Establishing a Lean Six Sigma Program in Higher Education

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Abstract

Purpose: The objective of this paper is to contribute to the body of Lean Six Sigma knowledge within the field of higher education institutions. The paper will review the initial phase of an implementation and highlight future challenges of applying the Lean Six Sigma method in a complex transactional environment.
Design/methodology/approach: The observations presented in this paper originate from rolling out a large Lean Six Sigma implementation at a recently established university. The paper is further supported with secondary data from literature.
Findings: The implementation of Lean Six Sigma methodology at King Abdullah University of Science and Technology (KAUST) has resulted in improvements in business processes and efficiency. This has been achieved through project execution and training programs. Approximately 350 staff members have completed awareness training, 200 yellow belts and 230 green belts have been trained, and the first round of seven black belts have completed training, of which three have completed independent certification.
Research limitations: This paper is based on an empirical study of a single instance and the authors' experiences as practitioners.
Originality: This paper is the first description of what is believed to be one of the largest implementations of Lean Six Sigma in higher education.
Keywords: Lean Six Sigma, Process Improvement, Business Process Management, Organizational Development, Higher Education.
Paper type: Case study.

1. Introduction

In an ongoing competition for the brightest minds and external funding, the motivation for universities to redesign business processes is often to reduce the administrative overhead and improve the services delivered to students, industry partners, faculty and researchers. Universities are increasingly working systematically to improve business processes. Universities are also increasingly showing interest in the Lean Six Sigma (LSS) method, which is a structured approach to process improvement.

This paper is a case study of how LSS has been rolled out at King Abdullah University of Science and Technology (KAUST) in Saudi Arabia. Focused exclusively on graduate education and research, KAUST's aim is to advance scientific and technological research in four broad areas: Water, Food, Energy and the Environment. Established in 2009, the university is still maturing and business processes are subject to continuous improvements.

The LSS program was launched in 2011 to systematically improve business process quality in administrative procedures and provide staff members with a platform to initiate process improvements. To disburse the knowledge of LSS within a short timeframe, the yellow belt and green belt training was made available to staff members free of charge via the organizations learning and development department.

The lean six sigma method was selected to ensure that team members had the necessary tools and a structured method for changing administrative processes. The program has progressed to the point where approximately 25% of the administrative staff has been trained on the method and improvement projects are being executed across the

organization. It is believed that the KAUST LSS program is one of the largest LSS programs in higher education in terms of trained staff. The purpose of this paper is to support other organizations contemplating a LSS program by providing an overview of the sequence of activities in establishing a LSS program from initiation to maturity and highlighting some of the challenges.

2. Literature Review

The concepts of LSS can be traced back to the principles of scientific management (Taylor, 1911). A 100-year history of systematic improvements of industrial processes has led to a very advanced level in terms of efficiency and quality management. However, one might go as far as to argue that transactional process improvement is in its infancy, still waiting to undergo industrialization, when compared to manufacturing.

This powerful continuous improvement methodology is a combination and synergy between Lean thinking and Six Sigma. Lean Six Sigma (LSS) was defined by Snee (2010) as "a business strategy and methodology that increases process performance resulting in enhanced customer satisfaction and improved bottom line results." The main aims of LSS are to achieve efficient and effective process, improve customer satisfaction and to increase the bottom-line (Antony *et al.*, 2012; Antony, 2014).

From an academic standpoint, several authors suggest that LSS is merely repackaging and simplification of well-known quality management concepts. However, the popularity and impact on businesses around the world cannot be disputed. (Shah *et al.*, 2008: Andersson *et al.*, 2006).

For the purposes of this paper, we will proceed with the following definition of the hybrid process improvement method LSS: "Together Lean and Six Sigma combine their independent approaches to form a Lean Six Sigma approach that seeks to improve efficiency and capability primarily by removing wastes and variation" (Jing, 2009).

Lean is a powerful methodology in reducing waste, non-value adding activities in business processes, and solves visible problems in an economical manner (Antony, 2014).Womack *et al.* (1990) defined Lean as a "dynamic process of change, driven by a set of principles and best practices aimed at continuous improvement." These can be achieved through utilizing Lean tools and techniques for instance; Value Stream Mapping (VSM), 5S, cause & effect analysis, etc., to name a few here.

Six Sigma was defined as "a well-established approach that seeks to identify and eliminate defects, mistakes or failures in business processes or systems by focusing on those process performance characteristics that are of critical importance to customers" (Antony, 2008). Six Sigma has the power to reduce defects and variations in the process, increase the bottom line and more. Six Sigma is the best solution for solving problems in companies where the root cause is unknown by using DMAIC (Define, Measure, Analyze, Improve, Control), which is the most common method in Six Sigma, plus some tools and techniques that can be used under DMAIC. Some of these tools and techniques are Capability Analysis, Design of Experiments (DOE), Control Charts, etc. The use of these tools and techniques depends on the nature of the problem and the required skills to use them effectively (Salah *et al.*, 2010; Antony *et al.*, 2012).

However, the deployment of Lean or Six Sigma in isolation has received some criticism from academics and practitioners and in some cases, companies need to reduce waste in the process as well as reducing defects/variations. Hence, the combination of Lean and Six Sigma is the ideal solution in these cases and it is highly recommended by experts. Antony (2014) has stated that the nature of the problem can determine whether the company needs to start with Lean first or Six Sigma first.

The first integration of Lean and Six Sigma was in the USA in the George group in 1986 (Chakravorty & Shah, 2012; Vinodh *et al.*, 2012). Furthermore, LSS has been successfully deployed in many organizations in the manufacturing sector followed by other organizations in the service sector. However, the deployment of LSS in the HE sector is still far behind (Antony *et al.*, 2012). From a practitioners perspective there might be several reasons for this including the complex organizational structure, the multifaceted organizational objectives and the practical fact that waste and rework in higher education administration is not as visible as in manufacturing where scraped material and queuing have a physical manifestation.

2.1 LSS in Higher Education

While LSS originated in manufacturing, the method has proven its merits in transactional environments as well (Ehrlich, 2002). Some of the first organizations to apply LSS to improve administrative processes where the same manufacturing companies who had successfully applied the method in manufacturing. Over time a number of public sector organizations established noteworthy LSS programs such as the US Army (George *et al.*, 2004) city of Fort Wayne (George, 2003). While universities have been under pressure to deliver measurable results due to increased reporting demands and increased competition for funding, Higher Education institutions have been slow in adopting LSS (Antony *et al.*, 2012). From the practitioners' perspective, the reasons for the slow adoption of LSS include the decentralized nature of traditional universities and no direct linkage to the core business of research and education.

Universities are by any standards complex organizations, consuming significant resources. Being complex organizations, there are thousands of business processes facilitating the primary functions and if those processes are streamlined, then efforts can be focused on the primary functions of research, innovation and education.

According to Antony (2014), there are many higher education institutions (HEIs) which have started with Lean to improve process efficiency; such as St Andrews University, Cardiff University, Central Connecticut State University, MIT and more. He also stated that Lean Six Sigma deployment has appeared in a low number of higher education institutes so far. This could be due to the view that LSS is only applicable in the manufacturing sector and it is not applicable for the Higher Education (HE) sector. However, improving the education system can be done in the same way as any other industry, including academic and non-academic processes (Simons, 2013). This is evident from the benefits gained in some HEIs as reported by Simons (2013) and Antony (2014), including increases in student satisfaction, providing HEIs with problem solving templates, changing the institution's culture, identifying and reducing hidden costs, tackling process efficiency problems, establishing measures and so on.

On the other hand, some challenges of LSS deployment in HE are (Antony *et al.*, 2012):

- The application of terminologies, tools and techniques from manufacturing and service organizations to HEIs

- Improving processes in isolation instead of designing them from a system-perspective

- Lack of awareness about customers types and needs

- Lack of communication, management commitment, visionary leadership, process thinking, resources (financial, technical and physical, etc.)

For successful LSS implementation, it is critical for any HEI to understand its readiness level, before starting any deployment. Typically the group of decision makers is wider in HEI's, compared to commercial organization, hence making stakeholder management, communication and change management essential to the successful completion of projects.

When the HEI is ready for the deployment, it should customize its LSS roadmap to guide the deployment process (Antony *et al.*, 2012). It is also important to select the best projects in order to give the best return to the organization.

2.2 Continuous Improvement Practices in Higher Education in Saudi Arabia

In Saudi Arabia higher education is getting a great deal of attention from the Ministry of Higher Education, and significant investment has been made to enable the establishment of new universities and colleges to meet student numbers. Currently, there are 21 government universities, six private universities and 18 private colleges distributed across different regions of the Kingdom (Ministry of Higher Education, 2014). Moreover, the Ministry has established a program of scholarships for Saudi students to study abroad to bridge the shortage of places in the local universities (Assaf *et al.*, 2011; Saleh, 1986). Therefore, according to the Ministry, Saudi Arabia ranks as one of the highest cost per student countries in higher education, and with this investment by the Saudi Arabian Government, the outcomes of higher education could be improved further (Alruwaili, 2013).

The challenges facing the higher education sector in Saudi Arabia have been highlighted in a number of reports, and among these challenges is the situation where higher education institutions are connected to various governmental sectors such as the Ministry of Employment. This can limit the freedom of the HEIs to develop their own employment policies and regulations in terms of creating positions, making promotions, defining salaries, etc.(Alkhazim, 2003). In addition, some HEIs are facing challenges when trying to secure sufficient resources, including financial and human resources (Alkhazim, 2003).

HEIs in Saudi Arabia also face challenges when attempting to deploy continuous improvement (CI) methodologies. For example, an empirical study on TQM in higher education in Saudi Arabia stated that among the issues facing TQM implementation are regulation, bureaucratic restrictions, lack of education and inadequate training (some managers had not attended any training courses for years), the absence of an adequate reward system, low employee morale and job satisfaction, corruption and malpractice, management resistance to change and many others (Alruwaili, 2013; Al-Qahtani and Al-Methheb, 1999). Furthermore, HEIs are struggling to deploy any CI initiatives due to the policies, regulations and procedures imposed by the Ministry of Higher Education (Alruwaili, 2013). This study concludes that in order to deploy TQM in Saudi HEIs, radical changes must be made to the environment in the institutions both locally and nationally, or, TQM must be reshaped to fit the Saudi context (Alruwaili, 2013). According to Al-Qahtani and Al-Methheb (1999), the application of TQM in the public sector in Saudi Arabia is not an easy task because the Saudi public sector has a different environment and culture than public sectors in western countries. They also state that managers in the Saudi public sector see TQM as a long term, complicated process requiring discipline, massive investment and significant organizational change. Furthermore, TQM methodologies are new to managers and employees in the Saudi public sector, and these new tools and techniques will need to be learned.

There are some TQM success stories such as in the Northern Area Armed Forces Hospital, King Khalid Military City; Saudi Consolidated Electric Company-East (SCECO); Post, Telegraphs, and Telephones Ministry (PTT); Ministry of Health (MOH); Saudi Arabian Petrochemicals Company (SAPC) and Saudi Airlines.

However, some of the named organizations have failed to sustain improvements and some of them have slowed down their implementation processes. Moreover, each of these organizations has deployed TQM in their own way without any support from experts, education or training. This is illustrated by the absence of a standard TQM model for Saudi public organizations to adopt to ensure successful deployment and sustainability.

Currently, King Abdulaziz University (KAU) states that there is a department for TQM which "focuses on planning, development and participation process in carrying out quality programs and it is concerned about monitoring quality, performance measurement and evaluation and putting standards and criteria for these processes aiming at continuing the developmental procedures" (KAU, 2014).

King Saud University (KSU) has adopted the Quality Management Model and the Malcolm Baldrige National Quality Award model to commit to the continuous improvement of performance and customer service and to maintain its responsiveness to society needs (Teay and Al-Karni, 2011). King Abdulaziz University has also

deployed TQM in the faculty of education. The research done by Alsuhaimi (2012) has shown that the implementation of TQM has increased the faculty performance and progress. He argues that TQM should be deployed in all institutions and universities in the country to increase the level of education and research.

Although ISO standards have been widely adopted by organizations in the manufacturing and service sectors, there is little evidence of use of such standards in the education sector. The only evidence is that ISO 9001:2008 has been awarded to Deanery's Agency of Admission and Registration at King Abdulaziz University (KAU, 2012) and to the Olayasha Centre for Girls at King Saud University (KSU, 2014).

Apart from Lean/Six Sigma at King Abdullah University of Science and Technology (KAUST), no further studies have been found on any other continuous improvement practices in HEIs in Saudi Arabia. In fact, there are a very limited number of academic papers which target any continuous improvement practices in the higher education sector at all. The aim of this paper, therefore, is to present a case study on the deployment of Lean Six Sigma at KAUST in order to bridge the gap in the current literature.

3. Case Study

3.1 The LSS Program

The LSS program at KAUST was started with the objective of creating a platform for improving business process quality across the administrative functions within the university.

The university developed its business strategy around the advancement of science and technology through research and education. In order to play this role effectively, the support services within the university (such as Administration, Finance, Procurement and IT) need to be efficiently organized to provide students, researchers and the faculty with the necessary support to allow them to excel.

The LSS program contributes to the operational strategy delivery. The focus of the program has been on streamlining the support functions so that these services are provided smoothly and efficiently to students, faculty, and staff. It helps to enable a user-centric approach, increasing the efficiency and effectiveness of functions and processes such as Graduate Affairs (for student onboarding), procurement services, and IT services.

The program was initiated in 2011 and sponsored by the Chief Information Officer and hence the program management resided within Information Technology (IT) Department. The program began with a vision of providing staff members at all levels of the organization with a vehicle for change, as part of a culture of continuous improvement.

The primary objective of the IT Department is to enable organization-wide business processes. Applying LSS allows the organization to ensure that business processes are aligned to the overall objectives of the organization, and ensures that technology facilitates the automation of well-designed processes and takes into consideration all aspects of people, processes and technology. Providing a single methodology such as LSS provides the benefit that projects follow a standardized, predefined structure; Define, Measure, Analyze, Improve, Control (DMAIC), leading to consistent results.

LSS methodology was chosen based on several factors; a structured, data-driven approach, emphasis on identifying internal and external customers and the implementation of continuous quantitative monitoring of process performance. No generally accepted framework for implementing Lean Six Sigma has been identified (Pepper and Spedding, 2009) resulting in an ad-hoc approach, which at KAUST included:

- Establishing the team (May-June 2011)
- Procuring training material (July 2011)
- Management Awareness sessions (August-September 2011)
- Green Belt Training (core team August 2011))
- Green Belt Training (open October 2011)

- Project Coaching
- Project Selection
- Communication and Awareness

By the second year of the program, 25 projects had been completed and business process quality was increasingly being discussed across the campus. Figure 1 illustrates the activities KAUST went through in establishing the program.

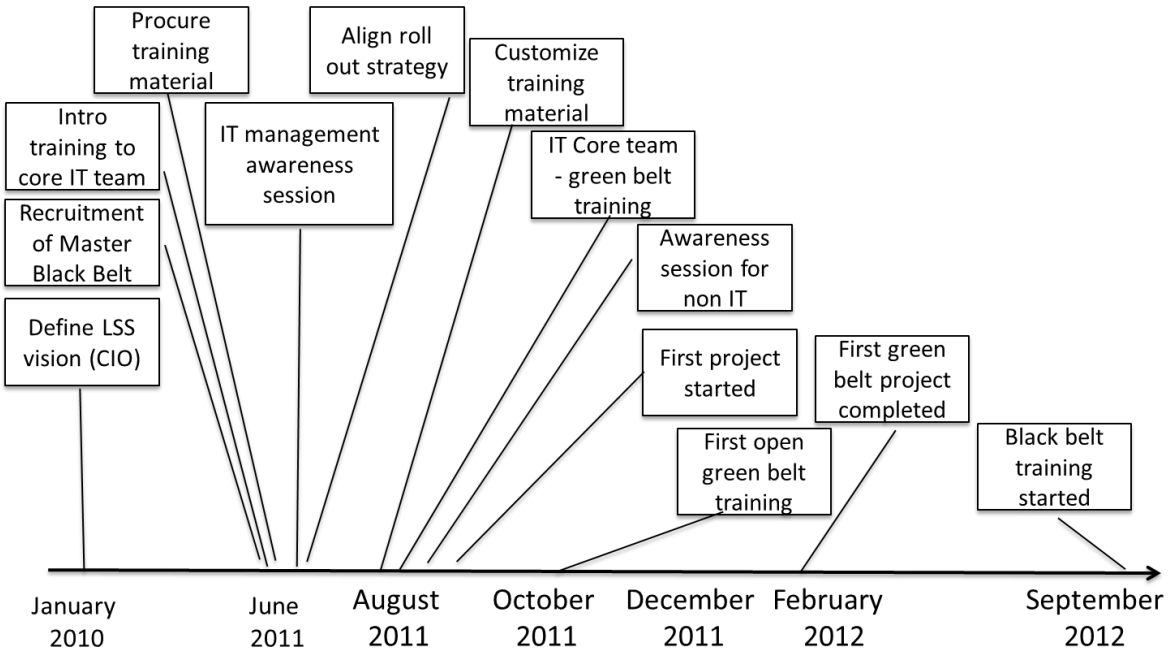

Figure 1: Timeline for the rollout of the LSS program

3.2 The training program

The LSS training program was made available free of charge and advertised to the entire organization, the rationale being that the LSS method would become the shared standard for business process improvement and that familiarity with the methodology would facilitate acceptance with project stakeholders.

Out of a staff of approximately 2.000, 350 staff members have completed awareness training. 200 yellow belts and 230 green belts have been trained as shown in figure 2.

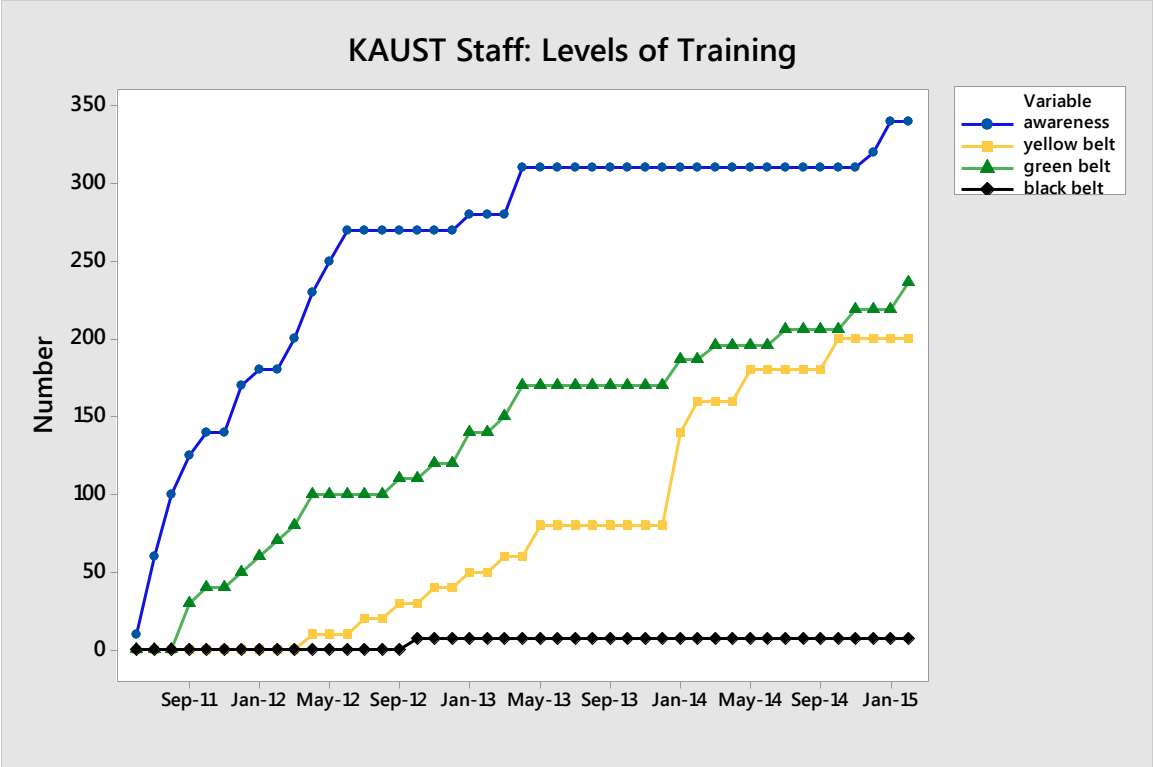

Figure 2: Summary of staff trained in LSS

The yellow belt training runs over four half days and focuses on the applied lead process improvement tools such as CTQ's, value adding activities, flow charts, scatter diagrams, Statistical Process Control (SPC) charts, SIPOC, pareto charts, sampling, 5's, the Kano model, sigma scores.

The green belt training course runs over five full days and has a stronger analytical component covering tools such as CTQ's, SIPOC, Input and Output measures (X's and Y's), Project risk management, process mapping (using the ARIS toolset), data collection plans, calculation of cycle times, sample sizes, Statistical Process Control (SPC) charts, sigma scores, process capability analysis, , interrelationship diagrams, Ishikawa diagrams, hyposis testing, root cause analysis solution selection and change management.

Finally the 12 day black belt training program builds on the green belt training, with advanced statistics and change management tools. The curriculum include topics such as special cause analysis, non-normal data, I-charts, box-cox charts, data transformation, selection of control charts, sigma shifts, z-test, t-test, chi-square, ANOVA, non-parametic tests, linear, multiple and logistic regressions.

The only staff member dedicated exclusively to LSS is the master black belt. Other belts combine their project obligations with their daily duties.

Full time employees have been able to choose freely between the yellow belt and green belt trainings with the only following limitations; manager approval and capacity, each training is limited to 15 participants. The course descriptions have contained a recommendation of the prerequisites for green belt training (e.g. basic understanding of statistics, basic project management skills, advanced excel skills). The training material is based on the book "The Lean Six Sigma Improvement Journey" (Morgan, J., 2006).

Following the green belt training, participants complete an online exam and, if the green belt successfully completes an entire DMAIC cycle, an internal green belt certificate will be awarded. KAUST also facilitates an external certification by the British Quality Foundation if requested by the green belt.

The first round of seven black belts have completed a training program, tailored towards higher education. The black belt program is not open enrollment. Participants have been selected by the master black belt in coordination with their management. The selection criteria for black belt candidates is the successful completion of two green belt projects, external green belt certification, relevancy to position and managerial support for continuous involvement in business process improvement projects.

All training has been delivered by the master black belt on-staff, who is also responsible for coaching the delivery of the LSS projects taken on by the trained staff members.

3.3 Project Coaching

When introducing LSS to an organization, coaching is widely recognized as a critical activity (Hagen, 2010). Coaching in a Lean Six Sigma Context have been defined as "*the process of instructing, directing, prompting, modeling, and guiding others as they work towards the business's desired outcomes*" (Adams *et.al.*, 2003).

In 2011 when the first KAUST LSS projects were started, the first group of lean six sigma project managers- also known as "belts"- had completed the theoretical training providing them with statistical tools and basic change management techniques. The belts at KAUST range from junior staff embarking on their first project, to seasoned professionals. But few of the belts have hands-on LSS experience. To ensure progress, the master black belt provides individual coaching to each of the belts.

Most projects will encounter a new set of challenges. The challenges can appear to be insurmountable to a junior project manager, but for the experienced master black belt they are trivial. The coaching provided covers both application of tools and statistical analysis as well as softer aspects of the project including stakeholder management, change management and communication. Coaching is being used as a vehicle to transfer experience and instill confidence in the project managers to overcome the challenges and successfully complete the projects. The project coaching is proactive in helping the project managers in selecting viable projects, overcoming obstacles and ensuring project quality. Once the belts had completed the first projects, confidence grew and the coaching became increasingly orientated towards the application of statistical analysis. As the program expands, the black belt candidates are taking on coaching responsibilities for green belts, as part of the black belt program.

The Lean Six Sigma coaching is not limited to the project managers and team members. Often project champions are also unfamiliar with the methodology and their contribution. In these cases the master black belt will meet with the project champion and review their role as outlined in "Champion's Guide" (Catalyst Consulting, 2012).

3.4 Selecting initial projects

After the first wave of training was completed, the first projects were launched. While it was tempting to take on the organization's most pressing and visible projects, the strategy applied was slightly different. The initial projects were selected based on the project manager's (belt) level of control within the organization where the project was carried out, the availability of data, and the skills of the specific belt.

As a result, the initial projects were scoped to allow the belts to develop their skills, before taking on the more complex problems. Following the initial wave of projects, the belts have taken on increasingly complex projects, which are highly visible across the organization.

Certain areas such as helpdesk, or processes supported using IT-tools, proved to be particularly data-rich and therefore good candidates for improvement projects that would deliver measurable improvements to internal and external customers. The initial projects' timescales were ample, and one of the future challenges will be to set the expectation that completion times for subsequent projects will be greatly reduced.

3.5 Involvement of executive management

To emphasize the importance of continuous process improvement, a committee of the Chief Information Officer (CIO) and the management group reviews two current LSS projects a week. The review session consists of a program status update, presentations of specific projects by the project manager, followed by questions and answers.

The benefit of these sessions is the clear commitment at executive level and a continuous alignment between projects and overall organizational objectives.

The project presentations offer staff members at the operational level an opportunity to present their contributions to the organization. In addition to providing management with an overview of on-going activities, this also helps the staff build generic business skills.

3.6 Tools

The Lean Six Sigma methodology offers a long list of tools, including but not limited to:

Business Process Mapping, Value Stream Mapping, SPC charts, SIPOC, 5S, VoC (Voice of the Customer) Translation Matrix, Operational Definitions, sigma calculations, FMEA, CTQ's, Gauge R&R, scatter plots, house of quality, Affinity Diagram, 5s, 5 whys, A3 report and error-proofing.

Selecting the appropriate tools for analyzing and improving process is critical to the successful completion of the projects. Not all of the individual tools are applied in every single project, and one of the project leader's responsibilities is to select the tools appropriate to the project in hand, with the coaching of the master black belt. A survey on the use of LSS tools was made of 23 LSS green belt projects completed within the first two years of the Lean Six Sigma program at KAUST.

Figure 3 shows the results of the survey.

Tool	Org diagram	Project Charter	Fishbone / Ishikawa	Voice Of the Customer	SIPOC	Process modelling	SPC chart	CTQ's/output measures	Pareto	Sigma calculation	Data collection plan	Scoping frame	Minitab statistica summary	Elevator speech	Improvement Priority Matrix	Boxplot	5 whys	Scatterplot/collelation	Risk Assesment	ANOVA/two sample T/chi-sqare
% of Projects	87%	83%	78%	74%	70%	65%	65%	48%	48%	43%	39%	35%	30%	26%	26%	17%	17%	13%	9%	4%

Figure 3: Survey of the tools used in 23 completed projects

Looking beyond the fundamental project tools of organizational diagrams and project charters, the survey shows a bias towards the Lean tools supported by basic data monitoring tools, which can be attributed to the developing experience of the belts as well as the balanced complexity of the projects selected at the start-up of the program, where the selected projects primarily been addressing process defects rather than process optimization. While the Lean tools were frequently applied, it was a priority from the organization that the projects were data-driven, hence the common usage of statistical process control (SPC) charts. As the LSS program matures and projects become increasing complex it is expected that the master black belt and black belts will apply more advanced data analysis tools. The application of more advanced tools will be a key to the maturing of the LSS program. If the belts in the program do not build experience through the completion of multiple, increasingly complex projects, there is a risk that the organization will not build the advanced capabilities required to systematically improve complex and data rich processes.

As the skillset develops and the program takes on increasingly complex projects it is expected that more of the advanced tools will be applied where applicable.

4. Example of initial project - *Student Onboarding Process for new international students:*

Complex organizations such as universities offer extensive opportunities for process improvements. Mentioned here are two examples of green belt projects delivered within the program. Examples of other LSS projects that have been delivered and that are of a nature that could be of general interest are: processing of travel claims, processing of invoices, managing employee benefits, managing logistics for graduating students, managing digital identities, increasing first-call resolution for IT helpdesk, onboarding of new staff members, identifying revenue streams, managing catering processes, managing gas cylinders, software acquisition, reduction of printer downtimes and reducing rejection of invoices.

One Lean Six Sigma project that was delivered as part of the program and that has proven to be common across universities is the Student Onboarding Process for new international students. The project was sponsored by Graduate Affairs and the team consisted of staff members from Graduate Affairs, the Onboarding team and a trained green belt from the IT department.

LSS Improvement Charter

Project title: Student Onboarding Process	**Date commenced:** July 4, 2011

Why - High level business case describing why this project is important and how it links to our business plans

In order to ensure newly selected students arrive on time and with all necessary documents and system accesses, a robust and accurate student onboarding process is critical to KAUST's goal of educating high quality students.

What – the problem and goal statements, the scope, and the CTQ and defect definitions for the relevant customers and processes

Problem statement	**Goal statement**
The current student on boarding process creates a risk for incoming students arrival in time for the academic semester start. Additional risk can be foreseen in the retention of applicants (damage to KAUST credibility), incompleteness of student files and documents, as well as increased administrative costs in the relevant departments within KAUST.	By Oct 15, 2011 and without any unplanned increase in human or financial resources, 98% of all students involved in the onboarding process will be accurately and successfully processed first time with their data being synchronized across all involved IT systems.
In Scope Non-academic processes from selection to arrival IT Department/systems	**Out of Scope** Academic processes including class registration Non-IT departments/systems
CTQ: Timely arrival of students Successful student log-on first time after receiving log-on details. Students input their data only once. No corrections or manual rework. No unplanned additional human or financial resources.	**Defect definition** Unsuccessful student log-on and/or information retrieval. Additional input of same data. Any correction or manual rework. Any unplanned increase in human or financial resources.

Who – the process owner, champion, team leader, and team members. Who are they and what are their roles, responsibilities, and time commitments? What involvement is expected of the champion? How often should they meet?

Name	**Roles & responsibilities**	**Time commitment**
XXXXXXXXXXX ********** XXXXXXXXXXX **********	Champion Lead Belt Team Member Trainer/Coach	5% 33% 20% 5%

When – high level estimated timeframes for the phases.

	Start Date	Finish Date
Define	July 4, 2011	July 13, 2011
Measure	July 16, 2011	July 20, 2011
Analyse	July 23, 2011	July 27, 2011
Improve	July 30, 2011	Oct 12, 2011
Control	Oct 15, 2011	Nov 15, 2011

Figure 4: Project Charter for the Student Onboarding Process

4.1 Define Phase

The onboarding of new students is challenging because students need to provide a significant amount of information within a short timeframe and activities have to be coordinated across all time zones. The project was approached as a classic Lean Six Sigma project, following the DMAIC process.

In the Define Phase, process performance objective CTQs (Critical To Quality factors) were identified, and the project objectives were agreed upon with the stakeholders.

The objectives of delivering this Lean Six Sigma project were to:

- Ensure that incoming students have a good first impression
- Ensure the timely arrival of new students
- Reduce the effort for onboarding each individual student

4.2 Measure Phase

Following the Define Phase, the project team moved into the Measure Phase and started to collect data. The data sources were 2,000 emails sent by students as well as time-stamps on major process steps to give the project team an understanding of the throughput times and variation for each of the process steps.

Process steps:

- Arranging visas
- Coordination of student housing
- Arranging logistics

The process:

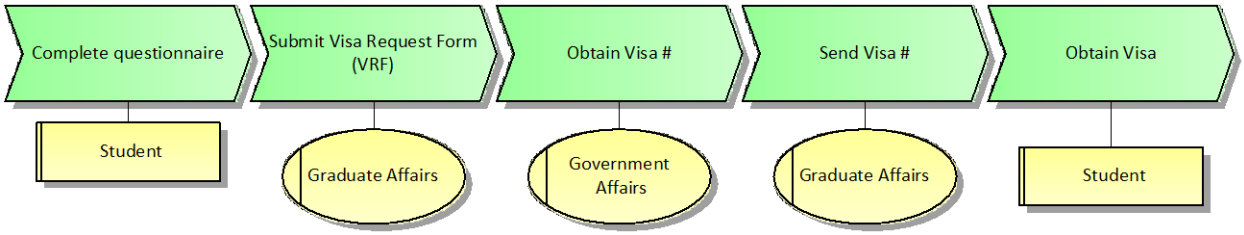

Figure 5 Steps in processing a student visa

Data collection:

The first stage was to review and assess the entire as-is process from a student perspective.

Approximately 2,000 emails, which had been sent to the 12 Onboarding Advisors, who arrange logistics for the students, were reviewed and categorized according to topic and the email response times were examined.

Five students were invited to participate in structured interviews as a supplement to the collected process data.

Initial findings:

On admission to the university, a student is sent an email instructing them to complete a number of questionnaires and submit key documents such as passports. In the first step of the onboarding process, the student is also asked to fill out a number of questionnaires. One of the initial findings was that some data fields were being requested twice by different departments.

Once the Onboarding Advisor has gathered enough information, a request is submitted for a visa, which, following authorization, entails the student going to the local embassy to obtain the visa. The process review revealed delays in this last step, the cause of which was students not being aware of the full documentary requirements for obtaining a visa.

The review of the as-is process made it clear that the process workflows were largely based on emails.

The collected data showed that prior to the process improvements, an average student would send six emails to coordinate their arrival.

To ensure smooth onboarding, an objective was set to respond to emails within 24 hours during working days. In general the performance of the team was very good, with the majority of enquiries taking less than three hours (figures 6 and 7).

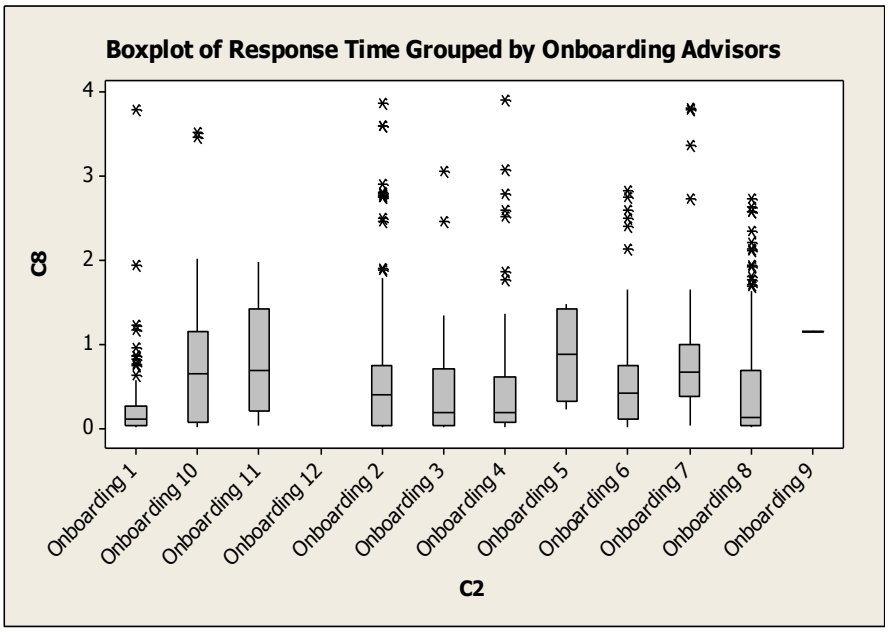

Figure 6: Response time on emails from students per Onboarding Advisor

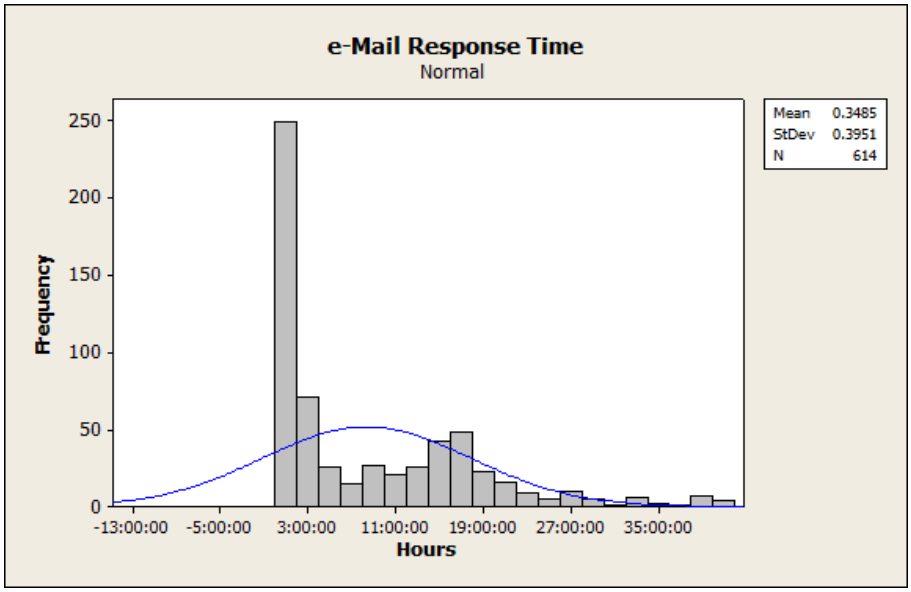

Figure 7: Distribution of response times to emails from students

4.3 Analysis Phase

In the Analyze Phase it was found that the most common causes of delay were due to issues with logging on, having to obtain government documents or getting documents notarized.

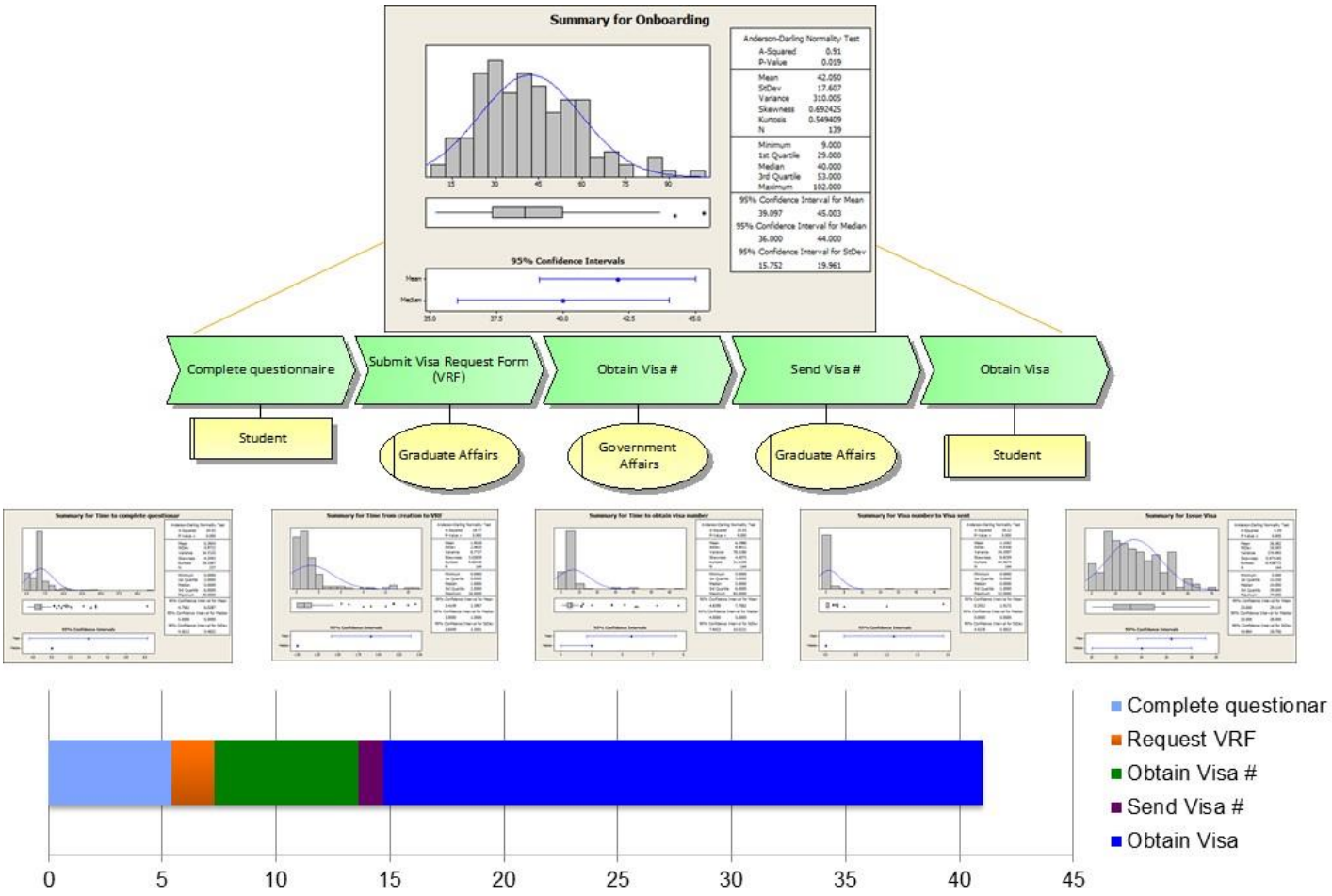

Figure 8: Analysis of as-is Onboarding Process

4.4 Improvement Phase

In the Improve Phase, the root causes for delays in the onboarding process which had been identified in the Analyze Phase were addressed and the supporting business processes were revised. Additionally, an effort was made to address common issues for emails used for wider mass communication.

The most common data errors that could delay onboarding were prevented by providing very specific data requirement instructions to the students.

Waste due to duplication of information which had been identified in the arrival process was eliminated by reusing available information provided by the students on admission, and improved controls were put in place on data entry.

To avoid using emails for workflow, questionnaires completed by students are now uploaded as amendments to the original application instead of emailed.

The responsiveness data that had been collected was shared with the team and used to set benchmark performance expectations.

Minor changes were made to the IT systems to eliminate login issues and the onboarding FAQ's were updated. Additionally all emails sent from the onboarding office now have a link to the FAQ's.

4.6 Control Phase

Following the initial project, the process has now gone into a continuous improvement cycle, where data is collected. So far a reduction in redundant processes and resources has been noted. During the project the process owners were also trained as green belts and they insure that the process is now reviewed following each onboarding cycle by the business process owners and systematic adjustments are being made.

5. Conclusion and Next Steps

The LSS program managed to prove its value to the organization by improving business processes and enabling the university to operate more efficiently. The successful delivery of projects helped individuals and process owners to understand the importance of LSS and also encouraged other process owners to undertake such projects in their respective areas. As a result, the frequency of project requests has increased, at both green belt and black belt levels. Approximately 40 new projects have been initiated this year covering business processes across the university in areas such as Information Technology, Human Resources and Finance.

The journey towards structured, data-driven process improvement has not been without challenges. The business process owners often express quite natural impatience for a solution once a problem has been identified. Similarly there will often be a push to roll out systems without having a detailed understanding of the improvements that are sought. In the case of KAUST, the program sponsor was very experienced in delivering LSS projects, and he was able to convey the message to his peers that LSS was powerful but patience was required in working through the structure of the methodology.

The LSS program is now out of the start-up phase, which has led to considerations on how the program is going to progress into the maturity phase. Moving forward, the objective of the program is to continue providing LSS methodology training to staff, and we are continuing the sponsorship of this program in the university. The Lean Six Sigma program will remain a cornerstone in providing staff members across the university with the necessary tools, coaching and platform to improve their own business areas, as well as cross-organizational processes. As the program matures, staff members will also be taking on increasingly complex projects which will leverage more advanced statistical tools.

To ensure that the process improvements withstand the test of time, cementing the concept of process ownership within the organizations will be critical. Additionally, and of particular importance, is the continued monitoring of process performance following the completion of any improvement project. Process governance should also be established, including periodic process reviews. The process owner must take responsibility for measuring and continuously improving process performance. A key component in this continuous improvement will be the identification and monitoring of key performance indicators.

From a project delivery perspective, the objective is to reduce the delivery time of a green belt project to between three and six months. This should be possible due to increased knowledge and experience with LSS projects, and also setting it as an objective at the onset of the projects.

The program has provided a plethora of benefits, and on a program level, the systematic registration of benefits will be improved by implementing a template for benefits registration inspired by MSP. (Sowden, R., 2002)

On a staff level, staff members have benefitted professionally from the training and completion of projects. One of the forthcoming challenges will be to ensure that the belts continue to undertake projects following the completion of their certification.

In terms of areas, the target of the program is to further improve the processes in Administration and Finance, as well as to extend its support to the teams within the Academic and Research functions, and to provide training and support.

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