

Insight from industry

Supporting small businesses in their transition to lean production

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Abstract

Discusses the importance of achieving alignment between buyers and sellers, with specific emphasis on efforts by buyers to improve the performance of their suppliers. Describes common barriers and presents strategies and methods that were successful in educating and developing suppliers' capabilities in lean production across multiple tiers. Presents supporting activities that can help facilitate implementation and ensure that lean production does not become another "flavour of the month".

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Introduction

The effective execution of supply chain management strategies requires the alignment of both internal and external stakeholders. Alignment is a highly sought-after goal, but one which is rarely achieved in western businesses (Mikami, 1982). This is due to a number of factors such as the temporal nature of business relationships, management turnover, inconsistent or confusing direction from senior management, poor morale, and systemic layoffs (Emiliani, 2000a). If internal alignment can not be achieved, then how can external alignment with even first tier suppliers be achieved? In fact, it is more typical for the senior purchasing executive to force alignment by sending letters to suppliers demanding that they must immediately reduce prices by 10 per cent or risk losing all business (Karnitschnig, 2000).

Today, many large manufacturing companies managed in the western tradition seek to obtain alignment with first tier suppliers by engaging them in activities to improve their production capabilities (Handfield *et al.*, 2000). Companies considered as leaders in lean production have long realized that entire supply chains (or supply networks), not just first tier suppliers, must mirror their production practices in order for just-in-time systems to function properly (Womack *et al.*, 1990; Ohno, 1988). The buyer will often devote considerable resources to develop their suppliers at no cost to them (Bounds, 1996; Bounds *et al.*, 1996). Senior managers at Toyota and Honda know implicitly that such investments are small and result in substantial improvement in overall performance including a reduction in total costs.

It has been much less common, however, for western companies to develop entire supply chains for a given type of product. This article presents the strategies and methods used by Pratt & Whitney, a manufacturer of gas turbine engines, for a three-year period (1996-1998), to develop the network of suppliers that produce small machined parts.

Overview of small machined parts

The small machined parts supply network is part of an aerospace economic cluster located

in the Connecticut Valley region (Porter, 1998), a 125km corridor paralleling the Connecticut River, from Springfield, Massachusetts to Middletown, Connecticut. It came into being shortly after Pratt & Whitney was formed in 1925, with initial emphasis on machining processes. As the product technology advanced from piston to gas turbine engines in the late 1940s, a wide variety of supporting services were formed in order to produce more highly engineered parts with increased durability. The support services include processes such as electroplating, shot peening, brazing and welding, thread rolling, grinding, de-burring, plasma spraying, heat treating, and metallurgical testing. Most machining and support services businesses have been part of Pratt & Whitney's supply network for over 40 years.

Small machined parts consist of a few thousand part numbers in a wide variety of configurations, most less than 30cm in diameter, and with an average price of <\$500 per unit. It was a highly fragmented spend of approximately \$75million per year which had never been managed strategically due to a historical bias in which these parts were perceived to be easy to make and a "no-brainer" to procure. While these parts are certainly not the most complex to produce, there are, however, many systemic issues that resulted in chronic deficiencies in cost, delivery, and quality performance. In addition, small machined parts were considered to have a low level of importance relative to more expensive parts, and thus did not garner much attention from the design or project engineering communities.

It was clear from the outset that the small machined parts supply network was not well-positioned to respond to the marketplace demand for significant improvements in cost, delivery, and quality performance that would arise after the 1989-1994 business downturn. More importantly, suppliers were not prepared for the change in production system, from batch-and-queue mass production to lean production, that P&W was undergoing since the early 1990s, and that they in turn would be asked to follow suit.

The supply network for small machined parts consists of over 100 mostly small, family-owned businesses, with revenues

between \$2million-50million and less than 150 employees. These businesses were established by entrepreneurs, many of which were former machine operators. It is not unusual to hear stories of how they started with just one machine and worked long hours every day of the week, for a decade or more, in order to grow their business.

The owners, many of them now second or third generation, are a remarkable group of people. Compared to large enterprises, small businesses tend to be responsive, resourceful, lower cost, and high quality.

But like any successful businessperson, the owners of small businesses have blind spots that can make it difficult to respond to changes in business conditions. For example, the management style tends to be top-down, with the owner making most of the decisions. They often find it difficult to delegate work to others, preferring instead to be directly involved in all activities. The owner may be so busy that they do not read *Aviation Week* or *The Wall Street Journal*, and thus lose touch with what is happening in the marketplace. In other words, they may possess a debilitating inward focus.

Owners and the management team may have a limited amount of formal education or may not recognize the shortcomings of their fundamental production processes or procurement practices – perhaps largely unchanged for 20 or more years. From the point of view of the owner, they are successful, and are not usually willing to listen to the new breed of young managers that switch jobs every two to three years. There may also be a historical bias against management practices developed in Japan and a general unwillingness to experiment. They will also likely view improvements made by a large company as unattainable in smaller businesses due to a perceived lack of resources. In addition, most owners have difficulty believing that their customer could begin to view their competencies as a commodity that can be purchased anywhere in the world (Emiliani, 2000b).

These management behaviors are not necessarily unique to small businesses. Nevertheless, they cause misalignments between buyer and seller that can take years to overcome. The trouble is, buyers do not typically give suppliers years to overcome them.

Supplier development strategy

The general strategy was built from the following viewpoint: the benefits of local supply networks greatly outweigh the disadvantages (Porter, 1998) and that opportunities can only be understood through extensive personal interaction with suppliers – i.e. the owner and his or her management team. This included three key components: understanding which business practices or procedures make it difficult for suppliers to meet their customers' expectations; making commitments to resolve systemic problems; and evaluating suppliers' operations and recommending areas for improvement.

The focus was to improve suppliers' operations by helping them understand and implement the fundamentals of lean production which include 5S, total productive maintenance, set-up reduction, mistake-proofing, visual factory, standard work, and cellular production of part families. The cost, delivery, and quality improvements obtained by implementing lean production would eliminate overseas sourcing from consideration.

However, this goal was not made explicit at the time due to rapidly changing conditions in the marketplace and extreme emphasis on the cost reduction of purchased materials.

If suppliers were successful at reducing the price differential by 20 per cent or more (exclusive of freight) within three to four years, then senior management could be convinced that the small machined parts supply network was improving at a high rate, the total cost was favorable for domestic suppliers, and that they were on the path to achieving world-class performance. This would make overseas sourcing considerably less attractive, and the buyer could continue to enjoy the benefits of a highly developed local manufacturing infrastructure.

The first challenge was to educate suppliers on what lean production was and then convince them to adopt new production practices. Suppliers also had to be convinced that lean production was not another fad, one of many that they had seen come and go over the previous 20–30 years.

Supplier development methods

The principal concern was how best to communicate with the supply network. While concentrated within the Connecticut Valley, the large number of suppliers made daily visits impractical. Part of the solution was e-mail. In early 1996, most suppliers had new computers and local area networks to support computer aided manufacturing, inspection records, deliveries, attendance, etc. However, only 5–10 per cent of the supplier network had e-mail. So the first step was to call the owner of every business and ask them to get an e-mail address, as well as Microsoft Office software, in order to support the exchange of text, spreadsheets, and presentations. Nearly every supplier honored this request, though some required additional prompting.

Though only a few suppliers had e-mail addresses, an activity was instituted whereby the supply manager would e-mail a note to suppliers, every other week, with relevant business information (Emiliani, 1996). This started out modestly, with short, half-page, communications regarding issues or upcoming events. As the distribution list grew, so did the e-mail note. Within a few months, the e-mail note expanded to several pages and typically included the following major sections: Cost, Delivery, Quality, Continuous Improvement, Training Opportunities, Master Production Schedule, Surplus Equipment, and Links to Valuable Web sites. The notes established and reinforced performance expectations, and reinforced parallel on-site supplier development activities in which manufacturing engineers facilitated *kaizen* events.

The e-mail notes consistently emphasized lean production as the only means by which market-driven goals could be achieved. It presented cost, delivery, and quality as parameters that could be improved simultaneously, rather than at the expense of one another, as is traditionally the view in batch-and-queue mass production. They explained the benefits of lean production in relation to the suppliers' own interests, such as reducing inventories, increasing cash flow, improving operating margins, marketing, and competitiveness. The benefits to P&W and the end-use customer were also explained. They also included market data and trends from various internal and external

publications. The e-mail notes provided context, interpreted events, and translated them into specific actions that people could take to improve performance.

They provided examples of set-up reduction and root cause analysis, and recommended important books or articles to read. They contained attachments such as presentations describing the fundamentals of lean production, performance measurement, and how to implement quality control process charts. One spreadsheet was developed to show the impact of set-up reduction on lot size, lead-time, and customer satisfaction, while another was interactive and programmed to show the benefits of process improvements such as set-up reduction on financial performance. The e-mail notes were followed up by personal visits to scores of suppliers in order to witness their progress and reinforce the central theme of lean production. In fact, much of the content of the notes came from supplier visits in which lengthy conversations with senior managers revealed gaps in awareness of each other's business or knowledge of lean production.

The e-mail notes also announced affordable, high quality training in lean production offered by third party sources. Organizations not affiliated with buyers were very effective at spreading lean production in the Connecticut Valley, as the legacy of past business behaviors or operating priorities often makes it difficult for suppliers to trust their customers (Blois, 1998; Kim *et al.*, 1999; Spekman *et al.*, 1998). In addition, suppliers generally regard detailed operating practices and the results of improvement activities as proprietary information.

We also held formal supplier network meetings, but did things somewhat differently. For example, the agenda of most supplier conferences consists of topics that are presented solely from the viewpoint of the buyer. Our agenda contained items of concern to both P&W and of the supply network. Responsiveness to suppliers' needs will always improve credibility. In addition, we gave the attendees some free gifts. But instead of giving out stickers, posters, and pens, we gave out books. Each attendee received a copy of *The Machine that Changed The World* (Womack *et al.*, 1990), *Lean Thinking* (Womack and Jones, 1996), and P&W internal publications on continuous improvement (P&W, 1997a, 1997b). The

supply network also received the book *Modern Approaches to Manufacturing Improvement – The Shingo System* (Robinson, 1990) in a subsequent mailing.

Several suppliers attended a lecture, "The lean leap" by James Womack, at P&W's expense (Womack, 1997). In addition, suppliers were offered discounts on software, computer training, and professional skills development courses. They were also invited to participate in *kaizen* events and have their employees tour manufacturing areas so that they could witness firsthand the many improvements that had been made at P&W.

The e-mail notes were effective because they contained practical information, put issues into context, and explained the specifics of how to achieve challenging goals. This, coupled with P&W-facilitated *kaizen* events, third party training resources, and market conditions that could no longer be ignored, helped propel many suppliers in the aerospace economic cluster to adopt lean production practices.

The next step is to ensure that lean production does not become corrupted or misapplied, and thus turn into yet another passing fad.

Conclusions

There are many things that buyers can do in order to support the implementation of lean production across its supply networks. Since most businesses are small (i.e. <500 people), higher tier buyers seeking to create lean suppliers must inevitably interact with lower tier suppliers. The interaction will be productive if the buyer first asks for feedback from suppliers and makes commitments to resolve systemic problems prior to requiring the adoption of lean production practices. This is a very effective starting point, as it can help the buyer fix or eliminate wasteful business practices and also gain supplier buy-in for transitioning to lean production.

Small family-owned businesses generally exhibit management behaviors that are very different from large publicly owned businesses because they have different life experiences and are accountable to different stakeholders. A challenge for small businesses is to understand and respond to these differences without compromising their desirable attributes. Likewise, large

businesses have a challenge to understand the strengths of small businesses and help them improve their weaknesses in a collaborative manner. This type of behavior is difficult to exhibit by those accustomed to western management practices because it is neither customary nor rewarded by investors (Emiliani, 2000a). So think of it as a moral imperative instead (Stainer *et al.*, 1999).

The owners of small businesses will implement lean production if they can obtain affordable, high quality instruction on the philosophy and practice of lean production. The substantial differences between batch-and-queue mass production and lean production must be made very clear, including the implications for leadership and human resource management (Emiliani, 1998; Emiliani 2000a). Knowledgeable third parties can be important resources to facilitate implementation in an unbiased and less threatening manner. But it is not just the role of outside teachers to impart knowledge. The owners have a responsibility to read some of the great books and articles published over the last 20 years to gain added depth of understanding, teach their employees, and reinforce their leadership role. They would also benefit from the creation of a local network of like-minded people from similar-sized businesses that have made substantial progress in implementing lean production. Finally, buyers that behave in ways that promote trust among all stakeholders will have discovered the foundation upon which lean production is built.

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