

Introduction to cellular manufacturing

In today's business world, competitiveness defines an industry leader. The drive toward maximum efficiency is constantly at the forefront of such companies' objectives. Managers across the country are striving to adopt lean manufacturing practices to help address worries about their bottom line. Cellular Manufacturing is one staple of lean manufacturing.

Cellular Manufacturing is an approach that helps build a variety of products with as little waste as possible. A cell is a group of workstations, machine tools, or equipment arranged to create a smooth flow so families of parts can be processed progressively from one workstation to another without waiting for a batch to be completed or requiring additional handling between operations. Put simply, cellular manufacturing groups together machinery and a small team of staff, directed by a team leader, so all the work on a product or part can be accomplished in the same cell eliminating resources that do not add value to the product.

How to incorporate cellular manufacturing

The implementation process of shedding the traditional manufacturing processes and embracing the drastically different cellular manufacturing techniques can be a daunting task. Management must deal with many issues including: cell design and set up, team design and placement, employee training, teamwork training, as well as other company functional issues. A project team should be put together that consists of management and production employees to handle these changes.

Cell Design and Setup should be executed to facilitate the movement of the product through its production cycle and should also be able to produce other similar products as well. The cells are arranged in a manner that minimizes material movement and are generally set up in a "U" shaped configuration.

Team Design and Placement is a crucial part of the process. Employees must work together in cell teams and are led by a team leader. This team leader becomes a source of support for the cell and is oftentimes responsible for the overall quality of the product that leaves his/her cell.

Employee Training must also accompany the change to cellular manufacturing. In cellular manufacturing workers generally operate more than one machine within a cell which requires additional training for each employee creating a more highly skilled workforce. This cross-training allows one employee to become proficient with his/her machines and while also creating the ability to operating other machines within the cell when such needs arise.

Teamwork Training should generate camaraderie within each cell and stimulate group related troubleshooting. Employees within each team are empowered to employ ideas or processes that would allow continuous improvement within the cell, thus reducing lead times, removing waste and improving the overall quality of the product.

Other issues that must be addressed include changes in purchasing, production planning and control, and cost accounting practices. Arranging people and equipment into cells help companies meet two goals of lean manufacturing: one-piece flow and high variety production. These concepts dramatically change the amount of inventories needed over a certain period of time.

- One-piece flow is driven by the needs of the customer and exists when products move through a process one unit at a time thus eliminating batch processing. The goals of once-piece flow are to produce one unit at a time continuously without unplanned interruptions and without lengthy queue times.
- High-variety production is also driven by the needs of the customer who expect customization as well as specific quantities delivered at specific times. Cellular manufacturing provides companies the flexibility to give customers the variety they demand by grouping similar products into families that can be processed within the same cell and in the same sequence. This eliminates the need to produce products in large lots by significantly shortening the time required for changeover between products.

Benefits of cellular manufacturing

Cellular manufacturing creates the ability to incorporate one-piece flow production which produces multiple time and monetary benefits. First, it reduces material handling and transit times. By having the machinery to complete a certain process grouped together in a cell, the product spends more time on the machinery and less time in transit between machines. Unlike batch processing, materials do not accumulate at a certain location to be worked or moved. This allows the operator the ability (in most cases) to move the unfinished product to the next station without the need of specialized equipment to move what would be, in a batch process, a larger load, farther distances.

With decreased material handling and transit time, accompanied by virtually eliminating queue times associated with batch processing, comes shortened part-cycle times. In other words, the time it to produce one unit of a particular product resulting in shorter delivery dates for the customer.

Also associated with one-piece flow are reduced work-in process inventories. With a continuous and balanced flow of product through the cell, no major

buildup of material occurs between workstations eliminating the need of excess space to store in-process goods. This also allows workstations and/or machinery to be moved closer together. Less WIP is easier to manage and allows the manufacture to operate with shorter lead times.

Another benefit of cellular manufacturing is based on the capability to produce families of similar products within each cell. Adjustments required to setup machinery should not be significant for each family product. Reduced change over times will enable more frequent product line changes and items can be produced and delivered in smaller lots sizes without significant cost implications.

In addition to the aforementioned production benefits, there are also numerous benefits that are associated with the employees and their involvement in each cell. First, a cell on average employs a small number of workers that produce the complete part or product. Workers become multifunctional and are responsible for operating and maintaining numerous pieces of equipment and or workstations. They are also able to cover other workstations within the cell when required to do so.

In terms of worker productivity, the ability to deal with a product from start to finish creates a sense of responsibility and an increased feeling of teamwork. A common purpose is created and gives "ownership" to the production teams. Feedback on quality and efficiency is also generated from the teams building continuous improvement within the cells and adjusting quality issues right away and not after an entire batch has been produced.

An example of cellular manufacturing in use

Tribon Bearin Company, a manufacture of discrete carbon composite parts and shapes, had been plagued by such problems as erratic product flow, high work in process inventories, poor quality and accountability. To make matters worse, their key customer, General Electric Aircraft Engines, was due to audit the Tribon's inventory turns and scrap rates for its supplier rating system. Tribon was a traditional manufacturing facility and its operations were highly compartmentalized which created transfer waste and also distrust and bad feelings distrust and bad feelings between front-line management and production floor workforce.

After being acquired by DuPont, DuPont Tribon Composites or DTC, decided to implement cellular manufacturing in its production process. Two years later, the plant had installed and implemented six workcells. Within three years, the plant's fixed cost productivity improved by 100 percent and on-time delivery increased by more than 75 percent.

Constrained by the layout of the building, DTC, built a new plant designed with specifications to implement manufacturing cells and allow room for expansion.

Within a week of the move, DTC was able to accept a 50 percent growth in orders due to the current cellular manufacturing setup. Efforts were made to provide cross training whenever possible. The plant has instituted a skill rating system to guarantee that employees become sufficiently skilled. Ninety percent of the plant floor personnel are now able to perform any job on the production floor adding flexibility.

Product quality has been the biggest benefit from the switch to cellular manufacturing. Quality planning, team members inspecting their own work, and a sense of ownership for the items they produce has decreased the scrap rate of the Tribraid product, which accounts for one-third of DTC's sales, from 20 percent to approximately five percent. Inspection is completed after every stage in the production process, eliminating the need for end-of-line inspections.

Before the switch to cellular manufacturing, the Tribon plant had total annual revenue of \$10.6 million and employed 106 individuals. DTC installed its last cell in 1998 and in the year 2001, it had revenues of \$31 million generated from its 11 workcells and 140 employees. It is also a winner of the GE Supplier Excellence award from GE Aircraft Engines.

Where to get more information on Cellular Manufacturing

The Handbook of Cellular Manufacturing Systems, Shahrukh A. Irani (Editor), published by John Wiley & Sons, Inc.

Reorganizing the Factory: Competing through Cellular Manufacturing, Nancy Hyer and Urban Wemmerlov, published by Productivity Press, Inc.