MA4605 : Introduction to Statistical Process Control

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### Origins of Statistical Process Control

Sampling techniques for quality inspection date back to the 1930s. These include the development of statistically based sampling plans as an alternative to 100 percent inspection and the associated use of control charts.

However, it was not until the 1970s, when U.S. industry began to react seriously to the high quality of products imported from Japan, that the application of statistical quality control became widespread. The continuing trade imbalance with Japan became a national issue during

the 1980s and 1990s, and thus spurred further interest in quality improvement.

Ironically, the high quality of Japanese products was achieved largely because they adopted suggestions of U.S. consultants in the restructuring of their manufacturing processes after World War II.

Pre-eminent among these consultants was the statistician W. Edwards Deming, after whom the Deming Award for Quality was named in Japan. Deming developed a philosophy of quality management that was the precursor of what is now called Total Quality Management, and which he summarized in his “14 Points.”

### Definitions

A process is a sequence of operations by which such inputs as labor, materials, and methods are transformed into outputs, in the form of products or services. In the first section of this chapter we differentiated internal and external outputs as well as product and service outputs. In any process, some variation in the quality measure from product to product or from service to service is unavoidable.

Statistical process control refers to the application of the methods of statistical quality control to the monitoring of processes (and not just, as in the earlier practice, to the inspection of the final outputs of the processes). The purpose is to control the quality of product or service outputs from a process by maintaining control of the process. When a process is described as being “in control,” it means that the amount of variation in the output is relatively constant and within established limits that are deemed acceptable.

There are two kinds of causes of variation in a process.

* Common Causes
* Assignable Causes

Common causes, or chance causes, of variation are due to factors that are inherent in the design of the system, and reflect the usual amount of variation to be expected.

Assignable causes, or special causes, of variation are due to unusual factors that are not part of the process design and not ordinarily

part of the process.

### Stable processes

A stable process is one in which only common causes of variation affect the output quality. Such a process can also be described as being in a state of statistical control.

An unstable process is one in which both assignable causes and common causes affect the output quality. (Note that, by definition, the common causes are always present.) Such a process can also be described as being out of control, particularly when the assignable cause is controllable.

### Control Charts

A control chart is a run chart that includes the lower and upper control limits that identify the range of variation that can be ascribed to common causes. Any outputs that are outside of the control limits suggest the existence of assignable-cause variation. The control limits are

determined either by process parameters having been specified, or by observing sample outcomes during a period of time in which the process is deemed to be in a stable condition.