Abstract. Lean and Six Sigma are about maximum efficiency – and achieving it through change. Beginning with the basics of Lean and Six Sigma, including DMAIC (Define, Measure, Analyze, Improve and Control) and the notion of achieving near perfection by limiting deviation, this workshop will take participants beyond initial implementation and explore ways to promote ever greater creativity and change even after “change” becomes the norm. Although Six Sigma is equally applicable to the service and manufacturing sectors, to date most Six Sigma success stories come from manufacturing. This workshop will: 1) address how Lean and Six Sigma methodologies can be used in tandem with one another to promote purchasing efficiency in the service industry; 2) explore the obstacles typically encountered in executing such change; 3) discuss the various phases involved in implementing these systems; 4) feature firsthand accounts of the successful outcomes ultimately achieved; and 5) suggest ways to achieve continuous improvement beyond the first round of success.

Summary:
The world has changed and so has Purchasing. Purchasing in the service sector has its own unique elements over conventional Purchasing. With advent of e-commerce and outsourcing, the world has become very small and every business is extremely competitive. Survival of the fittest is becoming normal and it is extremely critical to maximize every opportunity for demonstrating measurable savings. Negotiation alone is not enough as one cannot go below the cost of production and there has to be some sort of profit margin to survive in the business. Process improvement then becomes the only way to reduce costs and improve services. Let’s review two methodologies of process improvement and then discuss how we can apply those to Purchasing in the service sector.

LEAN:
Lean ideology goes back to early 1900’s with Henry Ford’s mass production system for Model-T automobiles. Toyota Motors took this a step further and evolved Lean through its continuous improvement efforts after WW II.

So what is Lean? Lean manufacturing identifies activities as value added and non-value added with a focus on decreasing non-value added activities and thereby reducing waste. Waste can be in any form, most common are: Overproduction, Inventory, Transportation, Over Processing, Motion, Waiting, and Defects.

Six Sigma:
The moment it is said in the business world, Six Sigma creates two different reactions. People who have been introduced to this methodology mostly think of DMAIC or Define, Measure, Analyze, Improve and Control cycle. For those who are not familiar with Six Sigma at all, an interesting and magical fix-it all model comes to mind. But is that what Six Sigma is all about? Let’s get an overview of the literal meaning of Six Sigma.
• Sigma is 18th letter of Greek Alphabet in Statistics and represents standard deviation, which is a measure of variation.

• Six Sigma is a metric, a symbol, a value. But, it is also a philosophy, a methodology, a tool, goal and a vision. It is a statistical measurement of variation, and an organizational mindset and a structured process for analysis of data.

The business philosophy of Six Sigma evolved at Motorola in 1986. The term ‘Six Sigma’ is actually a federally registered trademark of Motorola and was coined by an engineer named Bill Smith. Six Sigma aims at reducing variation, defects errors and waste to almost negligible limits and deploys statistical tools to eliminate or reduce variation precisely to 3.4 occurrences per million.

Six Sigma is often described as DMAIC methodology:
- **Define** the problem, the opportunity, the goals, and the deliverables to customers
- **Measure** the current performance of the process and document AS IS process
- **Analyze** and determine the root cause(s) of the defects and the gap between current performance and desired performance.
- **Improve** the processes to eliminate defects and/or variations
- **Control** the performance of the process and carry out periodic audits and strive for continuous improvement

Although Six Sigma focuses on continuous quality improvement, it is not an average quality program. The way it differs from TQM and other quality programs is that it focuses on customer demands and business processes and targets better financial results. As a result, Six Sigma can be applied to any transaction in any business.

**LEAN Six Sigma:**
Lean tools focus on improving product flows and standardizing work processes. The traditional view of Lean tools has been to focus on eliminating non-value added activities (waste) in a process with goal of reducing process cycle times and cost and improving on-time delivery performance. The traditional view of Six Sigma has been to measure and reduce process variation and achieve improvements in service, quality and cost.
Today we often use the term ‘Lean Six Sigma’ which really represents a powerful combination of increased speed and reduced variation to achieve optimized processes and effective business management.

**Achieving success using LEAN Six Sigma in Purchasing**
Six Sigma focuses on reducing the variation in processes. Basically everything we do can be considered a process or part of process and every process can be characterized by Average Performance and Variation. Processes are performing optimally when the result of the process is at expected value, meaning there is minimal variation.
Let’s study the Purchase Order process from requisition to cheque. The process begins when a requisition is processed to a Purchase Order and dispatched to a vendor and the process ends when the vendor is paid.
The swim lane diagram on the left provides a high level overview of the activities done by the buying company in the top lane and the vendor in the bottom lane.

In most of the organizations this process is automated using the help of software and ERP systems, such as PeopleSoft. To maximize the significant investments that companies make on ERP systems, they try to send purchase orders and receive invoices electronically. The system matches the Purchase Order, the invoice and the receiving document for item number, quantity, price, unit of measurement etc. and it releases the payment. If any of these user defined parameters don’t match, the payment is not processed. The terminology used for this is a Match Exception (ME).

ME is a variation from the norm. Hence, it becomes a prime target to apply Six Sigma methodology. At the same time, the swim lane analysis identifies an opportunity to standardize and lean the process. Below is the fishbone diagram for ME’s. The Fishbone Diagram, or Cause and Effect Diagram, is a brainstorming tool used to look for the Root cause, or cause and effect of a problem. Each “bone” represents a category that impacts the problem, Match Exceptions.
To further get to the root cause, we carried out Statistical Process Control (SPC) for Match Exceptions. As shown below, various vendors had varying degree of ME’s based on number of Purchase Orders.

This results in identifying the main defaulters. It is clear from the figure above that vendor B and vendor G have the highest variation. Incidentally 60% of the company’s Purchase Order’s were dispatched to these two vendors.

We defined the problem, measured the performance and identified the root cause. The next step was to improve the process in a customer focused way. We determined that vendor involvement was absolute necessity. We focussed on these two vendors and started weekly conference with their EDI managers and reinforced the policy that any Purchase Order has to be acknowledged within 24 hours and if the price is not acknowledged via EDI, the company would assume that the terms and conditions of Purchase Order were accepted by the vendor. The buyers were advised that any price change without a timely EDI ac acknowledgement would not be honoured. After the initial resistance and excuses, both vendors complied as did the company’s staff, who had rejected the idea of enforcing the acknowledgements and who had resisted the project in general. After successfully reducing the ME for the outlying vendors, we focussed on other vendors and in less than 6 months the number of open EDI’s on any given time was down by more than 95%. To track our improvements, we created a ranking system for vendors, and this factor was included in the score card, impacting the rank if acknowledgements were not received in 24 hours.

The question arises why six sigma and how it did it add value to this project. Customer Service is of paramount importance in today’s world and in the service sector, purchasing departments focus on fulfilling the needs of its internal customers while collaborating with its external customers or suppliers.

Six Sigma gives utmost importance to customer satisfaction. It focuses on the bottom line and provides breakthrough improvement in shareholder value. For the project in question, the projected savings were around $100,000.

**Conclusion:**
Lean Six Sigma is not a magic wand that you can use for overnight success. It is a methodology, a philosophy which has to be slowly incorporated into the culture of the organization. It can be applied to any process and we as Purchasing professionals need to make the best use out of this methodology.
Definitions:

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Lean</td>
<td>“Producing the maximum sellable products or services at the lowest operational cost while optimizing inventory levels”</td>
</tr>
<tr>
<td>Lean manufacturing</td>
<td>“An initiative focused on eliminating all waste in manufacturing processes. Principles of lean manufacturing include zero waiting time, zero inventory, scheduling (internal customer pull instead of push system), batch to flow (cut batch sizes), line balancing and cutting actual process times. The production systems are characterized by optimum automation, just-in-time supplier delivery disciplines, quick changeover times, high levels of quality and continuous improvement.”</td>
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<tr>
<td>Sigma</td>
<td>“A term used in Statistics to represent standard deviation, an indicator of the degree of variation in a set of measurement of process” taken from Greg Brue</td>
</tr>
<tr>
<td>Six Sigma</td>
<td>“A method that provides organizations tools to improve the capability of their business processes. This increase in performance and decrease in process variation lead to defect reduction and improvement in profits, employee morale and quality of products or services. Six Sigma quality is a term generally used to indicate a process is well controlled (±6 s from the centreline in a control chart).”</td>
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<tr>
<td>Process</td>
<td>“A set of interrelated work activities characterized by a set of specific inputs and value added tasks that make up a procedure for a set of specific outputs.”</td>
</tr>
<tr>
<td>Variation</td>
<td>“A change in data, characteristic or function caused by one of four factors: special causes, common causes, tampering or structural variation.”</td>
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**Process Capability at Sigma Level it’s literal meaning**:  

<table>
<thead>
<tr>
<th>Sigma Level* (Process Capability)</th>
<th>Defects Per Million Opportunities</th>
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<tbody>
<tr>
<td>2</td>
<td>308,537</td>
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<tr>
<td>3</td>
<td>66,807</td>
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<tr>
<td>4</td>
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<td>5</td>
<td>233</td>
</tr>
<tr>
<td>6</td>
<td>3.4</td>
</tr>
</tbody>
</table>

Fact ~ Most Organizations in the U.S. operate between three to four sigma quality levels.

*The above table is taken from ‘Six Sigma for Manager’ by Greg Brue.*

**REFERENCES**  
- Brue, Greg , Six Sigma for Managers  
- Donald W. Benbow, Thomas M. Kubiak, The Certified Six Sigma Black Belt Handbook