six Sigma is a well-known management strategy, it is not explained here. For the readers who want to know Six Sigma in detail, the references (Harry (1998), Magnusson at. el. (2000), Park, Lee and Chung (1999)) can be of help.

KBSS can be defined as "a company-wide management strategy whose goal is to achieve process quality innovation corresponding to 6σ level and customer satisfaction through such activities as systematic generation · storage · dissemination of knowledge by utilizing the information technology of the internet/intranet, data-bases and other devices." As shown in Figure 3, there are some differences between Six Sigma and KM. However, there also exist some areas of intersections such as data acquisition and utilization, data analysis, generation of information, and so on.

KBSS is a combination of KM and Six Sigma which can be developed as a new paradigm for management strategy in this digital society of the 21st century.

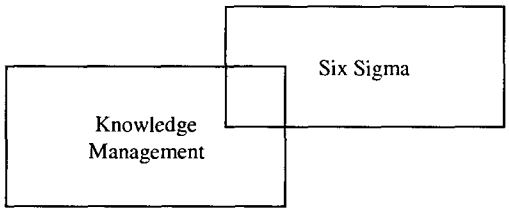

Figure 3. Knowledge-based Six Sigma

The methodologies in KBSS can be explained as follows.

◆ Process flow of improvement activities

In KM, it was proposed by Park (2002) that a good process flow of improvement activities is the CSUE cycle as shown in Figure 4. CSUE means Creating & Capturing, Storing & Sharing, Utilization and Evaluation. As explained previously, the well-known process flow of improvement activities in Six Sigma is MAIC.

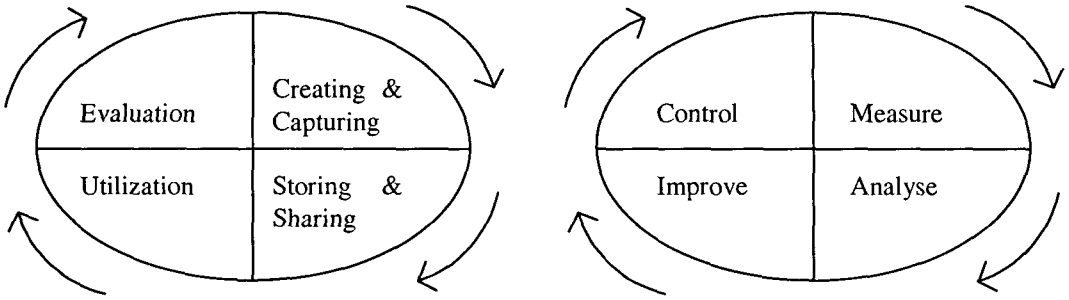

Figure 4. Process flow of improvement activities in KM and Six Sigma

The CSUE and MAIC cycles can be intermixed in order to create an efficient cycle in KBSS. One way is to use the MAIC cycle in each step of CSUE, or to use the CSUE cycle in each step of the MAIC cycle. We believe that CSUE and MAIC are both complementary to each other.

◆ Project team activities

The project team activities by BBs and GBs for quality and productivity improvement are perhaps most important activities in Six Sigma. If the concept of KM is added to these activities, more useful and profitable results could be made possible. We may call such activities KBSS project team activities. Through team efforts, we can create and capture information, store and share the information, and utilize it in the MAIC process. Also by using the MAIC process, we can create new information and follow the CSUE process.

◆ Education and training

Education and training is the most fundamental infra-structure in Six Sigma. A systematic training program for GB, BB, MBB and Champion levels is essential for the success of Six Sigma. Also in KM, without proper training, creation%storage% sharing%utilization would not be easy, and the process flow of knowledge would not be possible. It is often mentioned that the optimal education and training time in Six Sigma is about 5-7% of total working hours, and.in KM it is about 6-8%. this means that more education and training time is necessary in KM than in Six Sigma. However, there is a lot of duplication in Six Sigma and KM, so the optimal education and training time in KBSS would be 8-10% of total working hours.

◆ Information management

Information on areas such as customer management, R&D, process management, quality inspection and reliability tests are essential elements in Six Sigma. In KM also, information management concerning storage, sharing and utilization of knowledge is the most important infra-structure. We believe that information management is essential in KBSS.

◆ Scientific tools

Basic QC and statistical tools such as 7 QC tools, process flowcharts, quality function deployment, hypothesis testing, regression and design of experiments can be used in KBSS. Also some advanced Six Sigma tools such as FMEA, benchmarking and marketing surveys can be effectively used in KBSS. These tools are helpful in analyzing data, obtaining information, statistical process evaluation and generating knowledge. We can say that KBSS is based on these scientific and statistical methods.

We believe that DT, KM and Six Sigma can be combined in a nice way so that companies can adopt them to make their management an excellent one.

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