

Innovation^{insights}

OFFICE OF PLANNING AND
Institutional Assessment

Innovation Insight Series Number 23
<http://www.psu.edu/president/pia/innovation/>

Increasing Efficiency and Effectiveness Through Lean

One of the current approaches to improving productivity is Lean. This *Innovation Insight* provides an overview of Lean and how it can be applied in an academic or service environment.

An Introduction to Lean

Lean is defined as

“a systematic approach to identifying and eliminating waste (non-value added activities) through continuous improvement by flowing the product at the pull of the customer in pursuit of perfection.” (Green Suppliers Network, 2009)

and

“... maximizing customer value while minimizing waste.” (Lean Enterprise Institute, 2008)

Lean expands on the idea of working both efficiently and effectively¹ to best use resources while meeting stakeholder expectations. Lean uses additional analysis to reach the optimum balance between effectiveness – providing the service or product that the recipient wants when he or she wants or needs it – and efficiency – providing this service or product with the optimal use of resources, including time, money, and people.

Lean may be a useful approach to process improvement where individuals (George, 2003, p. 12):

- Chase information to complete a task (there is an ‘information shortage’)
- Deal with multiple decision loops
- Are interrupted while trying to complete a task
- Focus on ‘expediting’ reports, purchases, or similar outcomes
- Do work in batches, collecting a certain amount of work before starting the task
- Find work is lost between organizational units

The goal of Lean is to have a steady, even flow of work in the unit or for the individual while also providing what the recipients want in a timely manner. To do this it is necessary to:

- **Determine the value** of the product or service to the recipient(s), who may be:
 - a customer, the immediate recipient
 - the stakeholder, a person who has an interest in the product or service
 - students, parents or others from outside the organization
 - faculty or staff working within the organization who are ‘downstream’ receiving the product or service of another internal unit, and
- **Identify resource use** and activities that do not contribute to the value of the product or service.

The desired outcome of Lean is to standardize and streamline the process so that more time can be spent on more complex or unique services, products, or components.

Lean uses many of the traditional Continuous Quality Improvement (CQI) tools found in Innovation Insights #12, *Tools for Organizational IMPROVEment*. You may find that, if you have been using CQI approaches and tools to streamline internal processes, you have been working toward a Lean environment.

¹ See Innovation Insights #6: *Doing the Right Things Right: Enhanced Effectiveness and Cost Savings*

The Foundations of Lean

Lean is based on the concept of reducing waste of resources. **Seven types of waste**, or categories of inefficiency, were initially identified at Toyota, with an eighth about employee creativity added (Liker, 2004).

1. **Overproduction:** producing items not needed for immediate use, which will lead to waste in storage, transportation, and staffing
2. **Waiting:** idle time between activities due to scheduling errors, missing material or information; waiting for information or material from ‘upstream’
3. **Transportation:** moving material more than needed, due to poor layout or storing material between steps in the process
4. **Processing:** doing more during the process than necessary; unnecessary steps or motions; providing higher quality than is needed; overprocessing or incorrect processing
5. **Excess inventory:** excess materials; work in progress (WIP); completed work still on site
6. **Unnecessary movement:** extra motion not necessary, such as looking for or reaching for material or tools or walking to get material
7. **Defects or spoilage:** defective completed products; items needing rework or repair
8. **Unused employee creativity:** not making the most use of employee skills, creativity, and knowledge

Efficiency and Knowledge-work

DeMarco (2001) applies the concept of inefficiency to thought-based organizations. It is often believed that the goal should be 100% of the staff being busy 100% of the time. There should be no **slack**. However, removing slack can lead to less productivity in knowledge-based organizations. This is parallel to the manufacturing concept of having equipment operating and producing output all of the time, even if there is no order for it, leading to the inefficiencies of overproduction, transportation, excess inventory, and spoilage. There *are* penalties for a person having too many assignments or tasks to manage at one time. Switching one’s thoughts from one task to another takes time that becomes lost time. The more times during the day one switches, the more productive time is lost. DeMarco quantifies the cost of task switching as being the sum of the:

- mechanics of moving to a new task
- rework due to a previous inopportune stopping

- time to get back into the thoughts and concepts of the task
- frustration over having to switch, and
- decrease of any team cohesion

In a thought-based organization, the challenge in Lean is to find the optimum small batch size to minimize the cost of task switching while at the same time providing services in a timely manner.

The Five Ss

The **Five Ss** can be used as a starting point to reduce inefficiencies in many types of work.

1. **Sort:** get rid of what you don’t need; move rarely used items away from the immediate area
2. **Set in order:** organize and find a place for everything and label those places; move materials so they are easily and quickly accessible
3. **Shine:** make everything clean and in working order
4. **Standardize:** develop standards for the first three activities (Sort, Set in order, and Shine) and for work processes; having a standard process will make it easier to identify opportunities for improvement
5. **Sustain:** develop a means to maintain the above standards, which makes the process continuous

There is often a trade-off between safety and speed. For this reason, it may be helpful to include **safety** as a **sixth S**, (United States Environmental Protection Agency, 2009).

The Principles of Lean

Going beyond the eight types of waste and the Five Ss that contribute to inefficiency, Womack and Jones (2005) identify five principles that incorporate both the efficiency and effectiveness aspects of the Lean approach.

1. **Value:** Provide the value desired by customers. Identify what recipients value in your product or service.
2. **Value-stream mapping:** A value-stream map contains more information than a traditional process map. Map the process that produces the product or service. Steps in the process can be placed in one of three categories: those that add

value from the customers' perspective, those that are necessary for organizational or administrative functions, and those non-value added (NVA) steps in neither category. Consider using different colors or shapes to show which steps add value and which do not. Also consider including information in the mapping such as the daily or weekly demand for the product or service, how long it takes to complete each step, how many people are trained to do each step, how many people are needed to meet the daily or weekly demand, how long it takes to prepare for each step, and the waiting time between each step. Focus on eliminating non-value added steps and reducing resources expended on administrative steps.

3. **Flow:** Set up the process so that production of the product or delivery of the service is a continuous flow of work in an integrated work unit from the time the recipient asks for the product or service until the time it is delivered, with no waiting time between steps. As much as possible, eliminate batch processing that leads to a large inventory of materials or products that are work in progress (WIP) or work completed, taking up space, or requiring time to resume the process or deliver to the recipient. Applying the Five Ss to the work area can enhance flow.
4. **Pull:** Let the recipient pull your product or service, don't push it to them. When the recipient asks, respond with initiation of the product or service, rather than preparing it in advance. Work toward an optimum amount of both work in progress and customer wait time, from the perspectives of both the unit and the customer.
5. **Perfection:** Search endlessly for perfection. Continue to look for ways to increase the value of the product or service to the recipient, and to improve the process and reduce inefficiencies and waste.

Applying Lean in Academic and Service Environments

In a service environment customers arriving to be served can't be kept waiting. But, keeping in mind the concept of slack, having staff jump from one customer, topic or project

to another may not be the best use of resources. The goal may be to find the best batch size for batch processing, so the staff works efficiently, but customers are not kept waiting too long.

The University of Central Oklahoma (UCOK) has applied Lean throughout the university (Moore, 2005 and 2007). UCOK first applied Lean to their work order process for facilities management. Their efforts resulted in reducing backlogged work orders from more than 3,000 to less than 300. They later applied Lean to other processes, including financial aid coordination, purchase orders, and access control key approval and distribution.

State and federal environmental units have used Lean to reduce the time to process permits and improve the processes for setting standards and determining corrective actions (United States Environmental Protection Agency, 2009).

Other insights into how Lean can be used in academic support areas can be found in examples from *The Lean Office* (Productivity Press, 2005).

- Lean renovation of a building at Rice University led to the job being completed under budget and ahead of schedule.
- Fujitsu based its redesign of information technology help desks on customer demand for services rather than technical function.
- LG&E Energy implemented such basic changes as moving the fax machine to reduce walking, and labeling cabinets so it was clear what was located where.
- The City of Phoenix ambulance services rewarded Emergency Medical Technicians for getting client information legibly so that invoices for services could be processed within 24 hours of the ambulance service being provided.
- Canada Post realized that small batch flow was the best approach for dealing with letters, and cut the time for handling a piece of mail by two thirds and the amount of mail actually in the processing facility by half.

Tatikonda (2007) asked, "Are accounting professors teaching the right stuff?" and used Lean and other tools to develop a model that would produce the answer "Yes". Education is a process with four critical success factors: content (what to teach), pedagogy (how to teach),

organization of topics, and assessment. Once it is determined what knowledge and skills should be included in a course and how the information would be best delivered, the Lean concept of flow is used to determine how to most effectively and efficiently group topics by themes. Courses and topics taught or taken out of sequence, and students who do not have prerequisites, are examples of obstacles to the flow of the process. Material taught in more than one course, or time spent on review of prerequisite material, could be considered inefficiencies. Assessment can be used to identify opportunities for improvement in content, delivery, and flow.

Implementing Lean

To implement Lean, first determine what is of value to those you serve. Then, to reduce or avoid inefficiencies, analyze the process – each step in it, and what happens between each step – and create the value stream or detailed process map. Look at inventory, the layout of the area, and how often activities or systems are changed to provide different products or services.

- What's the optimum balance to produce the optimum quantity? It may not always be one, it may be small batches produced in a small amount of time.
- When should supplies be replenished so that you don't run short, but you don't maintain large inventory?
- How long does it take to shift from one process to another to provide a different service or produce a different product? Full production for each element in the process does not always lead to the most efficient system, and can lead to high inventory or slow response time to the recipient. On the other hand, producing just one complete item when requested may also not be the most efficient way to operate.

In many cases, much of this Lean analysis is completed through a 2 to 5 day structured event called kaizen, consisting of just-in-time training, process analysis, and identification and implementation of improvements.

Whether or not you hold a kaizen event, the following steps can be used to introduce Lean and create flow in service organizations.

1. Identify the key processes and the added value the recipient is seeking through that product or service.
2. Identify measures for the process, and gather current data.
3. Separate repetitive segments in the process from those that are unique and focus on the repetitive segments.
4. Map the process to determine value added and non-value added steps.
5. Analyze the process map – look at how work is prioritized, and look for batch processing that can be reduced or eliminated, waits or backlogs, non-standardized work, and full use of information technology resources. Develop a future state process map, based on identified inefficiencies, wastes and the Five S approach.
6. Implement the improvements, learn from the implementation, and expand the application of Lean to the less repetitive segments.

To assist in your analysis, you may want to use Lareau's (2003) list that includes possible office inefficiencies in four categories (People, Processes, Information, and Assets), or Keyte and Locher's (2004) list of possible questions to ask. Both can be found at the end of this *Innovation Insight*.

Lean involves taking the time to look at the details of routine processes. It can pay off in more time to serve stakeholders when dealing with complex or unique issues.

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September 2009

Identifying Inefficiencies in an Office or Service Environment

Where are there **People** inefficiencies?

1. Goal alignment – working at cross-purposes
2. Assignment – unnecessary or inappropriate tasks
3. Waiting – waiting for meetings, information, signatures, phone calls, broken equipment
4. Motion – walking and reaching without adding value
5. Processing – inefficient processes

Where are there **Information** inefficiencies?

1. Translation – changing data or formats between process steps
2. Missing information – resources to obtain missing information or compensate for its absence
3. Hand-off – waste due to transfer of materials or information without adequate communication
4. Irrelevancy – dealing with unnecessary information or the problems it causes
5. Inaccuracy – effort to correct incorrect information or deal with the consequences of it

Where are there **Asset** inefficiencies?

1. Inventory – materials waiting to be used or products waiting to be delivered
2. Work-in-process – resources for work in progress that are waiting to move to the next step in the process
3. Fixed asset – permanent resources such as equipment and buildings that are not being fully used
4. Moving things – transportation of materials and information not related to delivery to the recipient

Where are there **Process** inefficiencies?

1. Control – supervision that does not produce performance improvements
2. Variability – resources used to correct variation from expected outcome
3. Tampering – arbitrarily changing a process without understanding consequences
4. Strategic – focus on short-term goals rather than stakeholder value
5. Reliability – resources used to correct for unpredictable outcomes due to unknown causes
6. Standardization – resources used to deal with variations in employee work processes
7. Suboptimization – competition among processes leading to duplicate or degraded work
8. Scheduling – waste due to poor scheduling
9. Work-around – resources used to create additional informal processes
10. Uneven flow – waste due to bottlenecks
11. Checking – effort for unneeded inspection
12. Error – work that needs to be redone because of errors

Adapted from Lareau, William. (2003). *Office Kaizen: Transforming Office Operations Into A Strategic Competitive Advantage*. Milwaukee, Wisconsin: ASQ Quality Press.

A Checklist for Lean Analysis

1. What does the customer really need? What is required? When? How often?
2. How often will the performance be measured or monitored?
3. Which steps create value and which generate inefficiencies or waste?
 - a. Why are the current steps being performed?
 - b. When should decisions be made in the process?
 - c. What can be done differently or not at all?
 - d. Does the order of steps create waste?
 - e. What knowledge and skills are really needed to perform the steps?
 - f. Are current controls and guidelines appropriate?
 - g. What assumptions underlie the current process?
4. How can work flow with fewer interruptions?
5. How will work be controlled between interruptions?
6. How will the workload and/or activities be balanced or leveled?
 - a. What are the customer peaks and valleys? (for example, a higher demand on Monday or Friday)
 - b. Where are the organizational peaks and valleys? (for example, the start or end of a semester or fiscal year)
7. What process improvements will be necessary to achieve the future state?
 - a. Standardized work
 - b. Batch size reduction
 - c. Office layout changes
 - d. Visual controls
 - e. Cross-functional teams
 - f. Error-proofing
 - g. Better triggers to initiate work
 - h. Quantifying customer requirements
 - i. Reorganizing parts of the office
 - j. Revising measures of performance

Adapted from Keyte, Beau and Locher, Drew. (2004). *The Complete Lean Enterprise: Value Stream Mapping for Administrative and Office Processes*. New York: Productivity Press.