Summary of Key Points and Terminology – Module 10

- The tools and techniques of Six Sigma represent a collection of quality improvement and statistical methods that have been used successfully over the years in generic TQM initiatives, ISO 9000, and in Baldrige processes.
- A **defect**, or **nonconformance**, is any mistake or error that is passed on to the customer. A **unit of work** is the output of a process or an individual process step. A common measure of output quality is **defects per unit (DPU)**, computed as Number of defects discovered/Number of units produced
- In Six Sigma, a popular quality metric is **defects per million opportunities (dpmo)**:

  $$\text{dpmo} = \text{DPU} \times 1{,}000{,}000/\text{opportunities for error}$$

- A six-sigma quality level corresponds to at most 3.4 dpmo. Alternatively, it corresponds to a process variation equal half of the design tolerance while allowing the mean to shift as much as 1.5 standard deviations from the target. A k-sigma quality level satisfies the equation: k * process standard deviation = tolerance / 2
- A **problem** is a deviation between what should be happening and what actually is happening that is important enough to make someone think the deviation ought to be corrected. Quality related problems often fall into five categories: conformance problems, unstructured performance problems, efficiency problems, product design problems, and process design problems. A **mess** as a "system of external conditions that produces dissatisfaction," or essentially a system of problems, and are usually candidates for Six Sigma efforts.
- Factors that should be considered when selecting Six Sigma projects are: financial return, as measured by costs associated with quality and process performance, and impacts on revenues and market share, impacts on customers and organizational effectiveness, probability of success, impact on employees, and fit to strategy and competitive advantage.
- **Problem solving** is the activity associated with changing the state of what is actually happening to what should be happening. **Breakthrough** is the accomplishment of any improvement that takes an organization to unprecedented levels of performance.

- A structured problem solving process provides all employees with a common language and a set of tools to communicate with each other, particularly as members of cross-functional teams. The Six Sigma DMAIC methodology is one such process that provides a roadmap for conducting a Six Sigma project.
- In the Define stage, the process of drilling down to a more specific problem statement is sometimes called **project scoping**. The Measures stage includes collecting good data, observation, and careful listening. The first step in any data collection effort is to develop **operational definitions** for all performance measures that will be used. The Analyze phase of DMAIC focuses on *why* defects, errors, or excessive variation occur, and focuses on the **root cause** – "that condition (or interrelated set of conditions) having allowed or caused a defect to occur, which once corrected properly, permanently prevents recurrence of the defect in the same, or subsequent, product or service generated by the process." The improve stage focuses on idea generation, evaluation, and selection. Finally, the Control stage focuses on how to maintain the improvements.
- Six Sigma tools include elementary statistical tools, advanced statistical tools, product design and reliability, measurement, process control, process improvement, and implementation and teamwork. **Design for Six Sigma (DFSS)** is a relatively recent approach to product development that focuses on delivering the right product at the right time and at the right cost.
- Most failures of Six Sigma teams are due to failures in the "mechanics" of team operations, as opposed to poor project selection or improper use of tools; thus, effective team processes and project management skills are vital to success.
- Six Sigma can easily be applied to a wide variety of transactional, administrative, and service areas in addition to manufacturing. However, differences between services and manufacturing make opportunities in services more difficult to identify, and projects more difficult to define. Small organizations can use Six Sigma, although perhaps in a more informal fashion.
- **Lean production** refers to approaches initially developed by the Toyota Motor Corporation that focus on the elimination of waste in all forms, including defects requiring rework, unnecessary processing steps, unnecessary movement of materials

or people, waiting time, excess inventory, and overproduction. In service contexts, lean production is often called **lean enterprise**. Some of the key tools used in lean production are the 5S's – seiri (sort), seiton (set in order), seiso (shine), seiketsu (standardize), and shitsuke (sustain); visual controls; efficient layout and standardized work; pull production; single minute exchange of dies (SMED); total productive maintenance; source inspection; and continuous improvement.