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Lean Journey 2003-2007: Applying Lean Principles to a Mature Business Model with Financial Constraints

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Weir Minerals was founded in 1916 to serve the pumping needs of the anthracite coal industry. It is now a highly integrated pump manufacturer with pumps installed in all major industries in the United States and over thirty-five countries around the world. Weir is headquartered in Glasgow, Scotland, with offices and manufacturing facilities on five continents. This conference summary is a snapshot of Weir Minerals North America-Hazleton's 2003-2007 Lean journey.

In the Hazleton facility, there are ninety-five total employees, fifty of whom are members of a collective bargaining agreement. The facility has 92,000 ft² of floor space under one roof, consisting of 51,300 ft² of manufacturing, 25,000 ft² of pattern storage, and 15,675 ft² for office, support, and distribution. The product line is high mix and low volume.

The Hazleton plant has a good history of employee involvement, with 25 percent of employees involved in structured safety teams or committees, and is certified by the State of Pennsylvania and OSHA with Star Status as a Voluntary Protection Site (VPP). However, in 2000, Weir had a Lean program with a lot of employee involvement that was a false-start, and dispirited employee involvement in new Lean programs.

In mid-2003, the Weir Group announced Lean as the global improvement program for all of its companies. All manufacturing plants worldwide utilize a consistent color coding and manufacturing flow. A Lean trainer was identified at each business and sent to a one-week "Train the Trainer" session at the corporate center. The Lean trainer was then tasked to take the program and Lean Toolbox back to their individual company, lead local "Train the Trainer" sessions, and facilitate the improvement program. In 2003, the Hazleton facility scores were in the middle of the rankings. Early implementation success

was marginal based on the approach of “telling” rather than “involving” employees in Lean changes and projects.

In 2004, a formal Lean assessment was developed for use by all Weir businesses which created a consistent metric to trend across all businesses. It included monthly self-audits, with recognition for winning areas, and a formal external audit for every business at the end of each year (self-audit scores tend to be higher than outside audit scores). The auditors were Lean coordinators or Lean managers from other Weir businesses, which created good networking between businesses and created hands-on sharing of best practices as auditors visited other plants.

Key attributes for Lean development were agreed upon and weighted scoring was applied to more critical attributes. Audit questions with scoring [1 to 4] were developed for each attribute and plotted on a radar chart. Best practices were published and shared across Weir companies (*see page 5 for sample chart and audit questions*). In late 2004, a Lean Manager was hired and trained with the Weir Production System Toolbox for focus on the Hazleton Lean program. By the end of 2004 it had become clear to Weir businesses that those with a dedicated Lean resource showed better results and faster improvement rates.

The initial Lean approach in 2005 was two-phased: 5S and flow. Applying 5S gives a lot of benefits at once as it's an easy to apply, low- or no-cost approach; overlaps to improvements in safety, flow and quality; and it creates immediate visual results for all employees to see. To enhance flow, Hazleton identified parts families and set flow or cells for each, identified tooling and equipment required, and minimized back-tracking or cross-flow between cells. The factory was divided up into manageable zones and 5S was applied in each. These zones were further divided into miniature zones for parts types. Hazleton also ended up with a catch-all area for processes that do not fit in its flow, and outfitted it with the best machinists and most flexible equipment.

The VP of Operations and the Managing Director spent a lot of effort choosing the right team members. They wanted small and manageable teams of 5-6 people that included at least two union employees who worked in the cell they were working on, and made sure to include the cynics in the plant because of the word of mouth advertising it would bring for a successful program. The Operations VP and Managing Director set the initial goal and expectations. Then they chose the desired Kaizen event, keeping the number of events limited to two per month and the scope limited for manageability, such as “5S the shipping area” vs. “5S the entire distribution area”. They later added Safety as the sixth “S”. Then the Operations VP and Managing Director handed it off to the Lean Coordinator for implementation.

The initial activities concentrated on the standard product line and product flow. It included painting and improved lighting for the facility, spaghetti diagrams and shadow boards for processes. A side benefit to brightening the workspace with new white paint was that it seemed to make the employees' work life happier. Hazleton used indirect labor during slower times and outside companies during scheduled plant shutdowns, such

as holidays, to accomplish tasks like painting and lighting. Painting and lighting cost more than other Lean activities, but in retrospect the results were good enough that Hazleton would do it now during shift time. Hazleton continues to use indirect labor for on-going Lean programs to continue gaining efficiencies.

From 2005-2006, the results were dramatic. Shadow boards and 5S reduced set-up times, even without SMED activities. Pump assembly time went from 14 hours to 2 hours, which had often been due to needing tools, parts, and fasteners to finish pumps. The goal was to make the process simple so that people can take ownership of it. Hazleton emphasized signage to where anyone walking into the shop will know exactly what they do in each area, with the goal that a new employee can build a pump in 4 hours. And Hazleton spent a lot of time training employees. The Hazleton facility's score went from 86 to 128 in 2006.

Hazleton found that recognition worked very well at motivating people. The Hazleton facility won the corporate storyboard award, which came with a reward – the Lean Manager could travel to examine Lean practices at a Weir plant anywhere in the world. By 2007, the score was 142 out of 150. It's not perfect – but Hazleton's management feels that Lean is a journey. Hazleton will need to continue to fine tune processes, examine best practices at other plants, and apply it to their specific situation to maintain Lean gains.

In 2007, Weir's Lean applications were to re-establish machine preventative maintenance, establish a Kanban program for high volume SHW parts, establish a Repair Center Lean focus, and Heijunka scheduling for all work centers. Hazleton also planned to focus on Pareto charts and root-cause analysis of repeat non-conformances, factory 5S and visual improvement in all areas, error-proofing, and Andon lights and boards. In particular, they found that Andon lights with a posted phone contact board improved communications between Engineering and the shop floor.

Hazleton does a lot of "one-of" projects and custom work on older equipment, so older machines and tools are good for business. However machine maintenance needed attention so TPM at Hazleton is now a day-to-day checklist for each machine tool with who is responsible. The checklist is reviewed daily, weekly and monthly. Uptime is now 98.8 percent.

Hazleton found that consistent on-time delivery performance (now 98 percent) was critical to their business, especially in the Repair Center. For instance, Hazleton does not buy castings from China. There have been times when suppliers and supplies were difficult to obtain. As expensive as a casting can be, machine time is more expensive. Instead of buying from China for better pricing, Hazleton buys locally-made, partially finished castings, and keeps value added away from the casting until ordered. This improves turnaround time, and reduces inventory and freight costs. Work is put into a box by the day it is due to be completed and the operators plan their own day's work. Keep turnaround times faster than your competition – when you can quote half the turnaround time of your competitors, you can keep margins up.

Convince customers that you will not carry inventory, but will instead quote the lead time and make sure it's there when quoted. If a customer needs a part sooner, they need to carry their own spare parts. Hazleton found that speed through the shop therefore also reduced WIP.

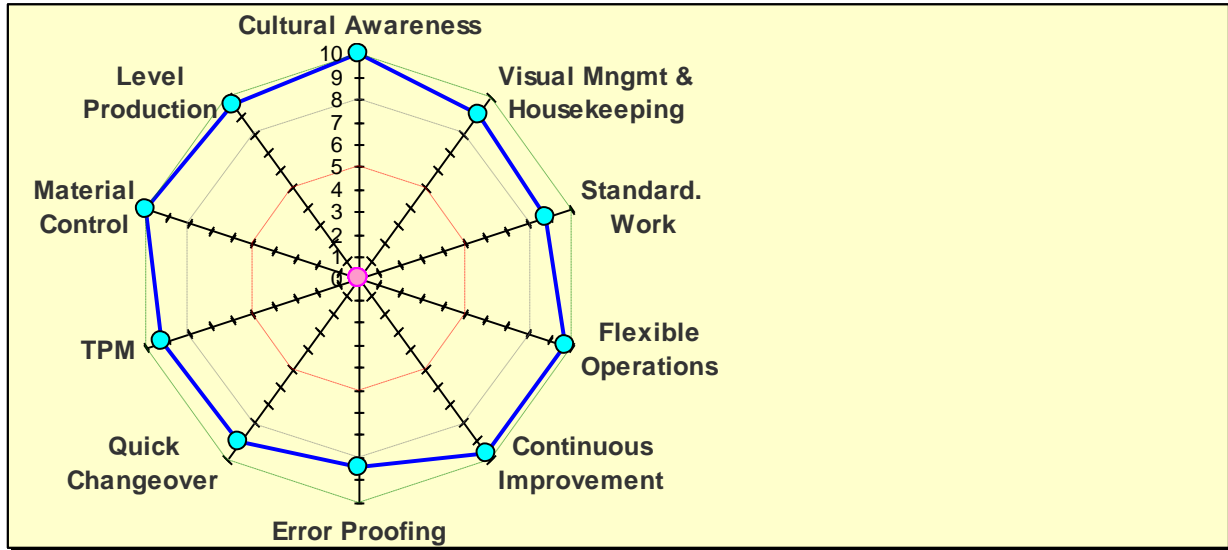
Error-proofing at Hazleton became focusing on engineering in the front-end as they were finding that a majority of error-proofing problems started in engineering. However, error-proofing in the engineering group was new to Hazleton. There were a lot of non-conformances, design finish notices (DFNs), and base plates were a problem (too heavy and too expensive, or too thin and bending). While Weir engineers-to-order, there are a lot of similarities between products, and Hazleton did not want to do something dramatically different than the drawing called for.

In 2008 and beyond Hazleton wants to use SMED activities to improve quick changeover and get set-ups down to 10 percent of the old timing, invest in a test facility, overhead cranes and new railings, upgrade or replace old equipment, and look at Lean business as well. Hazleton started with the sales organization by following an order around the plant to see how much work is being done on it and how long it sits in an in-box. They ended up dedicating one person to order entry and what previously took a day or more is now completed in about 20 minutes. Hazleton found that Lean builds speed into the process where people and things move faster.

In the end, Workers Compensation was reduced drastically due to better lighting and a better organized plant. Return on net funds employed increased significantly, from 15 percent to over 60 percent. Profit as a percent of sales increased from just over 6 percent to nearly 10 percent. Hazleton went from not being allowed to spend much capital investment, to some encouragement to spend capital. Other benefits included increased throughput without major capital investment, maintained and improved inventory turns, improvement in on-time delivery, improvement in customer satisfaction, and improvement in employee pride in the business (as measured by increased involvement in outside of plant activities like the employee Christmas party).

Weir Hazleton found the key pillars of success to be employee involvement – get people involved with patience, look around the plant and talk to the employees. Never say you are going to do something and not follow-through. Stay with it and you will gain employee confidence. Top management needs to set the priorities early on, and give consistent top management support via review and attendance at report-out meetings. Dedicate an accountable Lean coordinator resource, and maintain a consistent message and effort. Understand that it's a moving target with changing bottlenecks, resources and metrics. Identify measurable objectives to trend for consistency and direction, measure everything, and keep it simple.

Audit overview and accompanying radar chart:



<i>Category</i>	<i>Description of Audit Questions</i>
<i>Cultural Awareness</i>	<i>Employee communication, goals and objectives</i>
<i>Visual Management & Housekeeping</i>	<i>5S, Display boards, key performance indicator information (KPI) displayed</i>
<i>Standardized Work</i>	<i>Procedures created, maintained, controlled, improved</i>
<i>Flexible Operations</i>	<i>Cross training, signals, flow, defect prevention</i>
<i>Continuous Improvement</i>	<i>Employee involvement, strategy for improvement, seven wastes targeted, projects structured and tracked</i>
<i>Error Proofing</i>	<i>Devices, methods, employee involvement</i>
<i>Quick Changeover</i>	<i>Strategy to not run batches, make to order</i>
<i>TPM</i>	<i>Preventative maintenance approach and practices</i>
<i>Material Control</i>	<i>Pull systems, identify TAKT time and respond</i>
<i>Level Production</i>	<i>Customer demand determines pace of plant</i>