



Lean Transformation in IT – Case Study

التحول للتصنيع الرشيق في تقنية المعلومات – دراسة حالة

By

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Dissertation submitted in partial fulfillment of

MSc IT Management

Faculty of Engineering & IT

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November-2014

Abstract

Managing quality is crucial for all small and big organizations over the world. Meeting customers' satisfactions and needs by providing a high standard of quality for services and products will uphold organizations' image and reputation. A review of quality frameworks literature reveals that Lean production framework focuses in creating a culture of improvement by eliminating waste from organization's process with lower cost. Lean applications have spanned in different fields including automobile, healthcare, education and other services. This study argues the success of implementing Lean principles in uncertain environments such as IT application development. Since there is no such research has been conducted in UAE or Arab world in implementing Lean in software development and IT, this research paper is considered as a pioneer research in the field of IT quality management

The objective of this paper is to use a case-based approach to demonstrate how Lean principles and tools can help IT to enhance IT services quality, reduce cost and improve staff productivity. For this purpose a comparative case study method is used, two cases of the same financial institution were examined before implementing Lean and after implementing Lean. The study concentrates on analyzing the Lean transformation stages which are current state assessment, target state design and implementation and different tools which were used in each stage.

Conclusively, Lean principles improve organization performance as it is using different tools to evaluate current issues in existing business processes and recommend changes in process architecture and organization structure to resolve these issues. The findings of this case study show that Lean principles help to maintain high quality of IT services with lower cost by reducing 10% of none-valued activities and other benefits.

Keywords:

Lean principles, Quality improvement, case study, focus group, IT application development.

المخلص التنفيذي

إدارة الجودة من الأمور الهامة لجميع المنظمات الصغيرة و الكبيرة في مختلف أنحاء العالم. تلبية إحتياجات العملاء و كسب رضاهم من خلال توفير خدمات ذات جودة عالية يساهم في تحقيق سمعة جيدة للشركات. من خلال مراجعة البحوث السابقة المتعلقة بإدارة الجودة و معاييرها، فلقد تبين إن "التصنيع الرشيق" يركز في خلق ثقافة التحسين عن طريق التقليل من هدر الوقت و المال في إجراءات العمل. و قد امتدت تطبيقات " التصنيع الرشيق" لتشمل عدة مجالات منها: صناعة السيارات، التعليم، الصحة و غيرها من المجالات الخدمية. هذه الدراسة تبرهن نجاح تطبيق مبادئ "التصنيع الرشيق" في بيئة متغيره كبيئة تطوير التطبيقات في تقنية المعلومات. حيث إنه لم يجرى أي بحوث أو دراسات لنفس الموضوع في دولة الإمارات العربية المتحدة و العالم العربي، فإن هذا البحث يعدّ من أوائل البحوث المتعلقة بدراسة و تطبيق "التصنيع الرشيق" في مجال إدارة الجودة في تقنية المعلومات.

الهدف من هذه الورقة إستخدام منهج دراسة حالة لشرح كيفية مبادئ "التصنيع الرشيق" و أدواتها تعمل على مساعدة تقنية المعلومات في تحسين جودة خدماتها، الحد من التكاليف و زيادة إنتاجية موظفيها. و لهذا الغرض، تم إستخدام دراسة حالة المقارن لتحليل حالتين لنفس المؤسسة المالية قبل تطبيق مبادئ "التصنيع الرشيق" و بعد تطبيق المبادئ. تركز الدراسة على تحليل مراحل تطبيق "التصنيع الرشيق" و التي تنقسم إلى 3 مراحل وهي: تقييم الحالة الراهنة، تصميم الحالة المستهدفة و التطبيق الفعلي. بالإضافة إلى تحليل الأدوات المستخدمة في كل مرحلة.

ختاماً، مبادئ "التصنيع الرشيق" تحسن من أداء المنظمات و ذلك لتعدد أدواتها التي تستخدم في كل مرحلة لتقييم مشاكل الحالة الراهنة في الاجراءات التشغيلية و ما توصي من تغييرات في الاجراءات و الهيكل التنظيمي للمنظمات لحل هذه المشاكل.

تظهر نتائج هذه الدراسة بأن مبادئ "التصنيع الرشيق" تحافظ على جودة عالية لخدمات تقنية المعلومات مع الحدّ من التكاليف بتقليل 10% من التكلفة الاجمالية، و غيرها من الفوائد.

الكلمات المفتاحية

مبادئ "التصنيع الرشيق"، تحسين الجودة، دراسة حالة، مجموعة التركيز، تطوير التطبيقات لتقنية المعلومات.

Declaration

I declare that this thesis was composed by myself, that the work contained herein is my own except where explicitly stated otherwise in the text, and that this work has not been submitted for any other degree or professional qualification except as specified.

(Zamzam Alhammadi)

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Chapter 1: Introduction

The term 'quality' holds great interest in the Business world nowadays. In today's competitive market, organizations have realized that high quality will contribute to long term success rather than organization's capital or revenue. As quality improvement has become the master element for any organization success, many organizations are looking toward improving the quality of their products and services. Quality improvement starts from an organization's vision to satisfy their customers by providing the best services and products.

Organizations need to comply with the quality standards to ensure that their operational and production processes are consistent by following the best practices of quality management systems such as ISO 9001. However, there are other quality management frameworks which are sharing the same goal of raising quality and driving continuous improvement and consistency such as: six-sigma and lean etc. However, the differences come from the context of each framework. Six-sigma was developed to focus on customer satisfaction, employee training and learning, root cause analysis, and problem solving methodologies (Arnheiter and Maleyeff 2005). Lean framework focuses organization efforts in reducing wastes within operational or production processes and increasing value added inside the process flow to customers (Chiraini 2011). Lean consists of five principles and number of tools which create a continuous improvement paradigm for any business. There are different names of Lean such as lean manufacture, Lean management, Lean production and Lean enterprise, list of names can be longer as all these Lean types are part of main Lean manufacture which was inherited from the Japanese Toyota production system (Womack et al. 2008).

1.1 Background

After W.W.II, Japanese manufactures suffered a lot from the economic hardship in Japan. Manufactures like Toyota started looking at the American and Western automobile industries to learn from their methodologies. Toyoda Kiichiro, president of Toyota Motor Company, said "We need to catch up with America in three years. Otherwise the

automobile industry of Japan will not survive" (Ōhno 1988, p.1). At that point of time, American automobile (Ford and General Motor) were following mass production method. This method aimed to overproduce similar parts which can be interchangeably used for different car models through using assembly line to attach these parts together in a simple and quick way (Womack et al. 2008).

However, Toyota was not able to implement mass production due to capital constraints and the low volumes in the Japanese market (Holweg 2007). Thus, Ohno developed his method of eliminating waste from production flow based on two pillars which are: automation and just-in-time. Automation is to automate the production process to free Labor to only detect and fix any defects in parts. "Just-in-time" refers to producing a number of parts based on demand. The Toyota Production system evolved over one decade with more methodologies to improve production process such as: 5 whys to analyze root cause of problem and Kanban a method used to control just-in-time processing (Ōhno 1988).

These changes in Toyota production increased the productivity of workers over 30 years, from 4 vehicles per worker to 60 vehicles per worker, and the competition with other American manufactures by 1980s. (Figure 1.1):

FY	Toyota	Nissan	GM	Ford
1955	4	3	8	12
1956	8	6	7	10
1957	13	7	6	10
1958	12	8	6	9
1959	14	9	7	11
1960	15	12	8	12
1961	16	14	7	11
1962	16	15	9	11
1963	19	17	9	12
1964	20	18	9	12
•	•	•	•	•
1970	38	30	8	12
1980	56	41	10	10
1983	58	42	11	15
1985	60	42	11	15

Figure 1.1: Number of vehicles per worker (Cusumano 2013, P.4).

This dramatic improvement in Toyota production makes Western automobile manufacturers curious to understand what changed in Toyota. The first comprehensive study of Toyota production improvement was done by International Motor Vehicle Program (IMVP) which observed Toyota production methods and concluded that the Toyota operating paradigm was delivering higher quality products at lower cost by focusing on removing waste (Piercy & Rich 2009). Ohno book, Toyota Production system: Beyond Large-scale production, was translated into English by 1988 (Shah & Ward 2007). The term “Lean” was first coined by John Krafcik (1988) in his article “Triumph of the Lean Production System” to understand and analyze the success of Japanese manufacturers and the Toyota Production system and how it outperformed other frameworks adopted by the West (Shah & Ward 2007). In 1990, Womack et al. (2008) published his famous book “The Machine that Changed the World: The Story of Lean Production” in which he described the movement from mass production to Lean production and explained Lean principles and tools.

Lean framework can be described as a set of tools and principles which focus on eliminating waste and adding value to certain processes in the organization. This can be achieved by identifying the needs in an organization, defining value and waste in processes, and developing and implementing new value definitions (Chen & Taylor 2009). Lean thinking or Lean philosophy aims to change organization’s culture by involving employees in the improvement process continuously as shown in Figure 1.2.

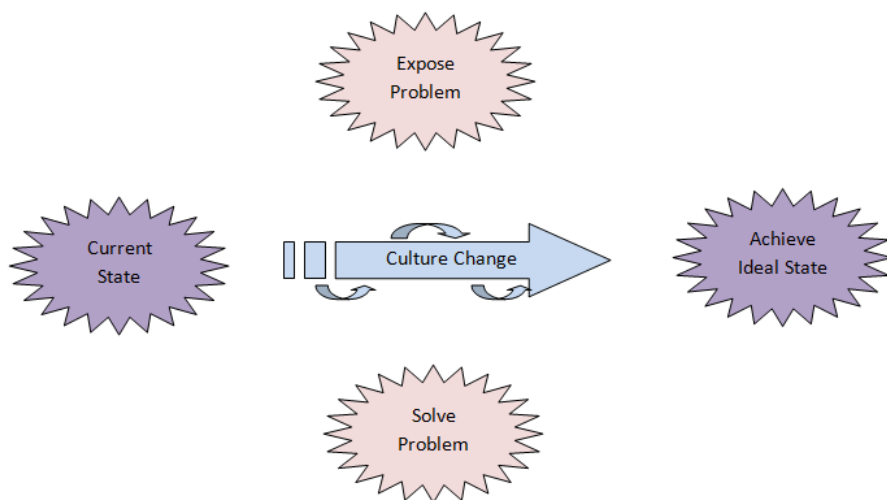


Figure 1.2: Continuous improvement Lean management philosophy (Koenigsaecker 2013, p.14)

Therefore, Lean principles are used and practiced in different fields and industries (Cusumano 2013).

1.2 Research Objectives and Aim

The overall purpose of this research is to implement Lean framework in IT field. As IT field covers variety of elements, this paper will focus on application development area.

The objectives of Lean implementation are:

- To evaluate the impact of Lean principles on IT application development.
- Understand the effect of Lean framework in IT services' quality and cost.
- To explore the changes on people mindset and corporate culture during Lean transformation.

1.3 Research questions

In order to achieve the research objective, this research seeks to answer below questions:

1. How does “Lean Framework” improve the quality of IT services?
2. How can “Lean Framework” reduce the cost of IT services?
3. Why does “Lean Framework” have a direct impact on organization culture and people mindset?

1.4 Description of the case

This study will evaluate Lean transformation in one of primary financial institution's IT department. Many leading banks such as: Citibank, Lloyds TSB and Barclays launched their Lean program under different names for example “operational excellence”, “lean six sigma”, and “lean management” between 2000 and 2011 (Booz & co. 2013). However, this is the first bank in GCC region and UAE to embark Lean transformation in IT which makes this case more interesting. A detailed description of the case will be given in Chapter 4.

1.5 Dissertation structure

This paper will start with a literature review to present a detailed overview of Lean principles, tools and application in services environment such as: Healthcare, Education and IT – Application development. Moving to the next chapter, “research methodology” explains the purpose of using case study as a research methodology for this topic. Then selected case will be described in details along with Lean transformation stages and tools used followed by “findings & results” chapter to present the results of Lean transformation and “discussion” chapter to analyze the finding based on the research questions.

Chapter 2: Literature Review (Overview of Lean Framework)

The Lean framework is an extension of the Toyota Production system which was first initiated by Taiichi Ohno at Toyota Motor Corporation, a Japanese automobile manufacturer, in the late 1950s. The main driver of lean framework is the need to improve a product's quality while reducing costs. The objective of this chapter is to provide a clear description about Lean principles and tools. A review of previous literature and the implementation of lean principles in services environments to show *how* successful lean is.

This chapter consists of four sections which are: a Lean framework description, Lean and other quality framework and standards, Lean transformation to services fields such as: Health care and Education, and the final section focuses on Lean IT and application development. The summary of this chapter will discuss the implication of the findings of this literature review and the reason for the research.

2.1 What is Lean framework?

Lean framework is one of quality management frameworks which evolved over time (Middleton and Joyce 2012). Suárez et al. (2012) and Shah. & Ward. (2007) agreed that there is no clear academic definition for "Lean" in their literature review as Lean philosophy is a new trend and most literature focuses on describing Lean concepts and principles. Other studies examined Toyota Production system and related to Lean production such as Spear and Bowen (1999, p.3) who tried to express Toyota Production system into four rules which form the essence of Toyota. These rules are:

1. All work shall be highly specified as to content, sequence, timing, and outcome.
2. Every customer supplier connection must be direct, and there must be an unambiguous yes-or-no way to send requests and receive responses.
3. The pathway for every product and service must be simple and direct.
4. Any improvement must be made in accordance with the scientific method, under the guidance of a teacher, at the lowest possible level in the organization.

In addition, Womack et al (2008) Lean explained the five principles that define Lean paradigm. Lean principles can be used by organizations all over the world to eliminate waste and focus on value-added activities. These principles are summarized in the below points (Piercy and Rich 2009):

1. **Value:** Determine what it is customers' value from their point of view in the product or service.
2. **The value stream:** Align each area/ step in targeted process with its value in order to remove any unnecessary areas/ steps from this process.
3. **Flow:** Ensure products and information seamlessly flows from start to finish of the value stream.
4. **Pull:** Only deliver what is actually demanded (pulled) by the customer rather than serving from stocks or buffers.
5. **Perfection:** Continually improve the processes and systems with the above principles.

By going back to the original source of Lean, i.e. Toyota Production System (TPS), we can find all the above principles are part of TPS methods and techniques. **Value** is the main focal point of the Lean framework, so all activities through the **value stream** create values and eliminate waste (Arnheiter and Maleyeff 2005). The value stream as defined by Wang et al. (2012) is a map that identifies every step in the process and categorizes each step in terms of the value it adds . The other principle is **Flow**, it is important that the production process and information flows continuously without any interruption. The **Pull** principle emphasizes that nothing should be produced until there is a need from the end customer. Companies which are following the Lean framework put a lot of effort to reducing waste by continuous evaluation of their processes and identifying ultimate cause of any issues or problems. **Perfection** is the goal and a journey with no end to continue improving.

The main concept of Lean is reducing waste and adding value. Waste can be identified as many things which can lead to customer's dissatisfaction. In the literature (Piercy& Rich

2009) (Kumar 2005) (Chen & Taylor 2009), different types of waste are discussed and they all focused and agreed on the waste criteria as shown in Table 2.1:

Waste Criteria	Description
Delays	Time waiting in queuing or waiting for information/ approval.
Reviews	Inspection of work for errors or omissions.
Mistakes	Errors and omissions that cause work to be redone or customer defection.
Duplication	Similar activities to be done in different parts of the system/ process which could be performed together.
Movement	Transportation or movement of information or personnel that is unnecessary.
Over Producing	Building more product than what customer need or requested for.
Processing Inefficiency	Ineffective use of resources in performing tasks or continual reinvention of potentially standard processes.
Resource Inefficiencies	Management of personnel, equipment or materials which are wasteful. Example: managing inventory.

Table 2.1: Different types of Waste.

Identifying areas of waste will help organizations to eliminate the causes of waste and keep activities which are adding value. This will help to reduce production time/ cost and enhance the quality of the product or service provided. This includes variability and variance such as: demand variability (e.g.: changing requirements or product specifications), manufacturing variability (e.g.: changing product quality characteristics), and supplier variability (e.g.: uncertainties in quality and delivery times) (Arnheiter and Maleyeff 2005).

The Lean framework has a tool kit to assess and remove waste. Based on organization needs, specific tools will be used and customized. Koenigsaecker (2013) has organized most common tools on different categorizes as shown in below table 2.2:

Tools for identifying value	
Kano model	A method for identifying ‘basic’ factors (what the customer expects), ‘performance’ factors (features such as speed of service delivery or ease of use), and ‘delighter’ factors (what the customer does not expect but their presence causes delight).
Pareto analysis	Pareto analysis uses the Pareto principle which is the idea that 80% of problems are caused by 20% of sources. Pareto analysis is a tool that helps organizations identify and prioritize problem solving.

Tools that prepare for flow	
5S	A structured approach to standardization, similar to 'housekeeping' it has the objective of keeping everything in order to reduce time wasted looking for things and to improve visibility at a glance. 5S consists of: sort, straighten, sweep, standardize and sustain.
Standard Work	All work should be standardized and unambiguous. It is this standardization of work that provides a platform for continuous improvement.
Demand management	Manipulating demand and managing capacity to allow for 'flow'.
Tools for Mapping and Analysis	
Value Stream Mapping	A value stream is all the actions (both value-added and non-value added) currently required to bring a product to completion. Helps people look at the bigger picture of material and information flow rather than discrete operations and processes.
Process Mapping	Focuses on actions at the level of the process.
Tools for ensuring quality	
Pokayoke	Error-proofing processes so it is near impossible to make a mistake.
Visual Management	The concept of visual management is to enable anyone in the workplace (even those unfamiliar with the work) to understand the current status of the operation at a glance.
Tools for Improvement	
PDCA	Also known as the Deming cycle, PDCA is an acronym for the continuous improvement cycle of 'plan, do, check, act' where 'plan' refers to understanding the problem, 'do' refers to implementation of a pilot/proposed solution, 'check' means to check (measure) the effectiveness of the piloted solution and 'act' means to implement the solution fully.
Kaizen	Kaizen refers to 'change for the better' based on small incremental improvements over time. A kaizen event refers to a short burst of improvement activity usually taking place over 3-5 days with a cross section of worker involved in a particular process.
Root causes	A process for dissolving problems by establishing the 'root cause'. 5 why analysis is a common tool to establish 'root cause' as is the 'Ishikawa' diagram/'fishbone' diagram.

Table 2.2: Some common tools associated with Lean (Koenigsaecker 2013).

2.2 Lean, Six-sigma and ISO 9001

Lean framework is a pragmatic methodology which can be applied as complementary rather than alternative to other quality standards such as: six-sigma and ISO. Although it is not the purpose of this paper to compare Lean with other quality standards, the

following paragraphs highlight the main characteristics of six-sigma and ISO 9001 and the influence of Lean thinking on both of these standards to aid readers' understanding.

Six Sigma was founded by Motorola Corporation in 1986 and was adopted by many US organizations. Six Sigma becomes a long term decision-making business strategy rather than quality management methodology as it focuses on customer satisfaction, employee training and learning, identifying root causes and problem solving methodologies (Arnheiter & Maleyeff 2005).

Lean Six Sigma (LSS) is one of names researchers called to organizations which adopt both Lean framework and Six Sigma. LSS help organization to select the right tool from Lean framework or Six Sigma to tackle their problems or needs. It is important for organizations to use both methodologies at same time instead of using them in parallel. Following this approach of using both Lean and Six Sigma simultaneously will ensure avoiding troubles in prioritizing initiatives, allocating resources, selecting the right methodology and providing financial gains (Salah et al. 2010).

ISO stands for the International Organization for Standardization which released the first ISO quality management in 1987. The ISO model consists of four processes which build the quality management system for any organization. These processes are (1) management responsibility, (2) management of the resources, (3) product realization and (4) measurement and improvement (Srivastav 2011). Chiraini (2011) in his study analyzed the impact of Lean principles and tools on ISO 9001 processes. Lean tools such as value stream mapping, 5S and kanban were used by organization to remove wastes from process and improve the management safety of ISO.

As a result of this comparison, it can be claimed that Lean principles and tools can be integrated with other quality standards to improve the quality management systems in organizations.

2.3 Lean Transformation in Services field

From the previous section, we have a looked into Lean principles which were implemented in manufacturers to eliminate waste and enhance efficiency. Lean principles

and thinking was evolved dramatically in last 20 years. Experts consider Lean framework as a framework which brings culture change and customer focus in organization by implementing its principles regardless of organization's industry (Chen & Taylor 2009).

As claimed by Graban (2014, p.1) in his article "Lean is not just for Manufacturing",

There have been many adaptations of Lean to the software world, including "agile" software development and the broader term "Lean software development." This has led to the "Lean Startup" movement that applies Lean principles to the design and continuous improvement of the business side of a company, not just the technology and software development efforts. [...] Also, there are healthcare organizations that have been working on their "Lean transformation journey" for over 10 years, such as ThedaCare and Virginia Mason Medical Center and many others. [...] There are even examples of Lean being used in city, state, military, and federal government levels. Lean is being used in public schools and universities. Lean is even being used in law firms and financial services firms.

What make the Lean framework applicable for different industries and fields? The answer is that the Lean framework consists of numbers of improvement activities and tools which can be applied in an arbitrary manner depending on the context of the organization and individuals. The most important point to be mentioned here is that Lean cannot be maintained as a project but it is a journey of culture change in organization (Yamamoto and Bellgran 2010).

There are many research papers that are presenting successful stories of applying lean principles and thinking into pure service administrative areas as an extension of Lean in the manufacturing industry. It has been proven that the Lean framework can enhance and bring improvement to such area like: supply chain processing, sales processing, accounting or human resources (Piercy and Rich 2009).

In this literature review, the author looked into non-industrial organization to examine the success of Lean transformation. Healthcare is one of popular fields where Lean transformation took place due to the fact that the Healthcare sector faced many criticisms regarding service quality (Suárez et al. 2012). Another field which shows a lot of lean implementation is Education.

2.3.1 Lean in Healthcare

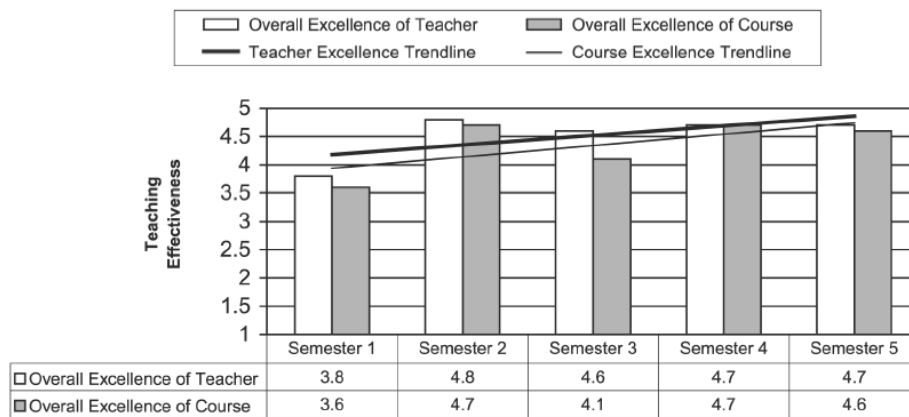
Lean framework is widely used in Health care sector. A recent survey by (Radnor 2010), found that 51% of the publications sourced focus on 'Lean' and 35% of those were in the Health Services.

Flinders Medical Center in Australia is one of first health care institutes that implement Lean which aims to improve overall work by reducing un-valuable activities. Gubb (2009) cited that Flinders Medical center was not able to handle number of patients. Also, the safety of care in the Emergency department was compromised. Deploying Lean principles helped Flinders Medical Center to redesign the processes of Emergency department using "value stream mapping" and increased employee (15-20 %) productivity with fewer incidents in patient's safety. This case presents two and half years of Lean transformation and how the productivity and quality of the Medical center increased without any increase in cost or resources.

Another example is Royal Bolton NHS Foundation Trust which reduced the average turnaround time for pathology cases from 24 hours and plus to 2-3 hours and save 3.1 million by using Lean weeklong tool. Royal Bolton achieved these results by using fewer resources and redesigning the process (Burgess and Radnor 2013).

2.3.2 Lean in Education

Improving the quality of Educational services is one of the most important goals worldwide (Shah and Ward 2007). An example of successful Lean transformation in the Education field was reported by Emiliani (2004) who concluded that the application of Kaizen tool in the educational process both in the classroom and administration achieved significant improvements on students' satisfaction as shown after applying Lean from Semester 2 onwards (Figure 2.1):



Note: Course ratings as reported by part-time graduate students using the IDEA Center survey (IDEA, 2004) administered at the end of the course, starting with the first semester the course was taught through the fifth semester. Significant changes were made to the course after the first semester, based upon student survey results and the professor's dissatisfaction. Semesters 2-5 incorporated improvements consistent with Lean principles and practices (Tables 3 and 4). The IDEA rating system for "Teaching Effectiveness" is: 1 = low to 5 = high. The IDEA national average for "Overall Excellence of Teacher" and "Overall Excellence of Course" are 4.2 and 3.9, respectively

Figure 2.1: Student Survey rating at end of semester (Emiliani 2004, p.10).

Another example of implementing Lean is the case of Oakland University, to improve the university's grade change administrative process by a group of students. Prof. Doman (2010) designed a new course called "Lean Workout" to teach students Lean principles and tools in order to improve one university process. The case was interesting as the author explained the learning modules and how students were able at end the to use Kaizen tool and the value stream map to enhance the university grade change process. The students were able to automate the process 100% and remove none valued actions from process in order to accelerate the process and make it more effectiveness and efficient.

2.4 Lean IT – Application/ Software development

As mentioned before, the Lean framework is not designed exclusively for the manufacturing industry it can also be applied to any other business. The software development and maintenance field can benefit a lot from Lean principles to optimize time and the cost of developing new software (Middleton and Joyce 2012). As stated by Kindler et al. (2007), applying lean framework principles in the software development sector can increase productivity by 20 to 40 percent while improving the quality and speed of execution.

Lean software development inherited its principles and concepts from Lean manufacturing. However, not all lean principles fit software development (Ebert et al. 2012). Basically the lean manufacturing principles can be applied to the software development process to resolve issues, improve process and obtain better results. Following lean thinking in software development, the important thing is to understand what “value” is and what activities and resources are absolutely necessary to create the value. Thus, it will be easy to eliminate and remove waste which can be: extra features (Over producing), requirements (Resource Inefficiencies), extra processing steps (Processing Inefficiency), finding information (Movement), bugs not caught by tests (mistakes) and waiting for decisions (Delays) (Kumar 2005).

Applying Lean in IT the software development sector is just growing, there are few research papers in this area. Most papers describe the integration of both Agile and Lean in software development and the benefits which can be gained by combining both frameworks. In a 2010 survey by Forrester, 35 percent of organizations polled described their primary software development methods are based on Agile and Lean principles (Ebert et al. 2012).

For the purpose of this research, we need to clarify the difference between Lean IT (in particular Lean software development) and Agile because both terms are used interchangeably in many literatures. Agile methods first emerged in 2001 by the Agile Manifesto group. The group consists of 17 people who were looking for better ways of developing software, with a number of principles such as: Satisfying customer requirements, more flexibility in accepting changes, engaging the end user throughout the development phase, and continuous improvement (Fowler and Highsmith 2001). By comparing Lean Software development principles and Agile principles, we found that customer focus and continuous improvement are common on both frameworks. Additionally, fast delivery, defer commitment and continuous improvements are interlinked on Agile and Lean (Fowler and Highsmith 2001).

There are different views regarding Lean Software Development methods if it is an instance of Agile methods or a separate new method. Wang et al. (2012) in their research

into exploring the usage of Lean and Agile frameworks concludes that some cases show that Lean principles were used along with Agile methodology to better collaborate and communicate with stakeholders of software development. While other cases used Lean framework to govern, control and improve agile software development activities. Since Agile methods focus on short term achievements such as: reducing documentation and unnecessary features which lead to a negative impact on project life-cycle overall; here the role of the Lean framework was used to bridge this gap and enhance Agile methodology (Ebert et al. 2012).

Significant improvement has been achieved by Wipro, an Indian software services firm, by employing Lean framework to enhance productivity (Staats et al. 2011). Wipro launched its Lean program in 2004 and within the first year, it was able to improve the quality of system development by reducing 6% of “rework”. Staats et al (2011) explained that using value stream map and visual management tools contribute to streamlining communication between the development and testing team. As a result, team productivity increased from 1.3 defects processed per engineer per week to 2.0 defects per engineer per week. Consequently, Wipro revenue was increased by 34% due to this enhancement (Hamm 2005).

Another case for Lean transformation of software development management is the case of British Broadcasting Corporation (BBC). Middleton and Joyce (2012) observed the improvement of Lean implementation in the BBC software team which resulted in improving project delivery time by 37% and enhancing the system quality by reducing reported defects by 24%. The main changes were (a) implementing value stream map to remove non-valued activities and (b) using information boards and daily stand up (meeting) to visualize the progress of each task and discuss any issue which can stop or delay work flow (Middleton and Joyce 2012).

2.5 Summary

This chapter has presented a detailed overview of Lean principle tools and their application in different industries. It is complex to define Lean as it depends on the

context where it is applied. However, Lean thinking is a way of enabling organizations to reduce waste and focus on customers and continuous improvement. Lean principles and tools help organizations to identify waste and ultimate root cause of problems instead of correcting failures.

From the literature review we can find that Lean can be deployed successfully in other businesses other than manufacturing. Many businesses (such as: Healthcare and Education) are using Lean principles as a means of enhancing business processes which improve organization productivity and competitiveness and deliver greater value to customers. Lean implementation in IT application development and in the Arab world specifically is still new and inter-related to agile methodology. Therefore, pure Lean framework needs to be evaluated in IT environment to measure its impact on IT services management and organization culture.

Chapter 3: Research Methodology

Research methodology is defined as a systematic or hypothetical analysis of data which was collected by applying different techniques to the field of study (Irny and Rose 2005). There are two basic types of research methodologies namely: qualitative and quantitative. Qualitative research method is used for examining opinions and motivation, exposing complexity and depth of an issue, and exploring and providing insights of specific subject/topic. It is considered as exploratory research which aims to analyze data subjectively and interpretatively. On other hand, quantitative research method is used for dealing with facts and quantifying a problem. It is mainly use for descriptive researches which aim to generate numerical data and transfer it into usable statistics for analyzing (Onwuegbuzie and Leech 2006). This chapter introduces the research methodology which was adopted to conduct this research.

3.1 Overview

Case study is a qualitative research methodology which is used in many research fields to contribute to our knowledge in psychology, sociology, political science, business and education. It looks at examining and investigating a particular subject in real-life. Researchers use different tools and techniques to collect data around the subject of the case study and analyze these data in order to understand the subject in depth (Thomas 2011). It was argued that the case study method allows researchers to observe the holistic and meaningful characteristics of real life events, such as individual lifecycle, small group behavior, organizational and managerial processes, neighborhood change, school performance, international relations, and maturation of industries (Yin 2009). The difference between case study and other research methodologies is that case study is an empirical inquiry that investigates a real-life phenomenon in depth especially when the boundaries between phenomenon and context are not clearly evident. On contrast, experiment methodology discovers a phenomenon from its context which is controlled by researchers in the laboratory environment.

The motivation behind carrying out a case study research varies from presenting a simple individual case to analyzing a broad phenomenon based on multiple cases. A case study can be used with other research methodologies for data collection and data analysis. Data collection methods vary using unstructured or semi-structured techniques. Some of the common data collections methods are: focus groups (group discussions), individual interviews, and participation/observations (Noor 2008). Data analysis techniques can be pattern matching, explanation building, time-series analysis, logic models or cross-case syntheses (Yin 2009).

It is important to mention that the case study cannot be used to generalize an idea as case study is about one specific subject which is under study and analysis. Yin (2009) considered this fact as one of the case study limitations. However, it helps to get a rich picture and to gain analytical insight a particular case.

3.2 Selection of Research Approach

Research methodology depends on the research objective and purpose. This research explores Lean framework application to IT department and investigates the changes in IT services quality, cost and people before and after Lean deployment. In this research, the case study methodology is relevant because the research's purpose is to observe the transformation of IT department to Lean and to study the impact of Lean on IT services. Therefore, using the case study methodology ensures investigation and analysis of the Lean transformation and its enhancement on research's case.

According to Yin (2009), the case study consists of five components of research design which are shown in below Figure 3.1.

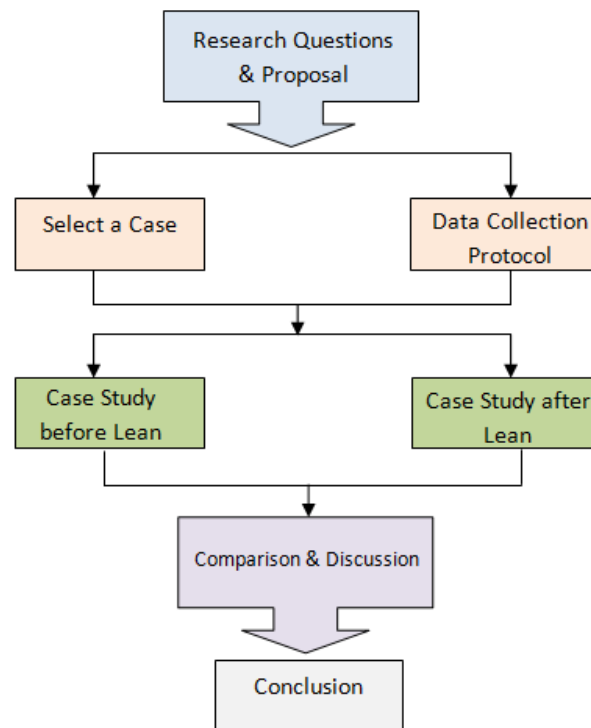


Figure 3.1: Research Design.

3.2.1 Research Questions

The research design starts from research questions which were developed from gaining knowledge around the topic “Lean transformation” and literature review.

4. How does “Lean Framework” improve the quality of IT services?
5. How can “Lean Framework” reduce the cost of IT services?
6. Why does “Lean Framework” have a direct impact on organization culture and people mindset?

These questions are emerged from “True North Performance” metrics which are part of Lean Framework measurements (Koenigsaecker 2013, p.19). These “True North Performance” metrics are:

- Quality Improvement
- Delivery/ Lead time/ Flow improvement
- Cost/ Productivity, and
- Human Development.

The first three measurements are related to the business performance dimension and the last measurement is for human development.

3.2.2 Research Proposal

Lean concept was coined by Japanese to achieve perfection and total improvement of their products. The success of Toyota story promotes Lean principles worldwide. Organizations start adopting Lean principles to improve products quality with lower cost (Abdulmalek and Rajgopal 2007). However, Lean Framework does not deploy explicitly in manufactures and industrial organizations. It can be employed in public sector, military, health care, and any business. Thus, Lean framework can improve IT services quality and reduce its cost (Middleton and Joyce 2012). Similarly, Lean principles and tools which were used by Industrial organizations can be implemented in IT to accomplish comparable results of improvement. Since Lean principles derived from removing waste, it focuses on value added activities, and increases customer satisfaction which can be applied in any business.

3.2.3 Selecting a case

This research will study a particular case of IT department in one of primary financial institution in UAE which is suffering from delay in project deliverables, quality issues and high cost expense due to the integration of two organizations. The management of IT department is looking to overcome these issues by reviewing internal operational processes and assessing current issues within IT. This case considers being a best candidate for Lean transformation. Therefore, author found that this IT department will help to investigate how Lean transformation can impact on IT services' quality, cost and people. As IT is a large field, this research will spotlight on application development field of IT. More details about IT department will be provided in next chapter.

3.2.4 Data Collection Protocol

Conducting this study depends on focus group meeting, direct observation, and reviewing existing documents in IT department to collect data during Lean implementation.

The focus group is one of qualitative methodology for collecting data which is known as “a form of group interview that capitalizes on communication between research participants in order to generate data” (Kitzinger 1995, p.1). As claimed by Kidd and Parshall (2000), focus groups’ participants find the experience more inspiring than participants in either self administrated survey or structured interview with less spontaneous interaction. Therefore, two to three focus meetings were arranged for IT management and other stakeholders (business representative, IT staff) to understand the current state in IT department and areas of improvement. Focus groups helped to understand and examine the need of using Lean framework in IT by discussing different subjects related to customer satisfactions, IT processes and services with experts and people who have a long experience in IT. The purpose of these meetings is to design target state for IT department and how to achieve that state after implementing Lean framework. Focus group structure can be found in Appendix A.

Another method of collecting data for this case is the direct observation of IT department’s employees. Direct observation gives more “reality” for this case since employees’ behaviors and environmental conditions will be analyzed (Yin 2009). Beside focus group meetings and direct observation, reviewing existing documents in IT department can be considered as another resource of data gathering. These documents include the Standard Operating Procedure (SOP), service catalog, inventory, project management process etc. Going through these documents gave more details about how work is being done and managed in IT department.

3.2.5 Data Analysis

Most of the data of this case study will be collected during the first stage of Lean transformation (Current State Assessment) to design the Target State. The outcome of Lean implementation phase is analyzed and aligned with research questions. Since the

purpose of this study is to evaluate the implementation of Lean framework in IT services, cross case synthesis is used to aggregate the finding of IT department before and after conducting the case study of the Lean case.

3.3 The Quality of Research Design

Since the subject of this paper is “Lean transformation” and its impact on IT services environment, especially in application development area. The evaluation of Lean transformation’s success will be on three dimensions namely: services quality, cost optimization and people productivity.

To ensure the quality of this case study, the construct validity tactics suggested by Yin (2009) were used. Construct validity tactics ensured that research design will develop operational set of measurements which are related to specific concepts and objectives of the case study. These tactics is serving quantitative research methodology which support this exploratory research and case study. According to construct validity tactics (Yin 2009), researchers can use the following tactics to provide more strength to their case study:

Multiple source of evidence.

Multiple sources for data collection are used: focus meeting, reviewing documents and direct observation. The findings of all of these sources are converged to conclude the case study findings and results. Using multiple sources gives more richness to the case study by collecting variety of data set which can support our objective.

Chain of evidence.

In order to increase the reliability of the case study, chain of evidence tactics will allow reader to follow the derivation of evidence (fact) from research questions to final findings – as showing in below figure:

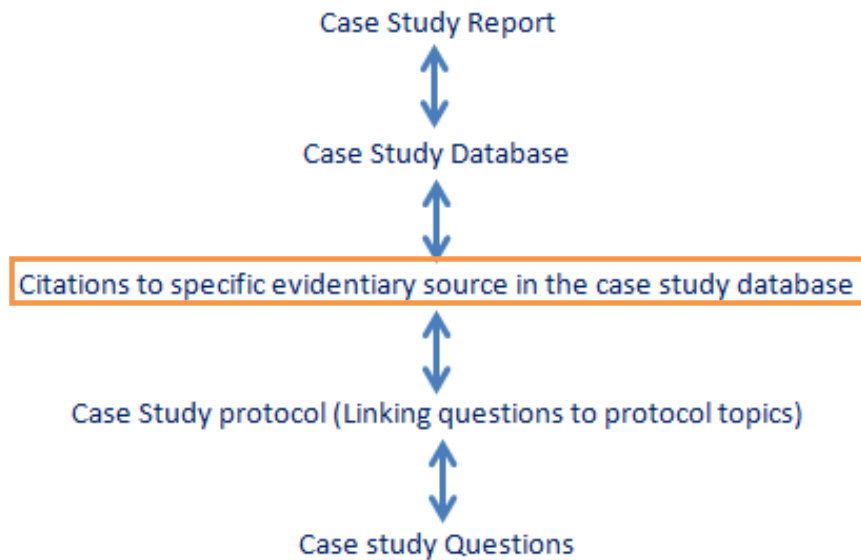


Figure 3.2: Maintaining a Chain of Evidence (Yin 2009, p.123)

Following these tactics, readers will understand the relations between data and collected facts, and the relations between research questions and final results. It will be easier for readers to trace and the link between all items which helps in giving deep understanding of the subject. Moreover, these tactics help researchers to analyze all evidences before coming to the final conclusion.

3.4 Summary

In summary, this research is adopting case study as a research methodology to assess Lean transformation in IT department. It focused in exploring the current problem in IT department and identify the target state by implementing Lean principles and concepts. The focus of evaluation will be in three elements: IT services quality, cost and staff productivity. Next chapter discusses the main three phases of IT Lean transformations and methods used for data collection and data analysis.

Chapter 4: IT Department Transformation (Case Study)

The purpose of this research is to study Lean framework in IT environment and analyze its impact on improving service quality, reducing cost and increasing people productivity. The case study was selected as a research methodology for this paper as described in previous chapter. This chapter delves into details about the selected case and the needs for applying lean framework in order to improve the IT services. Moreover, it explains lean stages and different tools that have been successfully used in each stage for data collection and analysis. The case study has been applied to the IT department of the largest UAE financial institution. The findings of Lean transformation are discussed in the next chapter.

4.1 Overview about Selected Case – IT Department

The selected case is an IT Department in financial institution (Banking sector) in UAE. This financial institution combines different companies with different functions such as: Banks, Brokerage services, Payment products/ services and Insurance. The strategy of this financial institution is to expand to international market by opening new branches in Middle East, Europe and Africa.

The major bank in group considers being the largest bank in UAE in assets and number of branches (227 branches) and over 900 ATMS. In 2007, it became the largest bank from a merger of two big banks. It took two years and a half to achieve an integration of the core banking platforms. A new IT Department was structured after the integration between both departments. The new IT team spent two years to stabilize and standardize core systems and IT functions across bank group.

IT Department is responsible of providing high standard IT services to all institution's subsidiaries. IT services include providing infrastructure support, application support and operation support for all users (around 10,000 employees). Figure 4.1 presents IT Department structure:

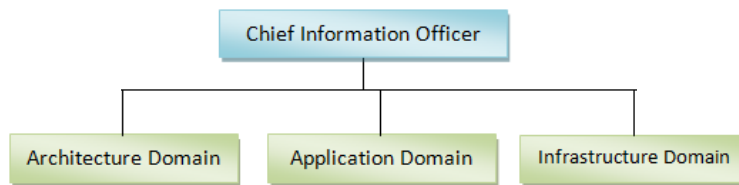


Figure 4.1: IT Department structure

IT Department consists of multiple units (so called domains in the banking institution understudy) with 420 staffs from different nationalities. The functionality of each unit is domain dependent described as follows:

- **Architecture Domain:** It is responsible of evaluating the system’s design and reviewing the architecture documents for every new IT projects.
- **Application Domain:** It consists of a number of teams, each of which maintains and supports the main bank’s applications, such as: Treasury, core banking system called “Finacle”, application services, enterprise data warehouse, channels, and enterprise software engineering, among others.
- **Infrastructure Domain:** It comprises network, telecom, storage, database and servers (windows/ Linux) teams.

Each of these domains acts as a separate unit that has a domain head and team manager. However, they should follow the IT Governance’s policies and processes at the end.

4.2 The need of Lean Framework

The integration process of any two entities is faced by many challenges, especially adaption from people in order to accept and cope with changes. Also, culture differences can cause some issues and confusions that we have to deal with. Stahl and Voigt (2008) explained that cultural distance can increase if top management styles are opposed to each other and employees do not share key values. Thus, in order to address these issues, the Bank and in particular the IT Department has introduced a new stage starting after the integration.

The IT Department was overwhelmed by a number of projects that were started within the two years that precede the integration and how to position itself in this large organization. Thus, IT Department investigated how to gain further synergies, reduce IT

spend and become highly effective and customer centric. IT Department vision is to become a leading IT partner and productive work force to propel the bank into strong market position. This vision drives IT Department management to search for a continuous improvement framework which focuses on building a culture of improvement and perfection.

Lean transformation journey started when IT Department management had met Booz & Co consultant, consulting Business Company, who proposed implementing Lean framework to achieve IT Department objectives and vision. Lean framework was selected because it was successfully implemented in different fields. Moreover, Lean thinking includes the focus of producing high quality products and services at relatively low cost. Lean consist of five main principles to identify the value of customers, implement value stream mapping, develop flow production capabilities and a pull-based system, and eliminate all forms of waste in the system (Chen and Taylor 2009).

4.3 Lean Office

To start Lean transformation and making IT Department as lean institution, Lean Office (LO) should be established as a separate entity in IT Department reporting directly to Chief Information Officer (CIO). Transformation office's objectives are (a) to coordinate lean initiatives within IT Department and other business units in Bank, (b) to execute lean activities and (3) to report the results of these activities with senior management. This team is dedicated to support Lean implementation including strategy, governance, methodology, resourcing, reporting change management and education.

LO consists of Lean consultant and existing IT Department staffs from different domain teams. Lean transformation will run for a long period of time in order to achieve its main objective of eliminating waste and creating a culture of people and process that value end customers' needs. LO included talented and experienced employees who act as Lean Champions to support Lean during its different stages. The role of Lean Champions is voluntary to fill the communication gap between LO, IT management and rest of staffs. Lean Champions acted as ambassador of their team during focus group meetings.

Moreover, they made awareness within their team regarding Lean transformation objectives and plans.

The establishment of LO and selecting the team members is the first step before the actual lean transformation takes place. The second step is to plan for the journey and identify the goals of each Lean stage. Lean transformation plan is divided into three main stages as showing in Table 4.1:

Lean Stage	2013				2014			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
LTO Establishment	■	■						
Current State Assessment		■		■				
Target State Design			■					
Implementation			■	■	■	■	■	■
Pilot Phase			■	■				
Roll out					Wave 1	Wave 2	Wave 3	

Table 4.1: IT Department Lean transformation stages and timeline.

Before moving to first stage, i.e. Current State Assessment, the LO is established and champions are selected and trained.

4.5 Lean Transformation Stages

The lean framework is typically divided to three distinct stages along with a number of continuous improvement waves/phases in order to ensure the perfection of the lean transformation. They are: Current state assessment, target state design, and implementation in which all stakeholders are engaged to understand and support the objectives of lean. Figure 4.2 summarized the tools which were used in each Lean transformation stage:

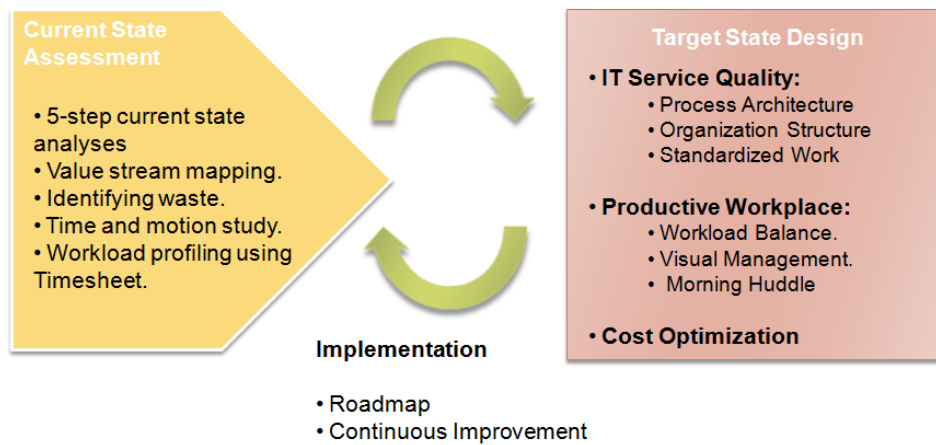


Figure 4.2:IT Department Lean Implementation stages.

During the first two stages different lean tools were used to collect data around current issues in IT and area of improvements. Focus group meeting is one of main tools which used to collect data around IT services, quality, cost and work environment. These questions are driven from IT Department improvement strategy that aims to assess current state and help in designing/implementing target state.

Stage 1: Current State Assessment

The first stage is designated to understand the needs of IT Department and analyze the current state of organization. The LO discusses the following questions with other stakeholders, IT domains managers, Lean champions and business units' representatives:

- Are we aligned with our business strategic?
- What are the issues with IT project deliverables?
- What are the current pain points related to IT services?
- How much time do we spend on value-added activities?

To answer these questions, LO with help of Lean champions used five different tools to evaluate the current state. These tools are:

1. 5-step current state analyses
2. Value stream mapping.
3. Identifying waste.
4. Time and motion study.

5. Workload profiling using Timesheet.

It is important to mention that these tools are a sub-set of the overall lean tools which are customized for IT Department case. In general, the lean framework aims to come closer to understand customers and focus on value added activities in order to indentify customers' needs (Arnheiter and Maleyeff, 2005).

The **5-step current state analyses** tool is used to provide foundational understanding of the existing situation in IT Department by enabling “deep dives” across people, process, technology and tools. LO relies on 5 step to analyze the current state during focus group meetings with IT Department management and other business stakeholders. The aim of these meetings is to identify IT Department customers, business demand, IT performance against this demands and environmental conditions.

Step 1: Understanding customer and customer purpose:

The first step is to clarify who the customer(s) is and their general purpose. For example, the internal customers for IT application domain are business units requiring software applications. Another example, is the end user who is calling Help Desk to resolve issues related to IT services, such as services provided by PC, telephone, printer, etc.

Step 2: Understanding type and frequency of demand:

The second step is to recognize the type and variety of demand and request hitting IT Department. Help desk can be a perfect source to analyze customer's demand. This step focused on monitoring daily volume of calls raised to help desk by end users and calculating the percentage of high and low priority calls.

Step 3: Assessing current performance:

The third step is used to analyze how well current process/ technology meeting customer demand. This can be achieved by review system availability against agreed SLA (Service Level Agreement) with business units.

Step 4: Identifying High-level value stream:

The fourth step is used to gain visibility of the current systems, work flows, information flows and overall performance. This step recognizes the overall workflow by engaging customer (business units) and gets their feedback.

Step 5: Assessing environmental condition:

The Last step is related to environmental conditions and its impact on IT Department performance. For example, consider the case of groups which their activities require close collaboration but they are in distant locations.

Going through all these steps, LO made use of collected data in analyzing current state and process in order to identify opportunities for cost optimization and performance improvements.

Value Stream Mapping (VSM) is one of most common Lean tools which used to provide an end-to-end view of the processes across entire team. It can be defined as “A map that identifies every step in the process and categorizes each step in terms of the value it adds” (Wang 2012, p.2). The benefits of this tool are: (1) visualizing work (within a value stream or process), (2) observing how the work “flows” or “doesn’t flow”, (3) calculating key systems metrics such as end to end time and process step time, (4) identifying problems and obstacles from a system and workflow perspective, focusing on system benefits as a whole, and (5) setting the background for the target state design (Koenigsaecker 2013).

By using value stream mapping, activities can be classified into three categories which are: value-added activities, non-value added activities that are necessary, and non-value added activities. Lean framework aims to streamline value adding activities such as: the ones that creates competitive advantage and transforms process inputs into outputs that the customer needs, and willing to pay for. Also, Lean framework uses value stream mapping to minimize the second category, i.e. activities with non-value adding but necessary, such as activities that transform process inputs into output that the customer does not need, yet are required by law or regulation or consider to be input to subsequent value add activities. In addition, VSM tool helps to eliminate non-value adding activities which transform inputs into outputs that the customer does not want or need, and hence not willing to pay for (Chen and Taylor 2009).

As part of current state assessment, two types of quantification measurement tools were used to analyze the time that IT Department staffs spent on value added activities. The **Time and Motion study (TMS)** which is applied through in-person observation to a process in the scope of IT service during an entire working shift. Below are the methods how TMS is applied:

- Conducting a study on one of IT Department staff for a full day by Lean Champion. Lean Champion will shadow the subject at his/ her workstation, during his/ her performing work, moving around, conferring with teammates, and so on.
- Recoding data on each task in an excel sheet, including the activity type, process step, and the time it takes – at a minute by minute level of detail.
- Observing the workspace conditions, work blockages to flow, and issues are captured throughout the study.

Studies are conducted over a sufficient time (one to two days) for sample of employees in order to ensure that collected data is representative and accurate. The LO used TMS data to understand the natural of activities that employees are involved on and how they spent their day on work placement. A sample of TMS template can be found in Appendix A.

The second tool is **Timesheet** which is used to analyze the workload of each team members in the IT Department. The Timesheet tool is useful for tracking the time spent by each team member in his/her assigned tasks. At the end of each month the timesheet data is collected and analyzed according to task's category such as project delivery, production support and new initiatives. The data is filtered out for non-productive milestones such as leaves and public holidays. Finally, the data is aggregated and analyzed in order to manage resources based on the time allocated for different activities.

Stage 2: Target State Design

Upon completion of the first stage, the current state is well understood and analyzed. The LO team along with IT Department management defined the target state based on the IT Department improvement strategy and the findings of current state assessment.

This stage set required changes for IT Department to achieve a successful Lean transformation. These changes fall into the following three categorizes.

IT service quality and project delivery

To improve the quality of IT services and avoid issues related to IT project delivery, a number of Lean techniques and tools are implemented. First tool is **Process architecture** which is used to redesign some of IT process according to the results of investigating the reasons behind “wasteful” activities and determining the ultimate cause of such activities. The new process is more streamlined and focused on the quality of services and customer needs. Lean framework recommended changing **Organization Structure** in order to simplify and standardize workflows, and to enhance productivity. For IT Department case, organization structure for Application domain is to be re-defined to align with the streamlined processes. Another change which positively affects IT services is **Standardized Work** that is achieved by a well-designed organization template for eliminating any waste. As a matter of fact, many templates and documents across the organization should follow one standard in order to streamline day to day operations such as: procedures, tools, reports, forms, training and all paper work. Minimizing variation in certain processes adds flexibility since others are able to perform the same tasks at the same expected quality.

Creating productive workplace culture

One of main objectives of IT Department is to improve staff engagement and performance with the aim of creating a culture of improvement. **Workload Balancing** is one of aspects that LO recommended to enhance organizational capacity and create efficiencies.

Miscommunication or low communication between staff and management lead to produce “waste” and confusion. Using **Visual Management** tools, e.g. whiteboard, to communicate the state of the process/ tasks during team meeting/ huddle will help to create visibility and engage staff in finding creative solutions (Bissett 2009).

As part of lean transformation, each team of the IT Department domains must have a whiteboard to track project status and main activities of each team member. Also, **Morning Huddle** (10 -15 minutes) is a mandate for every team in order to improve team performance and team building skills. The purpose of Morning Huddle is to motivate team members, focus their efforts in main tasks, discuss any issues and share team success.

Optimizing Cost

Cost reduction can be shown from removing non-valued activities (waste) and applying better process design. Tools and changes that improve the quality of IT services and increase employees productivity lead to positive impacts on cost optimization.

Stage 3: Implementation

The last stage of Lean IT transformation is the implementation stage. This stage focused on building the new strategy of IT Department to achieve its vision and become a leading IT partner for the bank and its subsidiary companies. IT Department started the Pilot phase for two teams in Application domain and observed the improvements on team performance for two months. A **Roadmap** for Lean transformation is designed by LO for IT Department to identify and prioritize IT initiatives. Roadmap defined as a plan or strategy intended to achieve a particular goal” Oxford English Dictionary (2004, p.316). Lean IT identifies multiple opportunities among people, process, technology, and governance which is prioritized along value and timeline dimensions. The designed roadmap should be communicated to all IT senior management to receive a proper support from all IT domains. After roadmap is developed and agreed by all IT domain managers. IT initiatives for implementation are grouped into waves (phases) to ensure **Continuous Improvement**. Moreover, dividing initiative into waves help in establishing governance for each wave of implementation to track and measure progress against the target state and preparing communication of current status.

4.4 Summary

Lean framework is a systematic approach to identify and eliminate waste through continuous improvement initiatives in order to gain customer satisfaction. Lean framework does not only apply on manufacture industry only but it can be applied to any process driven organization including IT. This chapter presented a case of one of IT department in financial institution which adopted Lean framework concepts and principles in application domain, i.e. Software development. The transformation journey of IT Department started after establishing a Lean Office which managed all activities related to Lean Transformation stages and changes. It was important to identify and analyze the gaps in current state and then to design and finalize the target state before starting the implementation phase of Lean framework. Different Lean tools are proposed for each stage in order to collect and analyze data and plan for the final implementation stage. The main improvement areas which IT Department identified during current state stage are: the quality of IT services, operational cost and workplace productivity.

Chapter 5: Findings and results

This chapter presents two cases of IT Department before Lean transformation and After implementing Lean principles and tools as discussed in Chapter 4. The findings and results of Lean implementation in IT Department for the last two years are presented in following sections which are focused on answering the research questions of the case study: 1) How does “Lean framework” improve the quality of IT services?, 2) How can “Lean framework” reduce the cost of IT services?, and 3) Why does “Lean framework” have a direct impact on organization culture and people mindset?

5.1 IT Department before Lean Transformation

❖ Incident Management process:

During current state assessment, the quality of IT services and deliverables is considered as an area of improvement. By applying the 5-step current state analysis, we found out that IT Department is responsible of supplying and supporting all IT related systems and devices across the bank and its subsidiaries. Users’ requests can be classified into two groups (Support request and Change/ Project request). All support requests are recorded in Incident management software and assigned to respective teams by the service desk to resolve support requests within agreed Service Level Agreement (SLA) as showing in table 5.1:

Incident Priority	Resolution Time
High	1 Hour
Medium	Within 3 days
Low	Within 7 days

Table 5.1: Service Level Agreement – Before Lean

❖ Aligning Business objectives (requests) with IT strategy:

For change/ project requests, which are usually associated with cost, Business Relation Manager (BRM) are responsible to log these requests in same Incident management software (which is not suitable for managing projects and changes). During focus group

meeting, we have been told that IT domains –in some cases- were receiving change requests directly from Business units through emails and phone calls. It was obvious that these cases cause confusion within IT domains to understand the role of BRM. The general assumption was that BRMs are involved only for changes and projects with cost above 20,000 AED in order to get IT management approval during ITAB (Information Technology Advisory Board) meeting. With the intention of understanding and clarifying the role of BRMs and the process of cost approval, value stream mapping was created as shown in Figure 5.1.

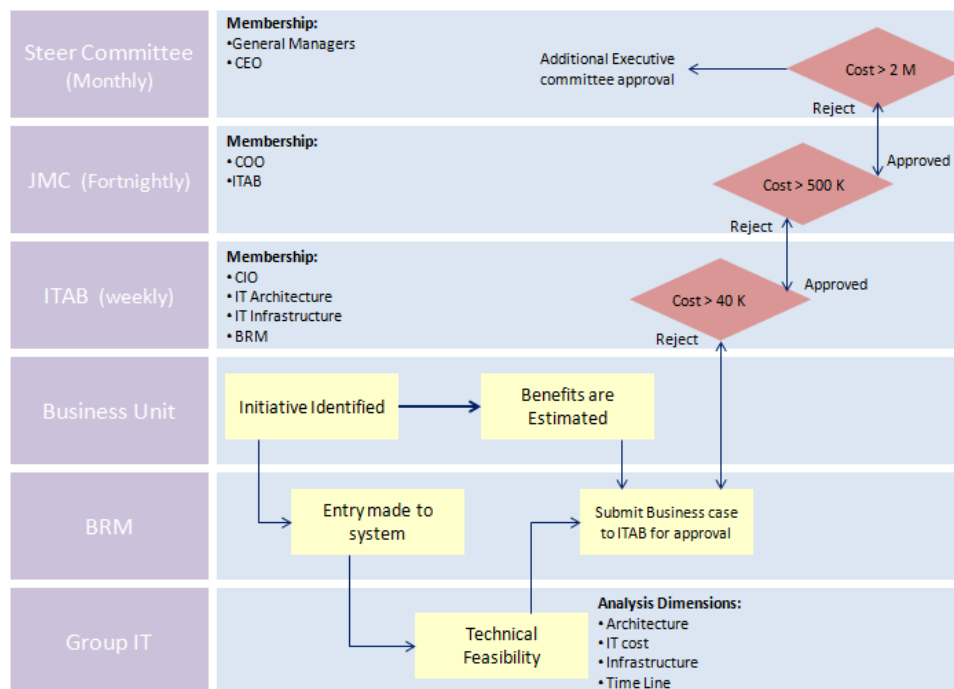


Figure 5.1: Approval Process – Before Lean

For any initiatives that have a budget above 15,000 AED, the respective business units need to send a business project request to BRM. The business unit in turn estimates the benefits of this change/project while IT Department assesses the initiative technically and provides estimated cost and timeline. Approved proposal is presented in ITAB meeting which is organizing every week to review and make recommendations concerning new projects/ changes initiated from IT Department or other Business units. ITAB forum consists of CIO, IT architecture manager, IT infrastructure manager and BRM. In case, the approved initiative's cost is more than 40,000 AED, then CIO along with BRM need to present the initiative to Chief Operational Officer (COO) during Joint Management

Committee. For initiative with 500,000 AED cost, CCO along with CIO have to present the initiative to the respective General Managers for all business units involved, including risk, compliance and audit units.

It is also worth noting that approximately 80% of projects are above 15,000 AED and have to be approved by CIO during ITAB meeting; majority of which includes “Lights-On” projects, see Figure 5.2.

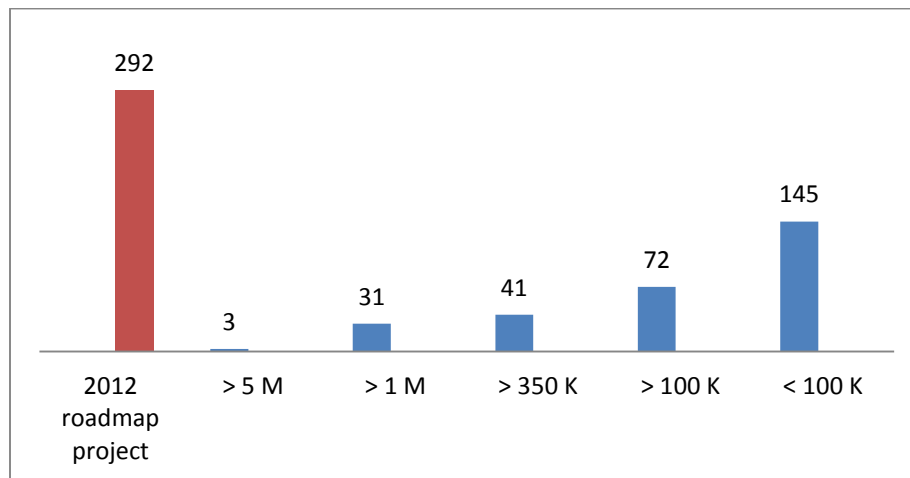


Figure 5.2: Number of projects in 2012

Focus group meeting helps in getting more insight on business case, project approving process and BRM role. Below are quotations from some of these insights:

- “We don’t have business case approval before we kick off IT effort estimation. As result, we spend considerable time on an initiative that might not kick off”.
- Based on the timesheet data, IT Department spent around 30,000 AED man hours in Business Case development of which only 20% BC are materialized into actual project.
- “Things are getting done randomly during pre-initiating phase with a lot of efforts from BRM to follow up with both IT Department and Business unit to finalize and submit Business case”
- “Major mismatch between the delivery timeline commitments. Timelines are decided before scope is informed. Somebody should funnel this adequately currently it’s all chaos”

❖ **Monitoring team performance and Resource capacity:**

During Focus group meetings also team leaders of Application domain expressed that they are struggling in assigning support activities to their team members who are already engaged with project tasks. It is difficult for team leader to prioritize between both tasks since both support and system issues have higher priority such that resolution for any system failure should take place at the earliest. On other hand, project tasks have restricted timeframe with specific work scope in which no deviation is acceptable.

Therefore, LO used direct observation of employees in their work placement - Time Motion Study (TMS), and Timesheet revealed of some issues with employees productivity. From TMS data, we ascertained that employees spent 26% (around 2 hr 23 min out of 8 working hours) of their time on none-value activities as per Figure 5.3.

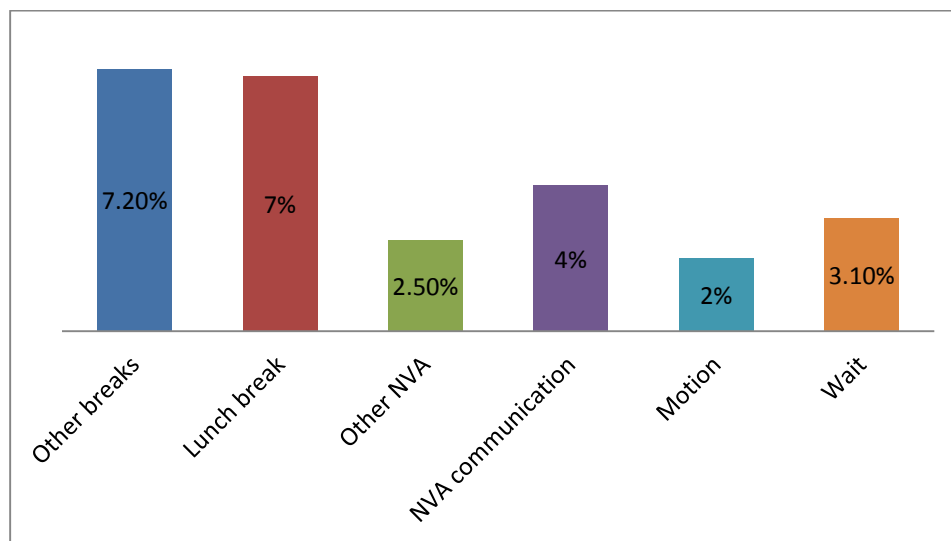


Figure 5.3: Waste time –TMS – Before Lean

These non-valued activities create waste, stress and instability. Moreover, it leads to increase of cost, delay in delivering value to customer, decrease in quality of output and frequent re-work. TMS helped in identifying different kinds of waste categorized into 8 waste groups, as shown in Table 5.2.

Waste Group	Example from IT Department
Rework	Bug fixes, change request
Over Production	Producing too much code without availability of resources to test it

Motion	Un-necessary data or people movement (Example: printing and getting managers signature for approval)
Transportation	Nonessential data and information transport
Waiting	Waiting on approval, waiting for a system to finish cycle
Inventory	Critical business requests waiting to be processed, and search for documents.
Over Processing	Un-necessary approving chains
Intellect	Mismatched talents/ skills and allocated tasks

Table 5.2: Waste Group

Timesheet analysis for application domain showed that application teams spent around 36% of their time in Project Management while 27% in Application support and 22% in Software engineering (development), see Figure 5.4.

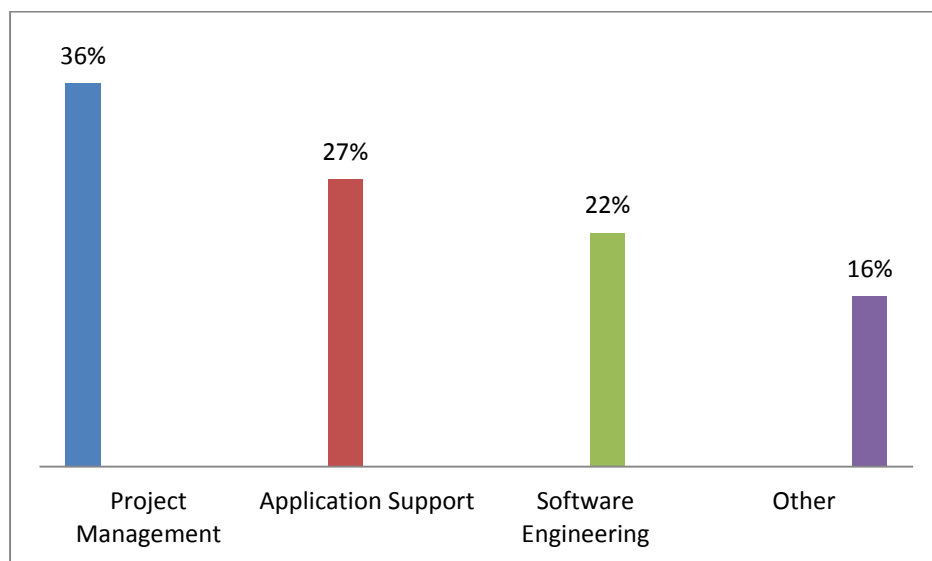


Figure 5.4: Timesheet analysis – Before Lean

The following are some quoted feedbacks which were collected during the focus group meetings in order to understand application teams' tasks and responsibilities:

- “Currently Business units often does not freeze the requirement for long time. Thereof we need to spend more time on rework”.
- “Consistently collaborate with Business units in enhancing various functionalities through Business changes or new projects”
- “We don’t use any tool to tie test cases to the original set of requirements. As a result, we lose traceability of functionality with requirement”

To sum up, IT Department lacks having proper incident management process. Also, it needs to increase BRM effectiveness and review project approval process in order to better align IT strategy with business objectives. On other hand, employees’ productivity and performance were not measured in a way that presents current resource capacity to higher management. Submitting business case to ITAB often takes several months which consumes huge organizational resources with low success rate because there is no standard business case template or standard procedure for performing technical feasibility. It was difficult to gain customer satisfaction due to delay in initiating new projects, providing accurate cost estimation and deliver project with high quality.

5.2 IT Department after Lean Transformation

❖ Incident Management process:

As part of Lean Transformation, LO conducts a review of the current processes and existing documents and how it can be modified in order to remove waste and focus on value added activities. Therefore, SLA was reviewed and new element was introduced to measure the ‘impact’ of incident, see Table 5.3.

Incident SLA Matrix		Impact		
		High	Medium	Low
Priority	High	1 Hour	1 Hour	1 Hour
	Medium	1 day	2 days	3 days
	Low	1 day	3 days	7 days

Table 5.3: Service Level Agreement – After Lean

Prior Lean transformation, incidents were treated equally unless there is a case where the priority rose to High or Critical. However, there are some cases where their priority level is Medium but their impact is high, such as: if a PC of branch teller is crashed, or a telephone set is not working for a member of collection team, or the fax machine in Sales department is not working. Once an incident is raised for such cases, its priority is set to Medium as it is just hardware issue with just one PC, a phone set or a fax machine. The updated SLA considers measuring the priority and impact of each incident in order to minimize the business impact and meet customer expectation.

❖ **Aligning Business objectives (requests) with IT strategy:**

The role of BRM is reviewed as well in order to reduce the gap between various business units and IT. A number of meetings and awareness sessions were arranged for IT Department's domain managers, team leaders and Business representatives to introduce the new role of BRM.

As per the new role, BRM is responsible for the following: guiding business units in key technology decisions, formulating IT requests and coordinating with Domain Manager for project initiation and delivery, and providing proper update to business units regarding project/ changes status. The new role helps in aligning Business requirement with IT and restricting the process of initiating request to IT Department to be through BRM. Along with new BRM role, a new set of template (business case, reporting, etc.) has been developed which standardizes documentation across all business units. The strategy of standardizing business case template is to provide more flexibility in managing individual projects which is extend to cover the project portfolio. The goal also is to establish a common understanding that a business case is ideal for high-level problem and opportunity statements, with a funding level reasonable to address the need and a general implementation timeframe. Additionally, a new tool for logging all business cases for change/ project requests is developed to automate the process of initiating project and provides cost estimation. In addition, project approval process was redesigned as shown in Figure 5.5.

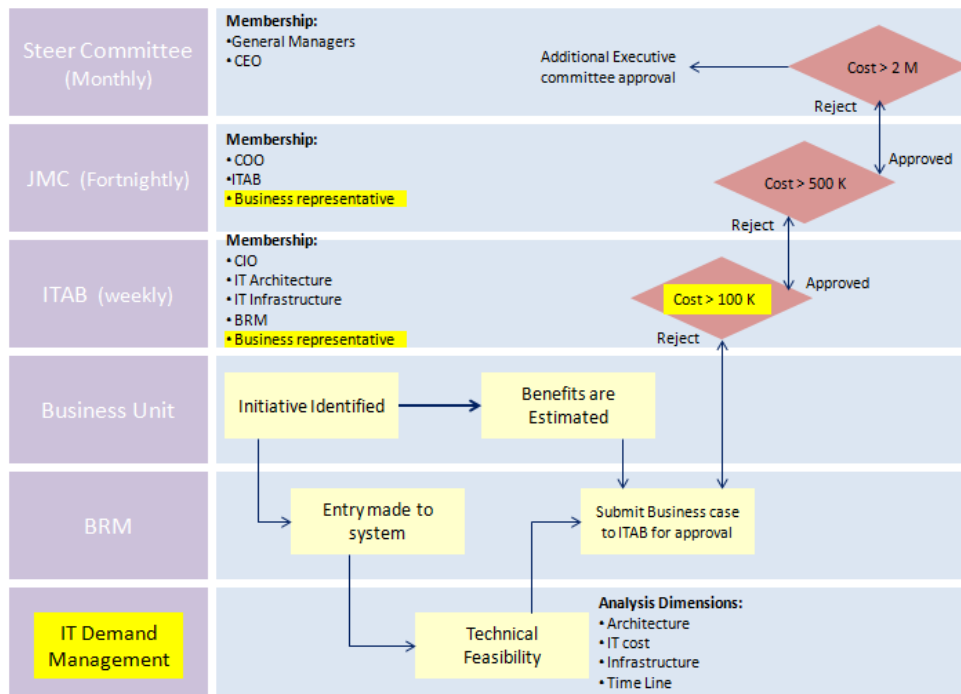


Figure 5.5: Approval Process – After Lean

The two main improvements of approval process are to increase the amount that needs approval from ITAB from 40,000 AED to 100,000 AED. Also, delegate the approval authority for any change/ project less than 15,000 AED to department heads with an annual capital of 5 Million. This change will reduce manager’s effort and time for approval and accelerate the delivery of small initiatives by avoiding ITAB formalities. The other change is to introduce a new team called “IT Demand Management” in Infrastructure domain to carry out the technical feasibility and coordinate with other IT teams to provide accurate cost estimation within 2-3 days. Demand Management is going to reduce BRM/ IT teams efforts on project pre-initiation through eliminating unnecessary work related to cost estimation and coordination with other IT teams and vendors. Other changes related to project approval is to engage business units’ representative during ITAB and JMC meetings to enhance the communication level with business units.

❖ **Monitoring team performance and Resource capacity:**

Furthermore, redesigning the project approval process and automating other process, such as logging business cases in system, user ID creation and password handover had a direct

impact on improving team performance by reducing 10% (around 1hr 29 min out of 8 working hours) of their time in none-valued activities. Figure 5.5 presents TMS analysis for application teams after the pilot phase of Lean transformation.

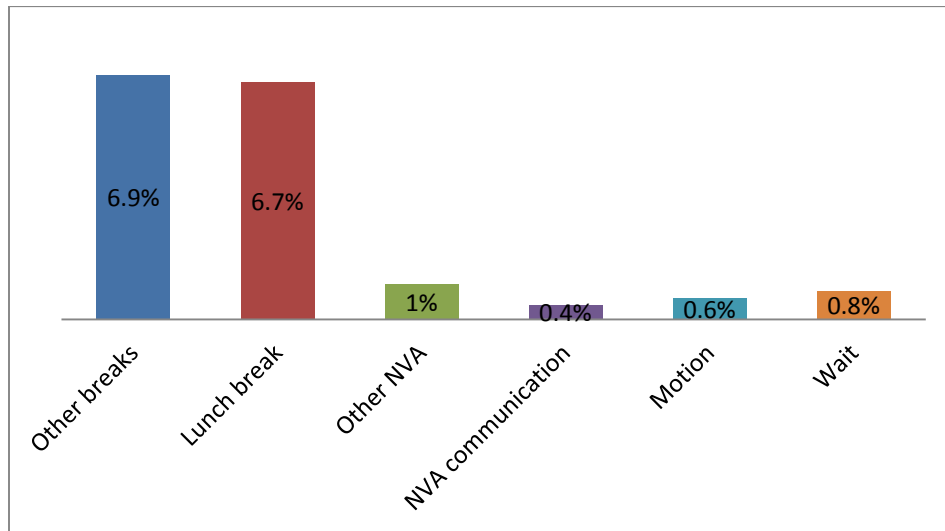


Figure 5.5: Waste time –TMS – Pilot phase results

IT Department capacity was outstripped by business demand and there was limited framework for prioritization at Group level. The challenge is that the same teams are handling both types of business demand, i.e. support issue and project tasks. Organization restructure is essential for IT Department to segregate projects tasks and daily support activities for application domain. Figure 5.6 shows the structure of Application domain before and after implementing Lean.

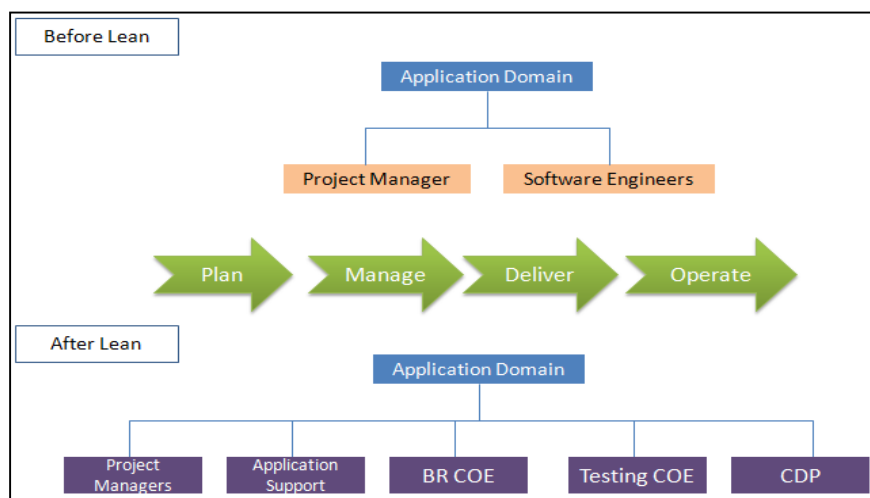


Figure 5.6: Application domain structure (Before & After Lean transformation)

It was obvious that staffs involved in Application domain are struggling between application support and project. Thus, the new organization structure helped to achieve workload balance by splitting the tasks of application support among members of the domain team who have deep knowledge in domain/ application and business units' relationships. Tasks of projects, such as requirement gathering, software design, coding, and testing are assigned to Center of Excellence (COE) teams. The new structure of application domain kept the original domain teams and introduces new COE team focusing on Project tasks as described in the following:

- Business Requirement – BR team: It is responsible of gathering detailed business requirement, providing direction and scope to align technology with organization's strategy and business needs, creating BRD (Business requirement Document) and ensuring requirements are sufficient and complete.
- Testing team: It is responsible of planning and managing the requirements for testing environment. It is also responsible for developing and executing System Integration Testing (SIT) based on business requirements, and supporting business in creating User Acceptant Test (UAT) cases as required.
- Common Developed Pool –CDP team: It holds the responsibility for the design, code creation and documentation. It also ensures that deliverables (code and documentation) are met and business objectives are achieved in respect to time, quality and cost. This COE includes technical staff with high knowledge on Java, .Net and Oracle administration.

The new structure allowed team members to focus on core activities which are project tasks and prevent them from constant task switching, such as between production support and project delivery. The new structure also helped in giving production support to respective application domain which helped COE teams to focus on project tasks and avoid COE members being pulled into unplanned support activities. The analysis of the timesheet of project managers after restructuring application domains showed that project managers spent more time on project delivery tasks which indicate quality improvement, see Figure 5.7.

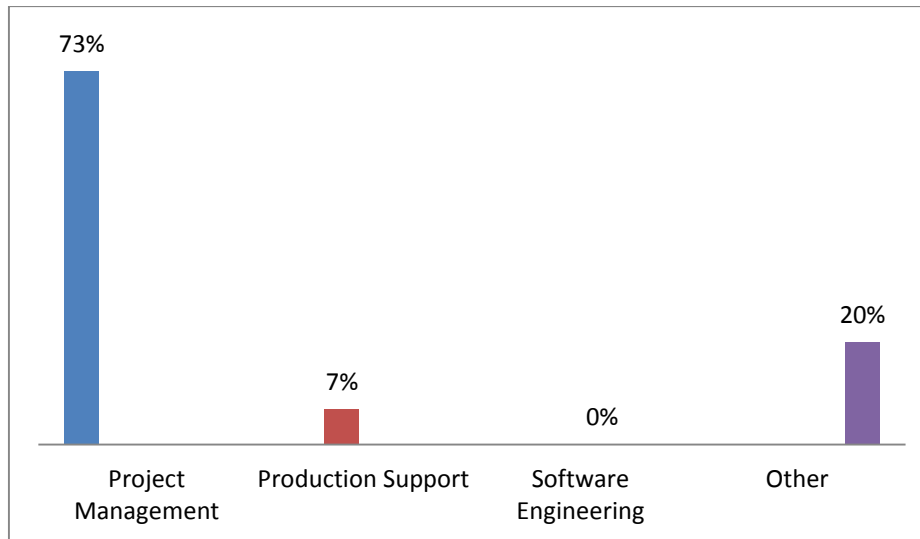


Figure 5.7: Timesheet analysis – After applying Lean transformation

All these changes can be misunderstood by some of employees so it was important for LO and IT management to promote the objectives of Lean transformation and every change implemented. LO spends a significant time to engage employees on multiple fronts such as Lean portal in Intranet to communicate Lean changes, including new templates, updates and training materials. Posters, related to Lean principles and IT Department vision, were distributed all over the floor to raise awareness between IT employees. Furthermore, Town hall meeting is organized every quarter by LO to share latest update on Lean initiatives to all IT Department employees and to provide an opportunity for IT Department staffs to have an open discussion with CIO.

At the team level, morning huddles and whiteboard discussions are useful tools that are used to communicate critical information among team members, encourage team members to share their ideas and opinion in solving any problem or issue, and to celebrate team success, reward and recognition. The overall feedback of Lean implementation –the Pilot phase- is positive within IT team as indicated by the following feedback that were gathered during focus group meeting:

- “The lean transformation helped us deliver projects within specific timelines following well defined processes.”
- “We can now focus on standardized task; the quality of our work as increased exponentially.”

- “It was not just about redesigning processes: the lean transformation has allowed us to see things from a different perspective.”

In summary, Lean transformation of IT Department was able to identify areas that add business value, improve project delivery and remove overheads by reviewing SLA, the process of approving project, redefining BRM role and introducing COE teams in organization structure.

5.3 Results

The impact of Lean transformation in any organization can be shown in terms of tangible benefits such as: reduction of processing or waiting time, reduction in costs and increase in quality through reducing errors and system bugs. Furthermore, there are intangibles benefits, such as increased employee motivation and customer satisfaction (Burgess and Radnor 2013). The main observations of lean transformation in the IT Department are:

1. Improving the productivity of application teams by reducing 10% of non-valued activities.
2. Reducing 60% of IT Department time and effort in project pre-initiation phase by standardizing business case template and technical feasibility process.
3. Enhancing the quality of project delivery by increasing 37% of project managers' time logged against project management tasks.

Beside these observations, customers' expectations are well understood after reviewing SLA and measuring the impact of any support requests on business. The project approval process is more simplified which helped in reducing time and increasing throughput. Using timesheet led to understand demand management and plan team capacity. Furthermore, utilizing visual management tools to facilitate performance measurement and communication across IT Department which improved employee engagement and empowerment.

Chapter 6: Discussion

Three aspects were defined based on exploration of the Lean principles in IT field and objectives of this research paper. These three aspects were stated as research questions and got answered by observing Lean transformation of IT Department. The results showed that Lean principles have positive impact on IT services' quality and cost and improve employees' productivity.

6.1 Overview

Question 1: How does "Lean framework" improve the quality of IT services?

The observation of first stage, current state assessment, exhibited that IT Department should review the internal SLA, BRM role and project approving process to achieve better quality. According to the collected data, the main drawbacks of IT Department services are (1) delay in resolving incidents, (2) nonaligned business initiatives with IT strategy, and (3) ambiguous process to initiate project for business users. LO focused on reviewing existing documents, i.e. SLA and team SOP to improve and manage the time taken by IT teams to complete certain requests. LO also looked at empowering BRM and redefining its role in order to align Business objectives with IT Strategy. It was important to start with redefining BRM role during "pilot phase" because BRM serves as the strategic interface or link between business unit and IT. Expanding the responsibilities of BRM helped IT Department to meet business needs and provided significant value to organization.

Although IT Department is following waterfall methodology for software development, it failed in providing strong project management and approval controls. The old project approving process added more complexity and latency in delivering small projects to business. Pre-initiation phase of project took long time due to resource constraints and the absence of a standard business case in which business requirements and project scope is defined and documented. Lean principles introduce some changes in Software project management, see Table 6.1.

Activity	Project before Lean	Project after Lean
Project management methodology	Waterfall (All phases managed by one team).	Waterfall (Each phase managed by different teams).
Project requirement	Requirements are not well documented and transferred to IT.	Standard Business Case to document project scope and requirement. Dedicated team to translate business requirement onto technical specification.
Development and Testing	Different tools and documents are used for application development and testing.	Using standard tools and software for application development and testing.
Tracking work	Weekly meetings with team to track project progress.	Visual Management using white boards and daily huddle.

Table 6.1: Comparison between project management before Lean and after Lean.

The new organization structure for application domain segregated the role of application support to domain teams and application project tasks to new COE teams. Introducing new COE teams allowed Project Managers and team members to concentrate only on project tasks and how to improve project lifecycle process. Spear and Bowen (1999) pointed out that specifying a particular job for each employee would help to see deviations or issues and focus on improving this particular job. This is can be observed by analyzing the timesheet of application domain prior Lean transformation, see Figure 6.1. It shows that application domain spent around 46% of their time in gathering requirement and rest of the time was allocated to the other core activities. Team members didn't have much time to check and identify the deviation or issues of assigned activities. After Lean transformation, specific activity is assign to each COE team which result in reducing deviation rate. For instance, testing COE reduced defects rate by 30% and improved the quality of deployed application.

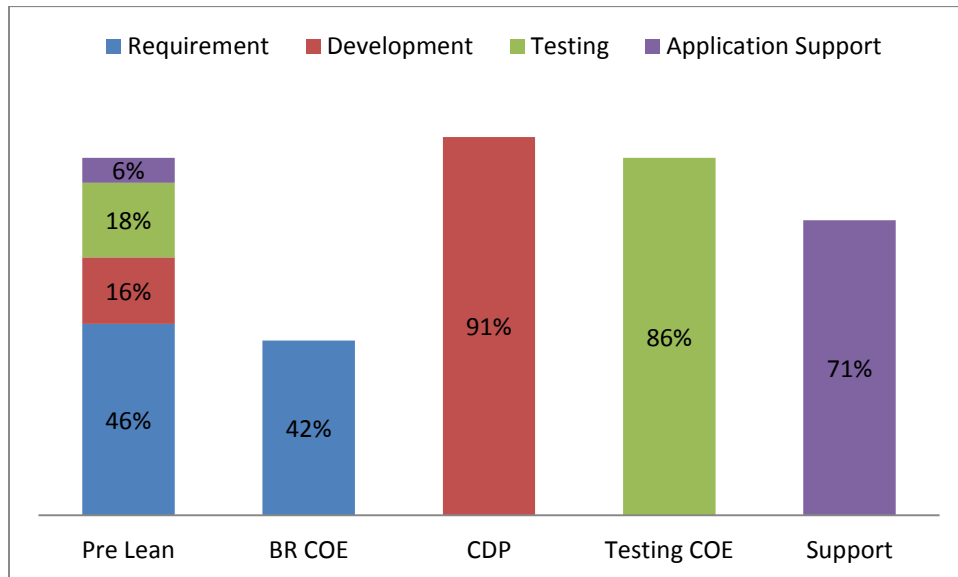


Figure 6.1: Comparison of application domain's timesheet prior Lean to COE teams' timesheet

Overall the quality of project controls and incident management are improved after Lean implementation in IT Department. Implementing Lean principles eliminated waste from project management process and assigned one specific core activity for each COE team to improve project management.

Question 2: How can "Lean framework" reduce the cost of IT services?

There was no direct cost saving from Lean implementation in application domain. However, cost optimization can be calculated from the new organization structure of COE teams. Aligning application development with portfolio demand, by balancing supply and demand through common developer pool, reduces the overall cost of software development. Placing employees with same skill sets into COE teams enable IT Department to scale up and down based on business demands and project. Developers will be working in their application domain to support software applications and whenever a new project is initiated; these developers will be pulled to COE teams to perform project activities and go back to their application domain once project is over.

Beside organization structure, deploying Business case for all new initiatives through BRM enabled IT Department to priorities project based on projects' return and investment value to the Bank overall. IT management used Business Case to rationalize project benefits and align Business and IT strategic. Additionally, Business case reduced

the effort and the time spent on project pre-initiation in which IT Department was spending around 30,000 AED (man-hours) before Lean transformation.

Question 3: Why does “Lean framework” have a direct impact on organization culture and people mindset?

The biggest obstacle of achieving Lean objectives is changing people mindsets. Lean framework works to change people behaviors towards issues and problems. Instead of neglecting these problems, Lean will encourage people to face issues and resolve it (Koenigsaecker 2013). Thus, to better manage people and attempt to change their mindset, we followed the suggested “mindset approach” of Yamamoto and Bellgran (2010) to ensure the success of Lean transformation. This “mindset approach” is close to Ohno’s beliefs, the founder of TPS, who believed that every improvement triggered by need (Ohno 1988). This approach works to bring up problems in surface and provoke people to feel the need of improvement and work hard to achieve lean objectives (Yamamoto and Bellgran 2010). This is can be illustrated in “Japanese sea-level” Figure 6.2. The sea level in left figure is covering all issues this can refer to weak project management controls in which overestimating cost or timeline in order to manage project and cover other internal issues. However, the sea level in right level is reduced to show strict and controllable management process in order to disclose issues such as, defect, lack of parts and delay.

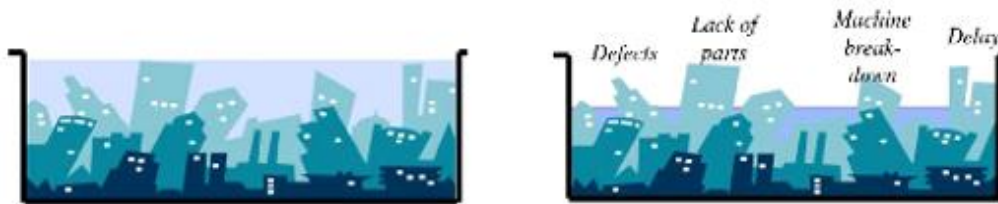


Figure 6.2: The “Japanese sea-level” model (Yamamoto and Bellgran 2010, P.4).

Following same approach, LO used a “time” controller for all projects and users requests. To explain this point more, the SLA example will be used, Service desk set a threshold time for all logged support requests to notify Domain managers prior SLA breached. Domain managers have to check the reasons behind the delay of closing the request and get it addressed before impacting business. In case the SLA is breached and request is not resolved yet, Domain managers need to discuss the issue in Operational meeting. Operational Meeting is organized by IT governance every week to discuss breached

support request and identify main issues of the delay with all domain managers and CIO. This practice (Operational meeting) enabled IT Department to change the way management look at breached request and the way employee think and tackle support request.

The key of successful lean framework is the sustainability of improvement which is related to people more than process or organization structure. Communication is the most area to improve within IT according to employees' feedback during focus group meetings. Thus, visual management tools were used to transfer as much information to team members. The more employees feel engaged the more motivated they will be. Staats et al. (2011) implemented visual control board in Wipro organization as well to resolve the issue of processing invisibility and streamline communication. Furthermore, LO aimed to attain workload balancing within the employees by analyzing their timesheet and shifting employees between COE and application domain to align resources with demand variability. Moving employees based on demand helped to reduce work pressure and employees' frustration which lead to increase efficiency in software development and project management.

By reviewing the findings of Lean transformation in IT Department we found out that there is a positive impact on the quality of IT services with less cost investment plus increasing employees' productivity.

6.2 Recommendation

This case study explored the influence of extending Lean principles to IT services and employees productivity in IT Department during the transition period. The learning from Lean transformation and other recommendations are mentioned in below listed points:

- Getting higher management approval across all layers in organization for implementing Lean principles to get proper support whenever needed.
- Setting Key Performance Indicator (KPI) should be made to reflect the direction and improvements of Lean implementation at the beginning of Lean transformation.

- Selecting and prioritizing changes to ensure maintaining the objectives of Lean transformation objectives.
- Promoting the Lean principles and goals to all employees by conducting training and regular discussion with management and employees.

Chapter 7: Conclusion

This chapter wraps up the main results and findings of the research, research limitation and suggested future research which can be done.

7.1 Conclusion

Lean framework is a methodology to improve quality by reviewing organization's process and removing none value-added activities. It is different than other quality standards as it focuses on building a culture that seeks continuous improvement in every aspect. Lean principles are based on making product or service "Flow" continuously and managed towards "Perfection". Lean principles can be applied by using number of tools to eliminate "waste" from organization process to achieve better quality. This paper examines the applicability of Lean framework in IT field and studies its impact on IT Department, specifically application domain.

The transformation journey of Lean went through three main stages which are Current state assessment, Target state design and implementation. Lean framework aimed to identify customer needs and re-designed organizations processes to meet that needs. Therefore, the first stage was to assess the current processes and identify area of improvements by using different tools and then to design the ultimate target state. This study compared between two cases of same IT department in one of leading banks in UAE before implementing Lean and after implementing Lean. The findings of current statement stage indicated some issues with demand management, project management and team capacity planning. Application domain spent a lot of time and efforts in pre-initiation and planning phases for project which may drop by business unit. Also, application domain handled both support and project tasks which affected the performance of team members and project delivery. Lean tools such as: value stream mapping, process architecture and organization structure allowed IT management to address these issues with application domain and improved project delivery and team productivity. Lean changes in application domain were successful in reducing 10% of non-added value activities. The New organization structure for application domain

enhanced the performance of application support and increased implementation effectiveness and quality through aggregating development knowledge and skill sets into COE teams.

Over all, Lean implementation in IT Department has positive results on project process, cost and team performance similar to other lean transformation cases which were discussed in Literature review.

7.2 Research Limitation

This study encountered some limitation. The main limitation it analyzed the impact of Lean framework for single case, and the results cannot be generalized for other cases. The other limitation is the timeline of this study which covered almost the first two years of IT Department transformation. Within this timeline, the research of this case study does not present a comprehensive benefits or results from Lean transformation as implementation process is still going on.

2.3 Future Research

Lean thinking is growing day by day; this paper explained the impact of Lean implementation for one single case. Future work can focus on implementing Lean framework for multiple cases and analyze the impact on different cases. This will help to demonstrate a complete outcome of lean implementation in IT.

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Appendix A

Focus Group Structure

The following Focus Group template was used during Lean transformation stages:

Lean Transformation –Focus Group Form “Current State Assessment”

Date of Focus Group:..... **Location:**.....

Instruction: This form to be used for recording the proceeding of the focus group. Notes should be extensive and accurately reflect the content of the discussion.

Participants Detail

Name	Position	Remarks

Key Area: Understand Customer purpose

Question 1/ Are we aligned with our business partner’s requirements?

.....
.....
.....

Key Area: Understand Customer demand and frequency

Question 2/ What are issues with IT delivery?

.....
.....
.....

Question 3/ What are the current pain points with IT incidents and change process?

.....
.....
.....

Question 4/ How much time do we spend on value-added activities?

.....
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Key Area: Assessing IT Department staff engagement

Question 5/ what are the challenges you are facing during performing your job?

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Question 6/ Do you have the opportunity to contribute to decisions that affect you? And how?

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Lean Transformation –Focus Group Form

“Target State Design”

Date of Focus Group:..... **Location:**.....

Instruction: This form to be used for recording the proceeding of the focus group. Notes should be extensive and accurately reflect the content of the discussion.

Participants Detail

Name	Position	Remarks

Key Area: Eliminate Waste

Question 1/ How do we stop/minimize/ automate activities that are non value-added?

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Question 2/ Can we streamline controls?

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Key Area: Focus on Customer needs

Question 3/ How do we prioritize and filter customer requests?

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Question 4/ What can be done to ensure project/ request delivered on time?

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Key Area: Increase staff productivity

Question 5/ What initiatives can reduce work pressure and increase employee efficiency?

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Question 6/ How can we improve the communication level between IT management and employees?

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Time and Motion Study

The following Time and Motion template was built in Excel Sheet:

Time Start	Work Type*	SDLC process type*	Activity code*	Activity type*	Remarks

Definition of Waste:

Rework	Any repair at any time in process	Waiting	Waiting for data, waiting for a system to finish cycle
Motion	Any motion that does not add value	Intellect	Any failure to fully utilize the time and talents of people

*Drop Down menu as showing below:

Work Type	SDLC process type	Activity Code	Activity code aggregated	Activity Type
Project	Initiate & Plan	General-Documentation (forms, artifacts, etc)	Documentation	Value Add
Change request	Requirements	General- Review (reports, document, etc)	Review	Non-Value Add
Incident	Architecture & Design	General – Searching (for files, documents, etc)	Searching	Non-Value Add but Necessary
Service Request	Setup Infrastructure	General- Research (new products, etc)	Research	
New Products	Testing	General- Audit Support	Audit Support	
Task	Deployment	Communication – Emails	Communication	
Problem	Post-Go-live Support	Communication – IM	Communication	
Other (Please specify work type in Remarks column)	Management	Communication – Meeting	Communication	

	Procurement	Communication – Adhoc discussion	Communication	
	Training	Communication – Planned one-on-one	Communication	
	Support	Communication – Phone/ video conference	Communication	
	Other (Please specify work type in Remarks column)	Communication – with observer	Communication	
		Break – Breakfast	Break	
		Break – Coffee	Break	
		Break – Prayer	Break	
		Break – Lunch	Break	
		Break – Smoke	Break	
		Break – Restroom	Break	
		Break – Extracurricular Activity (celebration, townhall)	Break	
		Break – Personal surfing / IM	Break	
		Break – Personal Emails	Break	
		Break – Personal phone calls	Break	
		Break – Talking to colleague	Break	
		Break – other	Break	
		Motion – Approval (walking to desk)	Motion	
		Motion – Communication (meeting, discussion, etc)	Motion	
		Motion – Printing	Motion	
		Motion – Server room	Motion	
		Motion – Help desk	Motion	
		Motion – Other (walking within location)	Motion	
		Motion – Commute (other site, building)	Motion	
		Wait – Approval (being idle)	Wait	
		Wait – External Dependency	Wait	
		Wait – PC Down	Wait	
		Wait – PC Startup & Response	Wait	
		Wait – System down	Wait	

		Wait – Other	Wait	
		Initiate & Plan – Business case development	Initiate & Plan	
		Initiate & Plan – Business case review	Initiate & Plan	
		Requirement – Business requirement development	Requirement	
		Requirement – Business requirement review	Requirement	
		Architecture & Design – Design	Architecture & Design	
		Testing – Unit (by developer)	Testing	
		Testing – Testing plan/ Case preparation	Testing	
		Testing – Functional	Testing	
		Testing – Performance	Testing	
		Testing – Security	Testing	
		Testing – SIT	Testing	
		Deployment – Migration	Deployment	
		Deployment – System Installation & Device Configuration	Deployment	
		Post Go Live – Troubleshooting	Post Go Live	
		Post Go Live – Monitoring	Post Go Live	
		Post Go Live – System Updates & Re-configure	Post Go Live	
		Management- Budget & Financial Management	Management	
		Management – Managing staff/ Giving feedback	Management	
		Management – Time & Expense reporting	Management	
		Training – Class room based	Training	
		Training – Computer based	Training	
		Training – Other	Training	
		Other (Please specify work type in Remarks column)	Other	
		Monitoring – System & Application level monitoring	Monitoring	

		Monitoring – Network level monitoring	Monitoring	
		Monitoring – System Backups and restorations	Monitoring	
		Third party monitoring and processing	Monitoring	
		Support Level activities (Adhoc)	Support	
		Support Level activities (planned)	Support	
		Reporting	Reporting	
		EOD processing	Processing	
		EOM processing	Processing	
		SOM processing	Processing	
		SOD processing	Processing	
		Management and retention of backup and tapes	Backup	
		Backup creation and restoration	Backup	
		Incident management and escalation	Incident management	