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Quality improvement in a large-scale IT project:
A case study

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Abstract

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The purpose of this study is to investigate the effects of applying *The Improvement Model Framework* to two objectives:

(1) Increase the monthly numbers of windows 7 deployments and
(2) Improve end user satisfaction levels of the deployment experience.

This case study uses an embedded single-case design approach and focuses on multiple units of analysis. The monthly targets span a period of 19 months with a total count of 19, 417 deployments occurring within the scope of this study. In addition, 844 closed surveys were received across the same time period. Data analysis was conducted from the findings of the data collection in the form of a run-sequence plot chart, displaying data in a time sequence. Identification of non-random patterns was used to determine how the changes in the process influenced emerging patterns.

The findings in this thesis resulted from the evidence of non-random patterns, hence, successfully supporting the statement that the changes implemented in the course of this study had a direct result to quality improvement in the project. The target of reaching 2000 deployments per month was achieved along with a clear shift above the median in the customer satisfaction rate in the overall deployment experience.

By putting the focus on managing the interaction between the service providers and stakeholders with the utilization of a *gatekeeper* and allocating tasks to *local champions*, creating accountability, the overarching business goals were aligned and allowed for a balanced and progressive move forward.

In addition, by implementing a *centralized resource directory*, both the concerns of the business and technical risks posed by the service providers were presented in a collaborative manner. Using consistent documentation within a standard location allowed for members in the weekly sessions to rescope the IT requirements originally put forth to fit into the specific environments in question.

Keywords:
quality improvement, process improvement, risk, Windows 7, deployment, case study

Table of contents

Table of Figures

Abbreviations

COQ	Cost of Quality
CQI	Chartered Quality Institute
Dp	Data Point
DP	Distribution Point
EFQM	European Foundation for Quality Management
PDSA	Plan, Do, Study, Act Cycle
QA	Quality Assurance
SCCM	System Centre Configuration Manager
SME	Subject Matter Expert
SOE	Standard Operating Environment
SoPK	(Deming's) System of Profound Knowledge
SQC	Statistical Quality Control
TQC	Total Quality Control
UAT	User Acceptance Testing
WAN	Wide Area Network

1 Introduction

By April of 2014, at least one billion copies of Windows XP were sold (Anthony, 2014). Windows XP was the most widely used operating system until August of 2012. As seen in Figure 1, in 2011, Windows XP worldwide owned 44% of the market share and by 2014, the market share ownership decreased to 16%. In 2011, Windows 7 covered 35% of the market and by August 2012 surpassed Windows XP and became the leader in market share at over 50% (Figure 1).

Finland provides quite similar numbers for Windows 7 operating systems with 38% of Finnish operating systems running on Windows 7 and increasing to 57% in 2014, above the global percentage of Windows 7 operating systems in use. Windows XP had an initial market share of 29% and has decreased significantly to just 4% in 2014.

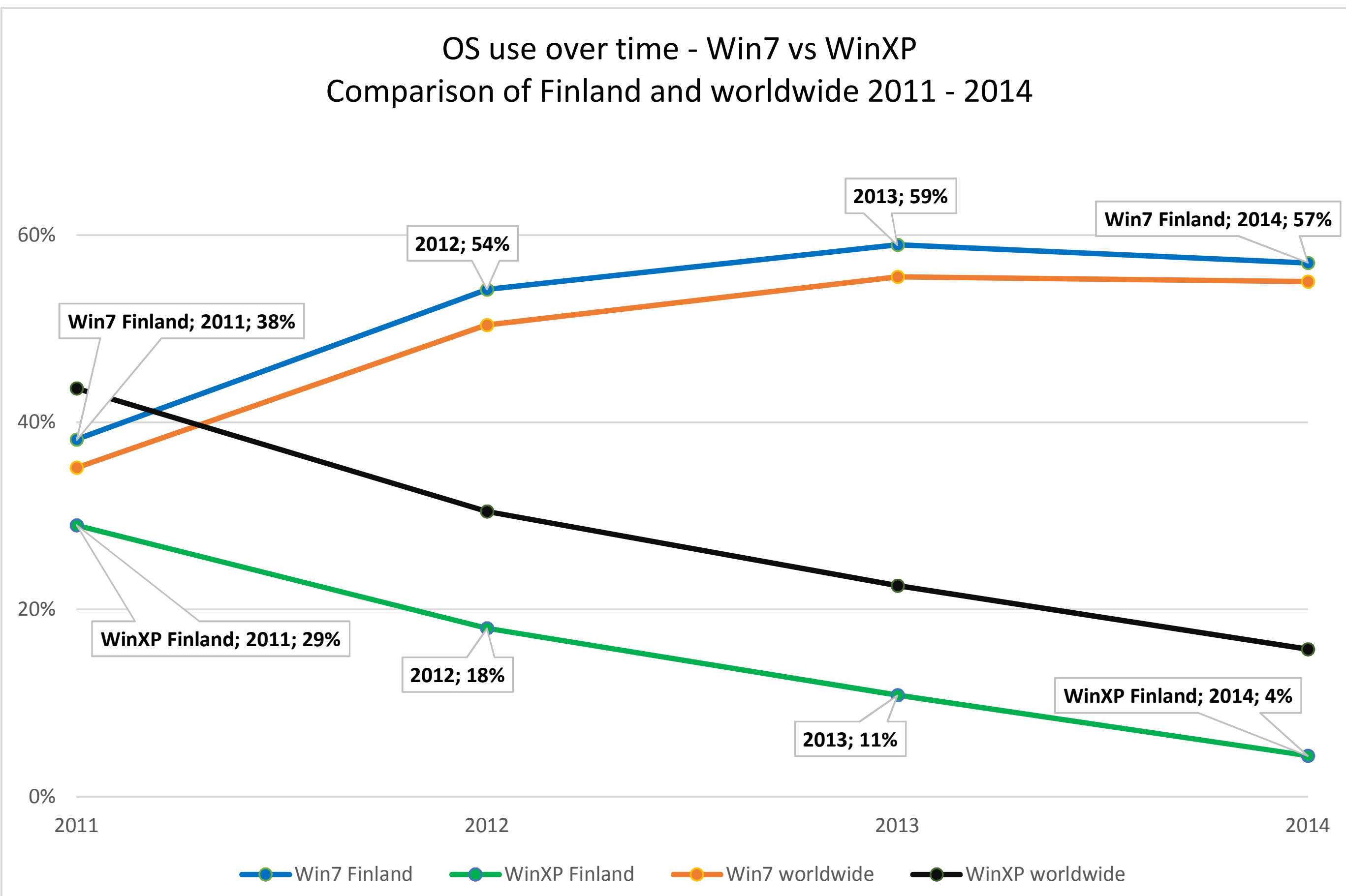

Figure 1:Operating system use between 2011 – 2014 for Finland and worldwide Dataset adapted (StatCounter, 2015).

With its release to retail in October of 2001, Microsoft's Windows XP sold approximately 400 million copies globally within the first five years of availability (Kirk, 2006; TechRadar, 2014). Eight years later on April of 2009, Windows XP entered the extended support phase when mainstream support ended. After this time Microsoft did continue to provide security updates every month, however, by April 8th 2014, extended support ended; twelve years since the release of Windows XP. As the end of extended support drew to an end, Microsoft urged their customers to migrate to newer versions such as Windows 7 or 8 due to a potential breach of security by the reverse engineering of security patches of newer versions of Windows (Infosecurity, 2013; Voss, 2012).

Microsoft Windows 7 was launched in October of 2009 and by June of 2010 had sold over 150 million licenses, making it the fastest-selling operating system in history. By that time 75% of enterprises were looking at Windows 7 for their organization (Ferguston, 2010; Thurrott, 2010). By July of 2012 Windows 7 sold over 630 million licenses and running on 50% of enterprise desktops (Warren, 2012) . As of April 2015, Microsoft Windows 7 holds 58% of the global OS market share (Figure 2).

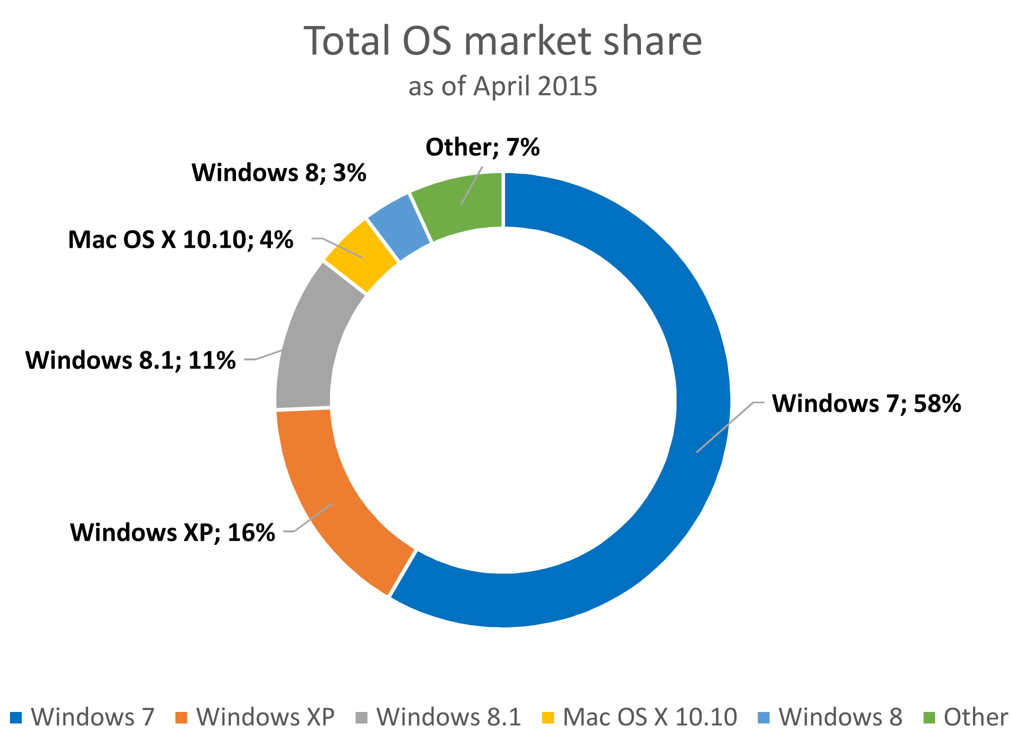

Figure 2: Global market share of operating systems. Dataset adapted (NetMarketshare, 2015).

1.1 Background

In 2011 a large multinational engineering and service organization based in southern Finland drew up a business case to launch a large-scale OS and Office upgrade initiative that would affect 43,000 personnel worldwide. The project initiation was triggered by the fast approaching April 8th, 2014 deadline, when Microsoft ended support for Windows XP and Office 2003 (Microsoft, 2014). This organization is the focus of this study.

At the time, supported end user PCs (desktop, laptop, tablet, etc.) currently ran on the Microsoft Windows XP operating system. Any support related to security updates or technical troubleshooting would no longer be available to enterprise users. An additional major change coming into effect was the dismantling of the internal packaged application distribution infrastructure, Radia, to prepare for the System Centre Configuration Manager (SCCM) infrastructure to be put into place.

The Radia client automation software, or Radia for short, was an end-user device lifecycle management tool used in automating client-management related tasks such as patch management, application software deployment, application use monitoring, security, compliance, and remote system management. (Gardner, 2009), and at the time proved to be a major pain point for the end-users as it resulted in a decrease in computer performance in the newer pc models of Windows XP.

1.1.1 Key drivers

The end of support for XP was the major driver for the transition. Other key drivers for this organization to initiate a large-scale project were the many software productivity and efficiencies available in Windows 7 over XP. There are 12 key drivers that were identified as supporting the business case for the transition to Windows 7. The end of support of XP, however, underscored the decision to upgrade to Windows 7.

With Windows 7 came more efficient IT support with better connectivity and data protection. The data storage capabilities allowed for improved data backup and did a better job in synchronization. Figure 3 gives a short description of the main drivers. This list was compiled with the author’s use of project documentation along with case studies present describing reasons why large organizations have chosen to migrate to Windows 7 (North, 2010).

12 Key drivers for migrating to Windows 7	
IT support and efficiency	The opportunity to take advantage of zero-touch, light-touch software deployments and to extend IT service capabilities to remote locations with little or no IT support.
Cost savings	Windows 7 makes it possible for organizations to eliminate costs of redundant software, including VPN systems, encryption tools, software restriction tools, search tools, PC power management tools, and WAN optimization services.
Connectivity	Using DirectAccess to connect users without the barrier of a VPN, especially when many users in the organization are remote, often at home or visiting customer sites, or are otherwise mobile.
Data protection	Hard drive and removable storage encryption using BitLocker and BitLocker To Go.
End user productivity	Enhancing employee productivity providing better tools
Data storage	Windows 7 offers improved data backup, folder synchronization, and storage centralization compared with the more limited capabilities of Windows XP and Windows Vista.
End of Support	End of Windows XP extended support phase in 2014.
Collaboration	Supports and enables new kinds of business scenarios and raises end user satisfaction.
Application compatibility	Partnering with third-party hardware and software, integrating with other software products and thus easing application compatibility testing and minimizing the risk of incompatibility.
Virtual Desktop for legacy applications	Running some legacy applications in Microsoft Enterprise Desktop Virtualization (MED-V), part of the Microsoft Desktop Optimization Pack, provides an option to continue the use of older applications while adopting Windows 7.
Office 2010	Resolves compatibility issues in handling of documents with customers and suppliers alike, and will also support the use of collaboration tools across the internal and external organizations directly from Office applications such as Excel and Word.
Unified Collaboration & Communication (UCC)	Closer integration to other Microsoft products such as Unified Collaboration & Communication (UCC) services, SharePoint 2010 services, Office 2010 services, etc.

Figure 3: 12 Key drivers for migrating to Windows 7 and Office 2010.

This list was compiled with the author's use of project documentation along with case studies (North, 2010) present describing reasons why large organizations have chosen to migrate to Windows 7.

1.1.2 Challenges

By January of 2012 relevant third party service providers were selected, teams were set into place, and arrangements were made for the project kick-off to take place during the summer of the 2012. The windows 7 rollout moved forward, but with challenges. By the summer of 2013, there was a clear need to review the processes that were in place. Trust lost among local stakeholders had prevented the project from ramping up Windows 7 deployments and reaching key milestones.

Process gaps also prevented a smooth experience and was evident by low percentages found in customer satisfaction feedback surveys. As a result, an essential prerequisite to ensure project continuity was to restore trust among local stakeholders and end-users alike. This triggered a quality improvement initiative while serving as the project's Jr. Project Manager in the organization.

The following sections explain how the lack of trust and other factors can work against the overall success of a global IT project.

1.1.2.1 Risks

Studies have shown that trust, cultural management and collaborative communication can become critical risk factors in the overall success of a global IT project (Mohtashami, Marlowe, Kirova, & Deek, 2006). Risk, as identified by Badiru (2009) are uncertainties which may prevent a project delivering expected outcomes in time, scope, budget, and/or quality. Risk in Global IT projects increase when there are differences related to geographic distances, ineffective structures for collaboration, language barriers, and technological incompatibility (Dawidson, Karlsson, & Trygg, 2004; Persson, Mathiassen, Boeg, Madsen, & Steinson, 2009; Powell, Piccoli, & Ives, 2004) as cited in (Lee, Blake, & Baby, 2015)

Lee, Blake, & Baby (2015) from the University of Massachusetts have compiled a framework based on related studies of risk in global IT projects within a set of seven risks (or what Lee, Blake, & Baby term as multiplicities) that arise within and between these elements (Figure 4). The risks described are defined as dynamic because of their unpredictable nature on global IT projects (Lee et al., 2006).

These multiple differences, or multiplicities, mean that each team and every individual involved in a global IT project may have a different set of goals, objectives, interests, standards, workflows, development platforms, and technologies (Kotlarsky, Oshri, van Hillegersberg, & Kumar, 2007; Lee et al., 2015) as cited in Lee et al., 2015).

The framework (by Lee, Blake & Baby (2015)) in Figure 4 considers how the multiplicities that naturally occur within the elements of global IT projects (i.e. people, process, technology, and external environments) can interact and emphasize risk. This framework allows for the risk(s) to be identified in order to implement the correct risk mitigation strategy or strategies.

Framework of global IT project dynamic risks		
Multiplicities	**Dynamic Risk**	**Example**
People – People	Multi-Stakeholder Relations	Unresolved conflict from divergent opinions and interests
	Communication Challenges	Multiple languages and cultural practices
Process – Process	Multi-PM Practices	Heterogeneous project management methodologies, practices, and capabilities
	Heterogeneous Business Traditions	Varying and possibly incompatible business processes, policies, and strategies across multiple locations
Technology - Technology	Heterogeneous IT Strategies	Varying levels of IT investment, organizational competencies (e.g. CMMI), and development platforms
People – Process	Multi-Group Knowledge Sharing	Lack of trust between two or more groups and difficulty to transfer useful knowledge from one group to another
	Task Distribution and Resource Coordination	Mismatch between task and resource allocations, or planned resources unavailable
People – Technology	New Technology Adoption	Resistance to new technologies from learning curves necessary, inertia, change organizational power
Process - Technology	Task-Technology Misfits	Discrepancy between tasks assigned to a group or location and availability of resources or technologies
	Misalignment of Business and IT Strategies	IT strategies that are inappropriate or ineffective in fulfilling business strategies
Internal – External	Multi-Regulatory Compliance	Different or ambiguous compliance requirements, misunderstanding of rules and regulations
	Project Continuity	Incompatible or varying disaster recovery plans, potential impact of local disasters or catastrophes

Figure 4: Framework of global IT project dynamic risks (Lee et al., 2015)

Within the Windows 7 deployment project, a difficulty to transfer critical information and feedback within the ***People-Process* multiplicity** resulted in a failed knowledge sharing efforts across multiple groups ranging from the external technical teams, the internal project teams and the local country stakeholder.

In addition to this, the multiple languages and cultural practices found within the ***People-People multiplicity*** in this project with having offshore service providers and having to deploy Windows 7 across 54 countries worldwide resulted in communication challenges and unresolved conflict from divergent opinions and interests within the multi-stakeholder relations category.

Heterogeneous business traditions resulted through the varying incompatible business processes, policies, and strategies across multiple locations within the ***Process-Process multiplicity***.

A fourth major element involved in enhancing risk within the project was the ***Internal-External multiplicity***. With the inability to communicate critical information in relation to a local business unit, a misunderstanding arose in understanding local governmental compliance requirements and the inability to assess the potential impact of local disasters such as total network outages, and other deleterious events that had major impacts to business-as-usual (BAU) continuity.

1.1.2.2 *Mitigating risks*

Lee, Blake, & Baby (2015) describe four strategies that can be used to mitigate the dynamic risks identified earlier. These strategies are based on the principles of service-oriented architecture (SOA) which is mainly used in developing software as independent services designed to be accessible in a standardized way (Bean, 2010). In this case however, Lee, Blake & Baby (2015) apply the principles of SOA to a global IT project so as to develop their framework. Suggestions divided within the four principles, *loose coupling*, *interoperability*, *discovery and reusability*, and *integrated coordination* can be found in Figure 5.

Dynamic risk mitigation strategies from SOA principles	
Principles of SOA	**Dynamic Risk Mitigation Strategies**
Loose Coupling	• Utilize a Gatekeeper • Delegate to Local Champions • Use Modular Architecture for Business and Technology • Develop Performance-Based Partnerships
Interoperability	• Develop a Uniform Interface • Standardize Communication and Collaboration Tools • Develop Business Templates • Improve Interpersonal Skills
Discovery and Reusability	• Employ a Centralized Resource Directory • Distribute Tasks Based on Available Competencies • Enable Flexible Resource Allocation • Create an Infrastructure for Knowledge Management
Integrated Coordination	• Develop a Central Coordination Unit for Project Governance • Promote a Strong Commitment towards Project Goals and Values • Establish Global Committees for IT Strategy and for Change Mgt • Centralize Planning for Project Continuity

Figure 5: Dynamic risk mitigation strategies from SOA principles (Lee et al., 2015)

Within the context of the Windows 7 deployment project, the *loose coupling* principle was implemented by utilizing a *gatekeeper* and delegating *local champions*. The first strategy related to *loose coupling* refers to elements having the least amount of dependencies on each other as possible. By utilizing a *gatekeeper*, one can act as an intermediary between two parties (clients and service providers) (Barzilzi-Nahon, 2008).

A **gatekeeper** could be a project manager or someone with equal knowledge. In the quality improvement project that was to follow, the author took on the role of gatekeeper and reorganized the client and service provider approach by creating a face to face platform in order to address issues related to the risks found in the people-people and people-process multiplicities.

The second strategy in this category is to delegate to local champions. By delegating tasks to **local champions**, a sense of accountability emerges and immediate awareness of changes and their potential impact on project outcomes becomes evident. Also, this strategy facilitates adaptation to unique needs at the local sites. During the quality improvement project, the local country managers, or local stakeholders, took on the role of local champions.

Within the discovery and reusability principle, a **centralized resource directory** was implemented in the Windows 7 deployment project during the quality improvement initiative. An additional recruit was hired to help keep the consistency in place within the additional regions. Consistency was essential when determining which approach would best fit an emerging requirement. Implementing a centralized resource directory also allowed the ability to correctly allocate resources on short notice across globally distributed business units based on available competencies.

It is important to note at this point that while there were various initiatives that improved the performance within the overall lifecycle of the project, this study focuses on specific measures taken between June of 2013 and September of 2014 to retain the buy-in of local stakeholders to re-launch windows 7 deployments within the specific country and to improve end user satisfaction levels regarding the overall deployment experience.

1.2 Purpose

The purpose of this study was to apply *The Improvement Model Framework* to a process change in a large-scale IT project to achieve the following results:

- Increase the rate of Windows 7 deployments to achieve target dates
- Improve end user satisfaction levels to make use of the more efficient operating system.

This thesis describes how *The Improvement Model Framework* has been applied to the Windows 7 deployment project in a large multinational corporation to achieve improvement in quality to regain the buy-in of local stakeholders and to re-launch Windows 7 deployments within pending countries. There appears to be limited research as of yet regarding the joining of the Improvement Model Framework with an IT project and based on the research that has been found thus far, there is a propensity to use the Improvement Model Framework in mainly healthcare related initiatives.

The concept of Quality, dating back to medieval Europe and culminating into a scientific discipline by the 20th Century has developed into a diverse set of methodologies that have been applied to all sectors of the society we live in today - healthcare, business, industry, government, military, to give some examples. To say that there has been research done and books written in this field would be an understatement.

Quality frameworks such as Six Sigma, Lean, TQM, etc., is the more natural choice when applying quality improvement initiatives within the business and technology sectors. The Improvement Model is similar to other quality improvement frameworks in that the basis for these models trace back to Shewhart's statistics based quality control and Deming's System of Profound Knowledge.

The Improvement Model Framework, based on Dr. W. Edwards Deming's philosophy, allows a deep dive into taking action to improve a specific aim that the organization -within a relatively short time frame required for planning. By documenting the learning of how The Improvement Model Framework can be applied to a process change in a large large-scale IT systems project, and determining how applicable it would be in this type of setting, this study can give the organization in question the possibility of using this methodology in further improvement projects within the organization to achieve desired results.

1.3 Objectives

The objectives of this thesis are the following:

- Identify where improvement action should be taken
- Identify the improvement action to be taken
- Implement and measure the outcomes of the improvement action taken

1.4 Research Questions

The author poses two questions to answer the purpose and objectives set for this study:

- How can the quality of the process be improved in order to regain deployment momentum to reach 2000 deployments per month?
- How can the quality of the process be improved in order to raise end user customer satisfaction levels by 5%?

1.5 Scope

The scope of this thesis is to show how confidence levels within Windows 7 deployment project was regained following a major problem with the initial deployment software chosen and inefficiencies in the processes that had been put into place. It will look at the processes put in place to achieve this confidence so that timescales could be met. It will also look at the metrics used to ensure that end user satisfaction was improved to meet the new timescales put into place.

This thesis will not be reviewing the technology being used unless the decision was made in accordance to the Quality Processes put in place. The author will not be reviewing in depth at the failures that caused the requirement to reassess the processes in place. The author will also not be looking at the problems that occurred during the rollout that are apart from those that have had a direct impact on the overall metrics of the new processes.

1.6 Case overview

The model used in the organization provides a path which leads a project from an idea through different phases and stages in the project (K0 – K6). By passing the standardized decision points and gates, the aim is to ensure that the project fulfils the quality criteria and develops to a profitable business for the company.

The planning stages for the Window7 and Office 2010 project began in December of 2011 and permission was given to start piloting in April of 2012 (Figure 6).

Milestones	Baseline	Actual
K0 – Permission for preparation	2011-12-09	2011-12-09
K1 – Permission to start project	2012-01-31	2012-01-31
K2 – Specification frozen	2012-04-15	2012-04-15
K3 – Development completed	2012-06-30	2012-06-30
K4 – Permission to pilot	2012-04-30	2012-04-30
K5 – Permission to roll-out	2013-01-07	2013-01-07
K6 – Project closed	2014-04-30	2014-09-30

Figure 6: Schedule of key milestones for the Windows 7 deployment project

Improvement initiatives for the windows 7 deployment project only include the following areas: operational readiness, specifically delivery and support of the windows 7 deployment, communication and buy-in from end users and stakeholders. Figure 7 shows the shaded areas where the process improvement changes have been set into place.

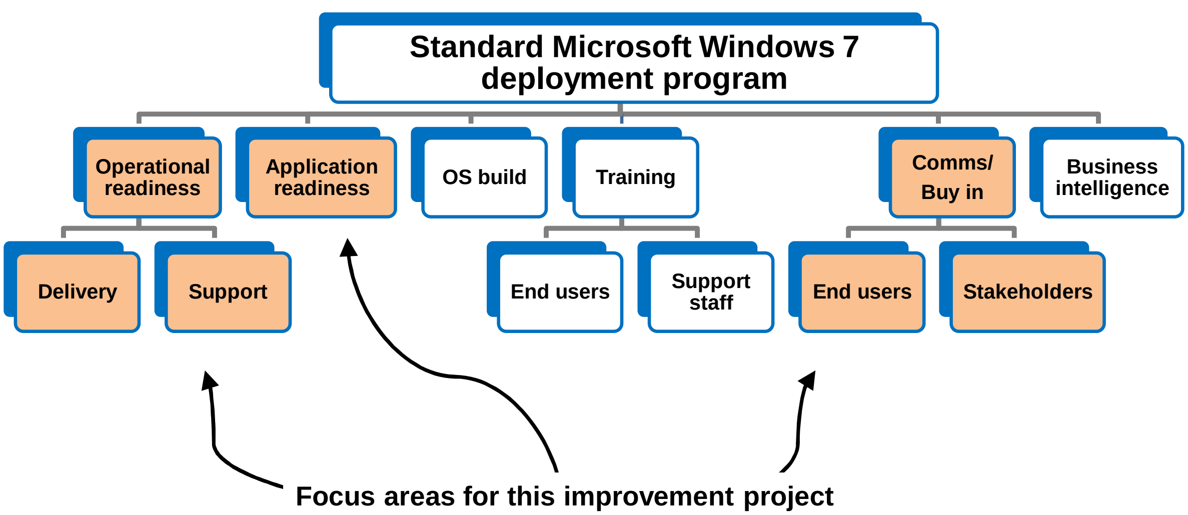

Figure 7: Standard Microsoft Windows 7 deployment program (Rajavelu, Eylon, & Duncan, 2010) .

1.7 Key terms and definitions

The terminology used throughout this thesis will be described here.

Microsoft Windows XP

Windows XP is a personal computer operating system produced by Microsoft as part of the Windows NT family of operating systems (Wikipedia).

Microsoft Windows 7

Windows 7 is a personal computer operating system developed by Microsoft. It is a part of Windows NT family of operating systems. Windows 7 was released to manufacturing on July 22, 2009 and became generally available on October 22, 2009 less than three years after the release of its predecessor, Windows Vista. Windows 7's server counterpart, Windows Server 2008 R2, was released at the same time (Wikipedia).

Unified Collaboration & Communication (UCC)

Unified communications and collaboration (UCC) describes the combination of communications and collaboration technologies (Gartner).

Microsoft System Centre Configuration Manager (SCCM)

System Centre Configuration (SCCM) is a systems-management software product developed by Microsoft for managing large groups of computers. Configuration Manager provides remote control, patch management, software distribution, operating system deployment, network access protection and hardware and software inventory (Wikipedia).

2 Evolution of quality improvement

2.1 Beginnings of quality

The concept of quality has origins that date back to the late 13th century when craftsmen began organizing unions called guilds in medieval Europe. Besterfield & Juran (as cited in (Yong & Wilkinson, 2002) describe how these guilds organized inspection committees that would assess the quality of the product and would acknowledge superior craftsmanship with a mark or symbol to show that specifications were carefully adhered to (History of Quality, 2014).

2.2 Industrial age

These practices continued to develop but it wasn't until the beginning of the Industrial Revolution when mass production became the norm and self-inspections were no longer possible (Yong & Wilkinson, 2002), that a new and innovative management approach was brought into the fold. One of the most influential writings in organizational science, as described by Bed & Wren (as cited in (Yong & Wilkinson, 2002), Fredrick Taylor's (1911) *Principles of Scientific Management* introduced a production methodology that would yield such efficiency on the manufacturing floor that profits increased and wages were raised (Satyanarayana, White, & Hough, 2002) through the implementation of a style called flow-line (Yong & Wilkinson, 2002).

Gabor (2000) as cited in (Satyanarayana et al., 2002) called Taylor the "Father of scientific management" and wrote, *"If American management became a global standard, it was due in large part to the foundations laid by Taylor. Without Taylorism, large-scale mass production would have been impossible".* As if to foresee what was to come, Taylor prepared the way for the era of "processes" in quality practices, marking the beginning of the 20th century (History of Quality, 2014).

2.3 Early 20th Century

In 1924, Walter Shewhart, with a background in physics, engineering and statistics began focusing on controlling the processes that went on in Bell laboratories and developed a statistical chart for the control of product variables (Yong & Wilkinson, 2002), in other words, he focused on making quality relevant not only for the final product but for the processes that created it (History of Quality, 2014). With the publishing of his book in 1931, *Economic Control of Quality of Manufactured Product*, Shewhart marked the beginning of a new era in statistical quality control (SQC) (History of Quality, 2014; Yong & Wilkinson, 2002). This endeavour by Shewhart was the first time a scientific approach was taken in the realm of quality (Yong & Wilkinson, 2002). The modern-day control chart is based on this foundation and is the analysis tool used in this study.

2.4 World War II

Parallel to this work, two additional colleagues at Bell laboratories were developing the practice of acceptance sampling, an important element in the growth of SQC (Yong & Wilkinson, 2002). Harry Romi and Harold Dodge proposed that checking a limited number of items in a production lot was much more efficient than checking every one. To state in a simplified manner, if the sample chosen did not pass inspection, then and only then would the entire lot be checked. These acceptance sampling techniques played a major role in the quality control used in the manufacturing of large volumes of ammunition during World War II (Yong & Wilkinson, 2002).

2.5 The move to management

By the 1950's a new contribution was added to statistical quality control (SQA) (Yong & Wilkinson, 2002) when Joseph Juran, also an engineer at Bell Laboratories, became involved in the subject of management (History of Quality, 2014). At the time companies believed that in order to improve quality, cost would be compromised. Juran, in his book *Quality Control Handbook,* brought a breakthrough in the managerial approach of the day and showed that expenditures on prevention were justified if they were lower than the cost of the product failures (Yong & Wilkinson, 2002).

It was at this time that Costs of Quality (COQ) was introduced, where Juran described the two aspects management needs to focus on: unavoidable and voidable costs. Prevention activities such as inspection, sampling and other quality control activities are unavoidable costs whereas defect and product failures such as break-fix, complaints, and recalls are avoidable costs (Yong & Wilkinson, 2002).

Feigenbaum also took it a step further in the subject of COQ by introducing Total Quality Control (TQC) (Yong & Wilkinson, 2002). Feigenbaum stressed the importance of including marketing, design, engineering, purchasing, manufacturing, inspection, and so on to create an effective system for quality development, quality maintenance, and quality improvement efforts (Feigenbaum, 1983 as cited in (Yong & Wilkinson, 2002).

It was also in the 1950's that Dr W Edwards Deming, a statistician with the U.S. Department of Agriculture and Census Bureau, and a proponent of Shewhart's SQC methods became a leader of the quality movement both in Japan and the United States (History of Quality, 2014). While in Japan, Dr Deming played a key role in introducing the quality philosophy to Japanese engineers in an 8-day lecture held in Tokyo (Yong & Wilkinson, 2002).

Through these and further efforts, Japanese industry rose to quality excellence and captured the world market within five years (History of Quality, 2014).

3 Review of quality improvement methodologies

Quality improvement has become a foundation of organizations today and various models, frameworks and methodologies can be found in the study of quality covering public and private sectors. The related methodologies discussed in this paper have been chosen for their relation to the Improvement model which is the theoretical framework used for this case study.

Methodologies that will be discussed in this chapter are Total Quality Management, Continuous Process Improvement, Six Sigma, Lean, Lean Six Sigma, Deming's system of profound knowledge, The Improvement Model Framework and the PDSA cycle.

3.1 Total Quality Management (TQM)

A means for qualitative evaluation of key factors for a total quality organization was developed by The European Foundation for Quality Management (EFQM) as a model that shows the interrelationship between people, processes and results. In other words, processes are the means by which an organization harnesses and releases the talents of its people to produce results (Cadle & Yeates, 2008) . Figure 8 shows how Customer Satisfaction (20%), People Satisfaction (9%) and Impact on Society (6%) are achieved through the Leadership drivers into the management of people, policy and strategy and resources. This will ultimately lead to a favourable impact to Business Results. The nine elements in this model are used to assess an organization's progress towards excellence. Authors Cadle & Yeates (2008) provide a relative value to each of the elements shown to give a quantitative assessment.

Enablers and Results each total 50%, and within these totals, the individual percentages reflect the importance of each element's contribution to the overall goal of business excellence within the criteria of Enabler or Results. Enablers focus on how the organization approaches each of the criterion parts. Information flow is vital regarding the excellence approach used and the extent of the deployment of the approach. The information flows through all level of the organization (vertically) and to all areas and activities (horizontally). The Results criteria focuses, through performance measures, what the organization has achieved or is achieving.

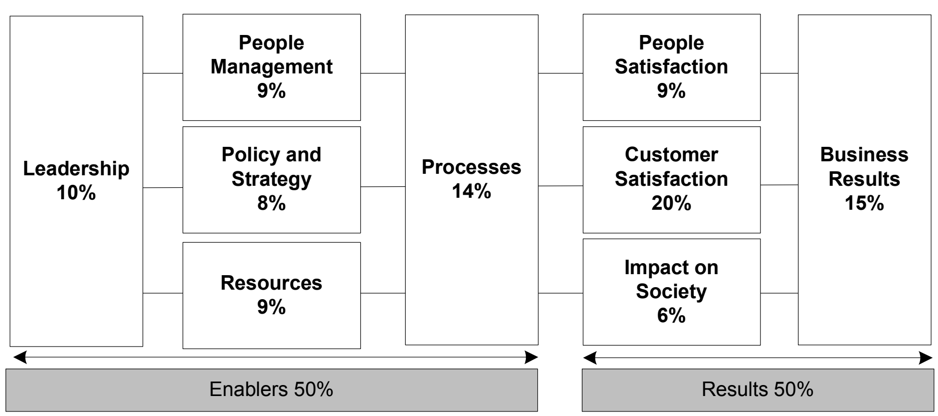

Figure 8: The business excellence model of EFQm (as adapted from (Cadle & Yeates, 2008))

3.2 Continuous Process Improvement (CQI & TQM)

As can be seen from the concepts presented at the introduction of this thesis, improvement and quality have been and are the focus of many organizations and can be found in every sector. Shaffie & Shabbaz (2012) write in their book, “”*Lean Six Sigma”* that no methodology (or framework) has staying power if there is no foundation and consensus on being committed to continuous improvements throughout the whole organization. In addition to dedication to improvement, the importance of managing information is just as important and go hand in hand.

Today’s business functions are interlinked with the presence of IT and information systems management and are vital in successfully aligning processes with business strategy (Shaw, 2013). In summary, having a specific framework may not be the ultimate goal, but having a standard roadmap on how to conduct improvement projects within one’s organization, is probably one of the most important facets of an organization today.

There is a vast body of knowledge on the concept of continuous improvement (CI), and process improvement is the key to keeping a quality product in production (McDermott & Sharp, 2008). *Kaizen*, developed by Masaaki Imai in his book, “*Kaizen: The Key to Japan’s Competitive Success*” describes 16 *Kaizen* management practices that can be applied in an organization. Continuous improvement also combines reengineering practices that stem from the first World Ward. Called, Chartered Quality Institute (CQI), the reengineering (CQI) and kaizen (TQM) communities have been brought together to form the general concept of process management as seen in Figure 9 (McDermott & Sharp, 2008).

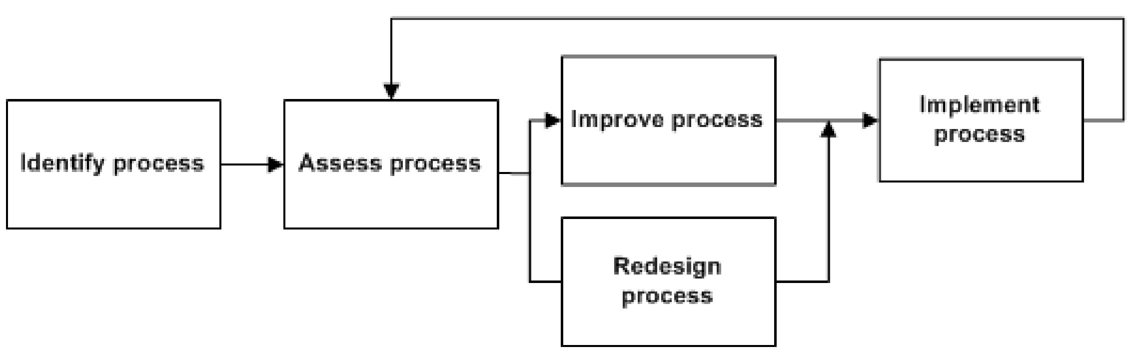

Figure 9: Merging Process Reengineering and Continuous Process Improvement (McDermott & Sharp, 2008)

3.3 Six Sigma

A familiar framework that is related to this research is Six Sigma. The hunt for a quality initiative that would be able to compete against Japanese companies using Total Quality Control (TQC) and Lean principles to improve manufacturing performance and design “customer-centric” products came to a head in the late 1970s, when many U.S.-based companies, leading manufacturers, began losing market share to overseas competitors (Shaffie & Shabbaz, 2012). A push toward a variation of TQC, Total Quality Management (TQM) became the main quality methodology to overtake U.S. firms. Six Sigma, began gaining ground in the 1990’s, with a solid endorsement from Jack Welch, CEO of General Electric at the time.

Fast forward to today and one can see Six Sigma in all major segments; financial services, healthcare, defence, government, and manufacturing. Six Sigma, as defined by Shaffie & Shabbaz (2012), is a statistical problem-solving methodology and a management philosophy, on that dictates that business and process decisions should be based on data. The Six Sigma methodology contains 5 phases, known as DMAIC; ***Define*** the problem, goal, or benefit, ***Measure*** how the current process is doing and collect data, ***Analyse*** the cause of the issue, ***Improve*** the process to troubleshoot and solve issues, and ***Control*** the process of improvement creating continuity and sustainability (Figure 10).

Critical in areas such as the service sector, the fundamental goal in the Six Sigma methodology is to reduce operational variance by improving the quality and performance; an ode to Walter Shewhart’s breakthrough work in the 1920’s making quality relevant not only for the final product but for the processes that created it (History of Quality, 2014).

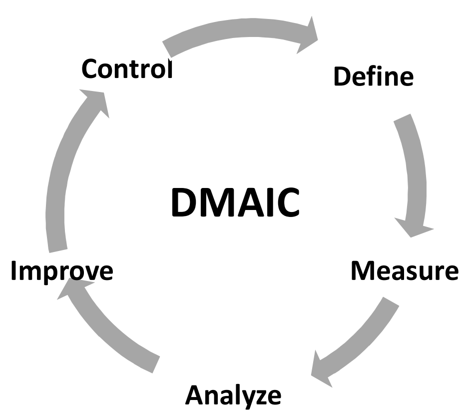

Figure 10: Six Sigma. DMAIC Cycle (Shaffie & Shabbaz, 2012)

The Six Sigma methodology provides a roadmap to identify hidden factors that can cause the organization money, opportunities and customers. Key deliverables that Six Sigma can provide, if applied at optimal level are improved service reliability, which is consistency of delivering high quality service the first time, improved responsiveness to customer needs, improved assurance that the customer's trust in the product or service can be upheld and reduced expenses by improving the effectiveness and accuracy of the organization's processes and lastly increased revenue by understanding how and when to deliver customer specifications at the right price (Shaffie & Shabbaz, 2012).

3.4 Lean

The Lean methodology focuses on improving value from the customer's point of view by shortening the timeline between the customer request and the delivery of the service, through the reduction of waste of time and resources. The basic steps an organization has to follow to implement Lean is to understand customer's needs and wants and develop a value stream to determine the steps, and discover where value is added and waste is produced.

Shaffie & Shabbaz (2012) define waste as any activity that adds time and cost but shows no improvement in the form of fit, form or function of the service or product delivered and undermines the value from the customer's point of view. Figure 11 describes the seven types of waste that is identified in the Lean methodology; defects, waiting, overproduction, unnecessary transportation, inventory, over processing, and motion.

Type of Waste	Description
Defects	Any nonconformance that leads to redoing. Reworking, recontacting, or reviewing.
Waiting	Any time during which work is not being performed on the customer request.
Overproduction	Producing more than required or more than a process step has the capacity to handle, resulting in the building of inventory.
Unnecessary transportation	Movement of files, data, or customer requests. With every movement, there is a risk of loss or delays in processing.
Inventory	Work in process, representing unrecognized potential revenue.
Overprocessing	Doing more than is required from a customer's perspective.
Motion	Movement to transport information or data. An example is extra steps taken by employees to accommodate an inefficient

Figure 11: The Seven Types of Waste (adapted after Shaffie)

3.5 Lean Six Sigma

The principles that are known today as Lean and Six Sigma have merged over the years. Six Sigma offers a method to go into in-depth problem solving while Lean focuses on quickly and efficiently improving processes by removing waste. By reducing variation through the enhancement of quality and accuracy of processes, Six Sigma provides a very structured approach not found in Lean. However when combining these two principles the root cause of various different business challenges can be addressed and work well together to provide a toolkit to the various tasks presented in obtaining the best results in an organization, whether it is to identify redundant processes or improve the quality in a product or service offered (Shaffie & Shabbaz, 2012).

A successful implementation of lean Six Sigma follows the path shown in Figure 12. In the rollout of a Lean Six Sigma effort it is vital for the Quality leader to align efforts with the organization's mission in the initial phase by promoting four milestones (Figure 12). Important to this first phase is the building of an infrastructure that promotes quality in the *Strategy that is developed*. The next milestone is to *create awareness* concerning the initiative by formulating a communication plan. The third milestone is the *Culture rollout* where the organization is shown what can be expected if it moves into the Lean Six Sigma path. The final milestone is to *institutionalize* the initiative to ensure that all projects are conducted under the Lean Six Sigma framework (Shaffie & Shabbaz, 2012).

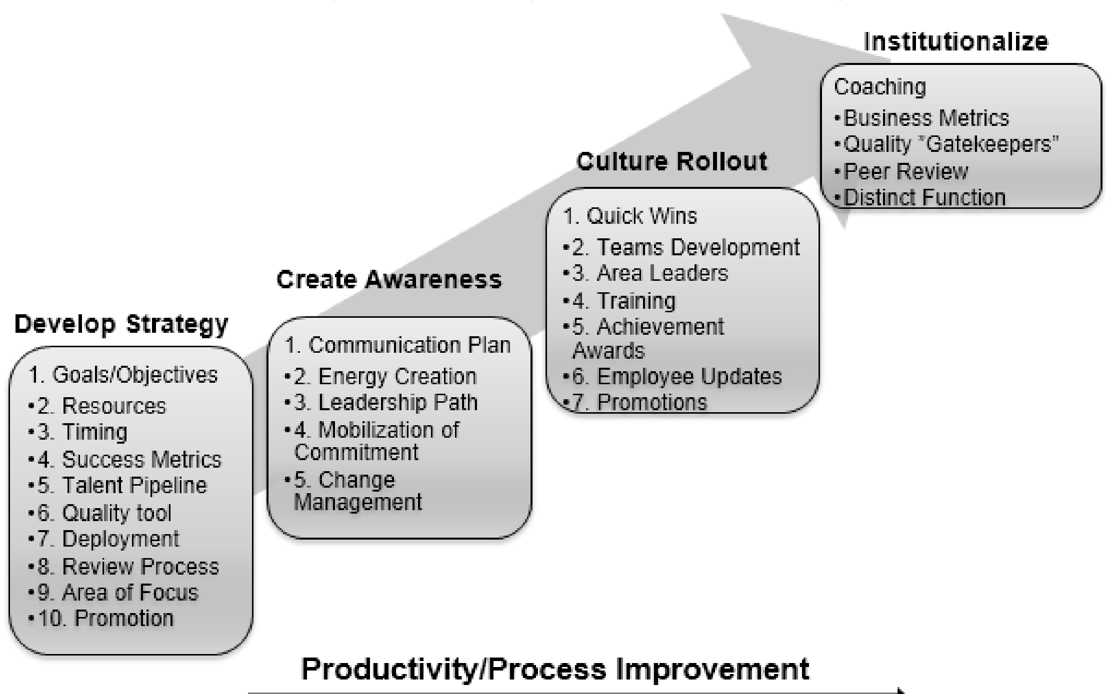

Figure 12 Lean Six Sigma Implementation, adapted (Shaffie & Shabbaz, 2012)

3.6 Deming’s System of Profound Knowledge (SoPK)

Dr. W. Edwards Deming, the father of quality, culminates his lifelong work into the System of Profound Knowledge (SoPK) a framework of thought and action to be used for the purpose of transforming and creating a thriving organization, with the aim for everybody to win (Deming Institute, 2015).

The Deming institute (2015) states that by applying the principles and practices of SoPK, a business can simultaneously reduce costs through reducing waste, rework, staff turnover and possible legal liabilities, while increasing profitability, customer loyalty, work satisfaction, and, ultimately quality.

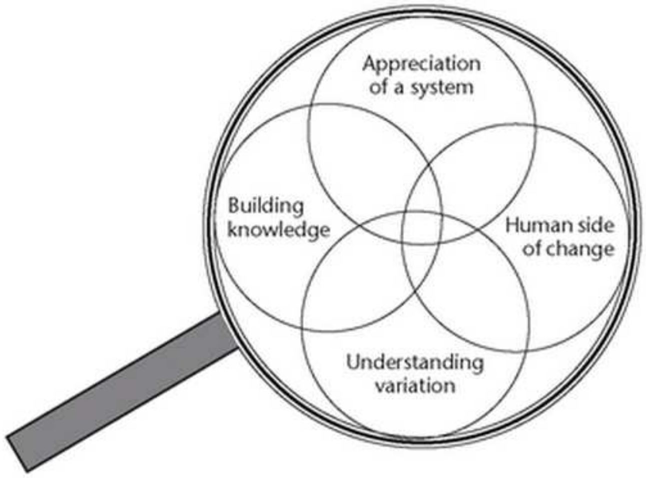

Figure 13: W. Edward Deming's System of Profound Knowledge (as cited in (Langley et al., 2009; Perla et al., 2013).

The System of Profound Knowledge is composed of the following four interrelated parts as seen in Figure 13 (Perla et al., 2013):

Appreciation of a system	***Understanding variation***	***Building knowledge***	***Human side of change***
A focus on how the parts of a process relate to one another to create a system with a specific aim.	*A distinction between variation that is an inherent part of the process and variation that is not typically part of the process or cause system.*	*A concern for how people's view of what meaningful knowledge is impacts their learning and decision making (epistemology), using the **PDSA** cycle*	*Understanding how the interpersonal and social structure impact performance of a system or process.*

In order to define the concept of improvement within Deming's System of Profound Knowledge, two ideas were presented by Langley et al., (Perla et al., 2013). Firstly, by developing, testing, and implementing changes, improvement can be achieved. Creation of feedback or learning loops to gauge the impact of these changes allows for measurement to play a key role over time in order to take into account the varying conditions of the environment in question. Another important point and one that is the core foundation of this study relates to how the solution matter expert (SME) plays a lead role in the changes that are being developed, establishing conditions for testing that increase the general consensus that the selected changes to be applied, will in the end lead to improvement of the process itself (Perla et al., 2013).

Within the theory of knowledge, (one of the four parts described above in the System of profound knowledge, Figure 13), Deming wanted to push the importance of attaining knowledge by developing what is known today as the plan-do-study-act cycle (PDSA). This was originally introduced to Deming by Walter Shewhart. Deming wanted to show a systematic and dynamic process introducing not only theory but applied science as well to yield valuable information that has the potential to be used for continual development of a process or product (Deming Institute, 2015).

The Associates in Process Improvement (API) took this one step further by developing the **Improvement Model Framework** through the joining of the PDSA cycle with three fundamental questions, and will be described in the next section. The Associates in Process Improvement (API) helps organizations improve their products and service by developing methods and working with leaders and teams to provide education and training to build their capability for on-going improvement.

3.7 The Improvement Model Framework (IMF)

The Improvement Model Framework is described as being a model based on questions that are answered when applying the Plan-Do-Study-Act cycle. The questions posed concern the goal, intervention, and result of improvement. From a leadership perspective it is important to familiarize oneself with improvement theories, as leaders of organizations often must be the driving force behind innovation and enhancement of every aspect within business operation. As stated earlier, this framework stems from Deming's system of profound knowledge and is used to fulfil the requirements of one of the four interrelated components in SoPK, **building knowledge** (Figure 14). This component provides a broader and more in depth view of the potential positive and negative factors at play that could possibly affect efforts for improvement.

Developed by the Associates in Process improvement (API), *The Improvement Model Framework* presents three questions in the quest for improvement. The three questions are shown in Figure 14 and are, **Aim**: *What are we trying to accomplish?* **Measure**: *How will we know that the change is an improvement?* And **Change**: *What changes can we make that will result in improvement?* This framework is a methodology based on trial-and-learning and provides an efficient and quick to grasp aid in initiating improvement in virtually any environment.

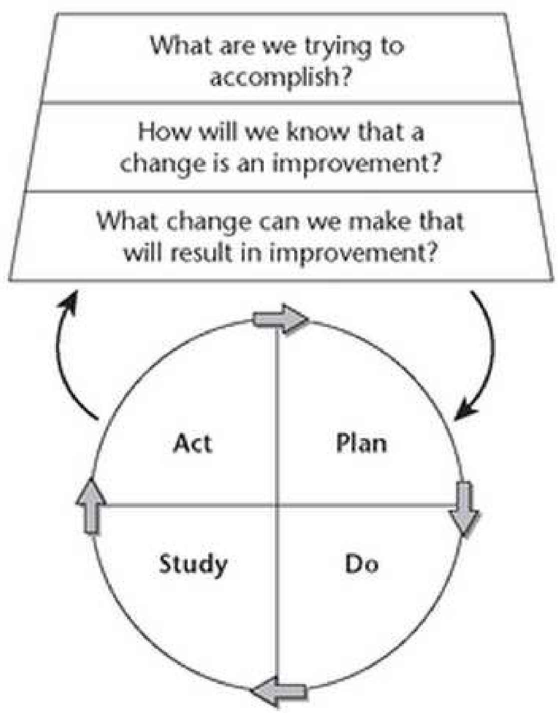

Figure 14: *The Improvement Model Framework* developed by API.

Walter Shewhart was the originator of this four-phase (PDSA) process and Dr. Walter Deming created a mainstream approach by implementing what is also known as the “Shewhart's cycle” (Deming Institute, 2015). This framework is used as the foundation for this thesis as it allows for changes to be tested relatively quickly instead of launching a large-scale planning initiative that could easy take several months before any action is taken.

To answer the **Aim**, **Measure**, and **Change** questions, the phases of *Plan, Do, Study*, and *Act* (PDSA) are included as a cycle in order to implement the change and determine if there has been a desired effect (Langley et al., 2009).

This framework is best applied with the formation of a team where each member has an important role in getting the change to happen in a complex system. With the question, *what are we trying to accomplish? ,* the aim is determined. The aim should be time-specific and measurable. Secondly, to answer, *how will we know that a change is an improvement?* , measures need to be established to obtain the outcome measures of the current state. Thirdly, *to identify what changes can be made that would result in improvement?* , a review of the current process needs to be made to see what improvement suggestions can be brought forward to be tested (IHI, 2015).

Once these three questions are answered, the next step is to begin the PDSA cycle, as shown in figure 14. The changes suggested in the third (**Change)** question along with the specific measures used as a benchmark in question two (**Measure**) can be applied and monitored to determine if the changes result in the accomplishment of question one (**Aim**), that is, the improvement goals set out in the beginning of the improvement project.

The PDSA cycle is ongoing as shown by the 2 arrows in Figure 14. Continual improvement is a constant effort, and once the aim is achieved, the next phase can begin with further improvement ideas based on the latest improvement efforts.

3.7.1 PDSA form - template

The PDSA form located in *Appendix 2* is a document adapted from the Institute for Healthcare Improvement (IHI) to carry you through the four phases of the lifecycle of an improvement project. During the ***innovation phase***, one can think about what changes are needed and could be tested. The ***pilot phase*** allows for the change to be tested on a small scale through the PDSA cycle and accompanying form in order to build knowledge. When the change is ready to be implemented the PDSA form can also be used to make the change the new standard process in one defined setting by hardwiring the steps to take to prevent backsliding into the old way of doing things (***implementation phase***). The final phase in the lifecycle of an improvement project is the ***spread phase*** and can also be documented in the PDSA form. This phase allows the change to be implemented into several settings, widely sharing this innovation across a vast network (IHI, 2015). The PDSA form (found in Appendix 2) would be applicable in all four phases and are described as such:

1. **Document information**
    i. Project information (title, ID, cycle #, start date, end date)
    ii. Objectives of this cycle (test, implement, or spread a change)
2. **Plan**
    a. What change will be tested or implemented?
    b. How will the change be tested or implementation be conducted?
    c. Who will run the test or implementation?
    d. Where will the test or implementation take place?
    e. When will the test or implementation take place?
    f. Predictions (unlimited)

    Data collection plan:

    g. What information is important to collect?
    h. Why is it important?
    i. Who will collect the data?
    j. Who will analyse the data prior to the study?
    k. Where will data be collected?
    l. When will the collection of data take place?
    m. How will the data (measures or observations) be collected?

3. **Do**
    n. Observations:
    o. Record observations not part of the plan:
    p. Did you need to tweak the original plan?
    q. Begin analysis of data (graph of data, pictures):
4. **Study**
    r. Comparison of questions, predictions and analysis of data
    s. Learnings
5. **Act**
    t. Describe next PDSA cycle
    (Based on the learning in “Study”, what is your next test?)

3.8 SoPK & IMF as a scientific tool for study

There is unquestionable doubt that the work done by Dr. Edward Deming and his colleagues have had a profound effect on the many quality improvement frameworks alive today. The foundation of this paper is to use **Deming's system of profound knowledge (SoPK)** described in Chapter 3.1 and the **Improvement Model Framework (IMF)** described in Chapter 3.2 to show how a change was documented and measured in order to bring about improvement in my organization.

In order to show that the System of Profound knowledge (SoPK) can be used as a scientific tool to implement, measure, and assess a change, **seven propositions** are presented to support SoPK as well as present the full cycle of how improvement can be achieved.

The figure below shows how the implementation of the seven propositions with the addition of SoPK (the **Improvement Model Framework** falls within this segment, and how it has been applied is explained in Chapter 5) can be applied to determine which improvement methods and tools, along with subject-matter knowledge, should be chosen as a support for innovation, testing, implementation, and spread of yielded improvement (Figure 15).

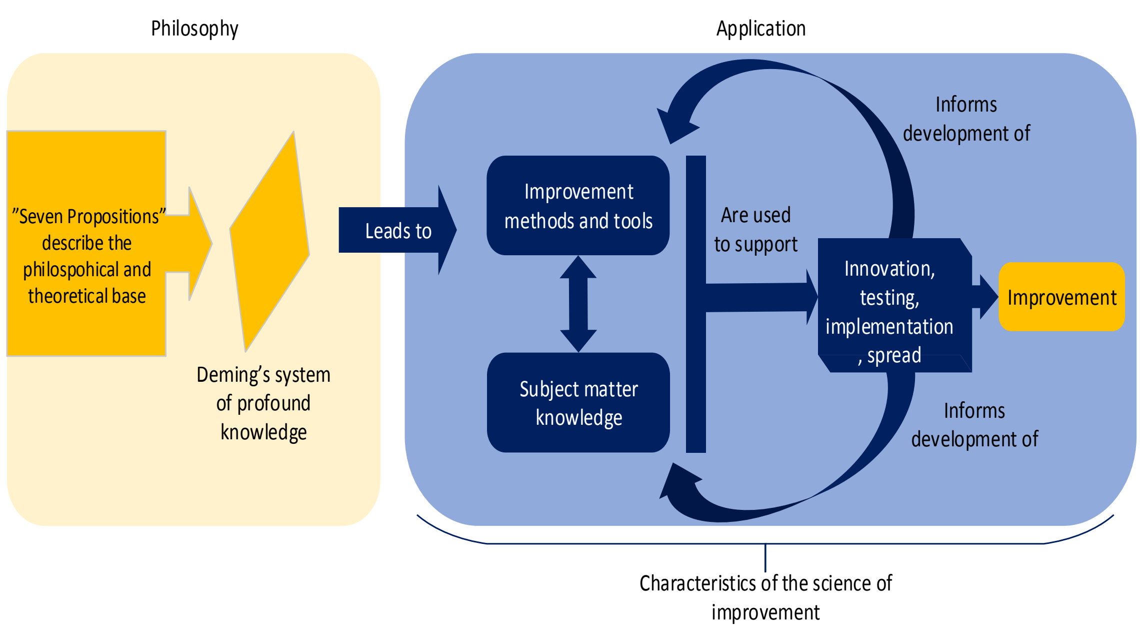

Figure 15 The science of improvement. Adapted (Parry, 2014)

Perla et al., (2013) write that it is the solution matter experts (SMEs) that are the closest to the problems and hence the most effective due to experience, knowledge and intuition to framing the change ideas in a scientific and test worthy fashion (Perla, Provost, & Parry, 2013). Effective changes, as stated by Perla et al., must be informed by SMEs -but to be most effective, these insights must be framed scientifically and tested.

Framing the change ideas suggested by SMEs using a scientific approach in a real world context is the essence of the science of improvement and will maximize learning about the ideas. Recognizing that testing ideas is the key to science, one can begin to understand that the problems encountered in various fields may be different and vary in complexity, but that all meaningful solutions must pass through a testing and learning phase (Perla et al., 2013).

3.8.1 Seven propositions supporting SoPK

Perla et al., (2013) discusses seven propositions giving Deming's System of Profound Knowledge a scientific foundation. If applied, these propositions could yield stronger improvement programs.

3.8.1.3 Testing and learning cycles

The first proposition, *The science of improvement is grounded in testing and learning cycles,* justifies the use of the Plan-Do-Study-Act (PDSA) cycle which is used in this case study. In this cycle, a hypothesis is established in the form of a prediction or aim (Plan), an analysis (Study) is done to determine if the prediction or aim is correct or achievable, and whether the results are correct or not, it can be brought forward as the basis of the next PDSA cycle (Act).

3.8.1.4 Conceptualistic proposition

The second proposition, *the philosophical foundation of the science of improvement is conceptualistic pragmatism,* emphasized the importance of prior knowledge obtained and supports the use of the Shewhart control chart methodology to bring about improvement methods. Perla et.al. (2013) define conceptualism as observations informed by past experiences. The past experiences in turn form the basis for future scenarios (pragmatism) that may be acted upon. This proposition underlines the importance of allowing these theories from past experiences to be applied in the form of change concepts in the future.

3.8.1.5 Psychology and logic

The third proposition, *the science of improvement embraces a combination of psychology and logic (i.e., a weak form of "psychologim")* emphasizes the importance of understanding a problem through different perspectives. Understanding the psychology of change and the necessity for creativity, innovation and problem solving to champion the improvement movement.

3.8.1.6 Justification and discovery

The science of improvement considers the contexts of justification and discovery, the fourth proposition, discusses how important it is to keep a balance between being rational and scientifically based, the "justification" phase of the work, and being creative and discovering, fulfilling the "discovery" phase of the work. Emphasizing one phase over the other can stifle possible leads to discovery or lose sight of data and measurement. The PDSA cycle serves as a good medium for this proposition as there is no set way in undergoing a PDSA cycle and the continuity process, in fact, each iteration provides the map for the next cycle.

3.8.1.7 Operational definitions

The fifth proposition is *the science of improvement requires the use of operational definitions* stresses the importance of having a common vocabulary for improvers. The aim or goal of an improvement project may be lost in translation if there is no shared meaning and understanding of concepts, ideas, goals, and measures. Deming writes in his book, "*Out of the Crisis*", the following; *"An operational definition puts communicable meaning into a concept. Adjectives like good, reliable, uniform, round, tired, safe, unsafe, unemployed have no communicable meaning until they are expressed in operational terms, of sampling, test and criterion. The concept of a definition is ineffable: It cannot be communicated to someone else."* (Deming, 2000 as cited in Perla et. al, 2013).

3.8.1.8 Shewhart's theory of cause systems

The sixth proposition, "*The science of improvement employs Shewhart's theory of cause systems*" states that in order to understand variation, one must be familiar with tools that Shewhart has provided to understand whether a process is stable or not. Shewhart's control chart can inform an improvement project team on whether the changes that are being applied is actually leading to an improvement or in fact increasing variation and leading down a road of poorer performance. Random variation is normal within certain chance-cause systems and it is important to distinguish between the two.

3.8.1.9 Systems theory

The last proposition, *Systems theory directly informs the science of improvement* is based on *Deming's "Appreciation for a System"* where understanding how all the parts fit together in a process or organization is vital to understand in order to lead improvement. Appendices 4 and 5 provide cross-functional diagrams on the processes occurring with the case study project **before** *(Appendix 4)* and **after** *(Appendix 5)* process changes. Figure 15 provides a visual description of how the seven propositions when combined can lead to innovation and improvement of the process.

4 Research design

The study design, theoretical framework and data collection are based on case study research. The following will discuss each area and is the foundation for the case study presented in this thesis.

4.1 Embedded single case design – mixed methods approach

This study uses case study research which is valuable when there is an unstructured environment and the theory base is not robust (Partington, 2002). Within case study research, an embedded single-case design is the approach taken and focuses on multiple units of analysis (Honggen, 2010). An embedded single case design uses multiple units of analysis in the course of an enquiry and helps to achieve an in-depth understanding of what is happening in the study. Yin, (as cited in (Honggen, 2010)) however, cautions against the potential to shift in focus and/or nature of the study in the process of implementing this type of study.

It is also important to determine how to implement the inductive and deductive approach. Inductive enquiry moves from observation to the development of general hypothesis, while deductive research uses general statements derived from a priori logic to explain particular instances. Both approaches can be used when doing an empirical research and describes in the following figure (16) how to conduct empirical research (Partington, 2002)

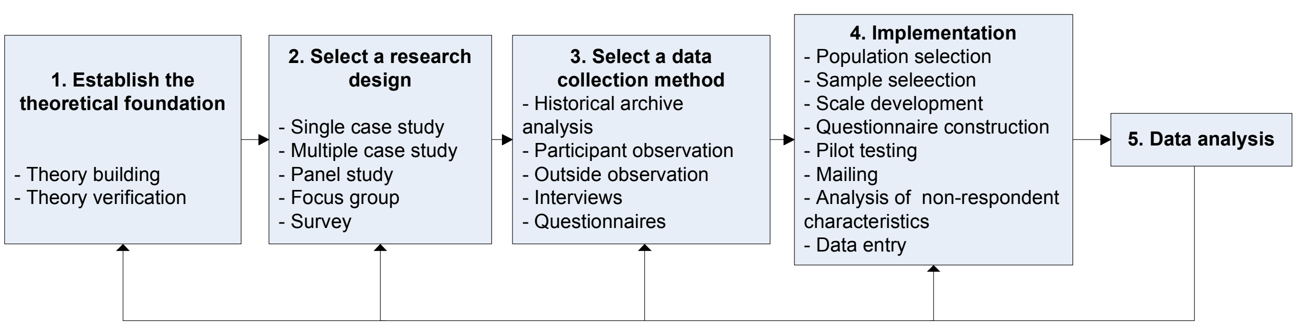

Figure 16: A systematic approach for empirical research (Partington, 2002)

There is a seven-stage process (described in Figure 16) where one begins by selecting a theory-building or theory-testing foundation. The empirical research design is selected at stage 2 and appropriate data collection method(s) to compliment the research design are determined at stage 3. The research is defined at stage 4 and lastly at stage 5, the data analysed.

Feedback loops have been added to interconnect stages 1 to 5 (Partington, 2002). The units of analysis used in this case study research is the content derived during the improvement phase of this project. The content is described to be weekly operational dashboards and action lists where the project team, local stakeholders, and the service providers were present and provided either feedback or issues to topics raised during the sessions.

4.2 Data collection

4.2.1 Semi-structured end user feedback survey

A semi-structured feedback survey was used as well as an analysis of both a closed and open end user questionnaire of a sample population. This questionnaire was sent in the form of a webpropol based feedback survey which sought information regarding the windows 7 deployment experience from the perspective of the end user, covering the preparation phase and the post-deployment phase (Appendix **I**). The windows 7 deployment feedback survey was sent in the form of a URL link within an automated Microsoft Outlook email message and used with an MS SharePoint 2010 developed scheduling tool system.

4.2.2 Data collection from internal project documentation

Data collection of project documentation consisted of all reports related to the project as well as the improved documentation containing status updates and action lists.

4.2.3 Reports from external third party vendors

The daily and weekly reports given by the service providers were also collected to measure and determine benchmarks for this study.

5 Applying the Improvement Model Framework

The framework used for this quality improvement project was *The Improvement Model Framework* described earlier in Figure 14. By applying *The Improvement Model Framework*, PDSA forms were completed for each test and implementation of each cycle. An example is shown in the next section. By regaining the buy-in of local stakeholders in order to re-launch Windows 7 deployments, the aims were to reach a target of 2000 deployments per month, and raise end user satisfaction levels by 5%.

5.1 PDSA form - completed

A PDSA form was completed when running a PDSA cycle, shown in Appendix 3. The first cycle is logged beginning in September of 2013 and ending in December of 2013. The change to be tested was the introduction of various actions to get face-to-face time with local country management to restore buy-in in order to proceed with the Windows 7 deployment project on a large-scale. The change was tested (and later implemented) by restructuring the weekly sessions with the local stakeholders/country management and improving the project documentation. The improvement project team leader, which was the author, monitored the test and later implementation of the change. The change was tested and implemented in the weekly call session with the local country management, averaging between 5 and 15 calls per week.

Based on studying feedback from the local stakeholders and end users experiencing difficulties during the deployment of Window 7, various changes to the process were introduces. As these changes were based on studied material, our predictions were as follows:

- Permission from the local country management to rollout in larger numbers will be given (through incremental increases of pilots)
- Increase in deployment numbers would occur compared to the current level of deployments
- A rise in customer satisfaction would occur when comparing to the current customer satisfaction (CSAT) average

The data collection plan to be followed included the gathering of the improved documentation which consisted of the weekly operational dashboard reporting, action points, concerns, and to-do's. Also, customer satisfaction surveys were collected via the scheduling tool along with the service provider's daily log regarding deployments done that day. The most important aspect of the data collection was the weekly operation dashboards and action lists as that was where the level of trust gained from local country management could be gauged. The project team leader collected the data. There were also automated systems that collected the survey results.

The analysis of the data was conducted by the project team leader and the internal solution matter expert. The system of use to store the data was MS SharePoint 2010 and was collected on a monthly basis with a final tally in December of 2013. The restructured weekly sessions and improved documentation allows for the local country management to focus on concerns that would otherwise not be brought up.

The realignment of resources was not part of the plan and signified a freeze in the data collection for a period of 3 months. No tweaking was done to the original plan, however instructions were added in order to train the new recruit of the changes. With the introduction of the restructured weekly sessions along with the improved documentation, there was more dialogue with the local country management and allowed for pilots to be undertaken despite the previous halt in deployments.

After the pilots were performed to the satisfaction of the local country management, larger-scale rollouts could be performed. With the implementation of the new weekly session, if any issues or escalations came up, the stakeholders could address them quickly and efficiently with the virtually-live presence of the service provider within each weekly call. As there were more deployments, there was the possibility to distribute more feedback surveys.

Though still to be determined, there seemed to be an increase in the satisfaction levels of the end-users. The next implementation would be to employ a new recruit to apply these changes to more countries in order to increase deployment numbers and obtain getter end-user satisfaction results.

5.2 Project lifecycle timeline

5.2.1 K5 milestone – permission to rollout

The timeline in Figure 17 displays the main events of the project as well as notes where the PDSA cycles were implement. The timeline of this project covers only the scope of this study. Hence, though the project began in early of 2012, for the purposes of this paper, the timeline shows the project lifecycle beginning in January of 2013. As described earlier (please see case overview in Ch.1.6 for specific dates), the model used in the organization provides path which leads a project from an idea through different phases and stages in the project (K0 – K6). By passing the standardized decision points, gates, the aim is to ensure that the project fulfils the quality criteria and develops to a profitable business for the company.

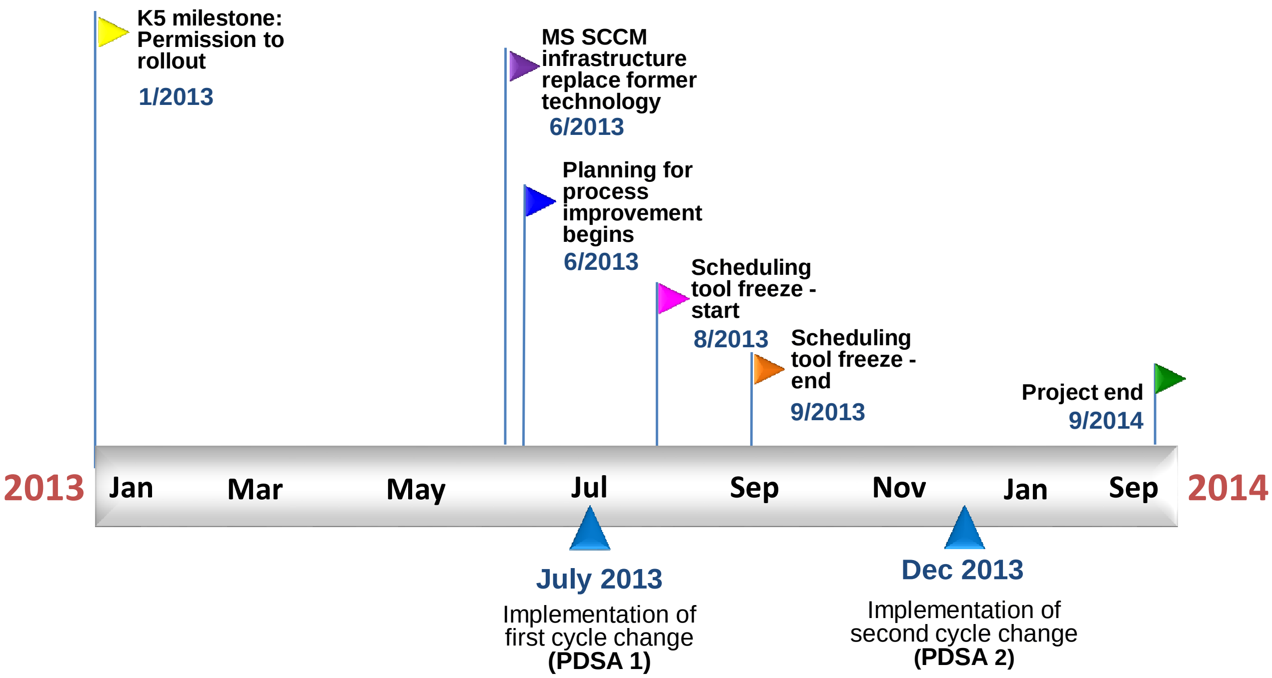

Figure 17 timeline of changes

The project reached K5 milestone (permission to rollout) in January of 2013 and during the summer months, the Microsoft System Centre Configuration Manager (SCCM) client (terminology found in Ch.1) was implemented as the chosen operating and application distribution management tool, a replacement to the former Mirage technology that was initially used. This client allows the control and distribution of the Microsoft Windows 7 image deployment and all necessary applications onto the user's machine via a distribution point (DP) a term from Microsoft to define hub where applications are distributed. This is done with minimum impact to the network and within the agreed amount of time.

5.2.2 PDSA 1 cycle – testing of new process

Based on studying the ***people-process**, **people-people***, ***process-process***, and ***internal-external* multiplicities** (see Chapter 1.1.2.2 for descriptions) targets aimed for improvement fell under the following mitigation strategies:

- A **gatekeeper** was appointed
  - ~ Reorganization of the client and service provider approach by creating a face to face platform in order to address issues related to the risks found in the people-people and people-process multiplicities. During the PDSA 1 cycle, the author was appointed to be gatekeeper
- Delegated tasks to **local champions**
  - ~ Accountability was created. There was immediate awareness of changes and their potential impact on project outcomes. Adaptation to unique needs at the local sites was facilitated during the PDSA 1 cycle. Local country managers/ local stakeholders, took on the role of local champions.

Appendix 5 shows the new process that occurred in the project. By July of 2013 a new approach in the form of a restructured weekly session and improved documentation was implemented. The development of this approach was based on improving lowered end user satisfaction due to unsatisfactory deployment experiences as well as the diminished buy-in from the local stakeholders. The change that occurred in this initial PDSA cycle was to create the opportunity to involve the local stakeholders, not only with the project team itself but with the technical project manager from the side of the service provider as well as an internal solution matter expert (SME) that had long-standing experience with applications and OS deployment within the organization. Appendix 5 shows a cross-functional diagram of the **new** process tested and implemented between June 2013 and September 2014.

Prior to this change user selection and issue resolution was performed centrally and was represented by the Windows 7 deployment project team and the service provider. Appendix 4 shows a cross-functional diagram of the process **prior** to any changes. The Windows 7 deployment project team would determine the selected users based on feedback by the local country stakeholders. This list would be prepared with prerequisites for deployment readiness and the interaction was limited to the project team and the service provider.

Interaction with the service provider by the either the end user or the local stakeholder would only occur if there were any issues post-deployment, essentially a phase where it would be too late to prevent any issues that may have been avoided if there had been interaction with the local stakeholder, and due to his/her in-depth knowledge of the local environment and the users themselves would have been able to avert the issue.

5.2.3 PDSA 2 cycle – new recruit & more regions

The second PDSA cycle was set into place after implementation of the changes made in the first cycle were established. The second change came about as an enhancement and involved creating consistency across all regions as a third mitigation strategy where:

- A **centralized resource directory** was implemented
  - ~ Consistency was essential when determining which approach would best fit an emerging requirement. Implementing a centralized resource directory allowed the ability to correctly allocate resources on short notice across globally distributed business units based on available competencies. An additional recruit was hired to help keep the consistency in place in the additional regions.

A new recruit came on board to cover more regions in December of 2013 and we were able to implement the second cycle, PDSA 2 of the improvement project (as seen in Figure 18). The project member was trained according to the new implementation and given the restructured operational dashboards and updated documents to proceed with the rollouts in the specified regions:

Team member 1	Team Member 2	Team member 3 (new recruit)
Scandinavia Central North Europe	West South Europe North America	Asia Pacific Middle East

Figure 18: Allocation of regions across the project team.

5.2.4 End of the project

The end of Windows 7 deployment project lifecycle took place on September 30, 2014 (K6 milestone). After this date, deployments did continue but are not considered within the scope of this study. The following KPI's at the closing of the project are shown in Figure 19.

Windows 7 & Office 2010 Project

KPI	Original	Closing (%)	Closing (amount)
Total number of devices	100 %	100 %	21,300
Number of XP devices	100 %	5 %	1,065
Number of WIN7 devices	0 %	95 %	20,230
As of Sep 2014: Number of XP Devices	n/a	8,8 %	1,878
As of Sep 2014: Number of WIN7 devices	n/a	**91,2 %**	**19,417**

Figure 19: Key Performance Indicators (KPIs)
Windows 7 & Office 2010 deployment project

6 Findings from data collection

6.1 Deployments over project lifecycle

In order to make an assessment on the outcome of the test change, a run chart was created to plot down windows 7 deployments per month before, during, and after the PDSA cycles. By annotating these events a clear picture can be achieved to determine whether any improvement has been made. The aim, or overall goal of this improvement project was to reach or exceed 2000 deployments per month as stipulated by the initial project charter at the start of the project's lifecycle. The planning of the change began in June of 2013 and the first PDSA implementation began in July of 2013. Clearance was given to resume a full-scale rollout by September of 2013 and the goal of deploying windows 7 to 2000 or more machines per month was set in place to be reached by December of 2013.

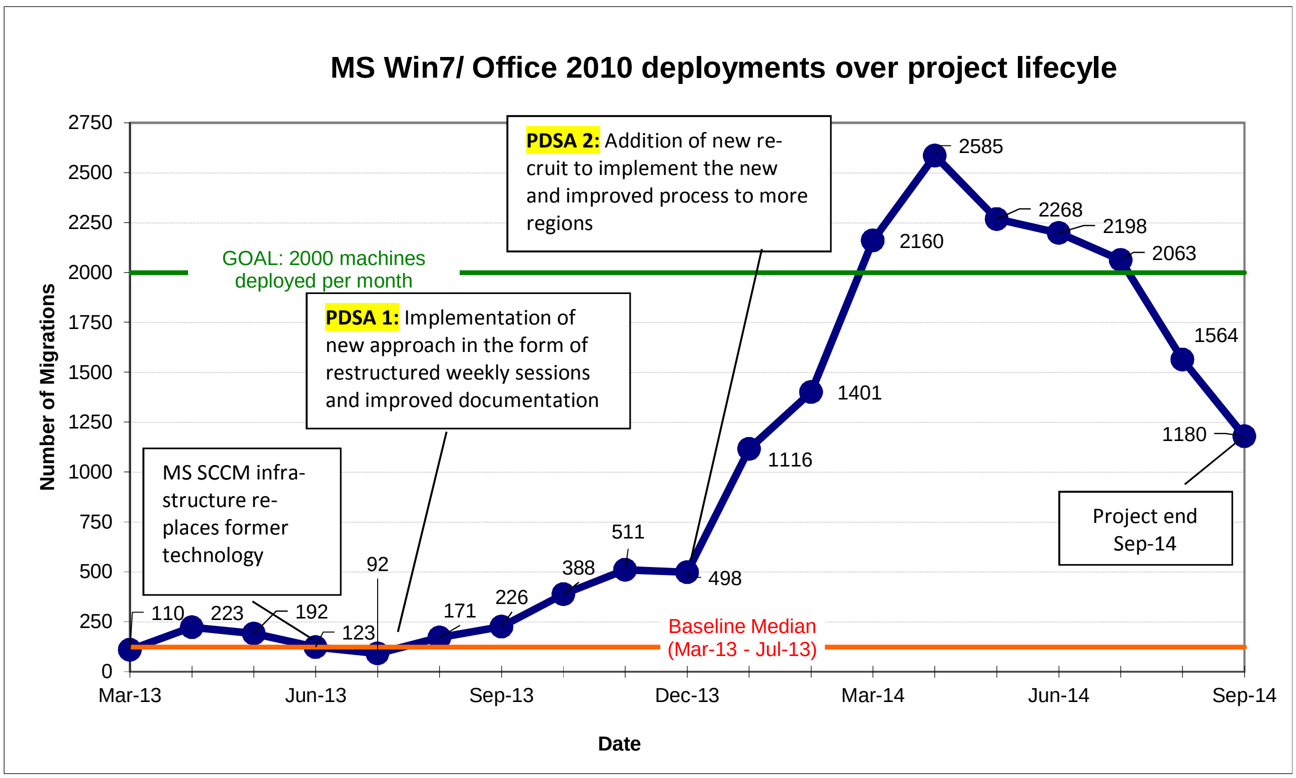

Figure 20 Windows 7 deployments over project lifecycle

6.1.1 Data plotted across 19 months

A set of 19 data points were used to portray the value of deployments that have been performed from March 2013 thru September 2014. To determine whether this change led to an improvement and the attainment of the specified goal, a baseline median is determined and placed across the chart. This forms the basis of the comparison.

The baseline is calculated by selecting the median in a set of values that are collected before the test of change. In this case the end median fell on July 2013 when the full-scale rollout was restarted after the end of a mandatory three month freeze of all activities due to project restructuring.

A run chart was then created based on the above mentioned dataset to determine if the PDSA cycles led to an improvement and whether the goal was reached; that is, with the implementation of the changes did the monthly number of deployments reach or exceed 2000 assets per month? Figure 20 shows the run chart with the monthly windows 7 deployments across the project lifecycle.

6.2 Deployment feedback survey Feb 2013 – Feb 2014

In order to assess how these PDSA changes affected end user satisfaction throughout the project life cycle, a run chart was created based on the results of the Windows 7 deployment feedback survey. The survey went through two iterations in order to have a better understanding on where the need for improvements lay. The first iteration, *migration survey Feb 2013 – Feb 2014* received 236 completed surveys. The second iteration, *migration survey Feb 2014 – Sep 2014*, received 608 completed surveys (Figures 21 & 22).

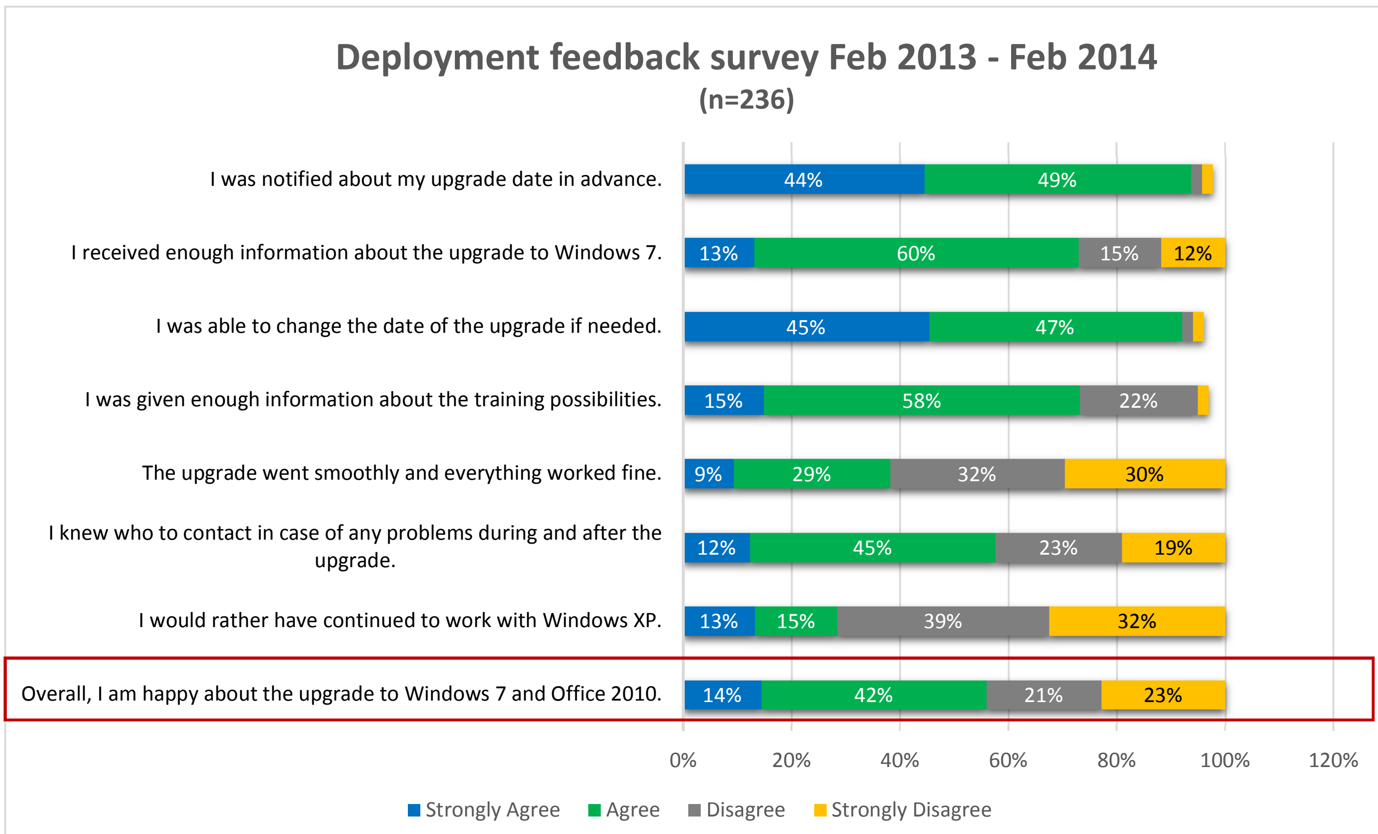

Figure 21: Deployment feedback survey Feb 2013 – Feb 2014 (n=236)

The first iteration of questions were delivered to the user post deployment between the months of February 2013 thru February 2014 (Figure 21) with 236 respondents. In order to gauge if the PSDA changes affected the end user satisfaction, the study only focused on the statement***, "Overall, I am happy about the upgrade to Windows 7 and Office 2010"(Q9),*** as this question was retained in the second iteration of the feedback survey.

In the first iteration 100 respondents out of the 236 surveys chose "Disagree", or "Strongly Disagree" to the Q9 statement. In summary, looking at the overall deployment experience, 42% of the total respondents were not happy with the upgrade process to Windows 7 and office 2010 during this time period.

6.3 Deployment feedback survey Feb 2014 – Sep 2014

The second iteration of questions was delivered to the user, post deployment, between the months of February 2014 thru September 2014. In the second iteration 608 respondents replied to the survey (Figure 22). Regarding the statement, ***"Overall, I am happy about the upgrade to Windows 7 and Office 2010"(Q9),*** 184 respondents marked that they either "Disagree", or "Strongly Disagree" with statement Q9. In summary, looking at the overall deployment experience, 30% of the total respondents were not happy with the upgrade process to Windows 7 and office 2010 during this time period.

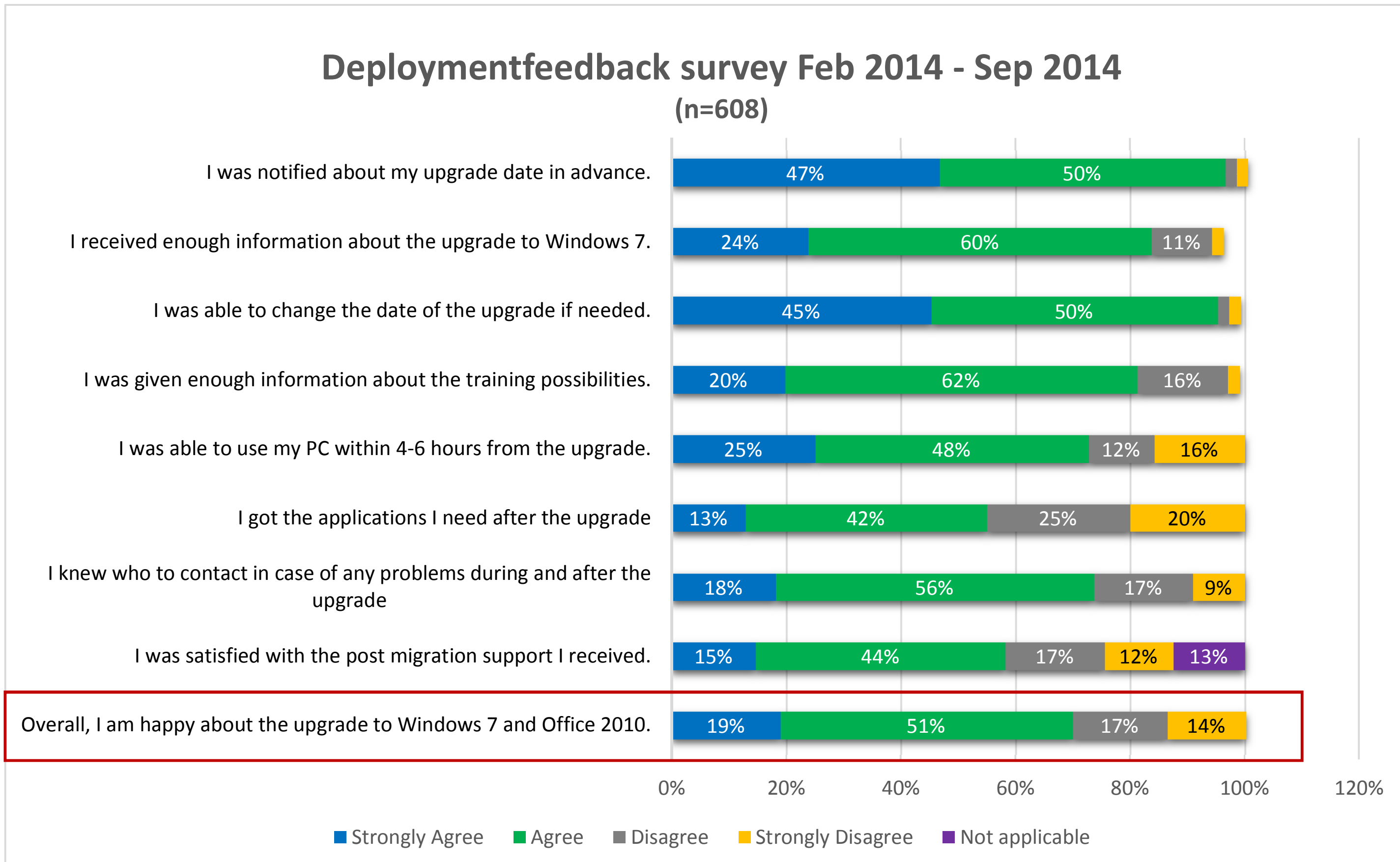

Figure 22: Deployment feedback survey Feb 2014 – Sep 2014 (n=608)

6.4 Monthly customer satisfaction (CSAT) rates

In order to get the bigger picture of how the overall end user satisfaction was affected in relation to the PSDA cycles being implemented during the project lifecycle, run charts were created to determine if there was any improvement on a monthly level before, during and after the PDSA cycles. A customer satisfaction survey (CSAT) log was created to mark how many respondents chose either **"disagree"** or **"strongly disagree"** to the statement, ***"Overall, I am happy about the upgrade to Windows 7 and Office 2010" (Q9)*** and monthly counts can be found in Appendix 6. Based on this log a set of 19 data points were used to portray the value on a monthly basis of the percentage of end users that chose "disagree" or "strongly disagree" to **Q9**.

Looking at *Figure 23*, though it may seem that 80% of end users were satisfied with the overall deployment already in June of 2013, one has to refer to *Figure 24* to see that there were only 5 respondents that month, of which 4 out of 5 were quite happy with their deployment experience.

To determine whether the PDSA cycles implemented truly did increase deployment numbers led to an improvement in the CSAT values and the attainment of the specified goal, the author looks closely against the total number of respondents for each month in the next chapter, during analysis of these data collection findings.

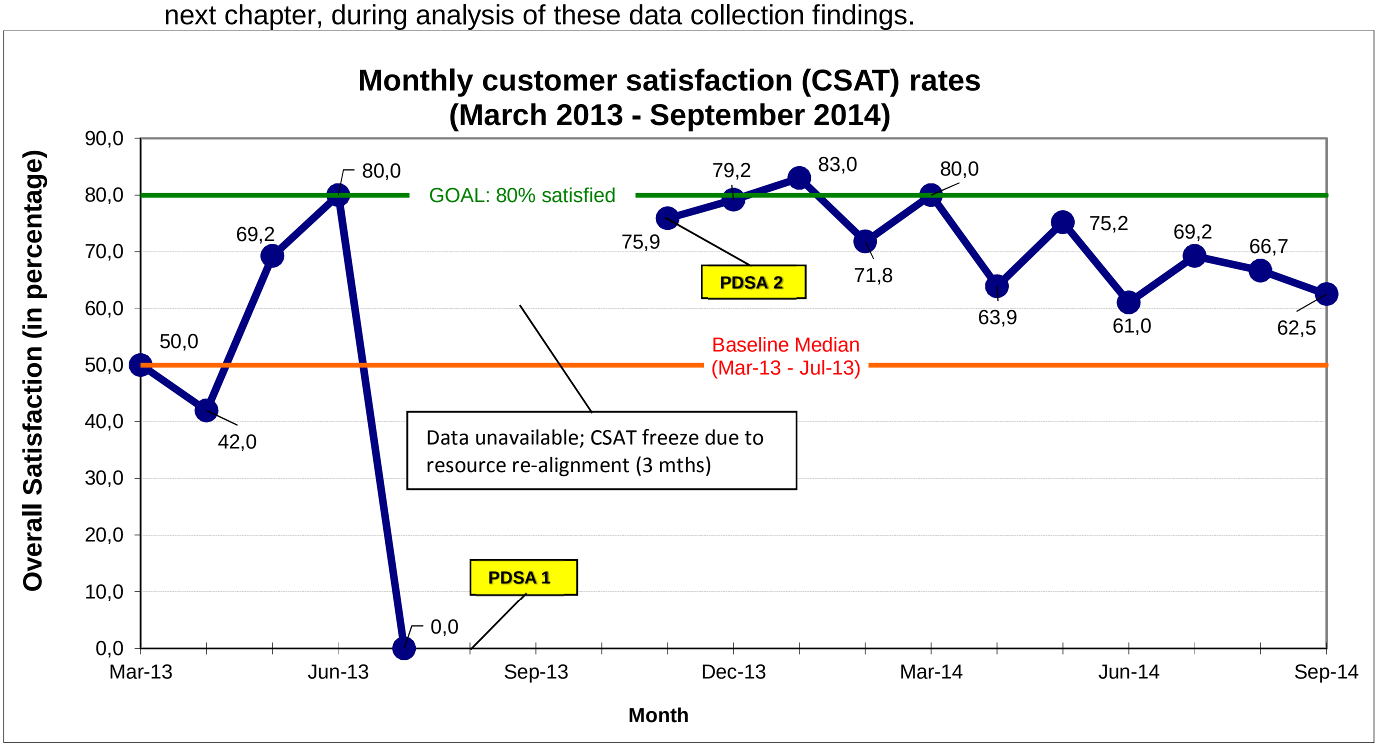

Figure 23: Monthly CSAT rates from March 2013 –September 2014

The median *(seen in Figure 23)* fell on July 2013 when the full-scale rollout was restarted after the end of a mandatory three month freeze of all activities due to project restructuring. The main question to answer is: With the implementation of the PDSA changes did the monthly number of respondents to Q9 increase overall satisfaction and/or reach the approximate goal of 80% ?

6.5 Customer satisfaction (CSAT) rates over project lifecycle

Figure 24 shows the total number of people who completed the CSAT surveys per month. This will be used to compare with *Figure 23* to see if there was any improvement in satisfaction in larger numbers.

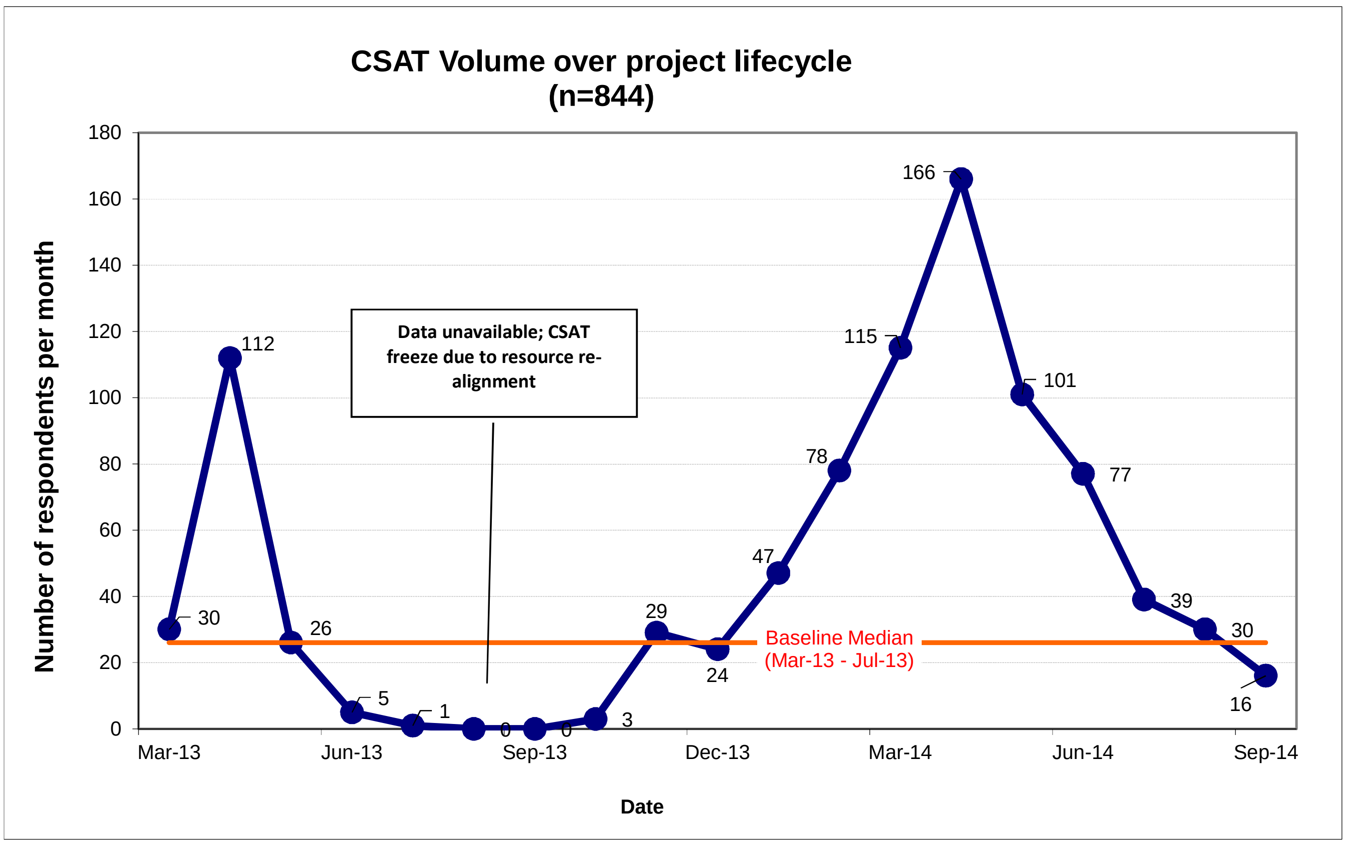

Figure 24: Total CSAT volume over project lifecycle (n=844)

7 Analysis

7.1 Types of variation

When conducting a statistical analysis of the results obtained there has to evidence that the change implemented actually resulted in improvement and was not due to random events. Figure 25 explains the various types of variation. There is the common cause variation, or “random” variation in which cause of the change seen is due to normal activities within the design of the process. Another factor that that can cause a random variation are regular, natural or ordinary causes. Basically, if the results depicted in the run charts are found to be normal, predictable, and stable, then there was no improvement and the variation is deemed to be random. If however, there are non-random events occurring, then once can assume that there has been an irregular or unnatural cause affecting a part of the process

Types of variation common cause (random) variation	"special cause" (nonrandom) variation
Is inherent in the design of the process	Is due to irregular or unnatural causes that are not inherent in the design of the process
Is due to regular, natural or ordinary causes	Affect some, but not necessarily all aspects of the process
Affects all the outcomes of a process	Results in an "unstable" process that is not predictable
Results in a "stable" process that is predictable	Also known as non-random or assignable variation
Also known as random or unassignable variation	

Figure 25: Types of variation (Lloyd, 2004)

7.2 Identifying non-random patterns

An analysis on the findings gathered in Chapter 6 can be accomplished through the use of run charts. A run chart is an effective tool to determine if improvement has been made over time by displaying all data points gathered during the improvement project. There are four rules used to interpret the run chart. If any of the following four rules apply then there is evidence of non-random patterns in the data. Confirmation can be made that the results produced are in fact the direct outcome of the changes that have been implemented in the process improvement project. The four rules are as follows (Figure 26):

Rules for interpretation	
Rule 1:	A shift in the process is indicated by 6 or more consecutive points above or below the median.
Rule 2:	A trend is indicated by 5 or more consecutive points all increasing or decreasing.
Rule 3:	Too many or too few runs indicate a non-random pattern.
Rule 4:	An "astronomical" data point indicates a non-random pattern.

Figure 26: Identifying non-random patterns (Provost & Murray, 2007)

7.3 Analysis of change in MS Windows 7 deployments

Based on the rules for variation explained in section 7.1 and 7.2, the run chart displaying the windows 7 deployments over the project lifecycle shows clearly the presence of a shift in the pattern (Figure 27). As stated above, rule 1 is a shift in the process indicated by 6 or more consecutive points above or below the median. Also visible in the run chart in figure 27 is a trend. Rule 2 states that a trend is indicated by 5 or more consecutive points all increasing or decreasing.

Altogether this pattern very strongly supports the statement that the changes made by the project team led to significant improvement.

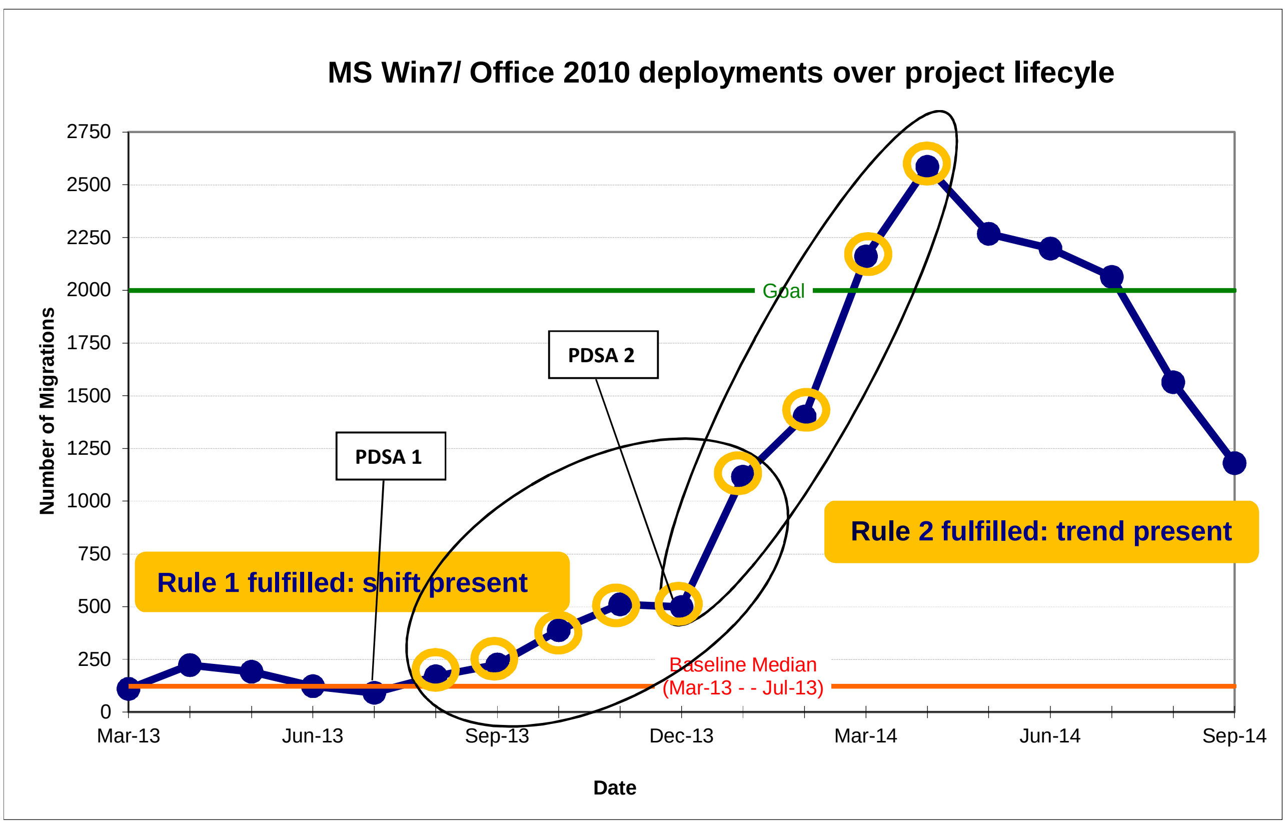

Figure 27: Analysis of non-random patterns in Windows 7 deployments over project lifecycle

7.4 Analysis of change in CSAT survey Question 9

Based on the rules for variation explained in section 7.1 and 7.2, the run chart displaying the monthly customer satisfaction rates over the project lifecycle shows clearly the presence of a shift in the pattern. As stated above, rule 1 is a shift in the process indicated by 6 or more consecutive points above or below the median. This pattern very much supports the statement that the changes made by the project team led to improvement, despite the variation of monthly CSAT results.

At the height of the deployments (seen in Figure 24) CSAT respondents maintained an average above the median and even reached the 80% satisfaction rate or surpassed it. This indicates a clear improvement from the initial 50% satisfaction rate in March of 2013, as seen in the graph below.

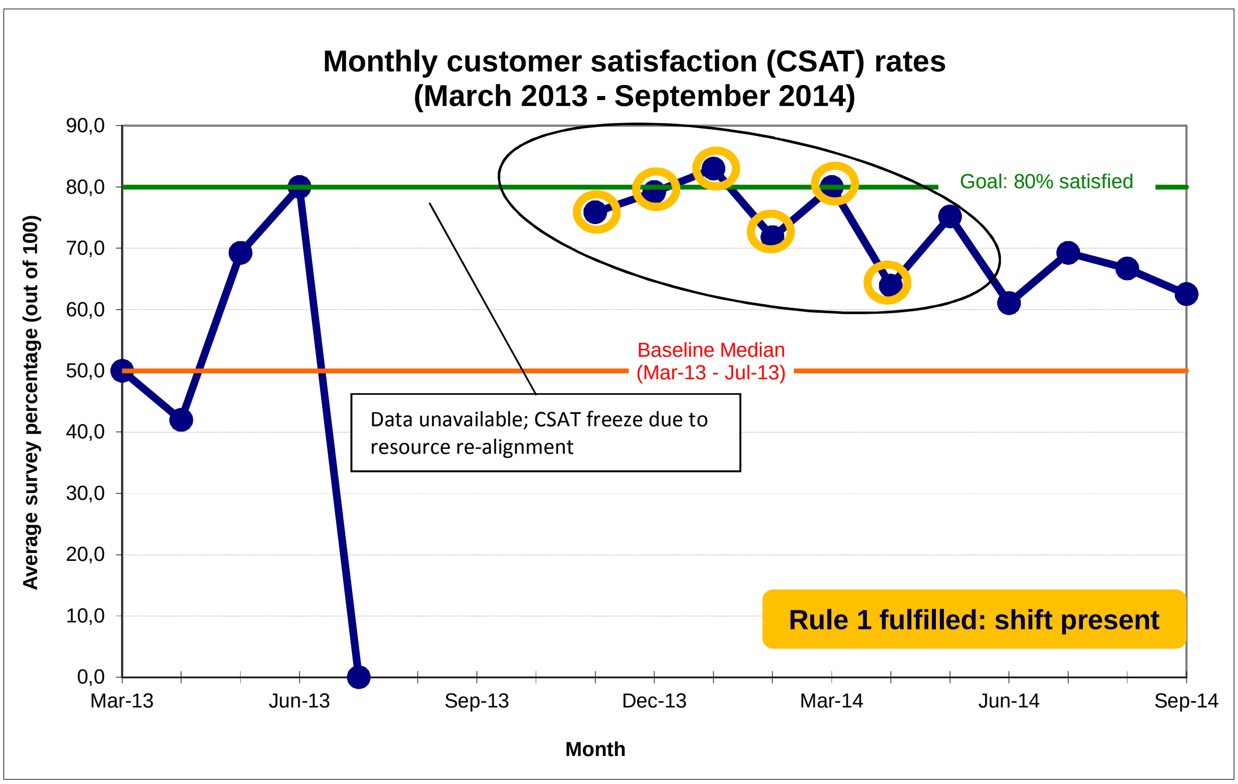

Figure 28: Analysis of improvement in CSAT survey (March 2013 – September 2014)

8 Conclusions

The improvement changes implemented in the Windows 7 deployment project have shown to be effective in reaching the goals set out in the initial stage of this improvement project.

8.1 Conclusion of results

The results obtained in this improvement project meet the goals initially posted in this study. The first objective was to achieve 2000 or more deployments per month. This goal was achieved and even surpassed in the months of March and April of 2014.

The second objective was to increase the satisfaction levels of end users responding to the feedback survey by at least 5%. By referring to Figure 28, one can see that the satisfaction levels are quite near each other. As stated in the statistical rules described above, Figure 28 does show a clear upward shift near the 80% satisfaction rate, which shows clear improvement in this area as well. However, more cycles could be run to really understand why the variations have occurred so frequently.

8.2 Personal evaluation

Perhaps the most rewarding aspect of this study was to witness the improvement unfold through the application of relatively straightforward changes. Despite the immensity of the project, basic principles were applied and within a matter of months, a grim outlook turned into a bright one. By putting the focus on managing the interaction between the service providers and stakeholders with the utilization of a ***gatekeeper*** and allocating tasks to ***local champions***, creating accountability, the overarching business goals were aligned and allowed for a balanced and progressive move forward.

In addition, by implementing a ***centralized resource directory***, both the concerns of the business and technical risks posed by the service providers were presented in a collaborative manner. Using consistent documentation within a standard location allowed for members in the weekly sessions to rescope the IT requirements originally put forth to fit into the specific environments in question.

9 Discussion and further development

The author hopes that through the implementation of quality improvement initiatives in an IT project, the organization can further develop this study by applying these techniques to other IT projects currently being rolled out in the organization. The aim of quality improvement in products and processes is never-ending, and this is a good start to apply the lessons learned from this process improvement project onto the next iteration.

Applying the Improvement Model Framework did not require many months of planning. Once a decision was made on where the pain points were, changes proposed were tested relatively quickly. The tools given to implement a quality improvement project allows for quick feedback through measurements done on whether the change put into effect is worth pursuing or should be replaced by another option. The PDSA cycle allows continual improvement based on past performance.

Any member of the organization can perform a quality improvement initiative by applying the tools described in this study. Most importantly is the organization's commitment from the senior level management to promote quality initiatives throughout the organization. As Shaffie & Shabbaz (2012) write in their book, ""*Lean Six Sigma",* no methodology (or framework) has staying power if there is no foundation and consensus on being committed to continuous improvements throughout the whole organization.

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11 Appendices

11.1 Appendix 1: Windows 7 deployment feedback survey

Please provide us with feedback on the upgrade to Windows 7. The feedback is given anonymously.

1. Please write down your country.

Preparation phase

Please tell us how much you agree or disagree with the following statements:
(Strongly Agree = 1, Agree = 2, Disagree = 3, Strongly Disagree = 4)

2. I received enough information about the upgrade to Windows 7.
3. I was notified about my upgrade date in advance.
4. I was able to change the date of the upgrade if needed.
5. I was given enough information about the training possibilities.

Post-migration phase

6. I was able to use my PC within 4-6 hours from the upgrade
7. I got the applications I need after the upgrade.
8. I knew who to contact in case of any problems during and after the upgrade.
9. I was satisfied with the post-migration support I received.
10. Overall, I am happy about the upgrade to Windows 7 and Office 2010.
11. Any other comments?

Thank you for your feedback.

We hope you enjoy working with Windows 7 and Office 2010.

11.2 Appendix 2: PDSA form template (adapted IHI, 2015)

Plan Do Study Act (PDSA) form

Document Information

Project title:		Project ID:	
Prepared By:		Cycle #	
Title:		Start Date:	
Objectives of this cycle (circle one)	test a change / implement a change / spread a change	End Date:	

Plan

What change will be tested or implemented?	How will the change be tested or implementation be conducted?	Who will run the test or implementation?	Where will the test or implementation take place?	When will the test or implementation take place?	Predictions

Predictions (unlimited):
1.
2.
3.

Data collection plan:

What information is important to collect	Why is it important	Who will collect the data	Who will analyze the data prior to study?	Where will data be collected?	When will the collection of data take place?

How will the data (measures or observations) be collected?

Do

Observations:	Record oberservations not part of the plan:	Did you need to tweak the orginal plan?	Begin analysis of data (graph of data, picture):

Study

Comparison of questions, predictions, and analysis of data:

Prediction 1	Prediction 2	Prediction 3	Prediction 4	Prediction 5	Prediction 6
Learning:	Learning:	Learning:	Learning:	Learning:	Learning:

Act

Describe next PDSA cycle:
Based on the learning in "Study"," what is you next test?

11.3 Appendix 3: PDSA form for the project - filled

Plan Do Study Act (PDSA) form

Document Information

Project title:	Office 2010/ Windows 2007 deployment project	**Project ID:**	**0554**
Prepared By:	project team	**Cycle #**	**1.00**
Title:	Process improvement initiative	**Start Date:**	**Sep-13**
Objectives of this cycle:	test a change / **implement** a change / **spread** a change	**End Date:**	**Dec-13**

Plan

What change will be tested or implemented?	How will the change be tested or implementation be conducted?	Who will run the test or implementation?	Where will the test or implementation take place?	When will the test or implementation take place?	Predictions
The introduction of various actors to get f2f time with local country management to regain buy-in in order to proceed with the windows 7 project on a large-scale.	Restructing of weekly sessions with local stakeholders	Project team leader will implement the change wthin the process and monitor changes.	The change will be implemented in the weekly call sessions with the local country management	the implementation of change will take place with each weekly call that is had. This could range between 5 and 15 calls a week.	Dialogue will be opened up between the concerns of the local country management and the service provider

Predictions (unlimited):
1. Permission from the local country management to rollout in a larger numbers will be given
2. Increase in deployment numbers compared to the current numbers
3. A rise in customer satisfaction compared to the current csat average.

Data collection plan:

What information is important to collect	Why is it important	Who will collect the data	Who will analyze the data prior to study?	Where will data be collected?	When will the collection of data take place?
Data will be collected from the weekly operational dashboard reporting, action points, concerns, and to-do's. Also, customer satisfaction surveys will be collected via the scheduling tool along with the service provider's daily deployment report.	The most important aspect of the data collection is the weekly operational dashboards and action lists as that is where the the level of trust gained from local country management can be gauged.	The project team leader collects the data. There are also automated systems that collect survey results.	The project team leader and the SME will analuze the data.	The data is collected in sharepoint 2010.	The data collection is collected on a monthly basis with a final tally in December of 2013.

How will the data (measures or observations) be collected?
The data will be collected in Sharepoint with excel tools to extrapolate the results.

Do

Observations:	Record oberservations not part of the plan:	Did you need to tweak the orginal plan?	Begin analysis of data (graph of data, picture):
The restructured weekly sessions and improved documentation allows for the local country management to focus on concerns that would otherwise not be brought up.	The realignment of resources was not part of the plan and signified a freeze in the data collection for a period of 3 months	No tweaking was done to the original plan, however instructions were added in order to train the new recruite of the changes.	

Study

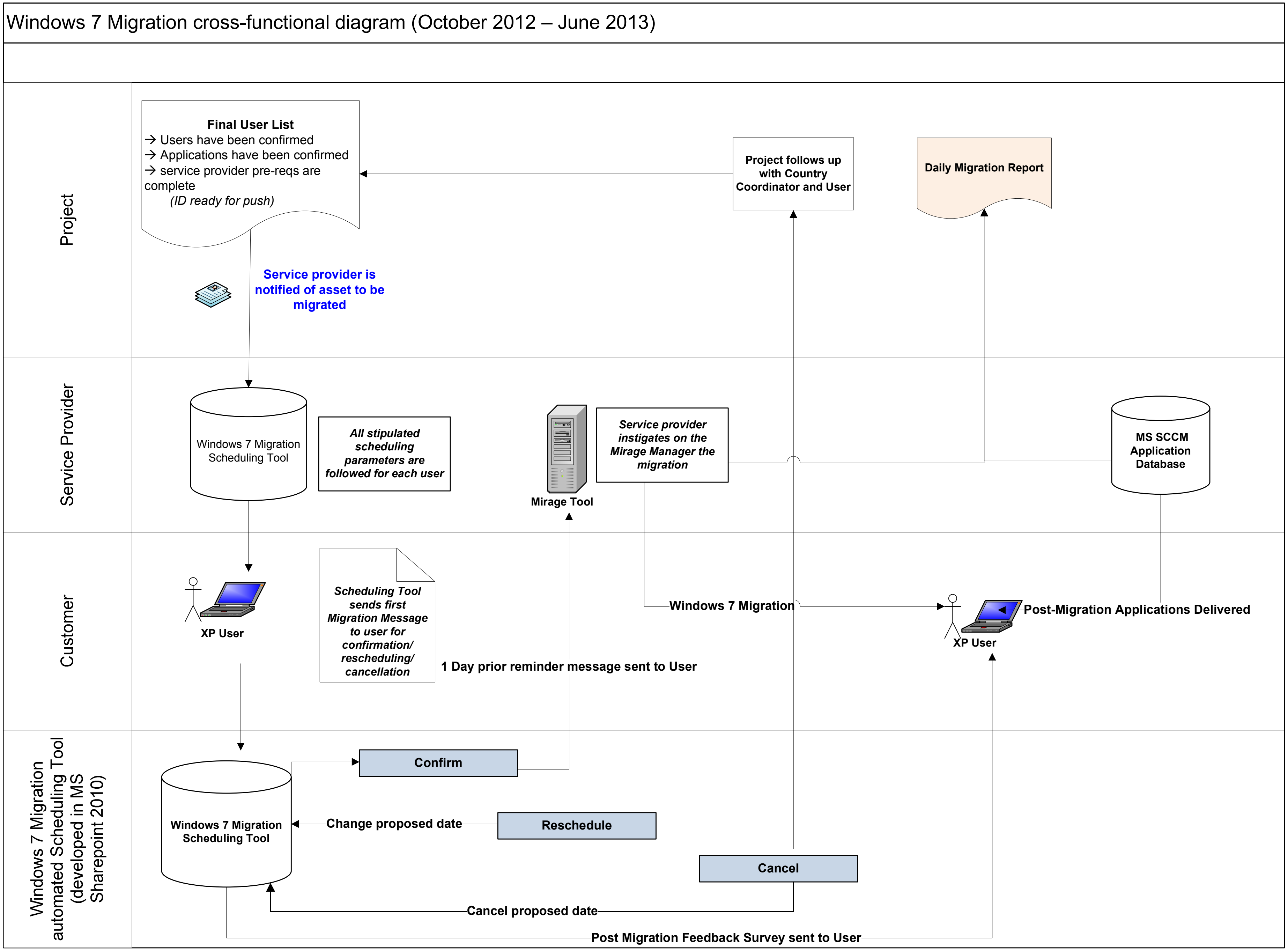
Comparison of questions, predictions, and analysis of data:

Prediction 1	Prediction 2	Prediction 3	Prediction 4	Prediction 5	Prediction 6
Learning: **With the introduction of the restructured weekly sessions along with the improved documentation, there was more dialogue with the local country management and allowed for pilots to be undertaken despite the previous halt in deployments.**	**Learning:** **After the pilots were perfomed to the satisfaction of the local country management, larger-scale rollouts could be performed. With the implementation of the new weekly sesssion, if any issues or escalations came up, the stakeholders could address**	**Learning:** **As there were more deployments, there was the possibility to distribute more feedback surveys. Though still to be determined, there seemed to be an increase in the satisfaction levels of the end-users**	**Learning:**	**Learning:**	**Learning:**

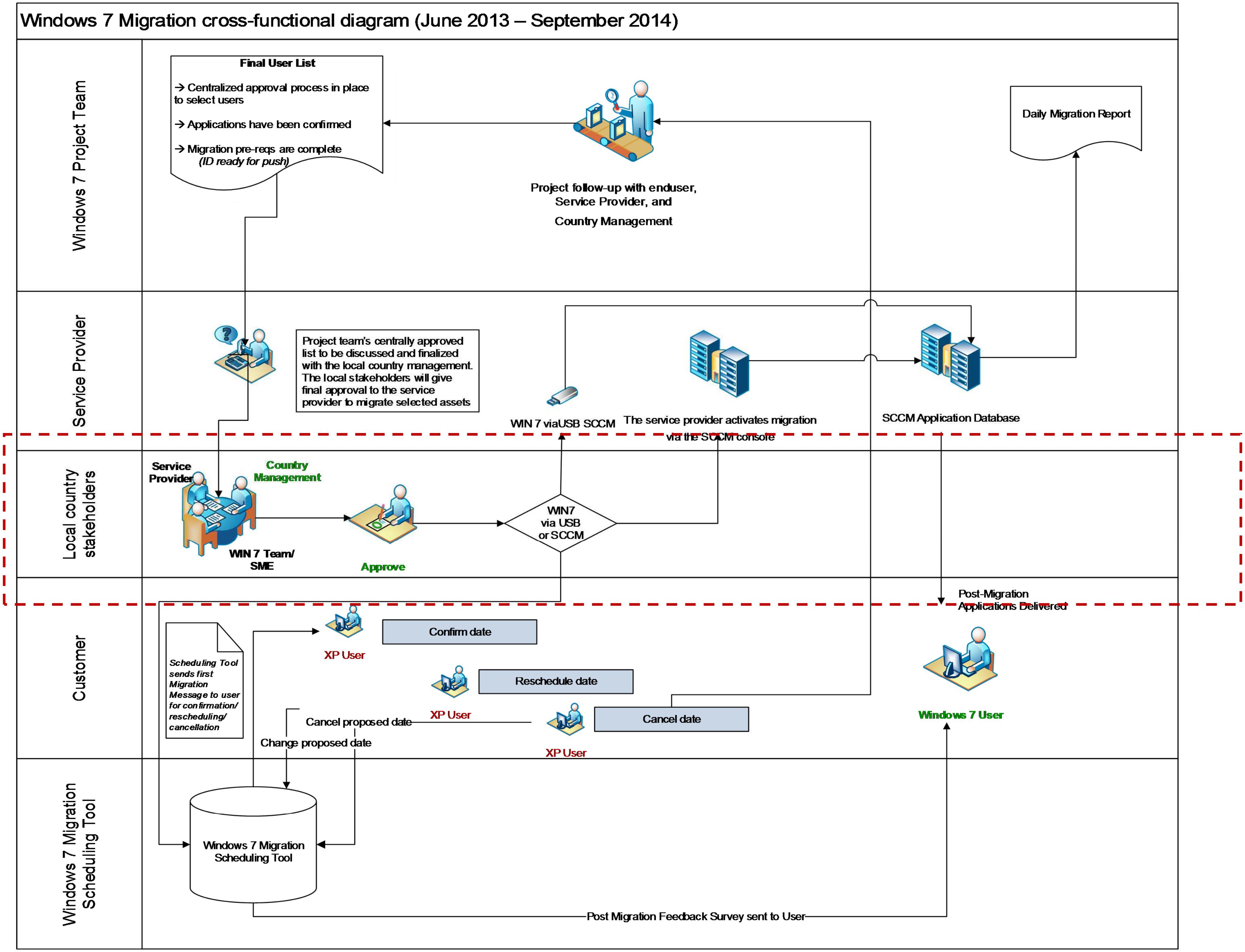
Act

Describe next PDSA cycle:
Based on the learning in "Study"," what is you next test/implementation?
The next implementation would be to employ a new recruit to apply these changes to more countries in order to increase deployment numbers and obtain getter enduser satisfaction results.

11.4 Appendix 4: Windows 7 migration cross functional diagram (October 2012 – June



11. 5 Appendix 5: Windows 7 migration cross functional diagram (June 2013 – September



11.6 Appendix 6: CSAT log March 2013 – September 2014

CSAT log March 2013 - September 2014

	Overall % CSAT of "unhappy" respondents (disagree, strongly disagree to Q9 response)	% CSAT respondents that answered "disagree" or "strongly disagree" to overall satisfaction of the migation process	# CSAT respondents that answered "disagree" or "strongly disagree" to overall satisfaction of the migation process	Total CSAT respondents in the last 30 days that	Annotation Type	Annotation
Mar-13	50,0	50,0	15	30	None	-
Apr-13	42,0	58,0	65	112	None	-
May-13	69,2	30,8	8	26	None	-
Jun-13	80,0	20,0	1	5	None	-
Jul-13	0,0	100,0	1	1	Change	CSAT freeze due to resource re-alignment
Aug-13	0,0	0,0	0	0	Change	CSAT freeze due to resource re-alignment
Sep-13	0,0	0,0	0	0	Change	CSAT freeze due to resource re-alignment
Oct-13	0,0	0,0	0	0	Change	CSAT freeze due to resource re-alignment
Nov-13	75,9	24,0	7	29	None	-
Dec-13	79,2	21,0	5	24	None	-
Jan-14	83,0	17,0	8	47	None	-
Feb-14	71,8	28,0	22	78	None	-
Mar-14	80,0	20,0	23	115	None	-
Apr-14	48,3	52,0	60	116	None	-
May-14	75,5	25,0	25	102	None	-
Jun-14	61,0	39,0	30	77	None	-
Jul-14	69,2	31,0	12	39	None	-
Aug-14	66,7	33,0	10	30	None	-
Sep-14	62,5	38,0	6	16	None	-