White Paper

Lean Six Sigma in higher education:
Applying proven methodologies to improve quality, remove waste, and quantify opportunities in colleges and universities.

Ross Raifsnider
National Advisor/Higher Education
and Region Manager
Xerox Global Services, Inc.

Dave Kurt
Managing Principal, Business Process Services
Xerox Global Services, Inc.

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Introduction

Competition in today’s higher education marketplace is fierce. Community colleges, four-year colleges, universities, and even higher ed schools that offer online distance learning courses are all vying for the same students—and the revenue they represent. To find success, institutions of higher education must demonstrate that they can offer what others can not. Naturally, providing a quality, affordable education is of the utmost importance to students and their families. But schools can also improve their chances of attracting students by improving the levels of service they offer in every “customer-facing interaction”—which often times necessitates improving internal work processes.

For instance, higher education institutions can become more responsive and offer better service to students by providing real time status to application acceptance, implementing an automated registration system that enables the integration of financial aid to support payment requirements, and integrating a system to retrieve and complete forms online.

Achieving these objectives is challenging, to say the least, and requires a disciplined and organized approach to process improvement. With this in mind, many institutions look to implement a robust document and content management solution to gain efficiencies and improve the handling and processing of information, which ultimately reduces time, cost, and labor-intensive paper-based processes.

As with any transformation of work process or implementation of new technology, there is risk. As a result, leading institutions look to maximize probability of success by managing variance through processes that are time-tested and proven to repeatedly yield desired results. This white paper explores two such processes: Lean Flow and Six Sigma.

In the follow pages, this white paper will:

- Provide the account and theories behind Lean Flow and Six Sigma methodologies.
- Clarify the synergy attained by integrating Lean Flow and Six Sigma into a consolidated approach.
- Validate how Lean Six Sigma can be utilized to improve the ways higher education institutions manage documents—and the information they contain.
**Lean Flow eliminates waste**

*The history of Lean Flow*

The Lean Flow process, also called Lean Manufacturing, Continuous Flow, and more recently, Just-In-Time Manufacturing, was innovated by Henry Ford just after the turn of the century. He likened his concept of the assembly line to a river that flows continuously. Anything that disrupts the flow is waste that must be eliminated. Utilizing this methodology, Ford Motor Company could start and finish a Model T in just over 30 hours.

In the late 1940s, Toyota Motor Corporation based its production system on the Lean Flow process. Of course, Toyota built on Ford’s concepts, which were methodical and streamlined, but highly inflexible. Lean Flow, as employed by Toyota, linked its production system with real-time customer demands and material replenishment requirements—so only the exact quantity of products and materials needed were produced at any specific point in time. This is similar to the Just-In-Time manufacturing paradigm that changes the traditional “supply-and-demand” model to a more efficient, responsive “demand-then-supply” model.

Toyota management recognized that to be effective, Lean Flow must be *inwardly focused* on eliminating waste (reducing inventory, costs, etc.), but *outwardly focused* on meeting customer demand (i.e. providing the car in the desired color, with the desired options, etc.). Flexibility became a large part of how this change was accomplished. Toyota was perhaps the first company to publicly note: “The ability to eliminate waste is developed by giving up the belief that there is no other way to perform a given task. It is useless to say, ‘It has to be done that way,’ or ‘This can’t be helped.’ At Toyota, we have found that there is always another way.”

**Lean Flow today**

While Lean Flow began as a manufacturing model, today’s definition has been extended to include the process of creating an “optimized flow” anywhere in an organization. The only requirement is that this “flow” challenge current business practices to create a faster, cheaper, less variable, and error prone process.

Lean Flow experts have found that the greatest success can be achieved by methodically seeking out inefficiencies and replacing them with “leaner”, more streamlined processes. Sources of waste commonly plaguing most business processes include:

- Waste of worker movement (unneeded steps)
- Waste of making defective products
- Waste of overproduction
- Waste in transportation
- Waste of processing
- Waste of time (idle)
- Waste of stock on hand

*Putting Lean Flow to work*

Implementing a Lean Flow requires having the right data and knowing how to use it. There are a number of different approaches taken by organizations, but fundamentally, Lean Flow is achieved by:

- Analyzing the steps of a process and determining which steps add value and which do not.
- Calculating the costs associated with removing non-value-added steps and comparing those costs versus expected benefits.
- Determining the resources required to support value-added steps while eliminating non-value-added steps.
- Taking action.

(These implementation steps, which tie into a process called Value Stream Mapping, will be explained in greater detail later in this paper.)
Six Sigma is driven by quality

The history of Six Sigma
In the 1980s, engineers at Motorola Corporation discovered the mathematically derived point where the cost of eliminating a defect is greater than the cost of living with (and repairing) the defect. That is, there is an acceptable point of imperfection—and any quality improvement made beyond that point is more expensive than the expected cost savings of fixing the imperfection.

Bill Smith, one of Motorola’s engineers, explained the acceptable level of imperfection for Motorola was Six Sigma, which equates to 3.4 defects per million units. This discovery forced Motorola to assess quality levels by measuring defects in millions rather than thousands, which had been the traditional method. This change enabled a vast improvement in the ability to assess—and improve—quality levels. Six Sigma enabled Motorola to cost-efficiently perform defect-free more than 90% of the time, resulting in a savings of $16 billion to date.

Six Sigma today
While the concept of Six Sigma began in the manufacturing arena decades ago, the idea that organizations can improve quality levels and work “defect-free” is currently being incorporated by higher education institutions of all types and sizes. So what is today’s definition of Six Sigma? It depends on whom you ask. In his book Six Sigma: SPC and TQM in Manufacturing and Services, Geoff Tennant explains that "Six Sigma is many things… a vision; a philosophy; a symbol; a metric; a goal; a methodology.”

Naturally, as Six Sigma permeates into today’s complex, sophisticated higher education landscape, the methodology is “tweaked” to satisfy unique needs of individual schools. But no matter how it is deployed, there is an overall framework that drives Six Sigma toward improving performance. Common Six Sigma traits include:

- A process of improving quality by gathering data, understanding and controlling variation, and improving predictability of a school’s business processes.
- A formalized Define, Measure, Analyze, Improve, Control (DMAIC) process that is the blueprint for Six Sigma improvements. (The DMAIC process will be described in greater detail later in this paper.)
- A strong emphasis on value. Six Sigma projects focus on high return areas where the greatest benefits can be gained.
- Internal cultural change, beginning with support from administrators and champions.

There have been a number of people in history who have contributed to today’s definition of Six Sigma:

- In the first half of the 1800s, Carl Frederick Gauss introduced the concept of a normal curve.
- In the 1920s, Walter Shewhart proved that three sigma from the mean is the point where a process requires correction.
- In the mid-1980s, Bill Smith, a Motorola engineer, explained that Six Sigma (which represents 3.4 defects per million) is the optimum level to balance quality and cost.
Putting Six Sigma to work
By incorporating Six Sigma processes, hundreds of organizations, including Xerox Corporation, Sony Corporation, and General Electric have been able to gain significant results. In fact, GE annual reports state that Six Sigma delivered $300 million to its bottom line in 1997, $750 million in 1998, and $2 billion in 1999—and those are just hard dollar savings. The George Group, an independent organization nationally recognized for expertise in Lean Six Sigma, learned that Six Sigma also generated tangible improvement in other areas at GE, including:

- 10-fold increased in life of CT scanner X-ray tubes.
- Improved yields of super-abrasives—worth a full decade of increased capacity despite growing demands.
- 62% reduction in turnaround time of railcar leasing repairs.
- Plastics business added 300 million pounds of new capacity—equivalent to one free plant.

After successes like the one at GE, it is no surprise that many companies currently look to Six Sigma Black Belts and Green Belts—individuals who have undergone extensive training to become experts in the Six Sigma process—to help improve quality and obtain results.

Lean Six Sigma achieves quality without waste
Operating by itself, Lean Flow focuses on using the minimum amount of resources (people, materials, and capital) to produce solutions and deliver them on time to customers. The process, however, does not have the discipline to deliver results predictably. That is, in some cases, Lean Flow implementation involves a non-formalized investigation into an organization’s workflow followed by immediate re-arrangement of processes. While this approach produces change quickly, it can not be relied upon to consistently yield desired results. On the other end of the spectrum, Lean Flow implementation can involve extremely thorough data collection and analysis that take years before any change occurs. This approach often yields desired results, but takes too long to get there.

Meanwhile, Six Sigma, operating independently, aims to improve quality by enhancing knowledge-generating processes. In many cases, this leads to slow, deliberate, change-intolerant practices.

To combat these challenges, organizations have found that by “nesting” the Lean Flow methodology within the Six Sigma methodology, a synergy is attained that provides results much greater than if each of the approaches was implemented individually.

When Lean is added to Six Sigma, slow processes are challenged and replaced with more streamlined workflows. Additionally, the data gathered during Lean Flow implementation helps identify the highest impact Six Sigma opportunities. When Six Sigma is added to Lean, a much-needed structure is provided that makes it easier to consistently and predictably achieve optimum flow. The two methodologies work so well together, that a new, integrated, Lean Six Sigma approach, with its own unique characteristics, has been defined and incorporated by several leading organizations, including Xerox Corporation.

Lean Six Sigma is the application of lean techniques to increase speed and reduce waste, while employing Six Sigma processes to improve quality and focus on the Voice of the Customer. Lean Six Sigma means doing things right the first time, only doing the things that generate value, and doing it all quickly and efficiently.

Lean Six Sigma outside the manufacturing environment
Lean Six Sigma is not limited to the manufacturing
arena. In fact, virtually any process can incorporate the methodology because the ideals of quality and waste reduction apply everywhere. To prove the point, Xerox Global Services currently employs Lean Six Sigma in the document world, helping customers obtain vast improvements in the ways they produce, store, and distribute documents. Document-related Lean Six Sigma, like in the manufacturing arena, follows a work process that can benefit from quality and waste reduction. Also like manufacturing processes, document processes consume resources and require management of changes and additions. And finally, document process improvements can provide the same types of quantifiable benefits as manufacturing process improvements:

- Greater efficiencies
- Faster response
- Enhanced customer service
- Reduced costs
- Increased quality

Many institutions look at image enabling, but not process improvements. One without the other is half a solution that does not consistently attain its goals of improving communication and information flow.

Many institutions take a departmental, rather than a holistic enterprise, approach and create silos of information, resulting in information that can’t be leveraged by everyone.

Institutions focus on the administrative side, but not the academic side of capturing documents, missing on opportunities to collaborate, share knowledge, and improve course work.

For more than 17 years, Xerox has been incorporating a Lean Six Sigma methodology to help improve the ways in which information flows in, through, and out of colleges and universities. Specifically, Xerox Global Services imaging and repository services leverage the Lean Six Sigma-based DMAIC approach:

**Define**
The Define phase of the DMAIC process is often skipped or short-changed, but is vital to the overall success of any Lean Six Sigma project. This is the phase where the current state, problem statement, and desired future state are determined and documented via the Project Charter. Xerox asks questions like:

*What problem are we trying to solve? What are the expected results if we solve the problem? How will we know if the problem is solved? How will success be measured?*

In most cases where imaging and repository services are involved, the problem relates to document management and access. Schools look to improve the ways documents are created, stored, accessed, and shared so they may accelerate and enhance work processes, share information more conveniently, and collaborate more effectively. As the project progresses and more information is collected in future phases, the problem statement developed in the Define phase is refined.
**Measure**

The Measure phase is where Xerox gathers quantitative and qualitative data to get a clear view of the current state. This serves as a baseline to evaluate potential solutions and typically involves interviews with process owners, mapping of key business processes, and gathering data relating to current performance (time, volume, frequency, impact, etc.).

Examples of common document-related problem statements developed in the Define phase include:

- Because student documents exist in 10-50 separate locations, schools do not have a single view of complete student files from application to grave.
- It is difficult for an institution’s staff to access or share information that resides only on paper. Documents are easily misfiled or misplaced.
- Work processes are typically organically grown over time based on what works, often without a holistic understanding of impact on other departments or work processes.
- Paper-based work processes are slow, expensive, and cumbersome, which challenges the ability to support admissions.
- Compliance with government mandates like the Patriot Act and Immigration and Naturalization Services (INS Audit) is difficult.
- The ability to provide relevant and timely information to alumni inhibits the ability to keep them committed.
- To share paper-based information, workers must make a copy and manually mail, overnight, and/or fax the document.
- Student access to profile information is frustrating for both the student and staff support.
- Paper documents are expensive to store.

Information that gives a clear view of the current state is found in numerous locations—and all of it is valuable and should be captured. Xerox therefore looks to all the places where information is stored (paper, servers, hard drives, removable media, employee’s minds, etc.). In addition, everyone who needs access to information is surveyed as well as IT personnel to get their view of the current state. The idea is to get all the human-, technology-, and process-related information possible. Some of the measures collected in this fact-finding stage include:

- Amount of storage space being used and how much is available
- Number of mail, phone, and fax requests
- Number of steps in a process
- Number of copies being made
- Number of approvals required
- Amount of time required to process a request
- Number of errors requiring re-work
- Level of user satisfaction
- Most common cause of defects
- Amount of duplication of effort

**Analyze**

In the Analyze phase, Xerox studies the information gathered in the Measure phase, pinpoints bottlenecks, and identifies improvement opportunities where non-value-add tasks can be removed. A business case is conducted, which takes into account not only hard costs but also intangible benefits that can be gained, such as user productivity and satisfaction, to determine if the improvement is cost-effective and worthwhile. Finally, the Analyze phase is when technological recommendations are provided.
A Value Stream Map is a common tool applied in the Analyze phase to understand an existing workflow process and to uncover inefficiencies. In building a Value Stream Map, workflow steps are broken down into:

- **Customer Value-Add tasks** that directly add value to the final deliverable (e.g., advertise bid-letting).
- **Business Value-Add tasks** that are required by the business but are not directly related to the final deliverable (e.g., Print Services performs quality and completeness check on title block information).
- **Non-Value-Add tasks** that do not provide value to the final deliverable (i.e., Print Services makes copies for inventory).

The following workflow graphic is an example of a Value Stream Map generated for a Xerox client. The green boxes represent Customer Value-Add tasks, the yellow boxes represent Business Value-Add tasks, and the red boxes represent Non-Value-Add tasks.

**Examples of how Xerox might quantify the benefits of implementing imaging and repository services include:**

- Cost reduction of storing information online or digitally instead of on paper.
- Savings gained by eliminating long-distance fax charges and postal and courier expenses for distributed campuses.
- Improvements in staff productivity and satisfaction by “digitizing” document search and retrieval methods.
- Intangible benefit of improved ability to share knowledge and collaborate “virtually”.
- Single point of access for all student information, from application to grave, including ERP/SIS and Imaging, in one single integrated system.

“Lean Six Sigma provided the tool that matched the solution to our requirements. And, my Xerox Global Services team is experienced, committed, and genuinely cares! This is a very special partnership”

– Dorla D. Watkins,
  VP Finance & Administration, Park University
**Improve**
The Improve phase is when recommended solutions are implemented. A project plan is developed and put into action, beginning with a pilot program and culminating in full-scale, enterprise-wide deployment. Where appropriate, new technology is implemented, workflows are streamlined, paper-based processes are eliminated, and consulting services are initiated. Key factors of success during this phase are acceptance by end users and enterprise-wide change without any degradation of current productivity levels.

Common imaging and repository solutions implemented in the Improve phase include scanning services, Web-based document access, and workflow solutions for task tracking and automation. When implementing these services, Xerox always looks first to leverage existing technology. If new technology is required, Xerox will ensure new solutions work within existing customer infrastructures so implementation is seamless with minimal disruption to current workflows.

**Control**
Once a solution is implemented, the next step is to place the necessary “controls” to assure improvements are maintained long-term. This involves monitoring—and in many cases, publicizing—the key process metrics to promote continuous improvement and to guard against regression. In many cases, Xerox will revisit the implementation after 3-6 months to review key metrics and evaluate if the initial progress has been sustained. A common practice is to put key metrics, including hard cost savings and achievement of pre-defined Service Level Agreements, in full view “on the dashboard” to provide continuous feedback to the organization and so decision-makers can assess the project’s level of success as it moves forward.

*The Control phase is where Xerox and/or higher education representatives ensure the imaging and repository solution consistently delivers:*
- Improved enrollment by responding quicker to inquiries through process efficiency gains.
- Satisfied students because of convenient self-service access and open lines of communication with staff.
- Productive faculty, staff, and administrators due to faster access to mission-critical information, simpler collaboration with fewer paper-based, labor-intensive tasks, and redundant effort.
- Secure solutions that ensure only authorized personnel have access to confidential information.
- Solutions that, even in the event of a disaster, ensure business continuity—because colleges and universities can never shut down.
- Potential to capture records around a life-long learner—application to grave—so they can be mined for alumni contributions.
Xerox Global Services helps companies streamline and digitize their document-intensive business processes—everyday processes like customer communications, billing, training, or records management. Our people work closely with clients to identify, quantify, and realize hidden opportunities to save money, find new sources of value, and simplify how work gets done.

For more information on how Xerox Global Services can help implement solutions that accelerate and improve document-related processes in higher education environments, call 800-ASK-XEROX ext. XGS or visit www.xerox.com/contactglobalservices.

Author: Ross Raifsnider
National Advisor/Higher Education and Region Manager
Xerox Global Services, Inc.

Ross has ten years experience in the document consulting industry, five of which were spent in Higher Education. He may be contacted at 317.815.4120 or ross.raifsnider@connect.xerox.com

Author: Dave Kurt
Managing Principal, Business Process Services
Xerox Global Services, Inc.

Dave has 12 years experience in the document consulting industry, nine of those focusing specifically on higher education. Dave currently manages Xerox Global