

VALUE STREAM MANAGEMENT: EMPIRICAL EVIDENCE ON LEAN ORGANIZATIONAL STRUCTURES

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ABSTRACT

Lean thinking represents a set of principles and techniques for the identification and elimination of waste in manufacturing and administrative processes. The lean journey typically begins with awareness and education on lean principles, applying 5S, and value stream mapping techniques, but over time, organizational constraints will create barriers to achieving a truly lean enterprise. Improvements in processes, facility layouts, and managerial spans of control encourage redefining an organization's hierarchy and adopting a value stream management system. This paper outlines the transformation process used by two leading electronics manufacturing companies to achieve value stream management or lean organizational structures.

Keywords: Organizational Structure, Value Stream Management, Lean Manufacturing

INTRODUCTION

Lean is defined as the process for doing more with less and less – less human effort, less equipment, less time, and less space – while coming closer and closer to providing customers exactly what they want [4]. Lean is a journey and results from five major principles [3] [4]:

- Define value from the viewpoint of the customer
- Identify and map the product or service value stream from raw material receipt to customer delivery for each product family
- After eliminating non-value adding activities, make the value creating steps flow continuously without interruptions or constraints
- Customer pulls the product or service at the rate they demand through the value stream
- Continue the journey towards perfection through radical or continuous improvements

Using the Toyota Production System framework of standardization and stability based on the pillars of Just-in-Time and Jidoka, many lean enterprises have developed their own strategy for implementing lean through the following techniques: 5S (sort, simplify, sweep, standardize, sustain), value stream current state and future state mapping, continuous flow, pull systems, standard work, load leveling, and continuous improvement or kaizen events [4]. These methods provide the tools for achieving the goals and objectives of the five lean principles. Numerous companies have successfully applied these techniques to achieve significant reductions in cycle times, production lead times, quality defectives, and order fulfillment times.

A systematic lean strategy contributes to improved quality, cost, and delivery performance metrics, but a lean enterprise must undergo key changes in organizational structure and the roles and responsibilities of its senior, middle, and lower management levels. These changes result in a

flat, responsive organizational configuration with clear upward and downward communication, and also include expanded roles and capabilities for supervisors, leads, and team members [1].

What does this lean management structure look like? This is a difficult and timely question. Womack and Jones [4] proposed that the lean transformation relied on finding a change agent, developing knowledge and awareness of the basic lean tools, seizing or creating a crisis for implementing lean, and then, value stream mapping to determine current and future states for the elimination of waste [4]. As many companies have achieved these four phases in their lean maturity, Womack states that the key question is then: “how do you effectively transform your complete enterprise?” He admits that Dan Jones and he do not know, and this paper reviews organizational approaches designed to answer this question.

LEAN ORGANIZATIONAL STRUCTURES

Lean represents significant change in manufacturing and office environments, and generally, companies implement the change in operations and management through the principles defined by Womack and Jones [4]. The critical value streams in any organization are 1) product development from concept to launch; 2) fulfillment from order receipt through delivery; and 3) customer support through the life cycle of goods and services. Value streams are identified and mapped to determine areas for improvement and waste elimination. Then, the structuring of each value stream business requires selecting value stream managers and reorganizing business functional responsibilities, performance metrics, and continuous improvement activities by value streams. Finally, the entire enterprise is organized according to value streams that reflect focused factories or business units within the larger corporation, and this demands systematic coordination and cooperation between the value streams.

In progressing towards value stream management, corporations must select and assign specific functional roles, responsibilities, and people to each value stream. This produces integrated product and process teams organized as self-managed and effective work teams supervised by a value stream manager [2]. Dedicated value stream organizations may include people from the following functions: sales and marketing, design and manufacturing engineering, purchasing, maintenance, quality, procurement, and manufacturing teams on the shop floor adding and improving value for the customer [1]. Business decision making is no longer vertically performed through layers of management, and the lean organization integrates the horizontal set of activities along the entire value stream. Cross-training and waste elimination through lean techniques in manufacturing and administrative activities should also reduce the number of people and functions necessary, while also increasing the competence and flexibility of value stream employees. Larger organizations may transition through several stages from a functional to matrix to value stream structure, but small and medium-sized firms should be able to transform directly from functional to lean value stream organizations [1].

EMPIRICAL EVIDENCE ON LEAN ORGANIZATIONAL MANAGEMENT

Based upon the theory and evidence of lean organizations, the author conducted interviews at two electronics manufacturing organizations on their organizational transformations to support the lean implementation. The sensitivity of the information required that the identities of the

companies and people interviewed were kept confidential. Therefore, the companies were categorized as Companies A and B, but general background information is provided on each firm. Discussion of their detailed organizational structures offers empirical evidence on specific approaches to creating lean organizations.

Company A

Company A started in 1948 and manufactures, distributes, and services electronic test tools and software and is a wholly owned subsidiary of a large holding corporation. It has two manufacturing facilities in Washington State. The firm sells and markets test and measuring instruments to technicians, engineers, metrologists, medical-device manufacturers, and computer network professionals. Manufacturing operations are conducted in the United States, Europe, and Asia with sales and service subsidiaries located in Europe, North America, South America, Asia and Australia. It has distributors and manufacturer representatives in more than 100 countries and employs approximately 2,400 people worldwide, and lean principles and kaizen events were implemented shortly after the firm was acquired by the holding company in 1998.

The lean structure exhibited in Figure 1 has expanded the original, functional organization through the Focused Factory concept. Company A's manufacturing operations are managed by the North American Plant Manager who reports to the corporate Vice President of Worldwide Operations. Shared processes, such as microelectronics, are managed by the Director, Subassembly Factories who also reports to the Vice President Worldwide Operations. Before lean, this function had responsibility for a chip foundry, printed circuit board shop, sheet metal operations, and microelectronics. Now, only microelectronics remains, as the other three fabrication processes have been outsourced.

Under the Plant Manager, the Washington State facility has a number of Focused Factory Managers, who were organized similar to the Business Unit Divisions before the acquisition. Parts, components, and finished product materials are managed across all Focused Factories with Buyer/Planners assigned to each Focused Factory's product group. The Focused Factories are similar to value streams, and they now have a scheduler, materials handlers, technicians, mechanical and test engineers, and Team Leaders. These individuals are all co-located within the physical area of the manufacturing cells, so there is close coordination between these production support services and actual production cell associates.

Generally, there are 1-2 Cell Associates per manufacturing cell using a rabbit chase system for the distribution of work. The rabbit chase has each operator perform all the work activities required to build a single product with operators following one behind the other in the cell. At Company A, cells were designed to allow approximately 3 operators performing the rabbit chase before the distribution of work would require split the work or a single operator per station. Given the number of cells, there are, on average, about 30 Cell Associates per Team Leader.

The Focused Factory structure is similar to a value stream organization in that the majority of support and manufacturing functions are located inside the physical layout of the product group with control over raw material ordering, inventories, and customer shipping.

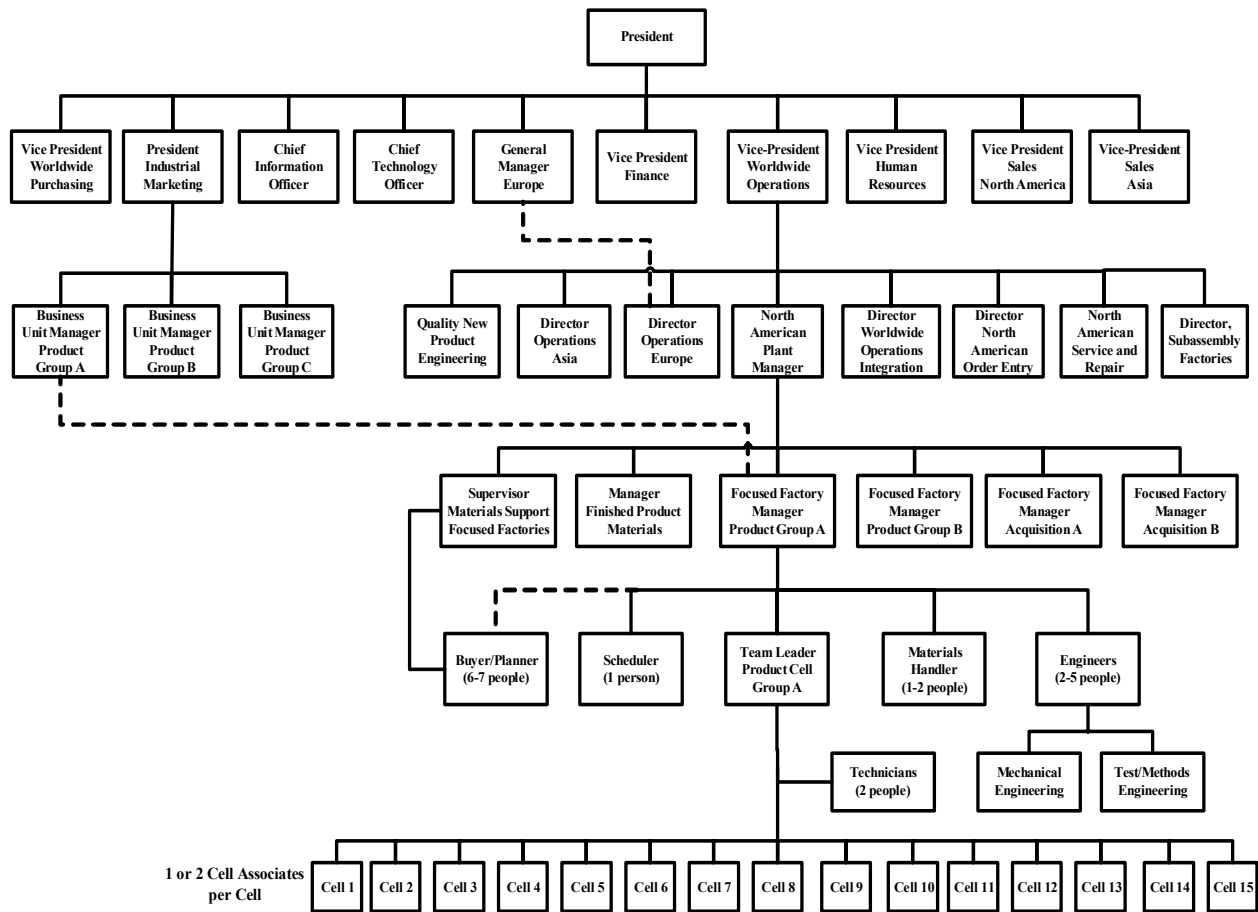


Figure 1. Company A - Lean Organizational Structure

Company B

Founded in 1958, Company B designs and manufactures electronic and electromechanical products for aerospace and defense applications. Its products are used on all major American and European aircraft, and it has operations in Washington State, England, and France. This company is a wholly-owned subsidiary of a large holding company. The holding corporation created the lean initiative based on combining six-sigma and lean principles and focuses on adding value for customers while eliminating non-value added activities. Prior to 2006, the company had two manufacturing facilities in the state of Washington, but lean improvements allowed the consolidation of manufacturing operations into the larger, original facility. When acquired in 1998, Company B implemented lean principles through the parent organization's six-sigma and lean black belt program. The implementation commenced in 1998 and represented a dramatic difference in the process improvement strategy at the facilities.

The company manufactures products in low volume with high mix by building to finished goods, and production lines were broken into cells. The cell configuration resulted from standard work and takt times, and the layout combined assembly, test, painting, and other required machinery through the right sizing of equipment. Visual controls using 5S, signboards, and labels achieved clear presentation of materials. The lean initiative also systematically reduced the number of

suppliers, and by obtaining quality suppliers, receiving inspection was eliminated and materials were delivered directly to the cells. Kanban and pull signals controlled the movement of materials through the cells.

Figure 2 exhibits the Value Stream Management structure for Company B and the business segment in which Company B is positioned. The parent corporation has five major business segments that are not contained in this chart. At the corporate level, Solutions Leaders now manage product groups, and their major roles and responsibilities focus on customers through on-time delivery of new development programs and the engineering of new product developments. These positions were originally termed Value Stream Leaders, but the name was changed to Solutions Leaders to avoid confusion between value stream leaders and manager.

For manufacturing, Site Leaders now manage the geographical facilities for the specific Industry Group within the Business Segment under the Senior Group Vice President, Global Sourcing and Management. Their major operational metrics are on-time delivery, inventory turns, and productivity, which is measured as total salaries and fringe benefit costs for their location divided by sales. The Site Manager for the state of Washington also directs overseas manufacturing, and two Lean Office Managers report directly to the position. The Site Leader also controls Facilities, Supply Chain, and Value Stream Managers who run the product family groupings for the facility.

Supply Chain includes materials, master scheduling, and logistics, but within production cells, there are engineering and production control people working for the Value Stream Manager. Supply Chain activities also include supplier on-boarding and partnerships. For supplier on-boarding, Company B has developed a Plan For Every Part (PFEP) process that reviews each part in the value streams and determines the best replenishment plan to reduce inventory and lead times. The Material Replenishment System (MRS) organizes the exact layout of inventory in the cell through placement of kanban cards or bins. Finally, the Manager of Shared Processes and Resources directs processes, such as surface mount technology, magnetics, sheet metal, and circuit card assembly, that are required in each value stream.

Under the Value Stream Manager, Cell Leaders control specific products and rely on cell leads to manage the cell team members. Each Cell Lead supervises about 3-10 employees, so on average, the span of control for a Cell Leader is 15-30 people. The physical layout of each cell is based on the goal of single piece flow moving in a counter-clockwise direction with all cells opening out onto an aisle for easy transportation of incoming materials and finished products. New derivations of existing products generally are manufactured in existing cells, but new cells are easily created for brand new product developments. Ideally, future changes may place more processes into the cells. The Main Stores in Supply Chain will be eliminated, and all stores allocated to their point of use in the cell. Company B uses the term “polishing cells” for the strategy to incorporate all steps for creating material and information flows within the cell.

CONCLUSIONS

This analysis has reviewed the theory of lean organizational structures and value stream management to identify major issues required in transforming a company’s strategy around lean

practices. Organizational structure and span of control are critical elements in the lean journey. The author then interviewed senior executives at two manufacturing companies that have been involved with lean thinking for almost ten years. Detailed organizational charts after lean were presented to highlight the major structural changes reflected in a lean organization.

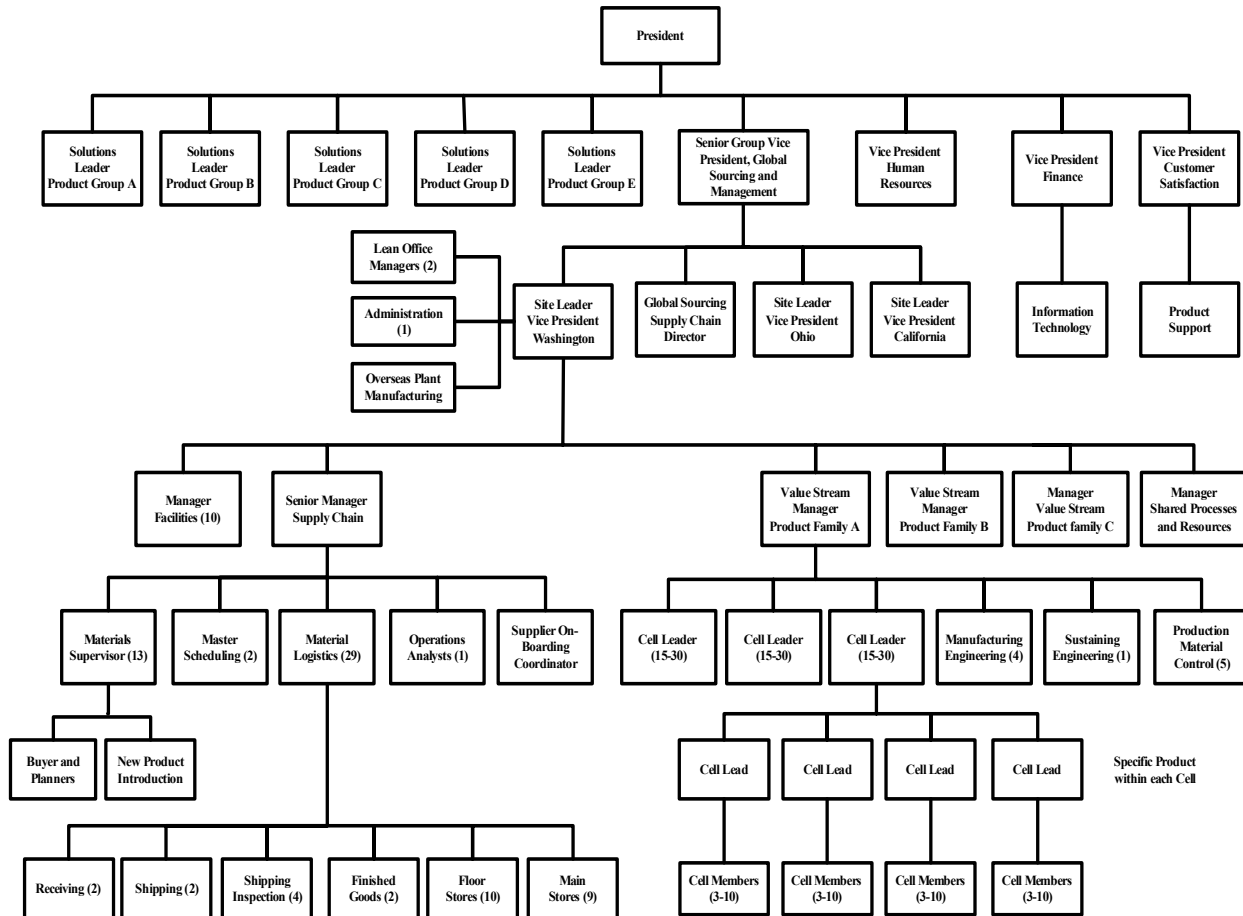


Figure 2. Company B – Value Stream Management Organizational Structure

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