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SIX SIGMA: A STRATEGY FOR QUANTUM IMPROVEMENT

In today's business environment, the challenges due to ever increasing competition are of the kinds that were hardly seen two decades before. Reduction in production cost, timely delivery, and zero-defect quality coupled with the requirements of highest reliability and consistency from the functional perspective are some of the issues that keep boggling almost every manufacturing or service organization. Whether it is profit or even mere survival, the imperative of continuous improvement can not be ignored. Six Sigma is a way of doing the same, but in a more objective and focused manner. It is a strategy of seeking improvements based on the facts and data, not the whims and gut-feeling.

Historically, the birth of Six Sigma took place at Motorola Corporation. Motorola's quality engineer, Bill Smith, dubbed the quality improvement process as Six Sigma. It was a catchy name, and the results were even more striking. In 1988, Motorola won the Malcolm Baldrige National Quality Award based on the results it had obtained in just two years. Now, almost two decades later, thousands of companies are using Six Sigma to optimize business processes and to increase profitability. In fact, an entire industry has grown up around Six Sigma Training and Consultancy. Motorola offers extensive training through Motorola University and its army of experts, called Black Belts, travel the globe helping organizations set up and run Six Sigma

projects. As of today, hundreds of books about Six Sigma have been published.

Following the Six Sigma pursuit of Motorola, to advance next was Allied Signal (now Honeywell) under able leadership of Larry Bossidy. His friend, Jack Welch, at General Electric Company started the work later but moved very fast towards its implementation. Today most of leading world organizations — Kodak, Sony, Federal Express, Toshiba, DuPont, Nokia, POSCO, American Express, Asea Brown Boveri, Black and Decker, Dow Chemicals, Citibank, Ford and many more — are the ardent follower of Six Sigma practice. Joining this group of Six Sigma companies are many Indian Industries, such as Maruti Limited, IDBI, Mahindra, Cummins, LG, Jet Airways, Raymond, Pidilite, Bajaj, Max New York, Onida, L & T, TISCO, Ispat Industries Limited, Infosys, Wipro, ICICI, etc., and not to forget the Mumbai Dubbawallahs with astounding success. Put simply, Six Sigma uses a rigorous methodology that reduces opportunities to commit mistakes or defects.

The concepts used in its practice are not new and were talked much before it was first heard at Motorola. Until then, the quality of products was assured using inspection and quality control methodologies. The backbone of such efforts, like Six Sigma, was also based on the historical data or 'Statistic'. This kind of control was termed as Statistical Process Control (SPC).

The basic approach of SPC is to simply control the unusual large variations in process parameter values. However, if the permissible variations are not small enough, they may cause a serious concern for quality in those cases where the variations may go beyond the spread defined by tolerance limits. In such cases, even SPC will not suffice in achieving zero defect situations. Therefore, it becomes natural to strategise for reducing the natural variability of the production process to much lower value as compared to the available tolerance spread.

Most of the world measurements are seen to follow Normal Distribution that has a bell shaped curve, with mean, median and mode having the same value. This distribution has a special characteristic of capturing 99.73% cases within $\pm 3\sigma$ distance from the mean, with σ representing the standard deviation value measures the extent of variability in the process parameter values. In case a process parameter, set at a mean value, is allowed to have variation such that $\pm 3\sigma$ value matches with the tolerance spread, even then 0.27% values (27 out of 10,000) can be noticed beyond the permissible zone of variation and thus becoming concern for quality. Six Sigma approach requires this variation to be much smaller and to the extent where the tolerance spread is covered minimally by $\pm 6\sigma$ values. In this case, the process is expected to result on an average only 3.4 defects over 1 million units, practically no chance and worry for bad quality.

Six Sigma programme was designed to be more structured and this differentiated itself from many existing quality improvement initiatives. It focusses on achieving measurable and quantifiable financial returns from any Six Sigma project and that too within an agreed upon time-limit. To this end, it lays an increased emphasis on passionate management leadership and support both in terms of finance and human resource. It involves at least some related top functionaries of the organisation as 'Champions' to lead, and "Master Black Belts," "Black Belts," etc. to implement the Six Sigma approach of making decisions on the basis of verifiable data, rather than assumptions and guesswork. Naturally, the

successful implementation of Six Sigma philosophy has to invoke a change in the mindset of the people and thus in the culture of organization to build up a habit within the people who not only love and admire taking decisions based on facts and data only, but do it simply.

Looking into the strength of six-sigma approach in doing away with the defects and increasing productivity, the organisations are employing this company-wide on a large scale. Persons are being formally trained and depending upon their learning of the relevant tools of six-sigma, they are certified as Yellow-belt, Green-belt, Black-belt, or Master Black-belt.

Six Sigma appears in two distinct variations depending upon the requirement: DMAIC and DMADV. DMAIC is used to improve an existing business process; whereas DMADV is approach is followed to create new product or process designs. **DMAIC** stands for the following five steps:

1. **Define** high-level project goals and the current process.
2. **Measure** key aspects of the current process and collect relevant data.
3. **Analyze** the data to verify cause-and-effect relationships. Determine what the relationships are, and attempt to ensure that all factors have been considered.
4. **Improve** or optimize the process based upon data analysis using techniques like Design of experiments.
5. **Control** to ensure that any deviations from target are corrected before they result in defects. Set up pilot runs to establish process capability, move on to production, set up control mechanisms and continuously monitor the process.

DMADV, known as DFSS (an abbreviation for 'Design For Six Sigma') also follows five steps, but because of the purpose they are somewhat different and are as follows:

1. **Define** design goals that are consistent with customer demands and the enterprise strategy.
2. **Measure** and identify CTQs (characteristics that are Critical To Quality), product capabilities,

production process capability, and risks.

3. **Analyze** to develop and design alternatives, create a high-level design and evaluate design capability to select the best design.
4. **Design** details, optimize the design, and plan for design verification. This phase may require simulations.
5. **Verify** the design, set up pilot runs, implement the production process and hand it over to the process owners.

Six Sigma has evolved over time. It's more than just a quality system like TQM or ISO. It's a way of doing business. As Geoff Tennant describes in his book *Six Sigma: SPC and TQM in Manufacturing and Services*: "Six Sigma is many things, and it would perhaps be easier to list all the things that Six Sigma quality is *not*. Six Sigma can be seen as: a vision; a philosophy; a symbol; a metric; a goal; a methodology."

Prof. A.K. Agrawal

Annual General Meeting 2008

The Annual General Meeting of the Institution of Engineers (India), Varanasi Local Centre was held on October 22, 2008 at 4.30 p.m. in the G-7, Department of Mechanical Engineering, Institute of Technology, Banaras Hindu University, Varanasi. Er. Prof. A.K. Agrawal Chairman Varanasi Local Centre called the meeting to order and welcomed the members. He welcomed and offered thanks to Prof. J.P. Dwivedi, Head, Department of Mechanical engineering, IT-BHU, Varanasi for making arrangements for the Annual General Meeting-2008 of the Varanasi Local Centre of the Institution of Engineers (India). He also extended his thanks to various organizations and members for their cooperation during the session 2008-2010 in organizing various events in a successful manner. The minutes of the annual General Meeting 2007 were confirmed. The Honorary Secretary, Er. Abhijit Banerjee presented the annual report on the activities of the Local Centre for the year 2007-2008. Annual Report & Audited Account for the year 2007-2008 as circulated to the members were unanimously approved and adopted by the house.

The house placed on record the appreciation of the services rendered by the Chairman Prof. A.K. Agrawal, Honorary Secretary Er. Abhijit Banerjee & the Committee members for the session 2006-2008.

The Chairman elect Er. Abhijit Banerjee, FIE & Honorary Secretary elect Prof. N.C. Karmakar, MIE then assumed the charge of the office as Chairman & Hon. Secretary respectively.

The following were elected as members of the Committee for the session 2008-2010.

Elected Members.

1. Er. N.D. Tewari, FIE (ET)
2. Prof. Ramji Agrawal, FIE (CV)
3. Er. U.S. Singh, MIE (CV)
4. Er. Alok Bishnoi, MIE (CV)
5. Prof. S.N. Mahendra, FIE (EL)
6. Er. Ram Kumar, MIE (EL)
7. Prof. B.B. Bansal, FIE (MC)
8. Dr. Pr. Bhardwaj, AMIE (MC)
9. Shri S.K. Shah, MIE (PR)
10. Prof. T.R. Mankhand, FIE (MM)
11. Dr. Piyush Rai, FIE (MN)
12. Er. S.C. Asthana, MIE (AR)

In addition to above, the following would be ex-officio members of the committee.

1. Prof. A.K. Agrawal, FIE, (PR)
Immediate Past Chairman
2. Er. Abhijit Banerjee, FIE, (EL)
Immediate Past Hon. Secretary

Students' Chapter Activities:

The Institution of Engineers (India), Varanasi IT-BHU students' chapter organised a talk on "The Four Decades of Microprocessors" by Er. P.K. Mukherjee, Reader, Department of Electronics Engineering, Institute of Technology, Banaras Hindu University at G-7, Department of Mechanical Engineering, on November 11, 2008. The talk was very informative and was attended by over 250 students and dignitaries. The following dignitaries were present:

1. Prof. A.K. Agrawal, Dept. of Mech. Engg.
2. Dr. P. Bhardwaj, Dept. of Mech. Engg.
3. Dr. R.K. Mishra, Dept. of Electrical Engg..
4. Dr. D. Singh, Dept. of Electrical Engg.

The deliberations were very useful for the students of various departments, as it presented the various technologies and development in the field of 'Micro-processors and Computing Units' starting right from the very existence of 'Abacus and Napier's bones' up to the most advanced units till date. The various stages for the last 40 years were the focus of the deliberation by Er. P.K. Mukherjee. He also dwelt upon the future challenges and issues in the related field and pondered over various parameters of the field of Microprocessors in the years to come. The lecture included an interactive question-answer session for the audience during which Er. Mukherjee clarified the doubts and answered the questions raised by the students. He expressed his gratefulness and thanked Prof. A.K. Agrawal (Dept. of Mechanical Engg.) and Mr. Praharsh Sharma (Convener, Varanasi IT-BHU Students' Chapter, IEI) for the invitation and conduct of the talk.

The event was conducted and compered by Mr. Praharsh Sharma. After the talk, Prof. A.K. Agrawal and Dr. R.K. Mishra presented the vote of thanks to Er. P.K. Mukherjee for his talk and deliberation on behalf of Varanasi IT-BHU Students Chapter, IE(I), Er. P.K. Mukherjee was presented a memento by Prof. A.K. Agrawal on behalf of Varanasi IT-BHU students' Chapter, IE(I) as a mark of gratitude and indebtness to him for his precious time, consent and concern for the talk.

Finally, Mr. Praharsh Sharma, (B-Tech. Part III, Department of Electronics Engg)

expressed gratitude towards all dignitaries present on the occasion and thanked the students for turning up in large numbers and displaying keen interest in the talk. The event was audio and video recorded in order to add to the digital library of Varanasi IT-BHU Students' Chapter, IE(I). The 'Power-Point Presentation file' of the talk was given to interested students with consent of Er. P.K.Mukherjee who also gave thanks Mr Shantanu Singh (B.Tech. Part IV, Dept. of Electronics Engg.) and Mr Himanshu Shekher (B.Tech. Part IV, Dept. of Electronics Engg.) for their help in the content of the talk and presentation.

Welcome New Members:

Er. Arun Kumar Bhagat M/137069/8 CV
Er. Sanjay Kumar Singh M/137558/4 CV
Er. Damu Charan Marandi AM/096554/8CV
Er. Rajendra Bahadur AM/096627/7 CV

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**THE VARANASI LOCAL CENTRE
WISHES
ALL THE MEMBERS
AND
THEIR FAMILIES
A VERY
HAPPY NEW YEAR**

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