THE NATURE OF SIX SIGMA QUALITY

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ABSTRACT

This booklet highlights the six sigma product quality concept and its relationship to Motorola's position in the marketplace.

The discussion zeros in on the concept of six sigma, which advocates that there are strong relationships between product nonconformities or "defects" and product yield, reliability, cycle time, inventory, schedule, and so on. As the number of defects found during manufacture increases, the number of sigmas decreases. In other words, the larger the sigma value, the better the product quality – and vice versa. Although the ultimate aspiration is zero defects, the threshold of excellence is six sigma quality.

Interestingly, six sigma quality is estimated assuming "typical" shifts and drifts in the average. In this sense, 99.99966 percent capability at the "part" and "process step" levels is an intermediate target toward the ideal of perfection. This may be illustrated by considering a product that contains 300 parts and the related manufacturing process that consists of say, 500 individual steps. A six sigma capability at the part and process step levels would ensure a final "rolled throughput" yield of 99.73 percent. This would be to say, out of every 10,000 units of product manufactured, there would be 9973 units that would be produced completely free of nonconformities. Of course, this example assumes that each part and process step possesses only one opportunity for nonconformance, that all parts and steps are independent, and that nonconformities are randomly distributed.

The notion of variation is presented as the number one enemy of quality, yields, and costs. It must be arrested and ultimately eliminated in order to achieve "best in class." By attacking variation during the design phase, within suppliers' processes, and within our own processes, six sigma product quality can be achieved. In doing so, the foundation of excellence is laid.

The discussion also focuses on a more statistically based understanding of the six sigma program. It describes the arithmetic mean (μ), standard deviation (σ), and practical uses of the normal distribution. In particular, the rationale for making quality and yield estimates under the assumption of a 1.5σ shift in the mean is emphasized. Based on the statistical perspective, the product and process engineering viewpoints are brought into focus by means of analytical examples. Through the discussion and examples, insights are developed as to the objectives of the six sigma program: enhanced product quality, yield, and cost – all of which, in turn, improve customer satisfaction.

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