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Furniture HIGHLIGHTS

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Helping furniture manufacturers achieve and sustain international recognition and competitive advantage through nationally recognized research, technical assistance and educational programs.

Inside this Issue

FWRC

Lean Manufacturing in Furniture and Supplying Industries

Strategies for Increased International Competitiveness

Is your company lean? It can be, with the help of MSU's Institute of Furniture Manufacturing and Management. Faculty in the Institute have been looking in depth at lean processes and how they can be implemented in Mississippi furniture and supplying companies. A series of studies that relate specifically to the development and use of lean manufacturing techniques in furniture and wood component supplying industries have been initiated and will be published in an FWRC Research Bulletin Series.

This issue of highlights will look at Franklin Corporation's implementation of lean manufacturing and adoption of the "Double D" manufacturing cell.

Lean processes are designed to produce superior quality products at a low cost while increasing the competitiveness of manufacturers using the concepts.

Although lean processes were first developed by the Toyota Motor Company in Japan to reduce inventory levels and add manufacturing flexibility while increasing productivity, the concept has not been applied widely to furniture manufacturing. Lean manufacturing is truly the manufacturing system of the future and companies today need to be more productive than the competition at providing customers with high-quality goods and services.

Dr. Steve Hunter, associate professor in the Department of Forest Products, is considered one of this country's leading experts in the design and implementation of Lean Manufacturing systems. He took the leading role in the implementation of the first published case study at Franklin Corporation's Chickasaw county-based furniture manufacturing company.

Funded by the USDA Forest Service, this is the first of four case studies to be highlighted. Topics for subsequent studies include the development of a new and innovative lean manufacturing system variant for final assembly in an upholstered furniture production line, the use of value stream mapping in a case goods production facility, and process improvement implementation in a wood components manufacturing facility.

One of the goals of these studies is to provide readers with informational resources for learning more about design and implementation of lean manufacturing systems and the benefits derived from these system conversions.

Hassell Franklin, president and chief executive officer of Franklin Corporation said, "with MSU's help, we are refining our mechanism assembly processes. We want to take out all of the wasted motion and streamline processes. These leaner processes and other assistance provided by MSU keep the industry's competitive edge sharp."

With the increase of foreign competitors in the furniture market place, companies who adopt lean principles will better survive this global economy.

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An Introduction to Lean Production and Cellular Manufacturing for Assembling Upholstered Furniture Hardware

by Steve Hunter and Amy Garrard

Manufacturing systems should be designed to minimize the expenditure of labor and materials while meeting the functional requirements of the system. Lean manufacturing is a long-term system approach designed to produce superior quality products, in a timely manner, at the lowest possible cost, and on a continuous basis. Lean production (LP) utilizes manufacturing and assembly cells to maximize output productivity while emphasizing quality. The goal of lean manufacturing is to maximize the two non-depreciable resources of a factory—personnel and raw materials. LP also has many other benefits such as short turn around time, minimal inventories, superior quality, and leads to a practice of continuous improvement. In addition, LP systems require less human effort, less manufacturing space, less tooling, and less engineering time to develop new products. Implementation of lean manufacturing requires a systems-level conversion from the archaic job shop manufacturing system. This conversion will impact every facet of a company. Lean production adoption requires direction, commitment, and full support from upper level positions down to all employees within a company.

Lean production systems rely on manufacturing and assembly cells which contribute to increases in productivity, reduced direct and indirect labor requirements, improved quality, zero-line balancing, improved ergonomics, and process improvement. This LP system can help a company to achieve and sustain "higher order" competitive advantages in an increasingly global environment. Lean manufacturing systems offer many advantages and improvements in productivity; unfortunately, these systems have not been readily adopted by the furniture industry.

Cellular Manufacturing

The cellular manufacturing system is one of the most important aspects of lean manufacturing systems. The manufacturing cell and parallel pull assembly lines are designed to flow product like water through a pipe. Primary to this subsystem is the "make one, check one, pass one on," method. The benefits of this methodology include shorter lead times, reduced work-in-process, improved quality, and satisfied customers. This leads to more business from satisfied customers, long-term contracts, and customer/vender partnering.

The manufacturing cell is designed for flexibility. The cell should be designed to handle demand fluctuations and mixed model production. There is one-piece flow between manual workstations in the cell. Strictly controlled small lots are allowed between cells. The processes in a lean manufacturing cell are the same processes as were used in a job shop or flow line. The variety of manufacturing cells and the processes used in them are equally varied. Cellular processes can range from simple manual assembly to technologically complex.

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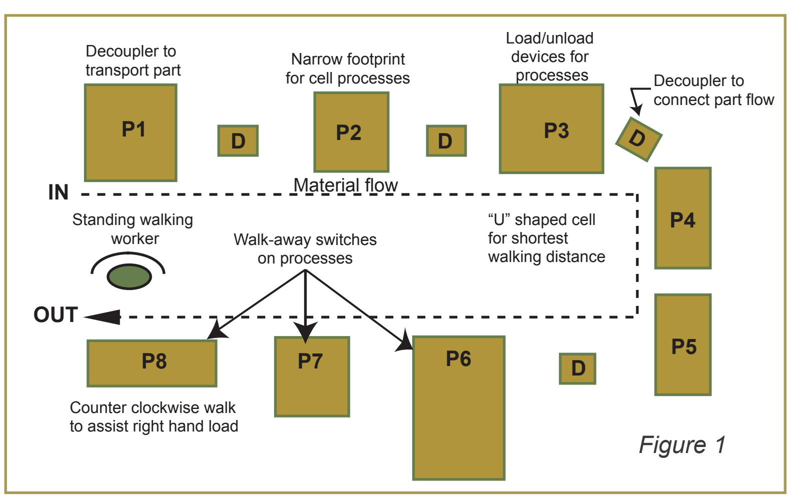
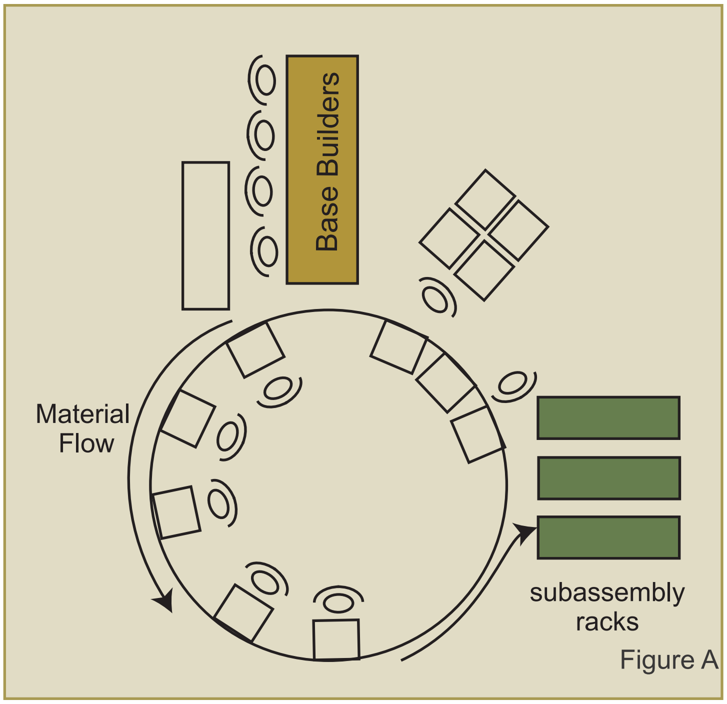


Figure 1

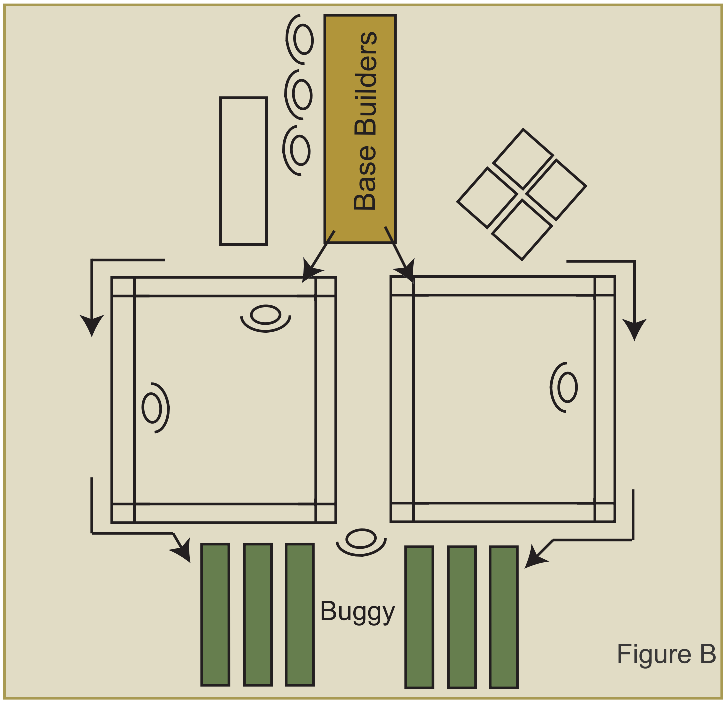
Franklin Corporations's Double-D Cell for Assembling Hardware in Upholstered Furniture Production: Case Study Number One

Subassembly Flow Line



Franklin flow line before conversion

DD Hardware Cell



Franklin Double-D manufacturing cell

by Steve Hunter and Amy Garrard

Even though Lean Production systems offer many advantages and improvements in productivity, these systems have not been widely implemented in the furniture industry. This is probably because conversion to a lean system is a major undertaking requiring a strong and sustained commitment from company management. Franklin Corporation is a leader in the production of upholstered recliners, sofas, and motion furniture. Franklin Corporation, a company with a long history of commitment to quality and value, began converting to a lean production system with assistance from MSU's Institute of Furniture Manufacturing and Management. Franklin management believes that converting to lean manufacturing will make them more productive, lower costs, and help them sustain international competitive advantages. This first case study demonstrates how Franklin Corporation reengineered a subassembly flow line into a Double-D designed manufacturing cell. The initial results indicate that the conversion of the manufacturing cell increased productivity by 36 percent.

By moving from a flow line manufacturing system with one worker per station (see Figure A) to the Double-D Cell design (see Figure B), Franklin Corporation reduced labor requirements in this subassembly unit from 11 to seven workers. The cell allows output flexibility by simply adjusting the number of workers in the cell. Supervisors have fine-tuned control over the speed of production. Employees in this system can communicate easier because of the "U" shaped cell. This allows workers to assist each other to solve problems faster. Increased worker movement on the job floor, as the cell workers move from workstation to workstation, reduces the risk of ergonomic problems while providing long-term health benefits. Cell employees inspect their own work, always striving to increase product quality.

Franklin Corporation benefits from LP because of on-going increases in quality, real productivity, lower workman's compensation costs, and a decrease in production costs. These strategic manufacturing advantages will become more pronounced as other parts of the factory are systematically converted to lean manufacturing cells and other LP subsystems.

Airline Manufacturing Installs State-of-the-Art Rough Mill

by Philip Steele and Duane Motsenbocker

MSU Extension Instructor Duane Motsenbocker and Judy Dunaway

Two-years ago Airline Manufacturing Company embarked on a modernization program of their furniture dimension parts manufacturing facility located in Columbus, MS. Process improvements focused on adopting Lean Manufacturing techniques where feasible. Both work cells and flow lines have dramatically increased productivity and speed. Equipment modernization included acquisition of new-generation CNC routers, panel saws and others.

"We dedicated ourselves to improving processes and equipment to increase product quality and to reduce costs and delivery times," said Judy Dunaway, Airline Manufacturing Company president.

The latest equipment installation is a state-of-the-art rough mill. The rough mill is composed of a Paul gang ripsaw, two high-speed optimizing crosscut saws and an automated sorting system.

The Paul gang ripsaw is a C/gL with a Model AB 920 in-feed system. Lumber enters the system from a tilt-hoist infeed with an unscrambler that feeds a chain transfer. The chain transfer transports the lumber to a position near the laser lumber scanners. The laser scanners are comprised of 15 laser modules positioned at one-foot intervals to detect lumber width and wane over a maximum 16-foot length.

After passing under the scanners, serrated pick-up bars lift the lumber and position it on rollers where it is held firmly by a traveling infeed chain. This reduces vibration and lumber movement which can result in inaccurate board placement with respect to the ripsaws. The scanned lumber is fed through 6 selective ripsaw blades that all move to allow maximum utilization of lumber width.

The system software solution considers lumber width, length, wane, crook and sweep from scanner information to maximize yield of cut parts. A frequent concern with selective ripsaw systems is the ability to provide a glue-line quality edge. "The Paul representatives assured us we would have the edge quality that is required for the numerous edge-glued panels we produce. Their system has more than lived up to this guarantee," said Mike Dunaway, director of manufacturing operations.

Productivity with the ripsaw has lived up to Airline's expectations. The system can process 15,000 BF of 12-foot long, 4/4 thickness lumber in an 8-hour shift. The productivity of the system has allowed the company to discontinue use of 10 straight-line ripsaws and reassign 20 employees who were required to run them.

The ripped strips from the gang ripsaw are hand marked for defects and transported to two optimizing parallel crosscuts. These crosscut optimizers are high-speed Paul Model 180s with MEGA upgrade. The high-speed crosscuts are necessary to handle the high volume of production from the new gang ripsaw. However, the high productivity of the ripsaw has also provided the expansion potential to meet future demand. Tim Vann, director of product development said the unused capacity available with the ripsaw allows the company to increase future production potential simply by adding a third optimizing crosscut saw.

Crosscut parts from the optimizers flow to a new automated sorting system that allows for high-speed sorting and final packaging of the produced parts.

"We estimated our returns from this investment based on increasing our parts yield from an average of 52 to 62 percent. At this point we are pleased that our actual yield increase has met these expectations," stated Dunaway. Tim Vann praises the ability of the new rough mill system to allow simultaneous processing of multiple cutting orders. "The ability to group large numbers of parts widths and lengths results in maximization of lumber length and width utilization. It took some effort to develop our information systems to fully capitalize on this aspect but now that has been completed and we are very pleased with the result."

In addition to the improved productivity and quality, the system has increased the accuracy of parts cost estimation. "Previously, lumber yield and labor costs were difficult to estimate. Estimated costs are now very accurate, assuring our customers of excellent products priced fairly for both parties," Vann added.

Those interested in a virtual tour of the Airline Manufacturing plant, including the new Paul rough mill system, can obtain a newly released CD from James Williamson, information systems manager, at jamesw@airlinemfg.com.

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A manufacturing cell must incorporate subsystems to make the cell work smoothly and productively. Production and inventory control are essential for a successful cell. This control must be integrated into the cell. Quality control, low-level preventative maintenance, and the cell team composed of multifunctional workers are the other critical subsystems and resources necessary for the basic lean manufacturing cell.

The transformation from the traditional job shop manufacturing system to lean manufacturing starts with the design and implementation of the manufacturing and assembly cell. The cell is composed of dissimilar processes grouped together and operated by multifunctional workers to process a family of parts. Typically, cells are laid out in a "U" shape as shown in Figure 1. The "U" shape configuration allows short walking distances for workers and encourages communication. The "U" shape also conserves floor space, ranging between 30 and 50 percent of space saved. Cellular manufacturing systems designers deliberately design manufacturing cells tight in order to reduce the amount of space available for the storage of in-process inventory.

Material flow is downstream and information flow is upstream in the typical cell. The cell uses the pull system for material control. Here, the cell pulls product through rather than pushes it through as is the practice with the job shop design. The cell incorporates inventory and production control via kanban squares, quality assurance, continuous improvement, and preventative maintenance functions. The cell has economy of scope; that is, the manufacturing cell has the ability to produce a wide variety of products at low cost.

The goal therefore is to systematically convert the functional job shop (see Figure 2) into manufacturing and subassembly cells. Then the individual cells are linked by the kanban inventory and production control subsystem to final assembly. In some cases, the manufacturing or subassembly cell may be directly linked to final assembly. Figure 3 illustrates such an evolutionary conversion from the job shop to the lean manufacturing linked cell system.

Transformation into Lean

The differences in a traditional system (figure 2) transformed into a Lean Manufacturing system are apparent. There are three cells in figure 3 with each cell composed of dissimilar processes grouped together and operated by multifunctional workers that use the cell to process a family of parts. The "U" shape configuration is best for short walking distances by the standing cell workers. This shape also encourages communication and conserves floor space.

Typically, workers go with the material flow and move from process to process, exchanging parts from processes or adding value at manual cell workstations. The worker is the most important and valuable manufacturing resource in the LP philosophy. One or more workers operate a manufacturing cell. The goal of the cell is that each worker should be able to setup and operate each of the cell's processes.

In this system, each worker is a quality inspector and each worker has the necessary tools and equipment to ensure their production is superior.

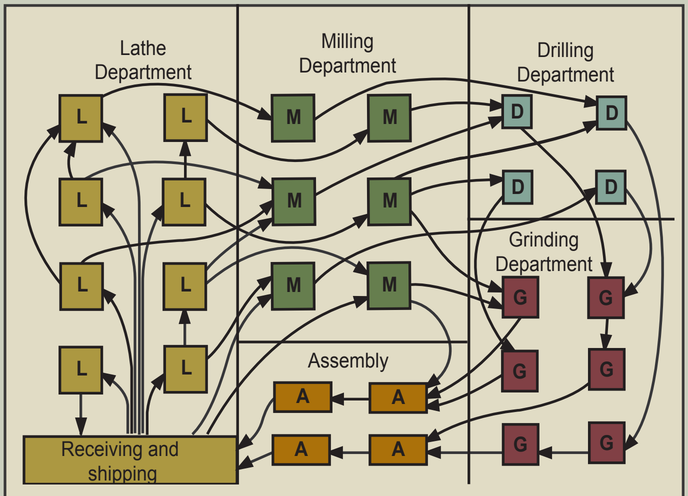
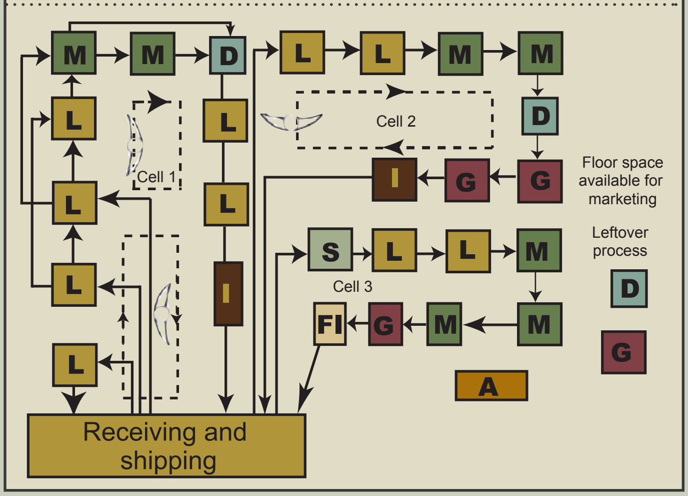


Figure 2 (above) before lean, Figure 3 (below) after lean



LP manufacturing systems have many benefits including improved turn around time and reduced lead-time. A factory can expect to see a 50 to 70 percent reduction in turn around time. In other words, an organization that properly implements LP manufacturing cells can expect to have product flow through the cell at least two or more times faster than the same work processed in a traditional job shop.

Implementation of an LP system also reduces defects, thus reducing waste. Waste in any of its many forms is the root of all manufacturing evil. The nature of the cellular manufacturing array lends itself to improved communication, which leads to improved quality. The fast feedback in the cell along with reduced variability provides a better quality product. If the old job shop is currently producing high defect rates, then the results from the implementation of cellular manufacturing will cause a dramatic upswing in quality because of the causal relationships inherit to cells. Cellular inventory control strives to control the amount of system work-in-process (WIP). When WIP is reduced, lead-time of the product decreases, which allows the system to operate at a more productive rate.

Workers can be added or moved to other areas depending on demand for that cell's output. Typically, workers go with the material flow and move from process to process carrying the just removed semi-finished work piece with them and loading it on the next process in the processing sequence. At various steps in the manufacturing sequence, the worker checks to ensure that each process has been completed correctly. The fast feedback in the cell along with reduced variability means better quality product.

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