

Honeywell Aerospace Electronics System, Singapore - Implementing Six Sigma Quality

Launched in April, the Insight Programme provides access through study missions to best practice information in Singapore organisations, based assessments done for the various award schemes. Participants identify key learning points from the study mission which they then translate into an action plan for implementation in their own organisations.

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Honeywell¹ is a US\$254 billion diversified technology and manufacturing leader, serving customers worldwide with aerospace products and services; control technologies for buildings, homes and industry; automotive products; power generation systems; specialty chemicals; fibers; plastics; and electronic and advanced materials. In Asia Pacific, Honeywell operates its core businesses through 13 sales and service offices.

One of its business units, Aerospace Electronics System in Singapore, uses Six Sigma as a best practice to improve processes in most of its operations. The organisation, which has 150 employees, was set up in Singapore in 1983. It manufactures high quality avionics and navigation equipment and systems. Its principal customers include Cessna, Bell Helicopters, Raytheon, Learjet, Mooney Aircraft, Piper Aircraft, FedEx and Singapore Aerospace.

¹ GE announced late October last year its intention to acquire Honeywell.

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What is Six Sigma?

Six Sigma is an approach to quality improvement which lowers costs and increases productivity and profits through statistical and problem-solving tools that brings about breakthrough improvements with measurable impact on the bottom-line. The tools are applied by trained practitioners known as Black Belts.

Sigma (s) is a measurement of quality which enables the determination of how effectively defects and variations from processes are eliminated. The various sigma levels are shown in Figure 1 as follows:

Defects per million Error-free rate opportunities

Two Sigma 308,537 69.2%

Three Sigma 66,807 93.3%

Four Sigma 6,210 99.4%

Five Sigma 233 99.977%

Six Sigma 3.4 99.9997%

The processes in a Six Sigma-rated project operate at only 3.4 defects per million opportunities, or 99.9997% error-free. This is equivalent to two seconds per week without electricity, compared to an hour per week at Four Sigma (99.4%) and almost seven hours monthly at 99% level of efficiency. For a process with 15 activities operating at Four Sigma, the loss of quality at every stage will lead to only 91.4% of the finished product being first quality the first time through. This translates to more than 8% of rework or waste.

As Four Sigma means that mistakes occur about six times in every 1,000 opportunities, it is equivalent to an organisation sending out six incorrect invoices out of every 1,000 transactions, or having six flaws in every 1,000 customer-critical design elements before it is fully commercialised into a new product.

Customers demand a high level of quality when they buy critical products and services. Hence, Six Sigma results in more delighted customers. As an organisation approaches this level of performance, it improves its outcome measurements such as customer satisfaction and financial performance.

Why Six Sigma Plus?

Six Sigma *Plus* is Honeywell's overall strategy to accelerate improvement in all processes, products and services, and to reduce the cost of poor quality by eliminating waste and reducing defects and variations. Six Sigma is already understood worldwide as a measure of excellence. The "*Plus*" is derived from Honeywell's Quality Value assessment process and expanded former AlliedSignal's Six Sigma strategic tools.

Six Sigma *Plus* is viewed as a proven method to driven growth and productivity. It also enables the company's E-Business strategy by identifying customer needs, designing value propositions and developing appropriate business models.

The strategy requires that the organisation approach every improvement project with the same logical method of DMAIC:

- **Define** the customer critical parameters
- **Measure** how the process performs
- **Analyse** causes of problems
- **Improve** the process to reduce defects and variations
- **Control** the process to ensure continued, improved performance.

Implementing Six Sigma *Plus*

The tools and skills that help in the implementation of the DMAIC method include:

- *Process mapping* which helps to identify the order of events in producing a product or service and compares the "ideal" work flow to what actually happens.
- *Failure mode and effect analysis* which helps to identify likely process failures and minimises their frequency.
- *Measurement system evaluation* which helps in the assessment of measurement instruments to enable the better separation of important process variations from measurement "noise".
- *Statistical tests* which assist in the separation of significant effects of variable from random variation.
- *Design of experiments* which is used to identify and confirm cause and effect relationships.
- *Control plans* which allow for the monitoring and controlling of processes to maintain the gains that have been made.
- *Quality function deployment* which is a tool for defining what is important to customers; it enables better anticipation and understanding of customer needs.
- *Activity based management* to look at product and process costs in a comprehensive and realistic way by examining the activities that create the costs in the first place and hence allowing for better subsequent management.
- *Enterprise resource planning* which uses special computer software to integrate, accelerate and sustain seamless process improvements throughout an organisation.
- *Lean enterprise* with skills to enhance the understanding of actions essential to achieving customer satisfaction. These skills simplify and improve work flow, help eliminate unnecessary tasks and reduce waste throughout a process.

Honeywell's Six Sigma *Plus* incorporates new skills and tools, and broadens the application of many existing tools. For example, it has added:

- A process methodology to enable the success of its E-Business value creation strategy. Each element of that strategy uses the power of the Internet and Six Sigma *Plus* processes to differentiate itself by creating more value for customers.
- Another learning curriculum specifically geared to marketing and selling processes to enable customer value creation and growth opportunities.
- The Honeywell Quality Value (HQV) assessment process, which is based on the Malcolm Baldrige Award in the US. The assessment process focuses on gaps and identifies opportunities for improvement.
- New skills and techniques for Total Productive Maintenance (TPM), a productivity skill-set which enables permanent improvement in the overall effectiveness of Honeywell's assets, be they equipment for production, laboratories, buildings, business support or transportation.
- Broader applications for Activity Based Cost Management to analyse customer profitability and target future costs for new product development.

Honeywell is committed to providing every employee with at least 40 hours of ample opportunities for continued learning annually. It believes that the learning and application of Six Sigma Plus skills will lead to growth, improved productivity and better business results. The implementation of Six Sigma Plus involves the introduction of the Six Sigma concept and methodologies to employees at quarterly presentations and the deployment of the Six Sigma plans. Honeywell is targeting for the majority of employees to learn the "basics" of the Six Sigma Plus tools.

Employees who become skilled in Six Sigma *Plus* tools are certified to the following core areas of proficiency:

- Green Belt - An individual with working knowledge of Six Sigma Plus methodology and tools who has completed training and a project to drive high-impact business results.
- Black Belt - A highly-skilled Six Sigma *Plus* expert who has completed four weeks of classroom learning, and over the course of four to six months, demonstrated mastery of tools through the completion of a major process improvement project.
- Master Black Belt - A Six Sigma *Plus* expert who is highly skilled in the methodologies of variation reduction. After a year-long project-based certification programme, Master Black Belts train and mentor Black Belts, help select and lead high-value projects, maintain the integrity of the Sigma measurements, and develop and revise Six Sigma *Plus* learning materials.
- Lean Expert - An individual who has completed four weeks of Lean training and one or more projects that have demonstrated significant, auditable business results and the appropriate application of Six Sigma *Plus* Lean tools.
- Activity Based Management (ABM) expert - An individual who demonstrates proficiency in Activity Based Management via a business application involving product costing, process costing, or customer profitability analysis. Certification involves attending an ABM training course, defining a meaningful project, displaying knowledge of the ABM tools and using the data for key decision making. ABM experts frequently link Six Sigma *Plus* tools to projected and actual financial impacts.
- Activity Based Management (ABM) masters - An individual with the skills of an expert and the ability to develop and deliver ABM learning courses. Certification typically takes one year and involves demonstrating the use of ABM data for multiple purposes with repeatable and sustainable results. ABM Masters are proficient in the use of advanced cost management tools and have the ability to tailor cost data and analysis to a business' vision and strategy.
- Total Productive Maintenance (TPM) expert - An individual who applies TPM and reliability methodologies and tools to assist and/or lead teams in optimising asset capacity-productivity at minimum life cycle cost. A TPM expert is responsible for determining critical equipment and measuring its overall effectiveness to enable growth and productivity through optimum asset utilisation.
- Total Productive Maintenance (TPM) master - An individual experienced in the use of TPM and reliability tools and methodologies. The responsibilities include assisting leadership in identifying high leverage asset improvement opportunities; leading critical, high leverage improvement projects in a business; and leading cultural paradigm shifts from reactive to proactive asset management.

Managers, supervisors and other professionals who control business processes are expected to become certified at least to the Green Belt level by successfully applying Six Sigma *Plus* tools to projects to improve company performance.

The effective usage of Six Sigma *Plus* requires an organisation to understand the problems in its existing processes. Before any improvement project is done, Honeywell maps out its processes to determine the inputs and outputs as well as the critical elements within the processes. The outputs must meet customer requirements; and suppliers are involved in providing feedback and understanding the process.

Cross-trained employees form cross-functional teams to work on the problem areas and identify control factors with relevant control plans. The teams make weekly presentations to management and share their problems. The management team assists them in setting priorities.

Every year, Honeywell sets stretch targets, which are communicated to both employees and key suppliers. Key suppliers are brought into the loop to enable them to understand how their performance affects the company; and Honeywell provides them with Six Sigma training. Six Sigma *Plus* process improvements are applied to almost every function within Honeywell and are not restricted to manufacturing operations.

Impact of Six Sigma Plus

In the past, generic and low-end competencies such as the manufacture of printed circuit boards were outsourced. With Six Sigma *Plus*, core competencies were redefined and control plans established.

Presently, Aerospace Electronics System, Singapore focuses on core competencies that are unique to itself, such as final assembly and test and final alignment. This helped to stabilise the workforce for the organisation, which once experienced high turnover for its front-end and low-skill jobs.

Waste has also been reduced from key business processes. For example, inspection, which is considered as non-value added, has been eliminated. Instead, reliance on operators' inspection (ROI) is practised and this has helped to increase the value-added per employee.

In the past, all Honeywell Singapore's products were 100% inspected by a team from the US. Currently, the Federal Aviation Agency (FAA) certifies its products for manufacturing in Singapore; and 100% of its products are shipped direct to stock to Kansas, US, saving \$1 million in inspection cost. In addition, audits by FAA involve only observations and not all processes need to be audited. This is achieved by ensuring that the necessary quality procedures are built into the process.

Honeywell worked with its customers to initiate a programme whereby reliance is placed on operators to conduct the inspection. Employees are trained to achieve customer requirements and their skills are assessed through technical assessment

and inspection and by analysing the processes. The results are then conveyed to the customers. This has led to lower product returns and increased demand for its product.

Six Sigma *Plus* in Honeywell has led to the following results:

- Increased Rolled Throughput Yield (RTY)
- Reduced variations in all processes
- Reduced cost of poor quality (COPO)
- Deployment of skilled resources as change agents.

Six Sigma *Plus* knowledge is shared through the Quest for Excellence (QFE), an annual Honeywell event designed to advance Six Sigma *Plus* continuous process improvement learning and improve employees' skills through sharing of best practices. Three Several QFEs are held each year - in the Americas, Europe (includes Africa and the Middle East) and Asia Pacific- many different locations.

Many teams, representing a wide range of businesses and functions are short-listed to participate after preliminary competitions. They then showcase their work to a panel of judges, comprising senior Honeywell executives and customer representatives, during the regional Quest events. Teams are evaluated on outstanding business results, adherence to corporate values, the use of E-Business and Six Sigma *Plus* tools. Winning teams from each of the regional Quest events are later honoured at a special ceremony at the corporate headquarters in Morristown, US.

Key learning points

Some of the key learning points are:

- *Strong management commitment and support.* Six Sigma *Plus* objectives are tied to Honeywell's goals of accelerating growth and productivity and there is structured allocation of resources to train employees.
- *Well-structured approach and deployment process.* Six Sigma *Plus* is customised to drive financial and performance excellence and E-Business. There is a focused approach with clear definition of roles and responsibilities and the streamlining of processes focusing on core competencies. The focus is on breakthrough processes, products and services. There is also the systematic usage of various Six Sigma *Plus* tools directed at root cause analysis and problem-solving and the certification of employees to the various Six Sigma *Plus* competencies.
- *Team-based approach.* Employees are cross-trained and work in cross-functional teams. Rewards and recognition are given on a team basis and Six Sigma *Plus* results are celebrated.
- *Sharing Six Sigma Plus knowledge.* There is active knowledge sharing and continuous learning among the employees on Six Sigma *Plus*. For example, the QFE provides the forum for sharing best practices.

Reference: Honeywell International Inc, 2000, Six Sigma Plus at Honeywell.