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Lean Transformation in Information Technology: The Case of IT Services in Financial Firms

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Abstract. In today's competitive market, organizations have realized that high quality contributes to long-term success. Lean transformation framework can be described as a set of tools and principles that positively impact quality by focusing on both eliminating waste and adding value to certain processes in the organization. This study argues the success of implementing Lean principles in IT. Since there is no such research has been conducted in the Arab world in implementing Lean in 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 productivity. A case study at a leading financial institution in the Arab Gulf region is examined. The study focuses on analyzing the Lean transformation stages, including current state assessment, target state design, and implementation; as well as describing the set of tools that guide the actions taken in each stage. The findings of this case study show that Lean principles can help in maintaining a 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, and IT application development.

1. Introduction

Nowadays, the term quality holds great interest in the business world. In today's competitive market, organizations have realized that high quality will contribute to long-term success rather than an 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.

Organizations need to comply with 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; the most notable ones are Six-sigma and Lean to name a few. 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 & Maleyeff, 2005). On the other hand, Lean framework focuses on 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 a 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 the main Lean Manufacture which was inherited from the Japanese Toyota production system (Womack et al., 2008).

2. Background

After W.W.II, Japanese manufactures suffered a lot from the economic hardship. Manufactures like Toyota started looking at the American and Western automobile industries to learn from their successful methodologies. At that point of time, American automobile (e.g., Ford and General Motors) were following mass production method. This method aimed to overproduce similar parts which can be interchangeably used for different car models through using an 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, Ōhno developed his method of eliminating waste from production flow based on two pillars: 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 the production process, such as: 5 whys to analyze the root cause of problem and Kanban a method used to control just-in-time processing (Ōhno, 1988). These changes in Toyota production increased not only the productivity of workers over 30 years, from 4 vehicles per worker to 60 vehicles per worker but also the competition with other American manufactures by 1980s (see Figure 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. Number of vehicles per worker (Cusumano, 2013, P.4).

This dramatic improvement in Toyota production makes Western automobile manufactures curious to understand what changed in Toyota. 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 and 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 of an organization, defining value and waste in processes, and developing and implementing new value definitions (Chen and Taylor, 2009). Lean thinking or Lean philosophy aims to change an organization's culture by involving employees in the improvement process continuously. Therefore, Lean principles are used and practiced in different fields and industries (Cusumano, 2013).

This paper begins with a "Literature Review" Section 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 section, "Research Methodology" explains the purpose of using the case study as a research methodology for this topic. Then, the selected case is described in details along with

Lean transformation stages and tools used followed by "Findings & Results" Section to present the results of Lean transformation and "Discussion" Section to analyze the finding based on the research questions.

3. Literature Review

Surveying the extant literature is an essential step before carrying out any research study (Al Emran & Shaalan, 2014a; Al-Emran, 2015a; Al-Emran, 2014; Al-Emran & Shaalan, 2015b; Al-Qaysi, 2016; Salloum et al., 2016; Salloum et al., 2018a; Salloum et al., 2017d; Salloum et al., 2018b; Salloum et al., 2018c). The Lean framework is an extension of the Toyota Production system which, was first initiated by Taiichi Ōhno at Toyota Motor Corporation, a Japanese automobile manufacture, in the late 1950s. The main driver of the lean framework is the need for improving a product's quality while reducing costs. Womack et al. (2008) explained the five principles that define the Lean paradigm. Lean principles can be used by organizations all over the world to eliminate waste and focus on value-added activities. The following summarizes these principles (Piercy & 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 the 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 & 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 that follow the Lean framework put many efforts to reduce waste by continuous evaluation of their processes and identifying the 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 anything that can lead to customer's dissatisfaction. Identifying areas of waste will help organizations to eliminate the causes of waste and keep those activities which add value. This will help in reducing production time/cost and enhancing the quality of the product or service provided. It includes variability and variance, such as: demand variability (e.g., changing requirements or product specifications), manufacturing variability (e.g., changing product quality or characteristics), and supplier variability (e.g., uncertainties in quality and delivery times) (Arnheiter & Maleyeff, 2005).

In the literature, many types of research shed the light on 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 & Rich, 2009). In this literature review, we looked into a non-industrial organization such as: Healthcare, Education, and IT software development to examine the success of Lean transformation. Table 1 summarizes six cases of Lean implementation and end results.

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, in general, and within the Arab world, in particular, is still new and inter-related to the Agile methodology. Therefore, the pure Lean framework needs to be evaluated in the IT environment to measure its impact on IT services management and organization culture. This study focuses on the analysis of the Lean transformation stages including, current state assessment, target state design, and implementation. It is aimed at demonstrating how Lean principles and tools can help IT to enhance services quality, reduce cost, and improve productivity.

4. 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 & Rose, 2005). Research methodology depends on the research objective and purpose (Al Emran & Shaalan, 2014b; Al-Emran, 2015b; Al-Emran & Al Chalabi, 2014; Al-Emran et al., 2015; Al-Qaysi, 2018; Malik & Al-Emran, 2018; Mhamdi et al., 2018; Zaza & Al-Emran, 2015). This research explores the Lean framework application in the IT department and investigates the changes in IT services quality, cost and people prior to and after Lean deployment. In this research, the case study methodology is relevant because the research's purpose is to observe the transformation of the 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 the research's case.

According to Yin (2009), the case study approach consists of five components of research design. This research follows the same research design and our methodology is presented in the rest of this section. Figure 2 shows the research components of our case.

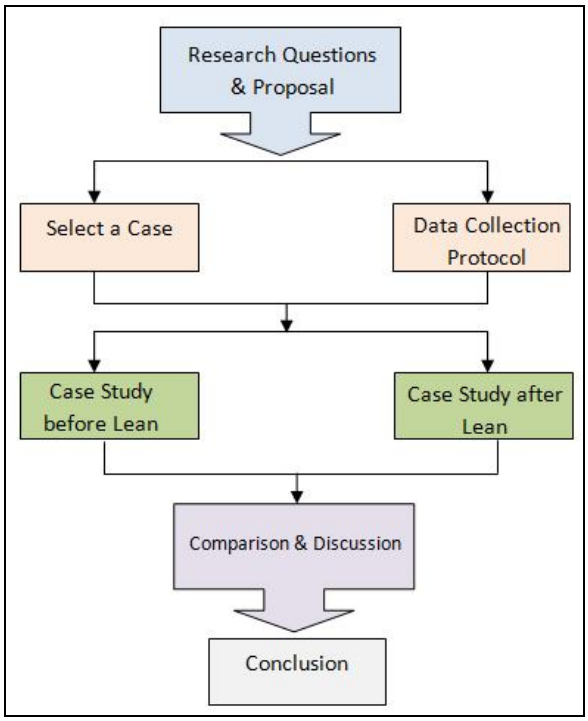

Figure 2. The Research Design

Field	Case	Problem	Changes	Resolution	Reference
Health Care	Flinder Medical Center	• High demand which hospital cannot handle. • The safety of care in the emergency department was compromised.	Redesigning emergency department flow using "value stream mapping".	Improve staff productivity (15% - 20%) with less safety incident within the same resources.	Gubb (2009)
	Royal Bolton NHS foundation	Long turnaround times of Pathology department.	Improve care system using weeklong activity.	• Direct saving of 3.1 m. • Average turnaround time in Pathology from over 24h to 2-3 hr.	Burgess and Radnor (2013)
Education	Higher Education	Course elements such as: syllabus, required reading, assignments, etc. are not clear, unnecessary information and not organized.	Using Kaizen events.	Increase student satisfaction from 3.8 to 4.8.	Emiliani (2004)
	Oakland University	Inefficient grade changes administrative process.	Process architecture to redesign grade change process.	Automate the process 100%.	Doman (2010)
Software Development	Wipro	• Task uncertainty, customer requirements change. • Development process not connected.	• Value stream mapping. • Visual management.	• Reduce 6% of re-work. • Staff productivity increase from 1.3 defect processed by engineer to 2.0 defect.	Staats et al. (2011)
	BBC	Improve software development team performance.	• Value stream mapping. • Visual management.	• Improve project delivery by 37%. • Reduce defect by 24%.	Middleton and Joyce (2012)

Table 1. Lean transformation researches in Healthcare, Education and IT software development

4.1. Research Questions

The research design starts by defining the research questions which we developed from knowledge gained around the Lean transformation topic and inspired by the literature review. The following is the research questions of this study:

1. How does "Lean Framework" improve the quality of software development?
2. How can "Lean Framework" reduce the cost of software development?
3. Why does "Lean Framework" have a direct impact on organization culture and people mindset?

4.2. Research Proposal

The lean concept was coined by Japanese to achieve perfection and total improvement of their products. The success of Toyota story promotes Lean principles worldwide such that many organizations start adopting Lean principles to improve products quality with lower cost (Abdulmalek & Rajgopal, 2007). However, Lean Framework does not deploy explicitly in manufactures and industrial organizations. It can be employed in the public sector, military, health care, and any business. Thus, the Lean framework can improve IT services quality and reduce its cost (Middleton & 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.

4.3. Selecting a Case

This research conducts a study to a particular case of IT department in one of primary and the biggest financial institution in the 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 the integrated IT department is looking to overcome these issues by reviewing internal operational processes and assessing current issues within IT. This case considers being the best candidate for Lean transformation. Therefore, the authors 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 software (application) development field of IT.

4.4. Data Collection Protocol

Conducting this study depends on focus group meeting, direct observation, and reviewing existing documents in the IT department to collect data during implementation of Lean transformations. The focus group is a 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 the IT department and areas of improvement. Focus groups helped to understand and examine the need of using the Lean framework in IT by discussing different subjects related to customer satisfaction, IT processes, and services with experts and people who have a long experience in IT. The purpose of these meetings is to design a target state for the IT department and how to achieve that state after implementing the Lean framework.

Another method of collecting data for this case is the direct observation of the 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 the IT department can be considered as another resource for 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 the IT department.

4.5. Data Analysis

Most of the data of this case study will be collected during the first stage of Lean transformation, i.e. assessment of current state and design of 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 the Lean framework in IT services, cross-case synthesis is used to aggregate the findings of IT department prior to and after conducting the case study of the Lean case.

5. IT Department: preparation, integration and transformation

This section provides more information about the selected case in order to clarify the need for implementing the Lean framework. The selected case is an IT department in a financial institution (banking sector) in the United Arab Emirates (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 the international market by opening new branches in the Middle East, Europe, and Africa.

The major bank in group considers being the biggest bank in the UAE in assets and number of branches (227 branches) and over 900 ATMs. Recently, 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 IT departments. The new IT team spent two years to stabilize and standardize core systems and IT functions across the bank group. IT department is responsible for providing high standard IT services to all institution's subsidiaries. IT services include

providing infrastructure support, application support and operational support for all users (more than 10,000 employees).

The IT team 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 management 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 workforce to propel the bank into a strong market position. This vision drives IT management to search for a continuous improvement framework which focuses on building a culture of improvement and perfection. The 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 a relatively low cost. Lean consists of five main principles which are 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 & Taylor, 2009).

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

6. Lean Transformation

The establishment of LTO 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. As shown in Table 2, the Lean transformation plan is divided into three main stages.

	2013				2014			
Lean Stage	**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 2. IT Department Lean transformation stages and timeline.

Before moving to the first stage, i.e. Current State Assessment, the LTO is established and champions are selected and trained. The transformation to Lean framework goes through three distinct stages which allow IT department to understand its current issues and plan for improvement. All areas of improvement are planned to be implemented in a Pilot phase in order to be measured. Figure 3 summarizes the main two stages of implementing the Lean framework and lists the tools which were used in each stage.

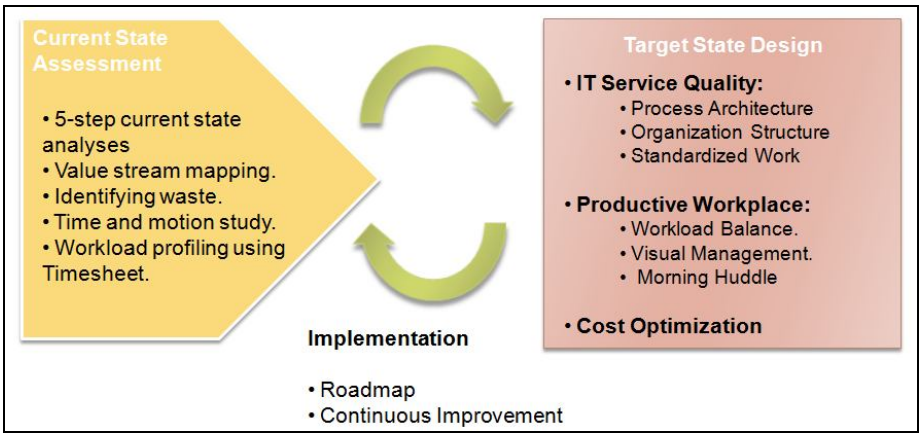

Figure 3. IT department Lean Implementation stages along with tools used in each stage

The first stage is "Current State Assessment" in which LTO team collects data around issues in IT department and areas of improvement by using different tools during focus group meetings. Focus group meeting is one of the main tools which were used to collect data around IT services' quality and budget and work environment. These meetings are driven from the IT department improvement strategy that aims to analyze/assess current state and help in designing/implementing the second stage, which is "Target State Design". A number of continuous improvement waves/phases between both stages will run in order to ensure the perfection of lean transformation by engaging all stakeholders to understand and support the objectives of lean. In the next section, we provide more details about each tool.

7. Findings

Focus group meetings revealed some serious issues with the IT department during "current state assessment" which can also be referred to IT department prior Lean transformation stage. These issues have been categorized into two categories, which are:

- Business objectives (requests) alignment with IT strategy.
- Team performance and resource capacity.

LTO team along with IT management worked together to minimize the impact of these issues and resolve it by using different Lean tools. The following sub-sections provide more insights into these issues prior and after Lean transformation.

7.1. Business objectives (requests) alignment with IT strategy

7.1.1. IT Department prior to Lean transformation

IT Department lacked a clear process for logging business request, which is usually identified as a change request (adding new features/ forms in the application) or a new initiative. The process was for any request from the business side, Business Relation Manager (BRM) have to log the request in incident management software and assign it to the respective IT team. However, during a focus group meeting, IT managers confirmed that –in some cases- they were receiving change requests directly from Business units through emails and phone calls. Receiving direct request from business did not allow IT team to organize and prioritize their tasks in order to achieve IT/Business strategic objectives. Moreover, many direct requests were not attended or tracked by IT team which caused delay, insufficient quality, and financial loss in some time. The general assumption was that BRM is involved only for changes and projects with a cost above 20,000 AED (AED is the UAE Currency. One ADED, i.e. Dirham, is approximately 0.27 US Dollar) in order to get IT management approval during ITAB (Information Technology Advisory Board) meeting.

With the intention of understanding and clarifying the role of BRM in the process of budget approval, this process is described in terms of value stream mapping tool, one of most common Lean tools, which is used to provide an end-to-end view of the processes across the 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). This tool is used to illustrate the process of budget approval as shown in Figure 4.

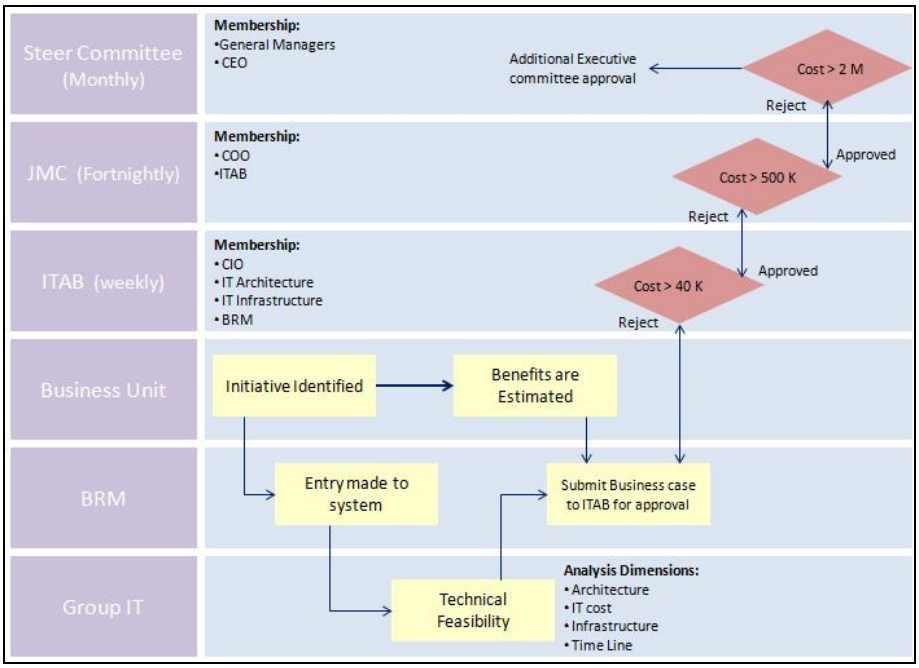

Figure 4. Budget approval process for change request/ new imitative – Prior to Lean

For any initiatives that have a budget above 15,000 AED, the respective business units need to send a "Business Case" to BRM. The business unit, in turn, estimates the benefits of this change/project while the IT department assesses the initiative technically and provides estimated cost and timeline. Approved proposal is presented in ITAB meeting which is organized every week to review and make recommendations concerning new projects/changes initiated by the 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, the CIO along with BRM need to present the initiative to the Chief Operational Officer (COO) during the 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 worth noting that approximately 80% of projects are above 15,000 AED and have to be approved by CIO during ITAB meeting; the majority of which includes "Lights-On" projects, see the distributions in Figure 5.

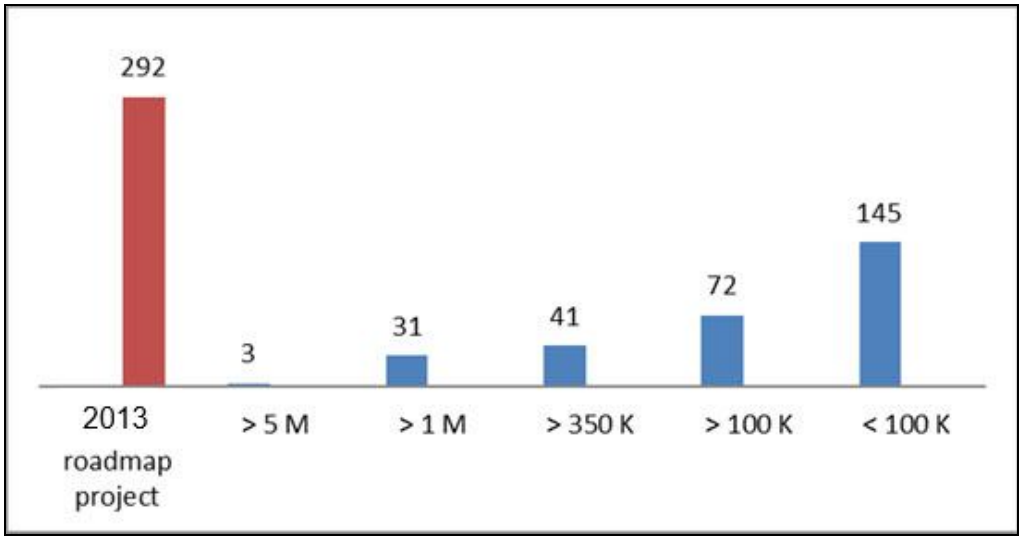

Figure 5. Number of projects in 2013

Focus group meeting helps in getting more insights on the business case, project approval process and the BRM role. The following are examples of quotations from some of these insights:

- "We don't have business case approval before we kick off IT effort estimation. As a 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% Business Case (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".

7.1.2. IT Department after Lean transformation

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 is arranged for IT department 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 a 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 a request to the IT department to be through BRM. Along with the new BRM role, a new set of the 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 extends to cover the project portfolio. The goal also is to establish a common understanding that a business case is ideal for the 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 the project and provides cost estimation. In addition, the project approval process was redesigned as shown in Figure 8.

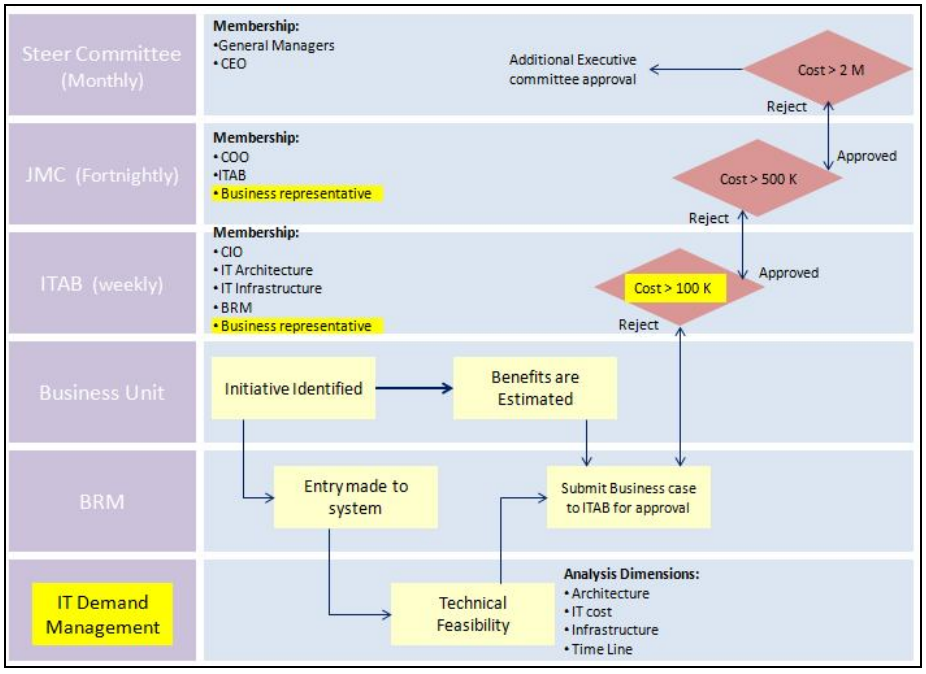

Figure 8. Budget approval process for a new initiative – After Lean

The two main improvements of the approval process of project budget 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 the manager's effort and time for approval and accelerate the delivery of small initiatives by avoiding ITAB formalities. Another change is the introduction of a new team called "IT Demand Management" in the 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.

7.2. Team performance and resource capacity

7.2.1. IT Department prior to Lean transformation

During focus group meetings, 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 a team leader to prioritize between both tasks since both support and system issues have a 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, LTO used direct observation of employees in their work placement by using two Lean tools. Time Motion Study (TMS) tool which is applied through in-person observation to a process in the scope of IT service during an entire working shift, and Timesheet tool which is used to analyze the workload of each team members in the IT department by tracking the time spent by each team member in his/her assigned tasks. The data collected by using these tools revealed 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 6.

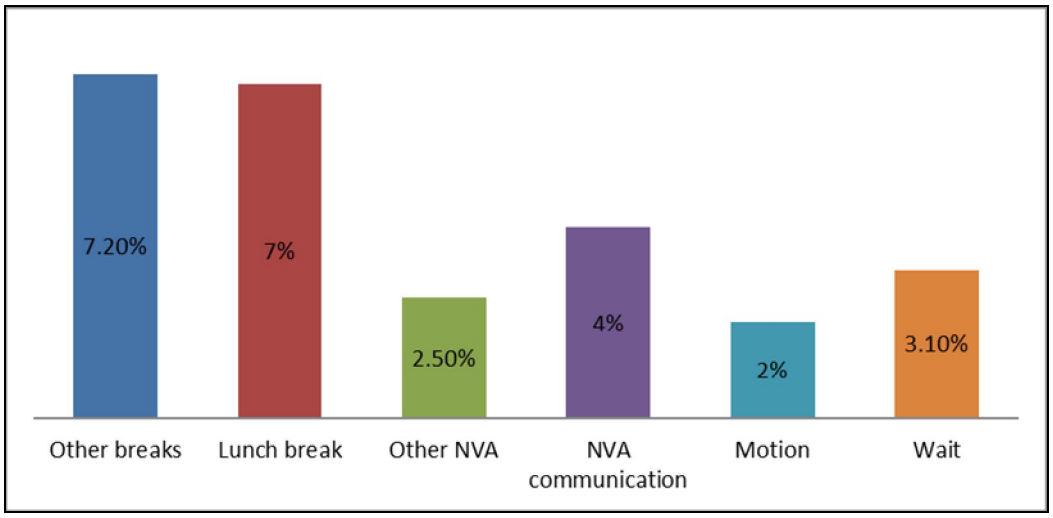

Figure 6. Waste time in terms of Time Motion Study – Prior to Lean

These non-valued activities create waste, stress, and instability. Moreover, it leads to increase in cost, delay in delivering value to the customer, a decrease in the quality of output and frequent re-work. TMS helped in identifying different kinds of waste and categorized them into 8 waste groups, as shown in Table 3.

Waste Group	Example from the IT department
Rework	Bug fixes, change request
Over Production	Producing too much code without the availability of resources to test it
Motion	Unnecessary data or people movement (Example: printing and getting managers signature for approval)
Transportation	Nonessential data and information transport
Waiting	Waiting for approval, waiting for a system to finish the cycle
Inventory	Critical business requests waiting to be processed, and search for documents
Over-processing	Unnecessary approving chains
Intellect	Mismatched talents/ skills and allocated tasks

Table 3. Waste Groups

Timesheet analysis for application domain showed that application teams spent around 36% of their time in project management while 27% in production support and 22% in software engineering (development), see Figure 7.

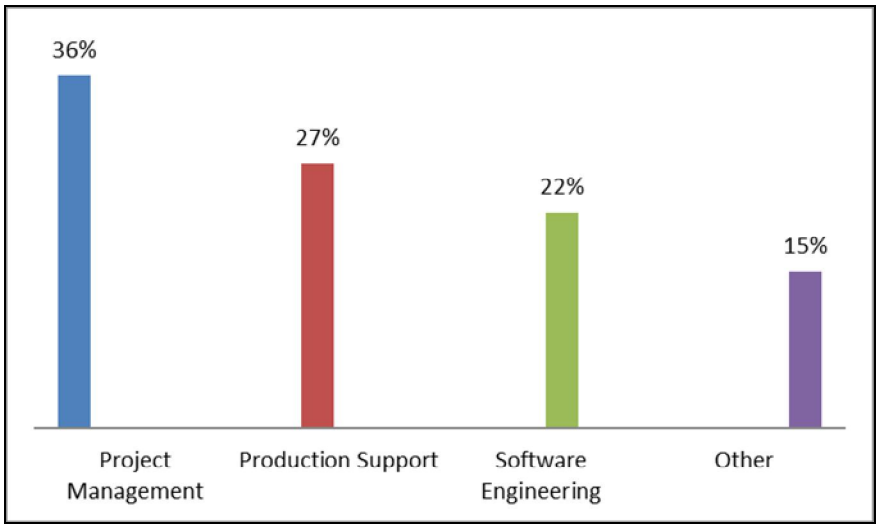

Figure 7. Timesheet analysis – Prior to Lean

The following are examples of quotations from some of these feedbacks, which were collected during the focus group meetings:

- "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 the observations about IT department prior to implementation of Lean transformation, the IT department lacks having proper incident management process. Also, it needs to increase BRM effectiveness and review the 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 a current resource capacity to higher management. Submitting a 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 the project with high quality.

7.2.2. IT Department after Lean transformation

Furthermore, redesigning the project approval process and automating other processes, such as logging business cases in the 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 9 presents TMS analysis for application teams after the pilot phase of Lean transformation.

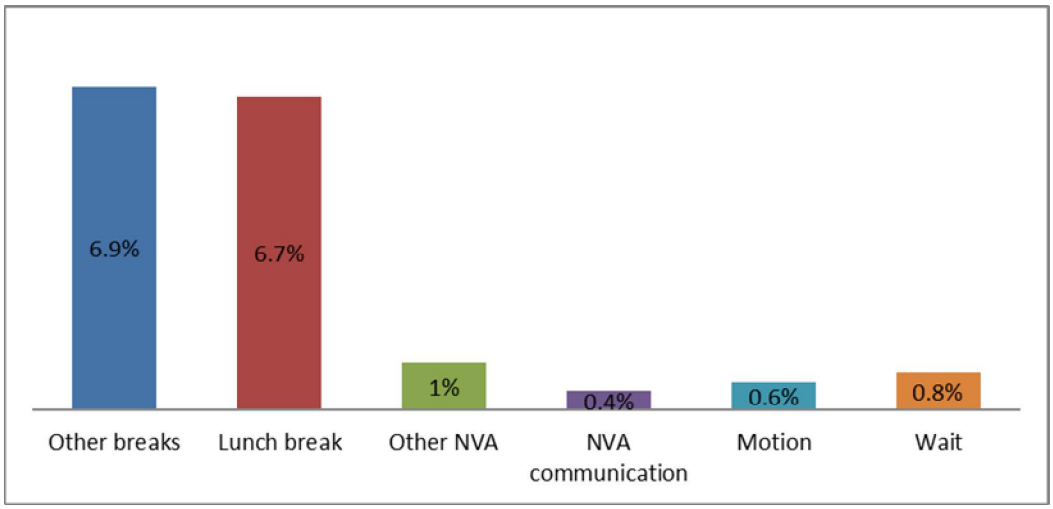

Figure 9. Waste time –TMS – Pilot phase results

IT department capacity was outstripped by business demand and there was a 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 the IT department to segregate projects tasks and daily support activities for the application domain. Figure 10 shows the structure of the application domain prior to and after implementing the Lean in the Pilot phase.

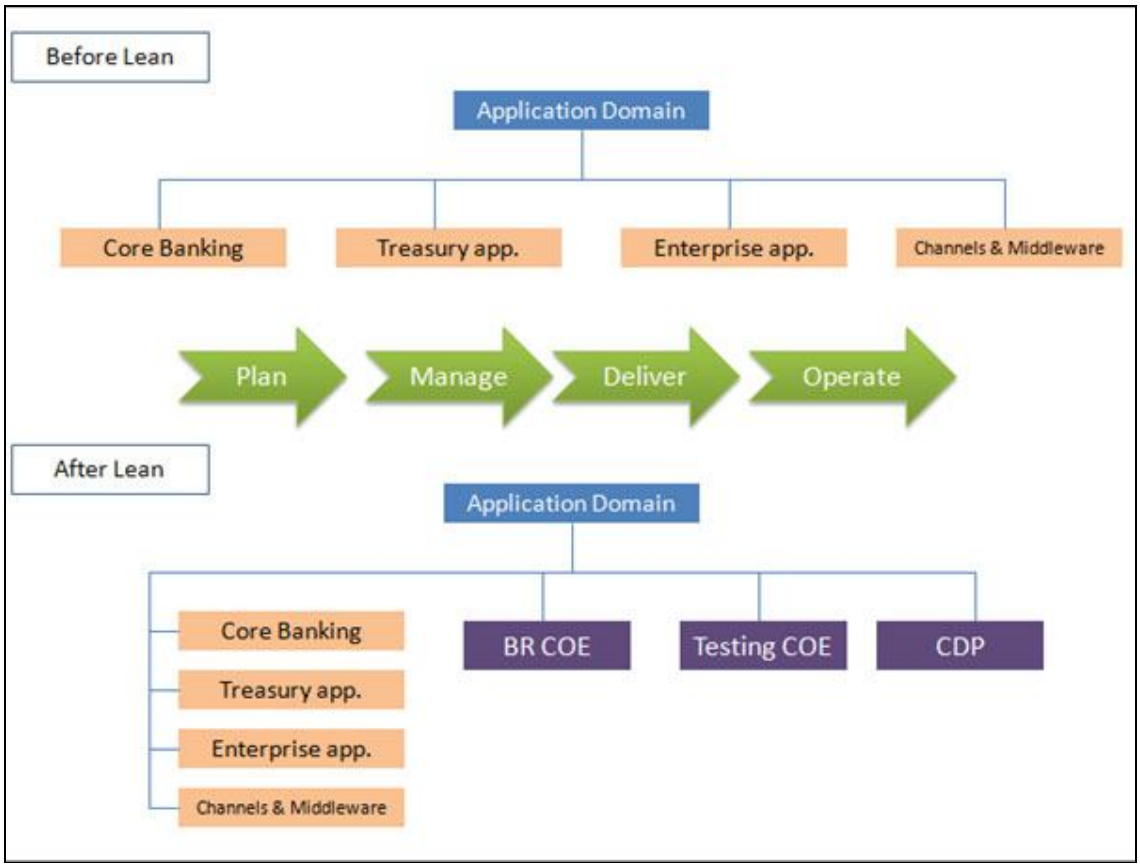

Figure 10. Application domain structure (Prior to & After Lean transformation)

It was obvious that staffs involved in the 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 as is and introduces a new COE team focusing on project tasks as described in the following:

- Business Requirement (BR) team: it is responsible for 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 for planning and managing the requirements for the 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 with 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 11.

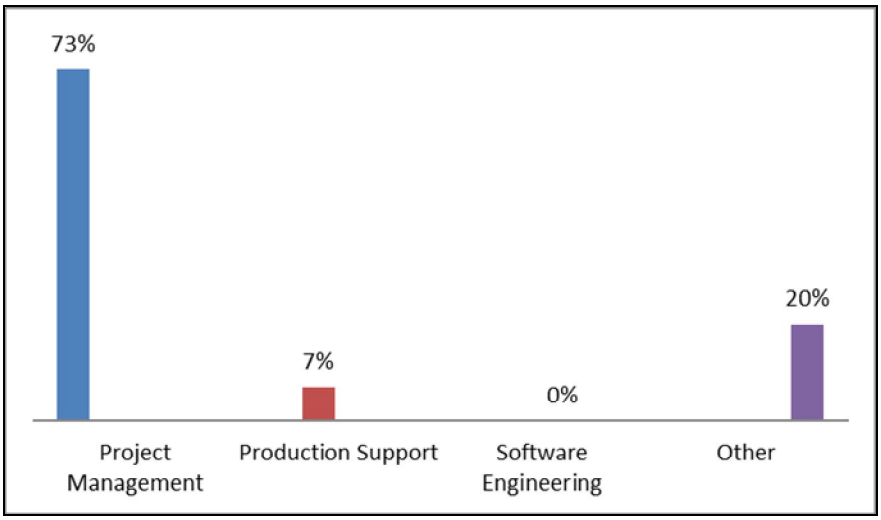

Figure 11. Timesheet analysis – After applying Lean transformation

All these changes can be misunderstood by some of the employees so it was important for LTO and IT management to promote the objectives of Lean transformation and every change implemented. LTO 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 among IT employees. Furthermore, Town hall meeting is organized every quarter by LTO to share the 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 opinions in solving any problem or issue, and to celebrate team success, reward and recognition. The overall feedback of Lean implementation – in 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 no 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.

7.3. Main 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 & Radnor, 2013). The main observations of lean transformation in the IT department are:

1. Improving the productivity of application teams by reducing 10% of none-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.

Besides these observations, the project approval process is more simplified which helped in reducing the 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 the IT department, which improved employee engagement and empowerment.

8. Discussion

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

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

The observation of the first stage, the current state assessment, exhibited that the IT department should review the BRM role and project approval process to achieve better quality. According to the collected data, the main drawbacks of IT department services are: 1) nonaligned business initiatives with IT strategy, and 2) an ambiguous process to initiate a project for business users. LTO 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 a "Pilot Phase" because BRM serves as the strategic interface or link between the business unit and IT. Expanding the responsibilities of BRM helped IT department to meet business needs and provide significant value to the organization.

Although the IT department is following the waterfall software engineering methodology for application development that provides IT services, 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 the business. The pre-initiation phase of the project took longer time due to resource constraints and the absence of a standard business case in which business requirements and project scope are defined and documented. Lean principles introduced some changes in Software project management, see Table 4.

Activity	Project prior to 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 4. Comparison between project management prior to 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 the new COE teams allowed project managers and team members to concentrate only on project tasks and how to improve a 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 can be observed by analyzing the timesheet of application domain prior to Lean transformation, see Figure 12. 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 did not have much time to check and identify the deviation or issues of assigned activities. After Lean transformation, specific activity is assigned to each COE team, which results in reducing the deviation rate. For instance, testing COE has reduced the defect rate by 30% and improved the quality of the deployed application.

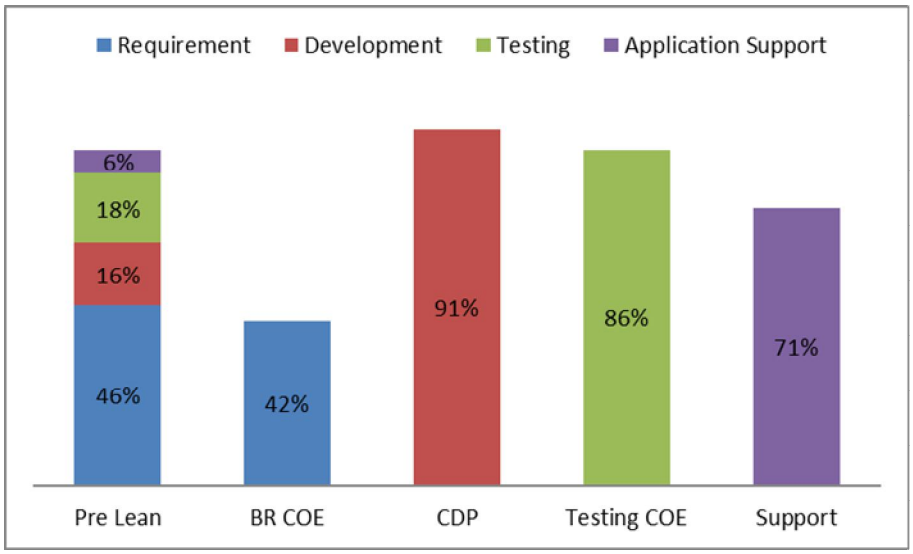

Figure 12. Comparison of application domain's timesheet prior Lean to COE teams' timesheet

Overall, implementing Lean principles eliminated waste from the project management process and assigned one specific core activity for each COE team to improve project management.

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

There was no direct cost saving from Lean implementation in the 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 a common developer pool, reduces the overall cost of software development. Moreover, placing employees with the same skill sets into COE teams enable the 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 the 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 strategy. Additionally, Business case reduced the efforts and the time spent on project pre-initiation in which IT department was spending around 30,000 AED (man-hours) prior to Lean transformation.

Research 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. People behavior towards any technology is changing (Al-Emran & Malik, 2016; Al-Emran & Salloum, 2017; Al-Emran & Shaalan, 2015a; Al-Emran & Shaalan, 2017; Al-Maroof & Al-Emran, 2018; Al-Qaysi & Al-Emran, 2017). The 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 Ōhno's beliefs, the founder of TPS, who believed that every improvement triggered by need (Ōhno, 1988). This approach works to bring up problems in surface and provoke people to feel the need for improvement and work hard to achieve lean objectives (Yamamoto & Bellgran, 2010). This can be illustrated in "Japanese sea-level" Figure 13. The sea level in the left of this figure is covering all issues, this can refer to weak project management controls in which overestimating cost or timeline in order to manage the project and cover other internal issues. However, the sea level in right figure is reduced to show strict and controllable management process in order to disclose issues such as, defect, lack of parts, and delay.

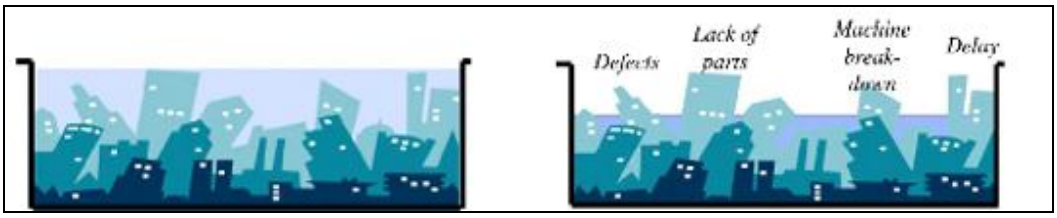

Figure 13. The "Japanese sea-level" Model (Yamamoto & Bellgran, 2010, P.4).

Following the same approach, LTO used a "time" controller for all projects and users' requests. To explain this point more, the SLA example will be used. The 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 the request is not resolved yet, domain managers need to discuss the issue in the operational meeting. The operational meeting is weekly organized by IT governance to discuss breached support request and identify the 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 the breached request and the way employee thinks and tackles support request.

The key of the 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, LTO 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 the 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.

9. Conclusion and Future Work

IT has become a part of every sector (Salloum et al., 2017a; Salloum et al., 2017b; Salloum et al., 2017c; Salloum et al., 2017e). Delivering IT services that reduce costs while improving quality becomes a challenging task for many organizations. The lean framework is a methodology to improve quality by reviewing the organization's process and removing none value-added activities. This paper takes case-study approach to explore the influence of extending Lean principles to IT services. The implementation of Lean in this case result of a positive effect on eliminating "waste", improving quality, and optimizing cost.

Lean thinking is growing day by day; this paper contributes to the existing literature by explaining the impact of Lean implementation for one single case in pure IT service. Future work can focus on implementing the 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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