IBN HALDUN UNIVERSITY
SCHOOL OF GRADUATE STUDIES
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MASTER THESIS

LEAN SERVICE OPERATIONS AND A LEAN MANAGEMENT APPLICATION AT A FOUNDATION UNIVERSITY

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THESIS SUPERVISOR

ASSOC. PROF. ALI OSMAN KUŞAKCI

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LEAN SERVICE OPERATIONS AND A LEAN MANAGEMENT APPLICATION AT A FOUNDATION UNIVERSITY

by

ALMOHANAD MIRA

A thesis submitted to the School of Graduate Studies in partial fulfillment of the requirements for the degree of Master of Arts in Management

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APPROVAL PAGE

This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Arts in Management

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This is to confirm that this thesis complies with all the standards set by the School of Graduate Studies of Ibn Haldun University.

Date of Submission Seal/Signature

ACADEMIC HONESTY ATTESTATION

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

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ÖZ

YALIN HİZMET OPERASYONLARI VE BİR VAKIF ÜNİVERSİTESİNDE YALIN YÖNETİM UYGULAMASI

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Yalın hizmet operasyonları ve yalın yönetim, somut/ürün sağlayıcılar kadar tüm hizmet sağlayıcılar için de gereklidir. Ancak üniversitelerin çoğu yalın düşünce kavramının farkında değil. Üniversiteler ve kolejler, kabul, araştırma fonlarının yönetimi, işe alma gibi tüm hizmet alanlarında ve çok adımlı süreçlerin basitleştirilebildiği ve kuruluş tarafından hizmet verilen kullanıcıların ihtiyaçlarına odaklanılabileceği neredeyse tüm işlevsel alanlarda yalın yönetimden yararlanabilir. Yalın metodolojiler, israfı (Muda) ve katma değeri olmayan faaliyetleri ortadan kaldırarak veya sürecin performansını geliştirmek için bunları azaltmaya odaklanır. Bu tez, üretim sistemleri için geliştirilen yalın yaklaşımların bir üniversite ortamında gerçekleştirilen operasyonel görevlerin verimliliğini artırmak için uygunluğunu vurgulamayı ve daha iyi performans için önerilerde bulunmayı amaçlamaktadır. Değer Akışı Haritalama (VSM) kullanılarak süreçlerin mevcut durumunu incelemek ve karşılaşılan güncel sorunlar için öneriler ve alternatifler sunmak için bir Türk üniversitesindeki en etkili üç süreç iki farklı fonksiyonel departmanda yalın metodolojiler uygulandı. Sonuç olarak, yalın uygulamadan önce ve sonra süreçlerin performansını karşılaştırmak için bazı göstergeler ile süreçlerin her biri için katma değerli ve katma değersiz faaliyetler belirlendi. Genel olarak, üç sürecin gelecekteki durumuna ilişkin öneriler üniversite yönetimi ile paylaşılmıştır.

Anahtar Kelimeler: Yüksek Öğrenim, Yalın, Yalın Yönetim, Yalın Hizmet Operasyonları, Kalite, Değer Akışı Haritalaması

ABSTRACT

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Lean service operations and lean management are becoming necessary for all service providers as much as tangibles/products providers. Most universities are not even aware of the concept of, lean thinking. However, universities and colleges can benefit from lean management in all their service areas such as admissions, the administration of research funds, hiring, and nearly any functional area where multi-step processes can be simplified and focused on the needs of the users served by the organization. Lean methodologies focus on reducing waste (Muda) and non-value-added activities by eliminating them or dealing with them to develop the performance of the process. This thesis aims to highlight the suitability of lean, which was developed in manufacturing, at a university's environment to enhance the efficiency of the operational tasks performed, and to provide suggestions for better performance. Lean methodologies were applied to two departments at a Turkish university, with the three most effective processes under these departments, to study the current state of the processes, and to provide suggestions and alternatives for the current issues faced, using Value Stream Mapping (VSM). As a result, Value-Added and Non-Value-Added activities were identified for each of the processes, with Indicative Ratios to compare the performance of the processes before and after applying lean. Overall, a proposal of the future state of the three processes was provided by the university's management.

Keywords: Higher Education, Lean, Lean Management, Lean Service Operations, Quality, Value Stream Mapping

DEDICATION

It is dedicated to my family.

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LIST OF SYMBOLS AND ABBREVIATIONS

AR	Activity Ratio
AP	Application Process
CS	Current State
FS	Future State
HE	Higher Education
HEI	Higher Education Institutions
KPI	Key Performance Indicators
LHE	Lean Higher Education
NVA	Non-Value Added
PCE	Process Cycle Efficiency
RP	Registration Process
SAO	Student Affairs Office
SGS	School of Graduate Studies
TSP	Thesis Submission Process
TPS	Toyota Production System
VA	Value Added
VSM	Value Stream Mapping
YÖK	Council of Higher Education

CHAPTER I

INTRODUCTION

Lean service operations and lean management is becoming a necessity for all service providers as much as tangibles/products providers. As a major group of service providers, most of the universities are not even aware of the concept itself, Lean Thinking. Universities and colleges can benefit from lean management in all their service areas such as admissions, the administration of research funds, hiring, and nearly any functional area where multi-step processes can be simplified and focused on the needs of the users served by the organization (Balzer, 2010; Langer, 2011). Lean methodologies focus on reducing waste (Muda) and non-value added activities by eliminating them or dealing with them in a way that will not affect the quality and time of final service (Francis, 2014). Being more efficient, reducing costs, and providing more standardized service are the main motives that attract service providers to think about lean. Lean operations were first brought up by the Japanese manufacturer Toyota when they decided to have mass production in their plant, by studying mass production in depth and coming up with the idea of eliminating Muda or waste.

In the literature, Womack et al. (1996) mentioned that Lean methodologies have five factors to be studied:

1. Specify customer value by understanding their requirements and expectations from the organization.
2. For each product or service, identify the value stream for all the processes included.
3. Ensure service or process flow.
4. Assure a pull system is being applied to the organization.
5. Always aim for perfection in terms of quality and delivery time.

These principles are mostly used in manufacturing sectors, and later we started to see lean applications in service sectors, such as healthcare or hospitals, banks, call centers,

and firefighting stations. Very few applications are being undertaken at a university or in higher education, and most of these papers are looking from the educational aspect.

1.1. Scope of This Study

In this thesis, lean thinking with all its concepts and the whole philosophy will be applied in a Turkish foundation university environment. The university subject to this study is a foundation university that gets most of its funds from external sources and provides scholarships for its students, which makes the idea of reducing costs more reasonable in order to accept more students so that the university provides more scholarships with the money saved. The research of this thesis will not examine the educational section of the university or look over the curriculums taught or how a professor is supposed to teach in his class. The main goal of this study is to focus more on the practical section of the university, by studying the two most important departments a graduate student usually interacts with, with three of the services provided by them, and how we can apply lean to improve these services. The main purpose of this thesis is to look at these different departments and observe the services they provide to inside or outside customers, then look in more detail at these service processes and implement lean principles.

Within the scope of the study, we will have a long interview with each head of the following departments: the School of Graduate Studies (SGS), and the Students Affairs Office (SAO). The interviews will be mainly used to draw the flowchart of the top three processes performed at the university, Application Process, Registration Process, and Thesis Submission Process, and later on confirming it with each process stakeholder to be sure the chart is representing real-life processes. Secondly, value-adding and non-value-adding activities will be specified by looking at the processes in more detail and observing each sub-activity as to whether it adds value to the final customer or not, and lean methodologies will be applied to reduce time and serve the service in the most optimal way we can.

These departments have different activities and tasks done by them, some of the tasks are common and they are done between more than one department at the same time, so a process map needs to be drawn for these activities and then after confirming it

from the people who are doing the tasks daily, the tasks will be analyzed to apply lean tools and concepts to improve these tasks.

Furthermore, this work aims to investigate specific problems in the departments, analyze the current situations, draw the flowchart and identify wasteful and non-value-added activities and eliminate them, analyze root causes of the problem and propose a solution to the management of the university.

While applying the lean management principles at the university, we will follow the steps below:

1. Defining the value and expectations of the process from the perspective of the person who receives the process or benefits from it and what they expect to receive.
2. Drawing the flow of the process and determining whether each step and activity contributes value to the end service provided or if it is a waste.
3. Eliminate wastes after identifying waste and propose solutions to improve the efficiency of the process from the receiver's perspective.
4. Making each process being pulled by the requester rather than pushing the service to them.
5. Seek for perfection in the process through continuous improvement and simultaneously observing beneficiaries' satisfaction and making rapid changes.

1.2. Research Questions

In this thesis, the research questions are split into two sections. The first section is about discovering the suitability of lean in a university environment and what tools and principles can be used, while the second section of the questions is about the real-life implementation of lean at a university (case-study) to improve the main operations.

The first section has the following two questions which should be answered primarily to understand how lean may be implemented in university settings:

Q1: Is lean a suitable tool in a university setting?

First, the whole concept of lean must be understood from the first initiative until how it has been transferred into the service sectors and universities. Is lean, which was originally designed for manufacturing a suitable tool for service operations in general, and for universities in particular? And how can this tool be translated to the service sector? The tools and techniques used by previous researchers for the transformation of lean manufacturing into lean services must be studied and looked at in detail.

Q2: Why lean university?

Secondly, why lean is an answer for improving the main operations of a foundation university must be answered with the motives to become a lean university. How to become a lean university? and the final impacts that must be expected from lean.

In the second section, lean will be applied to the School of Graduate Studies (SGS) and Student Affairs Office (SAO) of the target university to set an example of how lean can be applied and allow for further expansion of lean initiatives at the university in the future. Thus, the following research questions will be raised:

Q3: What are the most effective processes under SGS and SAO, which have the major impact on customer satisfaction?

For the perfect implementation of lean, the three major processes under the responsibility of SGS and SAO must be identified, and then for each process, the following questions must be addressed:

Q4: What does the process look like?

For each process, all the steps and procedures required to accomplish the process must be documented and formalized with a clear description of each step.

Q5: What problems does the process have?

The challenges of each process must be identified in terms of efficiency with the parameters to consider, disturbances, and obstacles that make the process lose its efficiency. Consequently, the last question is:

Q6: What improvements can be made to the current process to decrease the identified problems?

After knowing how the process looks, and what the issues that affect it are, improvement suggestions and a new process map of how the process should look in the perfect settings must be created. The research questions from 4 to 6 must be repeated for each process found from the first question. Each process must be studied individually to ensure that the maximum effort has been given by the researcher while working on them.

CHAPTER II

BACKGROUND AND LITERATURE REVIEW

2.1. Background of Lean Production

2.1.1. The Reason Behind the First Initiative of Lean

After the Second World War, car manufacturing companies were trying to take the lead after the major losses that happened to them and their production lines, not only car producers and car plants' shop floors but whole governments were trying to become major players in the economy of Scale, where they could produce more with less cost spread over a large number of products. Cusumano pointed to how American producers were in the dominant position against Japanese Industry (1985). The Americans did this by having complicated mass production systems where they were producing in huge quantities with high costs, non-flexible volumes, and unified options or standards in their cars such as one color for the cars produced from a production line. In the meantime, Japan was suffering the lack of experienced well-qualified labor, sufficient funding, and trustworthy suppliers of raw materials.

2.1.2. Toyota Production System (TPS)

The Japanese manufacturers had to overcome these obstacles and compete with their competitors with what was available. Toyota, the well-known Japanese car manufacturer, had to develop a competitive production system against General Motors' mass-production system. Since the scarcity of resources was the main enemy for Toyota, instant demand meeting and perfection were their competitive advantages. Toyota Production System started to be recognized as Lean with low to zero inventory and no defects, which gave them the superiority of producing at a low cost and small

volumes with huge varieties, given the same quality that Toyota is known for (Seddon, 2005).

The quality of the Japanese cars was more reliable, efficient, and required less maintenance compared to the American muscles. Especially with Toyota, it was clear to customers and car enthusiasts that the consistency of production and process had become a major feature for this Japanese manufacturer, in addition to the smooth ride and pure design. Toyota had its way of engineering and manufacturing to design and offering their products faster with the lowest cost possible, yet with the same expectations that customers are willing to pay for such as reliability and standardized quality, even with the high wages of their workers. Toyota had reached this point by continuously fixing their problems and redesigning their products to cover production errors and their weaknesses. Every time a design flaw showed up as an opportunity to the competitors, Toyota was able to rapidly fix it and come back stronger than before (Liker, 2004).

Toyota in 2020 is the second-largest car manufacturer in the world according to Wada, K. (2020) and it is the tenth-largest company in the world by revenue, with over 10 million vehicles produced annually. Toyota is expected to become the largest auto producer if the trends continue.

What made this great noticeable transformation and development had not been reached overnight. It took them years and years of developing a set of principles and practices to initiate operational excellence as a strategic ideology of the whole corporation (Liker, 2004). The system focused on continuous improvement and respect for the employees as a business strategy to reach the best product quality offered to their respective customers. These two strategies were always applied to eliminate waste and to improve the flow of manufacturing processes (Womack et al., 1996).

2.1.3. The Father of Lean

The father of Lean principles, Taiichi Ohno, started as a shop-floor manager in 1943 and worked his way up to become the TPS executive (Ohno, 1988). At the beginning of his career in the Toyota Production System, he was testing and developing new

techniques in the production to produce more with less. Ohno's thinking was to produce more products with less defects and cost.

> The Lean system, developed and championed by the Toyota Motor Company, evolved over 50 years with data to support that its balanced "top-down" and "bottom-up" approach can lead to immediate, significant and long-lasting improvements. The new paradigm follows the basic philosophy of one of the developers of lean, Toyota's Taiichi Ohno, and that is to make changes based on the needs and purpose of the enterprise (Ohno, 1988).

TPS had emerged due to a process of continuous experimentation on the whole system and refinement of mistakes and wastes (Langer, 2011). After recognizing the benefits of product quality, employee engagement, customer satisfaction and company profits in the late 60s, his techniques were applied by not only Toyota's shop-floor, but the techniques also extended to all aspects of the business, including new product development process, supply chain and logistics, finance and customer service (Womack et al., 1996). It even reached to other Japanese producers such as Nissan (Fujimoto, 1999).

This lean approach was re-introduced world-wide and in the United States in 1991 by Womack et al. (1991) under the name of "The Machine That Changed the World: The Story of Lean Production".

2.2. Conceptual Foundations of Lean: Three Levels of Lean Thinking

In the early adoption of lean, it was understood that it consists of few tools and techniques that can be applied on the shopfloor only without any strategic alliance. Lean thinking started to prove its efficiency, and it started to be seen as a holistic approach for the whole production system. This holistic approach emphasized studying and evaluating all the elements related to customer demand (Seddon, 2005).

Langer (2011) claims in his dissertation that there is no accurate definition of what lean actually is nor any specific tools and techniques to be followed when the decision of Lean Thinking considered to be implemented in an organization, due to different translations and academic interpretation and the continuous expansion in new sectors. Tobias had combined the Lean core principles into three conceptual foundations to make lean valid for specific circumstances of different organizations and industries.

2.2.1. Fundamental level: What is the Nature of Lean?

The best understanding of lean is "dynamic learning capability". Lean should be implemented as "a continuously evolving system that gives the organization the ability to integrate, build and reconfigure internal and external competences to address rapidly changing environments." (David J, Teece, Gary Pisano, 1997). Lean is a tool by itself that can be modified and adapted to suit the organizational routines and circumstances. Implementation of lean thinking takes years of committed development from the strategic level, tailored for each organization, and hard to decode or copy from one organization to another. Lean majorly invests in methods and behaviors at the individual level as well as organizational mechanism of involvement and participation of employees at the team level.

2.2.2. Strategic Level: What Are the Conceptual Building Blocks of Lean Thinking?

Referring to lean as a complex dynamic capability, Womack and Jones have set some basis and suggested five principles of Lean Thinking that could be followed in order to implement lean in an organization. These five principles were recognized by academics and practitioners as the conceptual basis in many case studies (Liker, 2004).

1. Define Value from the customer perspective: The Oxford dictionary defines value as "The regard that something is held to deserve; the importance, worth, or usefulness of something". In marketing, value is what the customer is willing to pay for and spend his money on. It is what the customer is interested in. Companies should do in-depth analysis to consider what customers are regarding as a 'usefulness' and 'necessity' in the company's products/service, through direct observation of the entire process, extracting information from archival data, and deep thinking to understand the value of their outputs from the customer's point of view. Lean is about delivering value as defined by the customer (Douglas, J., Antony, J., & Douglas, 2015). This strategic approach of lean thinking prioritizes and references customers as the center of the service, whether this customer is an internal or external one.

2. Identify the value stream of each product or service: Companies should be observed as a process-based organization. Each process should be mapped and recognized as a series of steps and consequences that if followed, the final product or output would be what the customer is valuing (Liker, 2004). A holistic view should be considered when applying Value Stream Mapping in an organization, processes must be drawn starting from the supplier and moving as end-to-end for all the processes (Womack et al., 1996).

3. Create smoothness in the product flow: After creating the value stream/process map for each product, an observation must be done on each activity in the stream to decide whether the activity is a value-added or non-value-added activity from information and material flow. Value added activities are processes that if combined the output would be what the end customer is looking for whereas non-value-added activities or wastes (Muda) are processes and steps that do not add value to the final product. When removing it, the output is still valuable from the customer's perspective (Shou et al., 2017)

   Ohno has defined seven sources of waste in a production plan setting:
   a) Transportation,
   b) Inventory,
   c) Motion,
   d) Waiting,
   e) Over-Processing,
   f) Over-Production,
   g) Defects,
   h) and People.

4. Introduce customer pull for value creation: When continuous flow is not possible, let customers pull value between all steps to remove more wastes and to maximize value creation. "Pull in simple terms means that no one upstream should produce a good or a service until the customer downstream asks for it" (Womack et al., 1996). Pull can be introduced into a production system by the following two techniques: Just in Time (JIT) and Leveled Capacity. JIT is a lean method in production where a product or a service is being produced

exactly at the time the customer is placing the demand, with the quality and quantity required (Liker, 2004). Leveled Capacity means the synchronization of all the activities in the value stream with the same cycle time, all the activities and steps in the value stream should produce semi-finished products at the same time (Slack, N., Chambers, S., & Johnston, 2010). So, this principle helps to "make the process flow smoothly, with its delivery "pulled" as needed by the beneficiary rather than "pushed" by the provider".

5. Strive for perfection of the first four principles: As discussed before, lean is not a matter of applying few steps and observing the results immediately. Lean thinking suggests going over the four steps repeatedly and aiming for the state of perfection, Kaizen, by continuous incremental improvement, reducing the number of steps and the amount of time needed for each customer (Womack et al., 1996). In sum, pursue perfection through a combination of continuous improvement and radical transformation of the process.

2.2.3. Operational Level: How Is Lean Implemented?

The concept of lean is not a straightforward tool and techniques that can be followed to reach "Leanness" in an organization, methods at the operational level are individually tailored for each situation, and each tool should be used for specific circumstances. Lean Toolbox is full of tools and techniques not only for Lean but also for other improvement approaches such as Six Sigma and Total Quality Management. Most of the time, lean interfere with these approaches and to complement their principle. A striking example of this is presented by Antony, J., Krishan, N., Cullen, D., & Kumar (2012) where they combined lean and Six Sigma Principles in Higher Education Institutions to come up with Lean Six Sigma tools and techniques.

2.3. How to Differentiate Between Service and Production Companies

Edgett & Parkinson (1993) suggested four characteristics to differentiate between manufactured goods and services, these factors are as follow:

1. Services cannot be provided without the customers' physical appearance; they are produced and consumed simultaneously.
2. Services cannot be stored; they are perishable.
3. Services cannot be touched, tasted or seen; they are intangible.
4. Services are difficult to standardize variables – the service may be perceived to vary from customer to customer. They are variable.

After looking at these four characters, it is obvious that universities are organizations providing service since courses are intangible and cannot be provided without students' attendance, even from the administrative side, student admission cannot be done without the student applying and filling the application. Also, the storage of service (courses) is not a possible option.

2.4. Applications of Lean Thinking in Service Sectors

Lean thinking is considered as "the endless transformation of waste into value from the customer's perspective" (Womack et al., 1996). A famous misunderstanding of lean is that it only can be applied at manufacturing or production settings, since it was originated in such an environment by the TPS. Lean is not combined with sets of procedures and tools for cost reduction or customer satisfaction only. Yet, lean is a way of thinking for the whole organization (Dragomir & Surugiu 2012).

The use of lean has spread over to the service sector, including financial services, telecommunication services and public services such as health and local government. Indeed, lean in healthcare is the area getting the lion's share of the reported literature related to Lean applications in the service sectors (Douglas et al., 2021).

Silva et al. (2010) interviewed ten service companies, three of them were warehousing and shipping companies and the other seven were financial services, to measure the degree of implementation of 9 key elements of lean. The results of the study confirm that the ten deeply observed service companies started implementing lean in processes with higher volume and lower variety to achieve a large portion of waste elimination and continuous improvement.

2.5. Lean in Healthcare

Lean implementation in a healthcare organization has been in use for over a decade since its benefits are obvious and can be reached with the correct tools and techniques. Reducing patient waiting times, improving the quality of the service provided to the patients, employee involvement, highlighting wastes at these hospitals and overall minimizing the operational cost are some of the few observed benefits of lean implementations in healthcare (Radnor et al., 2012).

Lean in healthcare has been proved to emphasize continuous improvement (i.e. capturing daily irritations and problems), value flow orientation (i.e. understanding the flow from the employee perspective that his/her task is adding value to the whole system) and teamwork (i.e. cross-profession self-managed teams) to build motivation and commitment among the staff (Antony et al., 2019).

The lean toolkit for leaner hospital varies. One of the most used techniques is waste identification through Value Stream Mapping, which is mapping the process of the handling of patients at the emergency unit and then shrinking the non-value added activities (Usman, 2020). Rapid Improvement Events (RIEs) also known as “kaizen blitz” is conducted to improve and support processes and eliminate wastes. RIEs usually are held over three to five days of evaluating, developing and redesigning processes by workers working on these processes for their familiarities (Radnor et al., 2012).

The application of lean healthcare management in Turkey can be observed in both Public Hospitals such as the work of Durur & Akbulut (2019) and Private Hospitals such as the work of Camgöz-Akdağ & Cumitini (2015). Additionally, lean thinking has been applied in various departments starting from the emergency department (Camgoz Akdag et al., 2018) all the way to radiology department (Camgöz-Akdağ et al., 2017), the physical therapy and rehabilitation departments (Doğan & Unutulmaz, 2016). Overall, although these implementations were implemented in different circumstances, yet almost all of the cases followed the same core practices of lean. First, VSM or value flow analysis for the main and most effective process in the department. Secondly, waste identification of the system. And lastly, proposing

solutions and drawing the future value stream (Camgöz-Akdağ et al., 2017; Camgöz-Akdağ & Cumitini, 2015; Camgoz Akdag et al., 2018; Doğan & Unutulmaz, 2016; Durur & Akbulut, 2019). The work of Doğan & Unutulmaz (2016) and Camgoz Akdag et al. (2018) have varied in the last step by simulating the proposed future value stream and measuring its efficiency before implementing these solutions.

2.5.1. Lean in Banking

Observing the success stories of lean in the industrial/manufacturing environment, the same methodologies and practices were replicated to suit the banking sector. The most commonly used methods in banking that were adopted from the manufacturing sectors are four: VSM, production balancing or "heijunka" to level the type and quantity of service provided in order to achieve Just in Time (JIT), and lastly applying 5S standardization for the organization of the offices in the bank (Leite & Vieira, 2015).

Replicating lean for a banking environment has also shown many positive effects on the service provided. For instance, (Jéssica Xavier dos Santos, 2016) have reached greater operational efficiency in a banking process by designing a lean approach based on multiple critical success factors such as the diagnosis of the current state, employees' empowerment, top management commitment and gradual implementation. The approach was guided by the concepts of lean, which were waste minimization, work standardization, teamwork and continuous flow.

The pioneering application of lean banking in Turkey was done in a nationwide state bank in the Aegean region, which resulted in up to 22% improvement in time spent and 33% in number of operations per process. The results of the application led to customer satisfaction and better quality service due to the reduction of the variability and probability of errors (Erdem & Aksoy, 2009).

2.5.2. Lean in Call Centers

Piercy & Rich (2009) have addressed the issue of lean improvement techniques in pure-service companies, they examined the following research question "Can the lean

principles and practices of lean thinking be successfully applied to the pure-service context?" Their paper has empirically demonstrated the validity of the lean approach in three different financial service companies. Techniques such as process mapping, modelling of backflow and failure demand, process re-engineering and problem solving were the key lean techniques to improve the quality offered at these call service centers.

2.5.3. Lean in Telecommunications Industry

Kundu & Murali Manohar (2012) and Psychogios et al. (2012) propose a lean implementation multi-factor approach and suggest a series of critical success factors for the implementation of lean in telecommunication companies and IT support services. The factors were categorized as facilitators that the company should pay attention to such as 1) top management leadership and support, 2) quality-driven organizational culture and communication, 3) improvement programs and training and skill building. On the other hand, some of the critical success factors are considered to be inhibitors of Lean, and the aim must be to minimize their influence, i.e., lack of awareness for the need of continuous quality improvement, lack of strategic orientation.

2.5.4. Lean in Firefighting Industry

One of the latest implementations of lean service has reduced the wasted time in a fire department by the lean team of an Indonesian university (Ginting et al., 2020). The team initiated the project of lean by drawing the current VSM or the process map of an emergency situation at the fire department, KPI's such as value-added average cycle time were identified to measure the change in performance and to identify wastes in the process. Later on, the future VSM was drawn by eliminating the wastes and proposing a lean solution for further improvement.

2.6. Lean in Higher Education Institutions

The effective applications of lean principles and practices as mentioned in the previous section across different cultures, industries and departments lead us to conclude that lean was effective in variety of service sectors. Thus, we expect that this will apply to Higher Education institutions.

Lean Higher Education (LHE) expands the applications of the lean philosophy for manufacturing, service, and professional organizations to Higher Education Institutions. LHE is a holistic approach to systematic change, which helps colleges and universities to reconsider their responses to the expectations and needs of those benefiting from their services. LHE principles and practices should become the culture of the institution, engaging faculty and staff in the improvement of the underlying processes of higher education to make them more efficient and effective.

Lean implementation in HEI is still at the initial stage and there is a huge space for improvement, all the applications are good examples to follow, but there is no one best way for implementation. The principles of lean have been applied in Higher Education Institutions, but the tools and techniques differ from one study to another.

Emiliani (2004) demonstrated the applicability of using lean principles and practices for the design and delivery of a graduate business school course. The objectives of the research were to improve consistency, eliminate waste, improve the quality and relevance of course materials, and deliver greater value as perceived by students. The objectives were reached through applying some key Lean processes and tools such as: Five 5S, Just-in-time, kaizen, Lean behaviors, heijunka, and VSMs. The results show a higher level of student satisfaction through more obvious expectations, less ambiguity regarding assignments through standardized format of assignments, level balancing of individual and team assignments over the course, and better time-management of students inside and outside class. Emiliani (2005) continued his applications of LHE using kaizen to improve graduate business school degree programs including ten courses. Based on student feedbacks of formal and informal surveys, the improvement opportunities were identified into four categories that were

the main focus of the kaizens to address them and make improvements in these opportunities.

An assessment of the use of lean sustainability concepts was developed Comm and Mathaisel (2005). The questionnaire was applied at five public universities and 12 private universities in the United States. The result of the study suggests that lean sustainability practices can be applied to the operational or administrative side of higher education enterprise more often than to the teaching or research side.

Hines and Lethbridge (2008) visualized in his article "New Development: Creating a Lean university" the lean process as an iceberg. Technology, tools and techniques affecting the process are what deceive those planning to implement lean in their universities. While the majority of the iceberg is beneath the surface and consists of enabling elements. Hines states that in order to have a successful, sustainable transformation of lean, the bottom of the iceberg should be addressed by forming a Lean implementation team (Hines & Lethbridge, 2008).

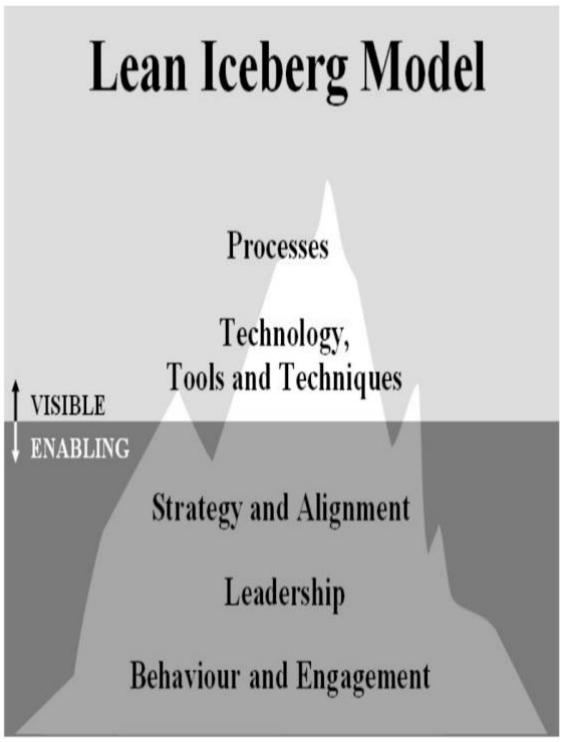

Figure 2.1. The Lean Iceberg Model (adapted from Hines & Lethbridge, 2008)

Various lean tools were used by Alagaraja (2010) to improve the development of teaching materials, and to examine the applicability of lean thinking in higher education. El-sayed et al. (2011) utilized the very well-known lean principles to help in the development of an educational program and course assessment process. The authors established performance criteria and targets for assessment with some illustrative examples.

Doman (2011) significantly improved a university administrative process by his new paradigm of teaching undergraduate students the lean principles, practices and techniques and allowing them to reinforce what they have learnt on the grade change process. The study shows that a small group of students can work with the lean team and suggest solutions if they were taught well, these solutions are already from the beneficiaries' perspective.

Dragomir & Surugiu (2012) have implemented lean in three higher education organizations by initially drawing a VSM for their current situation. After identifying the current VSM, opportunities for improvement had been analyzed and measured to draw the future VSM. The final analysis of the three case-studies came up with some 'particularities' to implement lean in an educational environment: Lean should not be triggered only when there is a crisis; it should be executed by higher level managers in the university beforehand. The initiatives of lean and the commitment is a lifelong commitment, and the outcomes take time to be visible, as a result, an office of process improvement must be created with the help of a lean facilitator.

HEIs do not contain only few processes and procedures, but a wide range of systems and processes. A university would not perform its duties without the comprehensive work of its departments and offices, for instance, International Relationship Office, Financial Affairs, Graduate and Undergraduate School, IT and so on. Each department has its own processes for identified activities to reach specific outcomes, these processes should add value from the customer's perspective, if the process is performed properly from the first time, and the customer perceives the value (Douglas, J., Antony, J., & Douglas, 2015).

Table 2.1. lists the significant studies focusing on lean implementation and practices on HEIs along with the benefits achieved.

Table 2.1. Studies Focusing on Lean Implementation and Practices on HEIs Along With the Benefits Achieved

Author/s	Area of implementation in HE	Lean tools and practices used	Benefits and results of the implementation
Emiliani (2004)	Leadership course of Graduate Business School	5Ss, JIT, heijunka, standardization, visual control	Higher level of student satisfaction, improved quality and relevance of course materials, delivery of higher value.
Emiliani (2005)	Ten courses of Graduate Business School Degree programs	Kaizen	Addressing improvement opportunities via rapid improvement(kaizen) events
Comm & Mathaisel (2005)	18 public and private universities	Seamless Flow of product/service and data, People utilization, cross-functional team development, customer focus, top management involvement.	Cost saving, waste elimination, better relationships, and improve efficiency to reach sustainability
Hines and Lethbridge (2008)	Various universities	Continuous Improvement process, Lean Value System, Top-down Bottom-up Approach.	Resource saving, eliminate wastes and improve customer value
Alagaraja (2010)	Course design and delivery	Cellular processes, Policy deployment, Flow, JIT, Kaizen, Kanban, Poka-yoke, Quality function deployment, Standardization, TOC, VSM, Visual controls, Visual management, and Waste elimination.	Suggested 15 Lean practices with examples to guide the implementation of LHE in course designing and delivering, no actual case-study or results.
El-sayed et al (2011)	Course assessment process	The five Lean principles: Value, Pull, Value Stream, Flow, Perfection.	A guidance for the development of educational program and course assessment processes, "objectives, outcomes, and performance criteria for all of the courses in the program should flow from the program-level specifications and should be aligned with it"

Table 2.1. continued

Doman (2011)	A university's grade changes administrative process	Process mapping and VSM, Lean Team, continuous improvement	A small group of undergraduate students can quickly grasp lean principles, tools and practices and apply what they have learned to improve university administrative process
Dragomir and Surugiu (2012)	Three case studies in UK and USA universities.	Value Stream Mapping, 4-steps toward Lean, Revised Processes.	The paper suggested some particularities for Lean: lean must be applied now without waiting for crisis to happen, lean in a long-term customer-oriented initiate of continuous improvement, A facilitator is needed to guarantee the correct implementation, Revised processes is a major key player for lean, Lean must be created for continuous improvement.
Thirkell and Ashman (2014)	Two UK universities	RIEs, Process mapping, Value stream mapping, Nominal grouping techniques, Competency frameworks, A3s, Visual management, Root cause analysis, Fishbone diagrams.	Culture change, focus on customer service, Personal respect and empowerment, Four Propositions were concluded for better implementation of Lean at these two universities.
Simmons and Young (2014)	Student academic experiences	Customer focus (the student is the customer), Five Why's, Jidoka (translated to identify students on the verge of leaving), Four Categories of Wastes.	Improving student (customer) value, waste minimization, and promoting efficiency and productivity.

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2.6.1. Critical Reflection Questions for HEI

Waterbury (2015) captured the challenges faced and lessons learned when implementing lean in seven colleges and universities who have experience with lean. The results of the multiple-case study can be used to assist HEIs considering a lean initiative. The following critical reflection questions should be considered before implementing lean in higher education to ensure success of the lean projects:

- Who will oversee the lean initiative?
- How will human and financial resources be allocated?
- When and how will professional development opportunities be offered for senior leaders, facilitators, and employees?
- How will facilitators continue to develop their skills?
- How will projects be selected?
- How will lean thinking be introduced into academic departments?

The movement from a traditional 'old school' university into a lean university is considered for so many reasons, such as reducing expenses in an era of increasing costs and lacking financial resources, redesigning outdated administrative processes and delivering expectations of students and all stakeholders, and going the extra mile for it, becoming more efficient and effective to meet the public demands, omitting employee job dissatisfaction and low productivity levels, last but not least, leveraging all available institutional resources to fulfill the educational scholarship and outreach missions of higher education (Balzer, 2010).

2.6.2. General Steps for the Application of LHE

Applying lean in HEIs is not a single step process that could be applied by a single researcher or quality assurance worker since lean thinking emphasizes inclusion of all employees and staff representing the name of the university in one way or another. Accordingly, there is no 'best method' to follow that combines lean principle and tools in order to become a lean university. Balzer (2010) draws general steps for the application of LHE from the lean principles, which are:

1. The initiative of lean should start from the strategic level managers, and the lean team must be established to keep the university on the track of lean principles and practices.
2. Identify the expectations and values of each process from the eyes of the customer or the beneficiaries of the process.
3. Develop KPIs to measure the performance of each process and the effectiveness of the improvements and solutions applied to the process.
4. Draw the map of the process not only from the university perspective, but also from the customer's perspective too.
5. Propose solutions from the lean 'toolbox' to improve the movement within the process by eliminating all the wastes.
6. Observe the change of the results in the KPIs of the process and seek for 'continuous improvement'.

2.6.3. Why Choose Lean Over Other Approaches to Improve Higher Education?

When it comes to improving the performance of higher education institutions, lean provides notably different results based on the well-established lean principles and practices. In comparison to unstable outcomes from other interventions, lean principles and practices are evidently applicable in higher education, with the comprehensive practical tools for implementing integrated institutional changes and improvements. Furthermore, LHE believes the success of an institution comes by developing exceptional employees and balancing between them and the long-term needs of the institution (Balzer, 2010).

2.6.4. Customers in HEI

In a production setting, it is easy to identify customers in the process. Usually, they are those who initiates the order in the system, pay for it and use the product/service (Emiliani, 2004). Yet, in the public sector in general and in HEIs in particular, it is quite complicated. In healthcare, for instance, an operation cannot be performed, and it would not have existed in the first place without a patient that the surgery is to be

performed on. So, patients are considered as the main customer in healthcare, along with patients' relatives, society, and government who are supporting the patient financially (Douglas, J., Antony, J., & Douglas, 2015). Applying the same logic at a university environment, courses would not exist nor be taught without the students' attendance and appearance in the classes. So, students may be seen as the main customers of universities, even if they are offered a scholarship, and they are not paying for their education. The funder is also considered as the sub-customer too.

Furthermore, the concept of seeing customers as 'outsiders' is false. The literature has identified customers of an organization into two: internal and external customers. Not all processes' outputs are provided to external customers. Some of the processes are performed upon the request of another department, and the result or the final stage of the process is to move the service/product to a different department within the same organization. This customer-driven approach states that "the customer or the beneficiary defines the value, the university's object should be to deliver that value rather defining it in all things academic" (Balzer, 2010).

2.7. Waste

"Waste is defined as any human activity that absorbs resources but creates no value" (Womack et al., 1996). In order to remove wastes in a service industry and streamline the process, firstly wastes must be recognized and highlighted from the whole process line; second, the causes for these wastes must be understood and addressed, remove the causes from the whole system if possible (Douglas, J., Antony, J., & Douglas, 2015).

2.7.1. The Transformation of Manufacturing Wastes into HEI Wastes

Douglas has studied how the development of the idea of waste has changed from a generic idea of waste in a manufacturing environment into specific waste for each sector. The father of lean, Taiichi Ohno identified seven categories of wastes that originated from his successful work at Toyota Production System in 1988, while Womack and Jones (1996) found the eighth one. These wastes are:

a) Transportation: Unnecessary movement of materials and resources not required to perform the process.
b) Inventory: Part, work-in-progress, semi-finished products or services not being processed.
c) Motion: People or equipment performing extra motions more than the required when performing the process.
d) Waiting: The idle state of machines and workers waiting for the previous steps to be done.
e) Over-Processing: Extra work that adds no value to the customer.
f) Over-Production: Producing more than the demand.
g) Defects: Time and work associated with identifying and correcting defects.
h) People: Not fully utilized workers and employees.

Since these eight wastes were developed for production systems, a small modification was to be done on them to make them suitable for service environments. MacBryde et al. (2006) represented these eight wastes but in service organizations based on the generic wastes of Ohno. Bonaccorsi et al. (2011) have appended two extra categories, which made them 10 categories in total:

a) Delay/Waiting: Idle time due to the previous step in the process map, waiting for approvals or supplies.
b) Duplication: activity that adds no value to the service/product, re-entering data, multiple signatures, or queries.
c) Unnecessary Movement: movement and motion that add no value to the service/product, Poor layout,
d) Unclear Communication: Lack of communication panel, wrong information, lack of standardized data format and workflow.
e) Incorrect Inventory: storage of products or work that the customer had not requested, printing extra copies and stock out.
f) Errors/Defects: usually appears in the final work, should be avoided when noticed, data entry errors, lost files and inappropriate and below expectation work.
g) Lack of customer focus: not paying attention to the real customer of the service and product and dealing with them in an unfriendly manner.

h) Overproduction: Excess of products that no one would ever use and would turn into inventory.
i) Underutilized People: excess number of workers that are not working to their full potential.
j) Variation: Lack of standardized work and procedures for specified work or service.

(Douglas, J., Antony, J., & Douglas, 2015) have translated the eight generic categories of wastes into wastes for Higher Education Institution:

a) Transportation: The movement of materials between the stakeholders of a process, multiple handovers, multiple approvals, and signatures for a paper from different advisors.
b) Inventory: The storage of more items or supplies than necessary in the office or stockroom, too many printables, too many photocopies for homework, piles of papers and documents for a small approval.
c) Motion: The unnecessary movement of staff and students, the movement of students and professors from one classroom to another, traveling between campuses.
d) Waiting: Waiting for approvals, waiting for documents to be approved, queuing in front of professors' offices, waiting for students to show up, or emptying the halls, waiting for technical problems to be solved.
e) Over-Processing: Doing non-value-added activities from the customer's perspective, multiple checks, too-long emails, requiring too many signatures, too many people involved in a process, etc.
f) Over-Production: The production of materials and work more than required for the current time, too many hand-outs, too much workload for staff to the point they are not doing their tasks properly, too many classroom hours per week for students.
g) Defects: The time and effort spent to correct errors. Errors when entering data, typo errors (typographical error), unused classrooms, timetabling errors.
h) People: Not using the full potentials and capability of staff and workers' knowledge, skills, and abilities or the assignment of workers in the wrong department. Professors not teaching their specialized subjects, workers

working in a department they do not prefer, not doing enough research and articles.

Kazancoglu & Ozkan-Ozen (2019) provided a model that categorizes waste in HEIs into wastes and sub-waste in terms of criteria and sub-criteria. The article also suggests a roadmap to be followed when implementing lean in HE.

Table 2.2. all eight types of wastes that might be found in HE with an example of each waste and a detailed explanation is provided.

Table 2.2. Waste Examples for HEI

Waste in HE	Sub-waste (examples from HEI)	explanation
Transportation	Moving/transferring administrative documents for approvals	Moving or transferring administrative documents for approvals between different administrative units is inefficient, such as sending course descriptions and contents to heads of departments
	Lack of technology usage in terms of course materials (hard-copying of materials, books, etc.) - carrying them between classes	Course materials must be created in hard copy and carried between classes, rather than using IT like USBs, e-books, etc.
Inventory	Lack of sources (academic journals, research materials, equipment, database, software etc.)	There are insufficient resources for academic work, including academic journals, research materials, equipment, databases, and software
	Excessive use of paper copies	Excessive amounts of paper are used instead of electronic copies for academic and administrative work that may be unnecessary
	Unbalanced course-classroom pairs (idle or over-capacity, inappropriate)	Classroom specifications (technological equipment, special software, etc.) do not match the course requirements or the capacity of classrooms is underused
Motion	Inefficient scheduling of classrooms and instructors (long walking distances)	Lecturers are inefficiently assigned to classrooms, which may force instructors to walk excessively long distances
	Redundant movements required between office machines and facilities	Office machines (printers, faxes, photocopiers, etc.) and facilities related to daily work are located far from offices, creating long walking distances
Waiting	Inefficient scheduling practice in terms of timing	The poorly prepared teaching schedule does not allow time to be used effectively, such as having long gaps between classes
	Non-standardization of workdays (unbalanced workloads across days)	Workload is not standardized across weekdays, such as having some over intense or busy days that decrease efficiency
Over-processing	Unnecessary repetition of tasks	Academic and administrative tasks are unnecessarily repeated daily or monthly, such as keeping track of weekly student attendance

	Excessive variability of courses	Academic staff have to teach a wide variety of courses that may not be mandatory for the curriculum of that program

Table 2.2. Continued

	Ineffective control of course contents	The contents of some courses are not coordinated carefully. For example, some subjects overlap in different courses
Over-production	Producing extra, unnecessary information	The complexity of the system creates excessive amounts of information in academic and administrative work, which is used ineffectively or not at all
	Excessive number of academic units	The university has too many academic units, which may cause excessive use of human, finance and time resources
	Excessive number of administrative units	There are too many administrative units with similar purposes, which may increase bureaucratic work for academic staff
	Excessive number of students to graduate	Due to the excessive number of students, the student/academic staff ratio is too high, so student-academic staff interaction is inadequate
Defects	Missing information (administrative or academic)	Communication deficiencies result in missing information in daily tasks, such as misunderstandings of regulations and bylaws
	Repeated work at the end of semester (preparing reset exams, remarking exams, etc.)	Work has to be repeated at the end of the semester (e.g., preparing reset exams, remarking exams)
	Errors owing to misunderstanding/communication problems	Errors occur owing to misunderstandings, communication problems or disinformation
People	Unnecessary bureaucracy	Unnecessary bureaucracy in academic or administrative work wastes time and decreases academic staff motivation
	Talent underuse	There is perceived underuse of staff talents, background, expertise. Some tasks could easily be done by subordinates
	Skill mismatches	Specializations and assigned responsibilities (e.g., courses taught) do not match

2.8. Value Stream Mapping

After an in-depth analysis of the previously made applications in HE, process mapping, process flow, and VSM can be seen repeatedly in most of the literature. It is worth mentioning that VSM and process mapping are similar and have been used to visualize the process to improve it. Yet, VSM looks at the process from a broader view, and

with more details. It is one of the reasons why it will be used in this thesis instead of process mapping.

VSM is one of the most used lean techniques over the lean literature. The objective of VSM is to visualize processes and to comprehend how the value is being created, and where wastes occur. The visualization of the process helps the stakeholders understand how the value is being created and sets the standardization of the process as a reference. It also helps in improving the process by emphasizing the sources of waste to eliminate them (NHS Institute for Innovation and Improvement, 2018).

Khurum et al. (2014) mentioned the process of VSM, with details for each process and the outputs of it. These steps may be seen in Figure 2.2., and more details about them will be mentioned in this section.

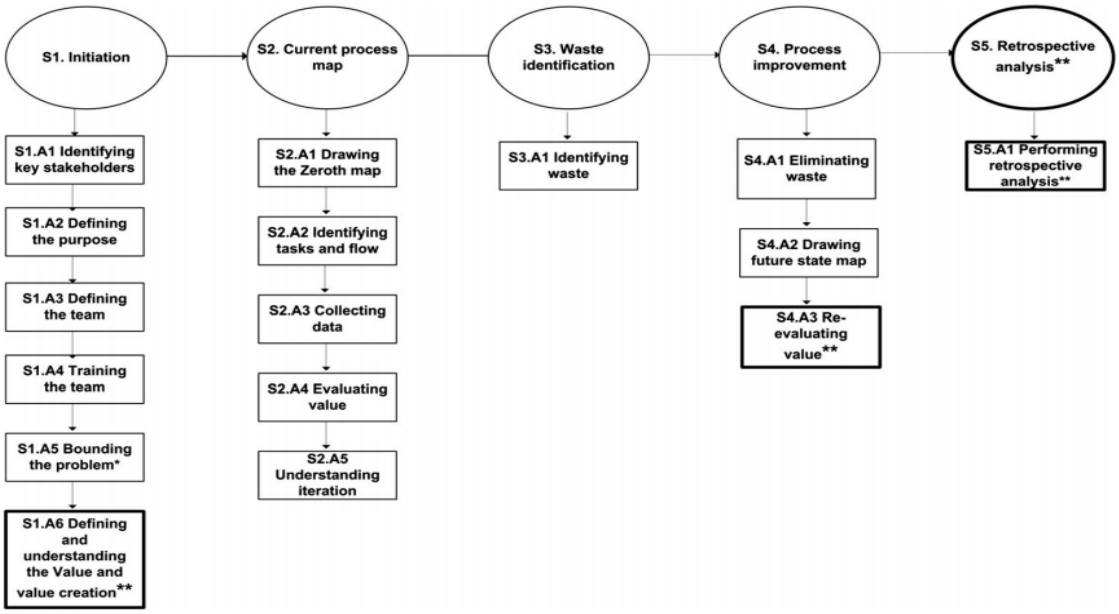

Figure 2.1. Value Stream Mapping Process (adopted from Khurum et al. (2014))

Initiation: To start the journey of VSM, some preparations and planning must be considered for an effective journey, the following activities should be done first:

- Identifying the stakeholders of the process.
- Defining the purpose of VSM.
- Defining the team to who is going to follow with the rest of the steps.
- Training the team on lean concept and VSM.

- Scoping the current problems, which the process is facing, and the reason for VSM to be implemented.
- Identifying the value and value creation relevant for the goal to be achieved.

Current Process Map: In the second step of VSM, the current state map is drawn. The map helps in understanding the whole process, how it occurs, and identifying wastes in the process that must be addressed later on. Steps to be followed to draw the most representable current state map are:

- Drawing the first draft of the process.
- Identifying tasks and flow of the process.
- Collecting actual data through observations and interviews.
- Evaluating the value from the customer perspective.
- Understanding how the process is repeating.

Waste Identification: After the first draft of the map is drawn, waste may be identified easily with accordance to value adding tasks.

Process Improvement: When wastes are clear and highlighted, improvement alternatives are suggested by following these tasks:

- Eliminating the major wastes.
- Drawing future state map.
- Re-evaluating value for the whole process.

Striving for Perfection: This last step suggests that after providing the alternative improvements, continuous observation and checking must be on the go to make sure that no misunderstanding has happened, and make sure that the suggestions are performed as planned.

CHAPTER III

METHODOLOGY

The purpose of this chapter is to elaborate on the research approaches and methods used to develop this thesis, to answer the research questions, and achieve the research objectives.

3.1. Research Design and Methodology

This work looks at the literature to find the suitable Lean tools and techniques to apply at a university, and then applies them to prove that Lean is an effective approach. This makes the paper a deductive paper. Furthermore, the thesis follows a mixed approach in collecting data, interviews and focus groups are examples of qualitative, and measuring the performance indicators by surveys and direct observations are examples of quantitative methods.

Accordingly, this research is composed of three phases:

- Phase 1: Diving into the literature to find real applications of lean in HEIs and coming up with the best and most used LHE tools and techniques to apply them at the university under study.
- Phase2: Observations of the Departments and Data collection to draw the current state of the process with its current performance indicators.
- Phase3: Measurements and Performance Indicators analysis to draw the future state and provide suggestions.

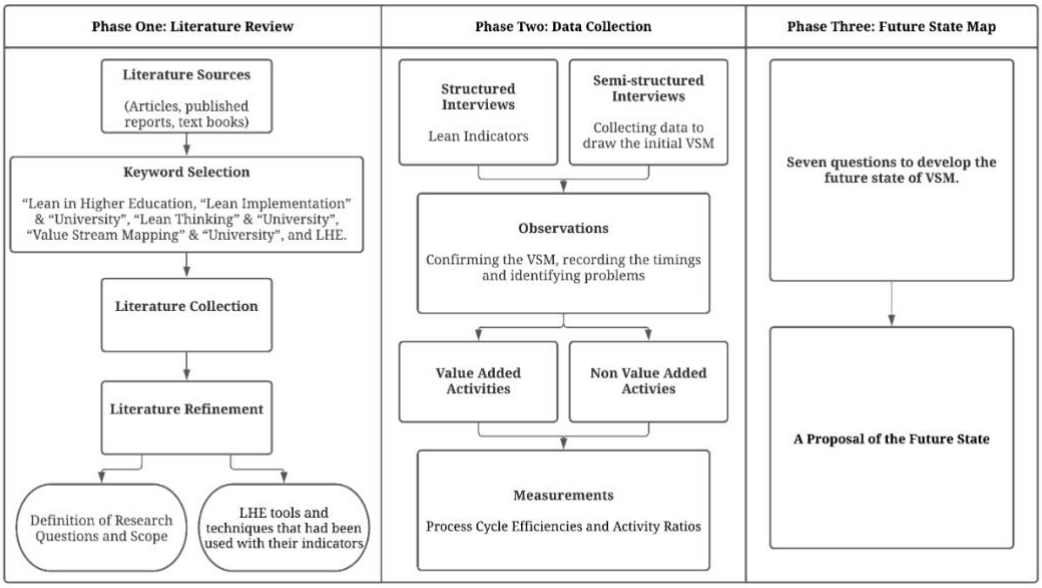

Figure 3.1. An Overview of the Three Phases of This Master Thesis.

3.2. Phase One: Literature Review

As the concept of lean in HEIs is still at its first glances, and the use of Lean principles was very famous in the industry but rarely used in a university's settings, an in-depth review of LHE literature was conducted to understand how the concepts and theories of lean were transformed from the production line to university's offices. Literature played a major role in this thesis to provide the tools and techniques that had been used with their indicators. The role of literature did not stop at the first phase only, there was always a need for the literature to support or answer some of the obstacles faced during the writing of the thesis.

The university's electronic library was of huge help in finding the resources and articles together with Google Scholar. Some of the keywords that were searched for areas such as "Lean in Higher Education, "Lean Implementation" & "University", "Lean Thinking" & "University", "Value Stream Mapping" & "University", and LHE.

3.3. Phase Two: Data Collection

After the phase of checking the literature and coming up with the research question, we moved to the second phase of the thesis where the following methods were used:

The interviews held for this thesis can be divided into structured and semi-structured interviews.
Structured interviews were held with the head of departments and staff with ready questions to decide whether the introduction of Lean should be considered or not. These questions were introduced by Brigel & Olsson (2018), if any of the following questions is answered by yes, then lean thinking must be the next strategy for the organization:

1. Is it normal to spend extra time (overtime) on an activity in the department?
2. Is there frequently a need to rework something after considering it done?
3. Do the staff of the department spend a lot of time on paperwork?
4. Is there more than one way to perform a task?
5. Do employees waste time by looking for the appropriate materials?
6. Were there any changes in the processes when the department grew and moved to the new campus?

For the following questions, if one answer is no then that should be an indication of the need for lean solution for the targeted process:

1. Does the department have a standardized procedure?
2. Does the department implement the best/optimum practices?
3. Does every process have a manager or a responsible one?
4. Do employees understand the impact that they make on the process?
5. Do employees in the department communicate the right information to the right person at the right time?

Semi-structured interviews are held after the structured interviews and after the discovery of lean needs in the university. Semi-structured interviews are a set of specified questions prepared by the interviewer beforehand to guide the conversation

according to the thesis objectives, yet, with the possibility of elaboration when something interesting comes up (Bell, 2015).
Mainly semi-structured interviews were held to specify the steps and procedure in detail from the stakeholders of it, timings and performance indicators such as the total length and time required to finish a step, process time, with the time the activity keeps waiting until the next step.

Not every detail is mentioned in the interviews, that is why observations took place to identify and record the behavior of the representatives of each department (Bell, 2015). Some details seem too obvious for the workers to mention during the interview because they are not aware of them, but they have a huge impact on the process.

The purpose of the observations is not to depend only on what the interviewee has said, but to understand and learn in detail the work they are doing, and to identify problems directly from the process itself, and to ask questions when there is something that is not clear.

For some of the process, the steps of some of the main activities were already recorded for students or other workers to use or to be as a reference when a worker forgets the procedures. These secondary data were collected from the website of each department or asked from the head of the department directly.

As suggested by the literature, the most feasible lean tool used to obtain time and screen the current state of the processes at a university setting is VSM. Below are the steps that were followed to implement VSM at the university and assess the current state:

- Identifying each step/task in the current process,
- drawing the map of the task in order,
- and confirming the map from the process stakeholders.

For each map, Value-added and non-value-added activities are identified from the customer perspective, keeping in mind for most of the processes in a service organization such as what we are working with, there are two types of customers,

internal and external. Waiting time, the time when the process is idle is measured. Additionally, for each task, process time, the time required to finish a step without any interruptions, is calculated for value-added and non-value-added activities. Lead time, time to complete an activity from the beginning until the end of the task, Lead time includes waiting time with processing time combined. In the last step in assessing the current process, Indicative ratios are calculated for further comparisons.

3.4. Phase Three: Future State Map

Locher (2016) suggested the following questions to implement and draw the future state:

1. What does the customer really need?
2. Which steps create value, and which generate waste?
3. How can workflow with fewer interruptions?
4. How will interruptions in the flow be controlled?
5. How will the workload and/or activities be leveled?
6. How will we manage the new process?
7. What process improvements will be necessary to achieve the future state?

We also followed the same approach and tried to find the answers to these questions before drawing the future VSM.

3.5. Measurements

In order to compare the current state of the process to other processes, and to observe the impact of the future state, the following measurements are applied to the studied process as suggested by (Krdžalić et al., 2020):

PCE is an important metric in Lean, it directly measures the efficiency the whole project is performing, and it gives a percentage on the time which is adding value to the total time.

$$\text{Process Cycle Efficiency} = \frac{Value\text{-}added\ time}{Lead\ time} \quad (1)$$

AR measures the portion of time spent on both, value added and non-value-added activities, in comparison to the total lead time.

$$\text{Activity Ratio} = \frac{Total\ process\ time}{Lead\ time} \quad (2)$$

CHAPTER IV

CURRENT STATE

4.1. Context and Objectives of the Studied Processes and Related Departments

In this thesis, three processes and two departments that have the major impact and represent the majority of the service provided by the university were studied and analyzed to set the baseline for lean implementation at the university. The first process is where the first interaction between the student and the university occurs in general, the Application Process. All Master's and Ph.D. students must go through this process in order to apply to the university. The second process studied is the process of registering the student officially at the university after receiving the acceptance letter, the registration process, led, in most part, by the SAO. Lastly, Thesis Submission Process, where a student submits the thesis in order to graduate from the university.

The aforementioned processes are under the direction of mainly two departments, SGS and SAO. Below is a brief description of each department.

4.1.1. School of Graduate Studies (SGS)

SGS is established to contribute to the university mission, and they offer multilingual degree programs and courses of study that comply with international curricular standards. The SGS consists of distinguished faculty members who work in the research areas of Political Science, International Relations, Management, Economics, Philosophy, History, Sociology, Psychology, Law, Education, and Religious Studies. At SGS, students, faculty, and staff work together on projects that have impact on society, in a supportive academic environment. This support is strengthened with the help of the university’s international education network ties— presenting students and

faculty diverse research opportunities both in and out of Turkey— in addition to its collaborations in the public and private sectors.

It consists of two sub-departments, the minor department which is Graduate School Management Board, and the main management which is the Board of Graduate School. Both are working to support international and local students in their graduate studies.

An interview was held with the Secretary of SGS to talk more about the department's performance in general and highlight the issues that the department is facing with the current process. Indicators of lean implementation were asked to him as suggested by Brigel & Olsson (2018), to see whether lean is a feasible tool to be implemented at the department.

After the first meeting with the SGS's secretary, his response indicated that lean must be applied at the department, and the application process with the thesis submission process are the two major works that the department is contributing to the university. Below is the current situation of the department as he perceives it.

For the SGS, it is normal for staff to spend overtime working on a task. Reworking on the same task is not general though, in the department, paperwork wastes the majority of worker's time. When it comes to performing tasks, there is only one way to perform a task and the steps are agreed on within the department. An employee does waste time looking for the appropriate material, and the procedures and steps are not updated often; they were only looked at during the pandemic time.

The department wrote all the procedures and tasks for the processes they are performing and even published them on their website for the students to follow. The department does not implement the best practice, yet; they are always seeking the best solution for their issues. Each task in the department has a task owner identified and assigned, and the employees understand the impacts they make in the process. The employees always communicate the right information, to the right person, at the right time.

4.1.2. Student Affairs Office (SAO)

SAO department is the division of support and services that enhances the student success at the institution in whole and help them in the growth and development in Turkey and abroad. The SAO follows a healthy execution of the education and training, guiding the students and staff towards the correct path with respect to their preference. It helps to increase institutional qualification by providing correct, modern, and fast service to the students.

The department is currently responsible for all the processes and tasks that make the students' lives easier and with the correct guidance. The impact of the department starts with the Students Registration Process and finishes with the Student Graduation Process. This office works as a reference for the student at the university for any Inquiry that comes to their minds.

A few meetings and interviews were held with the Head of SAO to understand the current situation of the department, and to start from the issues that the department is facing currently before even lean implementation. The department has been working with the same staff and the same task for the past four years. So, the process and tasks are not written down or drawn on a board, but every worker knows what to do, how to do it, and when to do it.

When SAO's head was asked about the lean indicator, the response indicated that lean must be the next quality tool to be applied at the department. Below is more explanation about the response to the indicators.

For the indicators, the staff of the SA normally spend extra time on an activity due to lack of staff in the department. It is not frequent to rework a done task since the same staffs have been doing the same task for years now, but the department is dealing with loads of paperwork and documents. The procedures and steps are not written down in one place as a reference for all, yet it is communicated within the department during departmental meetings. The tasks are done in a standardized way, and all the employees know what they are looking for, and they do not spend extra time looking for appropriate material. The department has to follow the legislation from the

government, that's why they do not update their procedures. The head of SA thinks that they are implementing the best practices since they are following the rules and regulations in their best act. For the Registration Process, there are three responsible members of staff, one of them has experience of four years, so this experience turned into a responsibility. All the staff of the department knows that the impact they are making for the university as a whole is huge. Lastly, the staff generally communicate the right information to the right person at the right time.

4.2. Current State Map and Description of the Application Process

The first and the most effective process studied is the application process. This process makes the first impression of the university in the student's mind, since it is the first interaction between the student and the university. Application process is a must go through process for any student who is planning to apply for a university, and it must make a good impression on them. It is worth mentioning that all students must apply online for the university, and no applications are accepted by hand anymore.

For the application, it does not start from the task of the student going online and applying for the university as it seems from the student's perspective. It actually starts a few tasks prior to the Online Application task where preparation of the application requirements and dates for the events take place. After holding interviews with the responsible staff for the application process, the first draft of the application was drawn and confirmed in response to the order of the tasks. After the first draft is confirmed, walkthroughs and staff's opinions were considered to fill the timing of each task to be as accurate as possible.

The current state map of the application process is shown below with a brief explanation of each task afterword.

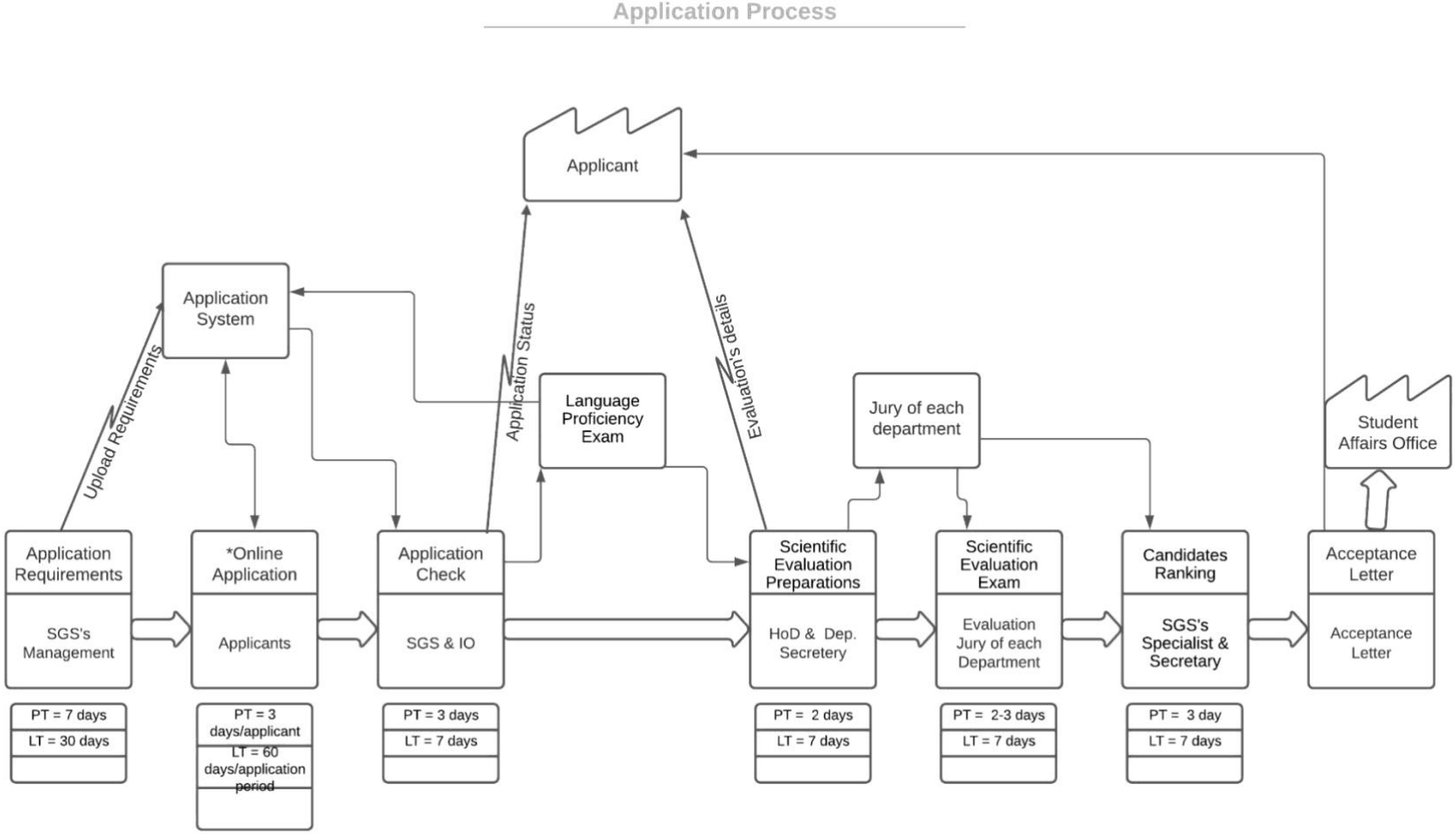

Figure 4.1. The Current State Map of the Application Process

AP.CS.S1: The Application Requirements Identification

The management of SGS requests from all the heads of departments to send their application requirements for the new academic year to which the application is to be received, the calendar (application start-finish, scientific evaluation exams, the announcement of the results, sending the acceptance letters), and the evaluation jury consisting of the lecturers of that program per program. After preparing the requirements, the SGS's management submits the requirements to the board to be approved during the next board meeting. After the decision has been taken by the SGS's board, the requirements are submitted to the University's Senate for approval of SGS's decision. SGS announces the determined application conditions and calendar through the web pages and uploads the specified application conditions and calendar parameters to the application system.

AP.CS.S2: Online Application

After The SGS's Specialist sets the requirements on the application system, the candidates apply online using the system. The candidate's responsibility is to provide the information and documents which meet all the requirements. It takes an applicant around 15-20 minutes to fill the whole application process if all his documents are available. Yet, it takes almost a whole day for the referees of the application to respond back to the email sent to them by the university. At the end of the period of the Online Application, the application system specialist creates a list of all the applicants separated by departments. The online application period is almost two and a half months for each call, the university has usually three calls for applications for the upcoming year, early, normal and late application call.

AP.CS.S3: Application Check

The applications list is checked by SGS and International Office staff by the information provided in the application and the documents attached at the end of the application period. The applications are checked according to the list of application requirements created during the first step. At the end of these checks, applicants whose applications are deemed invalid are informed by e-mail about their application status by SGS's specialist and assistant specialist. If the applicant has not got any English

qualifications, the application will be sent to the Language School in order for the applicant to attend the language proficiency exam, otherwise, candidates whose applications are valid will receive an e-mail stating that the scientific evaluation exam program is announced on the web pages.

Language Proficiency Exam

Candidates who do not have a certificate of English, Turkish, or Arabic language proficiency and declare that they want to take the university's language proficiency exam are taken by the School of Languages within a specified program. One of the issues in this step is that the applicant has taken an English Exam before, but the results have not been announced yet. After collecting all the scores, the School of Languages uploads the scores of the candidates to the application system. This process will not be studied since it is a complete whole process, and it goes under the language school department.

AP.CS.S4: Scientific Evaluation Preparations

The SGS receives the schedule (date and time) of the scientific evaluation exam, which consists of either written/oral exams from the head of departments depending on the announced calendar. The department secretary organizes the exam and informs the Jury of each department and the applicants via mail about the evaluation’s time and location. Due to the covid-19 pandemic, the evaluation is held via online meetings rather than normal settings where applicants must come physically to the interviews.

AP.CS.S5: Scientific Evaluation Exam

Each department arranges a distinctive evaluation according to the department requirements, some departments arrange a written exam and an interview after it. Candidates participating in the exam are evaluated by the evaluation jury at the end of the exam too. The Evaluation Jury sends the evaluation of each candidate at the end of the written/oral exam on a document containing the signature of each jury member to the SGS through the Department Secretary.

AP.CS.S6: Candidates Ranking

Along with the written/oral exam scores determined by the Evaluation Jury, SGS also calculates the scores of the other grades of the candidate (GPA, language score, ALES for Turks), ranks the winning candidates starting with the candidate with the highest score and creates an Announcement List. The same is carried out for candidates who could not win. Scientific Evaluation Exam results are announced on the SGS web pages by a predetermined date.

AP.CS.S6: Acceptance Letter

Acceptance letters are sent to accepted candidates on the Announcement List. The candidate who accepts the conditions on the acceptance letter signs it and sends it to the SGS. Candidates who are accepted and want to register apply to the SAO on the announced registration dates with the required registration documents. SAO checks the documents required for registration; if the required documents are available, then the registration procedure starts.

4.2.1. Value-Added and Non-Value-Added activities for the Application Process

After screening the current situation of the process with VSM, Value-Added and Non-Value-Added activities are differentiated with the timing for each task. Non-Value-Added activities are also considered as necessary activity or non-necessary activity, which must be excluded from the whole process. The table below shows each task that goes under the application process either Value-Added or Non-Value-Added from the student's perspective.

Table 4.1. Value-Added and Non-Value-Activities for the Applicaiton Process

Process / Task	Value Added	Non-Value Added	Necessary	Time
1. The Application Requirements Identification	2 days	5 days		PT = 7 days LT = 30 days
- Requesting the requirements for the new applications.		□		1 day

Table 4.1. Continued

- Preparation of the requirement.	□			1 day
- Decision from Board of GS.		□	□	1 day
- Confirmation from the Senate.		□	□	1 day
- Announcement of conditions and calendar on web.	□			1 day
- Setting the parameters to the Application system.		□	□	2 days
2. Online Application (per applicant)	1 day	2 days		PT = 3 days/applicant LT = 60 days/application
- Candidates apply online.	□			0.5 day
- Candidate upload documents.	□			0.5 day
- Referee's responds.		□	□	1 days
- List of Applicants created.		□	□	1 day
3. Application Check	1 day	2 days		PT = 3 days LT = 7 day
- List of Applicants check		□	□	2 days
- Application status via e-mail	□			1 days
4. Scientific Evaluation Preparations	0.5	1.5 day		PT = 2 days LT = 7 day
- Evaluation's details sent via e-mail.	□			0.5 day
- Exam's organization.		□	□	1 day
- Jury's notification.		□	□	0.5 day
5. Scientific Evaluation Exam (per department)	2 days	1 day		PT = 3 days LT = 7 day
- Applicants attend the exam at the university.	□			1 day
- Exam's evaluation.	□			0.5 day
- Jury's evaluation (interviews).	□			0.5 day
- Exam's scores determination.		□	□	0.5 day
- Evaluation documents sent to Dep. Secretary.		□	□	0.5 day

Table 4.1. Continued

6. Candidates Ranking	2 days	1 day		PT = 3 days LT = 7 day
- SGS receives the evaluation documents.		□	□	0.5 day
- Combining scores.		□	□	
- Scholarships information received.		□	□	
- Ranking applicants.	□			1 day
- Announcement List creation.		□	□	0.5 day
- Evaluation Exam Results announcement.	□			0.5 day
- Notifying the applicants about the results.	□			0.5 day

Student are considered the main customer of this process, since the whole aim of the process is to simplify the work of the student and to make the period of the Application as short as possible from applying online, until they receive the acceptance letter. The internal customers of the process are considered too, and they are kept in mind when working on this process.

4.2.2. Performance Indicators for Application Process

Based on the timings observed from the previous section, indicative ratios are calculated for each major task in the process separately, this is because in some tasks, processing is done for all the applications at once, and in other parts, each application goes through the process individually and must wait for the whole sub-process to finish in order to move to the next one. An example of this is the Online Application and Application check, each student must apply online on the website, yet wait until the application period is over to go to the Application Check task.

Indicative Ratios, PCE and AR are measured to set the baseline for the process performance before applying lean, and to compare it to other processes studied. Krdžalić et al. (2020) claims the process cycle efficiency to be around 5%-10% before applying lean tools and techniques.

Table 4.2. Indicative Ratio for the Application Process

Process Step	Value Added Time (days)	Non-Value-Added Time (days)	Process Time (days)	Lead Time (days)	Wait Time (days)	Volume	Position	Process Cycle Efficiency (VA/LT)	Process Activity Ratio (PT/LT)
Application Requirements	2	5	7	30	23	Once a year	SGS's management	6.67 %	23.33 %
Online Application (Per applicant)	1	2	3	60	57	*1216 International App. **563 Local App.	Applicants	1.67 %	5 %
Application Check	1	2	3	7	4	End of each call	SGS & IO	14.28 %	42.85 %
Scientific Evaluation Preparations	0.5	1.5	2	7	5	Once a year	Head of Department & Departmental Secretary	7.14 %	28.57 %
Scientific Evaluation Exam (Per department)	2	1	3 days for each department	7	4	Once a year	Evaluation Jury	0 %	42.85 %
Candidates Ranking	2	1	3	7	4	Once a year	SGS's Specialist & Secretary	28.57 %	42.85 %
Total	6.5 days	14.5 days	21 days	118 days	97 days			5.5 %	17.79 %

4.2.3. Issues Found While Studying the Application Process and Some Suggestions to Solve Them

The main aim of drawing the VSM overview is to show how the whole process currently functions, and to highlight the issues that unrecognized by the staff. Some of the issues became very clear while drawing the map.

Too many confirmations: Under the first step of the process, Application Requirements Identification, there is a noticeable amount of waits in the task, two confirmations and decisions that create extra wait. The decision is taken during the next board meeting that usually takes place once on weekly basis. These board meetings lead the Process Efficiency Cycle to be very low. The process time for the meetings is one day at max; yet the waiting for the next board meeting plays a major effect in the Lead Time of the process. As a solution for this, these board meetings may be held online, or combined into one decision instead of two.

Hold until the call period is over: Another issue that came up when drawing the map of the second task, Online Application, each student is applying online individually and uploading all the necessary documents for the application. Yet, sadly, they must be on hold until the application period is over and a list of all the applied applicants is created. The documents of the applicant are not checked unless the call is over, and then all applicants are moved forward to the next task, which is Application Check. This is what makes the PCE ratio very low for this specific task.

A suggestion here is to automate the checking process. The SGS may use a software that checks the documents of each applicant at the moment of their submission and sends and email to notify them if there is a missing file without waiting for the period to be over, or any interference from the staff.

Checking the documents by hand: For the third task, each applicant's documents are checked manually by SGS to avoid invalid certificates. The same suggestion of the previous issue would make the Lead Time of this process shorter, and as a result, more efficient.

No standardized way of holding the Scientific Evaluation Exam: Each department holds the Scientific Evaluation Exam according to what the professors of that department agree on; there is no standardized Exam for each department. Each department arranges a distinctive evaluation according to the department requirements. Some departments arrange a written exam and an interview after it, and other departments just stick to interviews only. This is what leads the lead time be high for this task. A standardized exam type and questions for each department performed the same way each year for all the departments must be considered for this case in order to make the process more efficient.

4.3. Current State Map and Description of the Registration Process

After a student finishes the online application process and gets the acceptance letter as output from that process, the registration process comes directly as the second process between the university and the student. The student registration process starts when the student decides to enroll at the university, and the responsibility of this process goes from the SGS to the SAO. There are some other departments working hand in hand to make the registration process go as smooth as expected, these departments are Financial Affairs, Student Information System, etc.

Since the university vision is focused on future researchers, only master's and Ph.D. student's registration is studied in this thesis. The undergraduate registration process is very similar to this process with a few small verities that are left to be studied later.

After long meetings and interviews with the responsible staff of the registration process, the current state map is drawn as shown below with an explanation of the task in detail afterward.

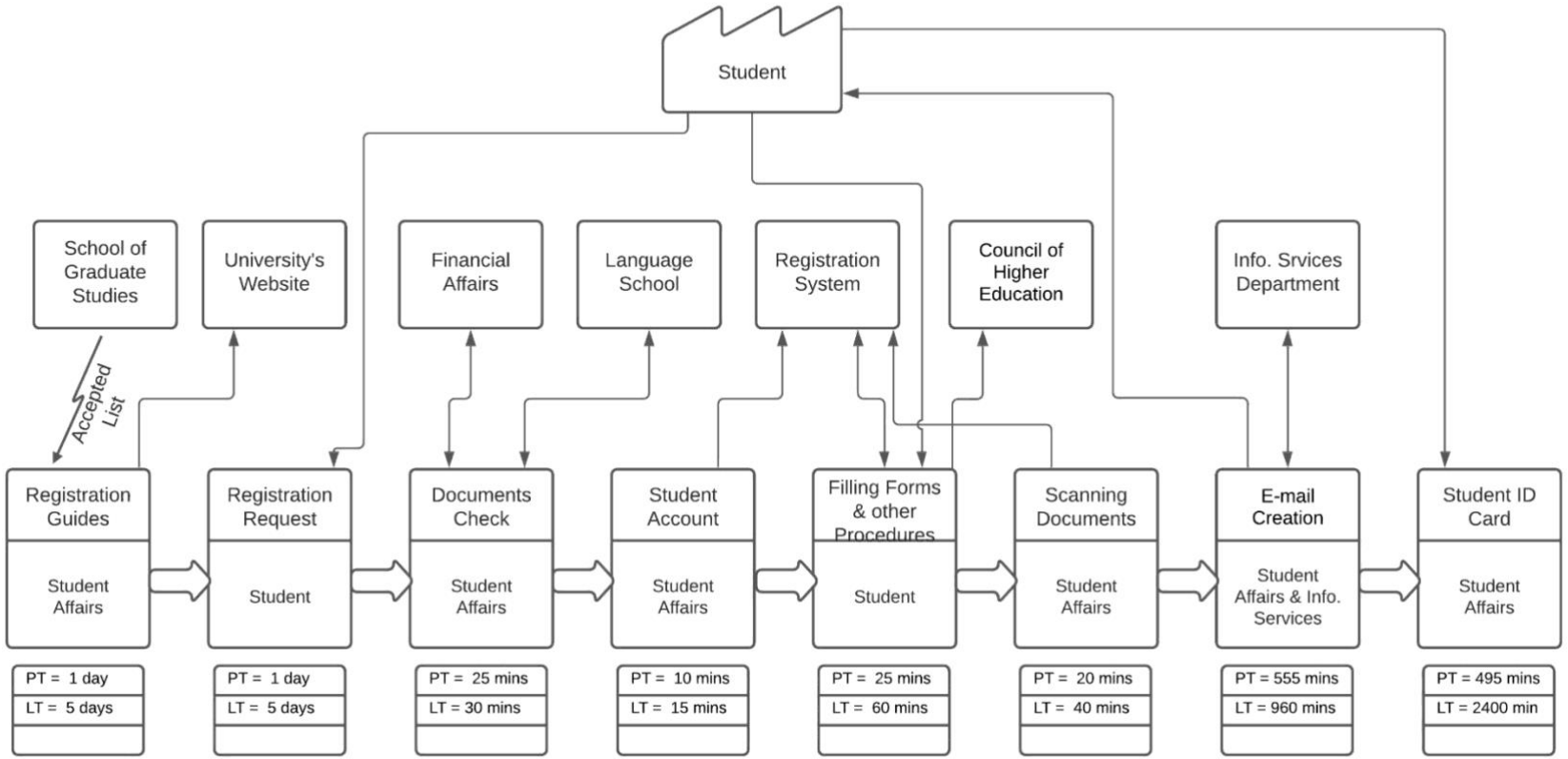

Figure 4.2. The Current State Map of the Registration Process

RP.CS.S1: Registration Guides

SGS Board of Directors' decision, about the candidates for whom a letter of acceptance will be sent is forwarded to the SAO. The decision with the acceptance list uploaded to the system (Electronic Document Management System (EBYS)), and information and the documents about the student are sent to SAO via e-mail. The registration guides published on the website are updated by the SAO after discussing the registration guides with other departments.

RP.CS.S2: Registration Request (Enrolment Day)

On the dates specified for enrollment in the academic calendar, the student who will register, comes in person with the registration documents and declares the registration request. According to the number of applicants, if the number of students exceeds 50 students per week, then an Enrolment week must be organized, and number of staff is increased to decrease waiting time for the students. The next three steps, until step 6 scanning the documents, happen on the same visit to the SAO in the best-case scenario, unless some interruptions happen and some of the processes get delayed.

RP.CS.S3: Document Check

While the student is still in the SAO, the documents are checked according to the Acceptance Criteria created by the SGS, and then approved by "Checked" or "True Copy" stamps and the student file is created.

Financial Affairs

The scholarship status of the student is checked and the students who are required to pay the fee are directed to the payment process under Financial Affairs Office. If there is a need for the student to give a visit to Financial Affairs, then some delay might happen. Especially, for some students, it can take a few days to finish the payment process. Meanwhile, the university's shift might be over, and a visit the next day becomes necessary.

Language Exam

Students who do not have a language proficiency certificate are directed to the School of Languages to take a language exam. This external process is another reason for some delay to occur in the process. It might take weeks to get the certificate from the School of Language.

RP.CS.S4: Student Account Creation

For students whose documents are complete, and they are done with the payment and have a valid English Exam, a student account with the student number is created while they are still in the office.

RP.CS.S5: Filling Forms & Military Procedures

It is ensured that the student fills in the required forms for registration through the system. These forms are asking for personal information about the students such as, parents contact numbers, home location, work details and so on. For male students, military service procedures are completed through the system by SAO. Student information is entered into the YÖK system (Council of Higher Education), and the registration process is completed. Students may get a student certificate after this step.

RP.CS.S6: Scanning Documents

Registration documents are scanned and uploaded to the student information system after registration period, under the student's file. This task happens after the enrolment day is over and does not happen consecutively with the previous tasks.

RP.CS.S7: E-mail Creation

Registered student information is shared weekly with Information Services department to create an e-mail account. Information Services create the email, and the information regarding the e-mail accounts created for the students according to the registration list are forwarded to the SAO. An information e-mail is sent to the students whose registration has been completed and the e-mail account has been defined.

RP.CS.S8: Student ID Card

Student ID cards are printed by SAO, students are informed via email and the cards are delivered upon student's signature.

4.3.1. Value-Added and Non-Value-Added Activities for Registration Process

After screening the current situation of the process with VSM, value-added and non-value-added activities are differentiated with the timing for each task. Non-value-added activities are also considered as necessary activity or non-necessary activity which must be excluded from the whole process. Table 5 shows each task that goes under the student registration process either value-added or non-value-added from the student's perspective.

Table 4.3. Value-Added and Non-Value-Added Activities for the Registration Process

Process / Task	Value Added	Non-Value Added	Necessary	Time
1. Registration Guides Upload	0.05 day	0.95 day		PT = 1 days LT = 5 days
- SA receives the Accepted Students List from SGS.		□	□	0.25 day
- Preparation of the Registration Guides.		□	□	0.7 day
- Announcement of the guides on web.	□			0.05 day
2. Registration Request (per student)	1 day			PT = 1 day LT = 5 days
- Students come to the university on the enrolment day.	□			0.5 day
- Students declare Registration Request & Hand the documents to SA's staff.	□			0.5 day
3. Documents Check (per student)	20 mins	5 mins		PT = 25 mins LT = 30 mins
- Documents Checked & stamped**.**	□			10 mins
- Students file creation.	□			10 mins
- Scholarship Status & Language requirement check.		□	□	5 mins

Table 4.3. Continued

4. Student Account creation (per student)	10 mins			PT = 10 min LT =15 min
- Student account and number creation.	□			10 min
5. Filling Forms on the System (per student)	25 mins	0 mins		PT = 25 min LT = 60 mins
- Students fill the required forms on the system.	□			15 mins
- Military Procedures done by SAO.	□			5 mins
- Student information entered to the System.	□			5 mins
6. Scanning Documents (per student)	10 mins	10 mins		PT = 20 min LT = 40 min
- Registration Documents are scanned.		□	□	10 min
- Registration Documents uploaded to the student's information system.	□			10 min
7. E-mail Creation	60 mins	495 mins		PT = 555 mins LT = 960 mins
- Sharing Student's info with the IS department.		□	□	15 mins
- E-mails are created & Emails List forwarded to SA.		□	□	480 mins
- Emails info sent to students.	□			60 mins
8. ID Cards	15 mins	480 mins		PT = 495 mins LT = 2400 mins
- Printing Students Cards.		□	□	480 mins (1 day)
- Informing Students about their cards.	□			10 min
- Students pick their cards.	□			5 min

Student are considered the main customer of this process since the whole aim of the process is to simplify the work of the student and to make the period of the registration as short as possible. It is assumed that this process is a one-day process for the students

if no interruption were to happen. The internal customers of the process are considered too, and they are kept in mind when working on this process.

4.3.2. Performance Indicators for Registration Process

Based on the timings observed from the previous section, Indicative Ratios are calculated for each major task in the process separately. This is because for some parts of the process processing is done for all the students at once, and in other parts, each student goes through the process individually and must wait for the whole sub-process to finish in order to move to the next one. An example of this is the enrolment day and email creation. Each student must visit the SAO to submit the documents yet wait until the enrolment period is over for the email to all the students to be created.

Indicative Ratios, PCE and AR are measured to set the baseline for the process performance before applying Lean, and to compare it to other processes studied. Krdžalić et al. (2020) claims that the PCE to be around 5%-10% before applying lean tools and techniques.

Table 4.4. Inicative Ratios for the Registration Process

Process Step	**Value Added Time**	**Non-Value-Added Time**	**Process Time**	**Lead Time**	**Wait Time**	**Position**	**Process Cycle Efficiency (VA/LT)**	**Process Activity Ratio (PT/LT)**
Registration Guides Upload	0.05 day	0.95 day	1 day	5 days	4 days	SA's staff	1 %	20 %
Registration Request (Per student)	1 day	0 day	1 day	5 days	4 days	Students	20 %	20 %
Documents Check (Per student)	20 minutes	5 minutes	25 minutes	30 minutes	5 minutes	SA's staff	66.67 %	83.33 %

Table 4.4. Continued

Student Account creation (Per student)	10 minutes	0 minutes	10 minutes	15 minutes	5 minutes	SA's staff	66.67 %	66.67 %
Filling Forms & other procedures (Per student)	25 minutes	0 minutes	25 minutes	60 minutes	35 minutes	Student & SA's staff	41.67 %	41.67 %
Scanning Documents (Per student)	10 minutes	10 minutes	20 minutes	40 minutes	20 minutes	SA's staff	25 %	50 %
E-mail Creation	60 mins	495 minutes	555 minutes	960 minutes	405 minutes	SA & IS departments	6.25 %	57.81 %
Student ID Card	15 minutes	480 minutes	495 minutes	2400 minutes	1905 minutes	SA's staff	0.62 %	20.62 %

4.3.3. Issues Found While Studying the Registration Process and Some Suggestions to Solve Them

The head of the SAO claims that this process is a one-day process from the student's perspective. Yet, we can see that the lead time for the whole process is not one day as expected. Below are some of the issues found in the process while working on it and drawing the map.

More cooperation between the departments is needed: There are three external departments working with the SAO to complete the Registration Process, Financial Affairs, Language School, and Information Service Department. More communication and cooperation between the departments is needed here to extract the unnecessary waiting time occurring due to a missing document or un-finished task.

Instead of the student going to each department to finish the registration, an alternative is to have a representative from each department at the SAO during the enrollment day. Or an email could be sent to the student beforehand requesting to give a visit to the other departments before giving the visit to the SAO.

Scanning the documents is not happening consecutively: After the student submits all the required documents to SAO, scanning the documents and uploading them to the system does not happen on the spot during the enrollment day. The staff waits until all the students have submitted their documents and then scans them and uploads them to the system.

An alternative to this issue is to request for the students to upload all their documents in a required format. Or, to assign a specific employee to accomplish this task while the student is available, and not to postpone submitting back the documents for a later time.

Working in bulks: For the last two steps in this process, Email and ID cards creation, the SAO wait until a list of all the student registered is created, and then send that list to the Information Services Department to create the emails and students ID cards.

A better solution for this issue is to print the ID cards and create the email of the student on the spot while they are in the office, rather than asking them to come when the cards are available. This could be done by making these two steps per students not per the whole.

4.4. Current State Map and Description of the Thesis Submission Process

The last but not least process studied in this thesis is the Thesis Submission Process, it is also the last process a graduate student goes through in order to submit the thesis and graduate officially from the degree. The thesis submission journey starts directly after a student successfully accomplish the thesis defense and ends where a master student graduates from the university. The process is currently under the responsibility of the SGS, with other supporting departments for few tasks.

The current state map of the thesis submission process is shown below with a brief explanation of each task afterword.

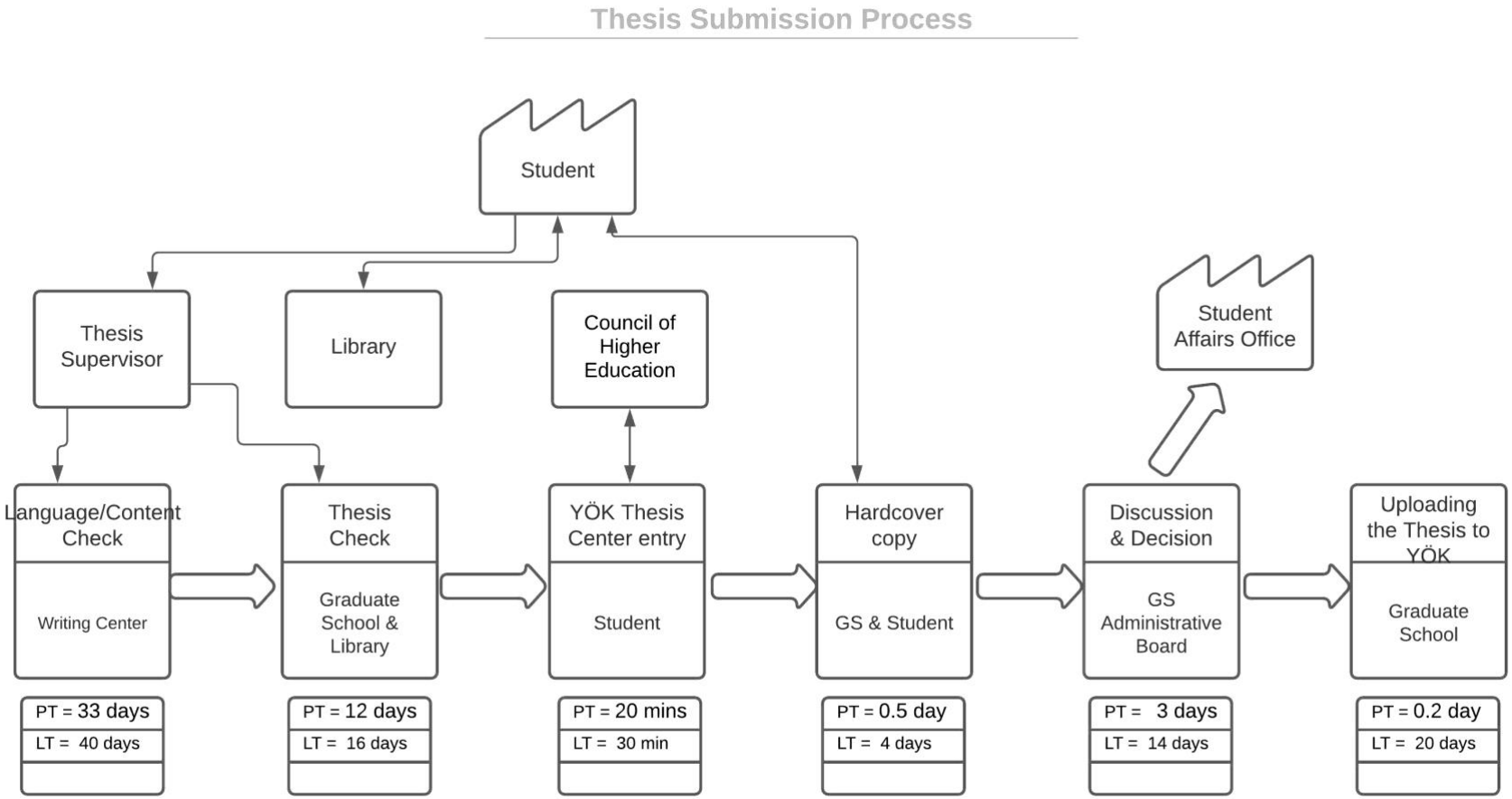

Figure 4.3. The Current State Map of the Thesis Submission Process

TSP.CS.S1: Language/Content Check

After the thesis has successfully been defended by the students, the department secretary sends thesis defense report to the SGS as an indicator of starting the Thesis Submission Process. Thesis supervisor of the student sends Thesis Copy Editing Evaluation Request Form and word format of the completed thesis to writing center email for copy-editing one month before thesis defense date, if possible. This process does not interfere with the thesis defense process, and the student is preferred to send the thesis for language check as early as possible. An editor from the writing center checks the thesis in terms of content and responds to the supervisor as qualified for submission or not qualified. Supervisor submits the form that s/he receives from writing center to SGS. If the thesis is not qualified for submission, the student gets support from a language editor outside the university. Then, the student sends the thesis to writing center again and asks for approval.

TSP.CS.S2: Format Check

In order to check the thesis in terms of form, the student sends the defended thesis to the thesis check email. The library checks the thesis in terms of writing guide and gives the student a Thesis-Check Approval Form for printing. This process will take up to 5 days depending on the number of corrections done on the thesis. The thesis supervisor signs this form and the student emails it to the GS. The SGS checks the thesis approved by the advisor is suitable to the Thesis Writing Guide in terms of format requirements.

TSP.CS.S3: YÖK Thesis Center Entry

Student enters YÖK (Council of Higher Education) Thesis Center, fills Thesis Data Entry Form gets the reference number, signs it and delivers it to GS by hand.
This website is only accessible by E-Government (E-Devlet) password. Student may obtain this password from any The National Post and Telegraph Directorate (PTT) by showing residence permit.

TSP.CS.S4: Hardcover Copy

The SGS gives the student the thesis approval page used in the hardcover. The student gets the signatures of jury members on three copies of Thesis Approval Page after thesis defense is successfully completed. The student submits the following to the SGS: hardcover thesis with the approval page, the electronic format of the thesis on CD, and the Thesis Data Entry Form.

TSP.CS.S4: Discussion & Decision

The SGS Administrative Board makes its decision in the SGS administrative board meeting, which is expected to take place once every two weeks. The decision is sent to the SA for processing by the GS.

TSP.CS.S5: Uploading the Thesis to YÖK center

The electronic copy of the thesis has to be uploaded to the YÖK Thesis Center after the student graduates, by the SGS, with the Publishing Permission Form (thesis can be hold from publishing it up to 6 months). Before the upload, the student's thesis is named with the reference number obtained from the YÖK Thesis Center.

4.4.1. Value-Added and Non-Value-Added Activities for Thesis Submission Process

After screening the current situation of the process with VSM, value-added and non-value-added activities are differentiated with the timing for each task. Non-value-added activities are also considered as necessary activity or un-necessary activity which must be excluded from the whole process. Table 7 below shows each task that goes under the thesis submission process either value-added or non-value-added from the student’s perspective.

Table 4.5. Value-Added and Non-Value-Activities for the Thesis Submission Process

Process / Task	Value Added	Non-Value Added	Necessary	Time
1. Language/Content Check (per thesis)	31 days	2 days		PT = 33 days/thesis LT = 40 days/thesis
- Supervisor sends the completed thesis to the Writing Center.	□			1 day
- The content of the thesis is checked by an editor.	□			30 days
- Responding back to the Supervisor.		□	□	1 day
- Supervisor submits the form to GS.		□		1 day
2. Thesis Check (per thesis)	6 days	6 days		PT = 12 days/thesis LT = 16 days/thesis
- Student sends the thesis to the thesis check email.		□	□	0.5 day
- The library checks the thesis in terms of writing guide.	□			3-5 days
- Student obtains the print approval from Library, after doing the corrections.		□	□	5 days
- Student emails the thesis to the SGS for Format Check.		□	□	0.5 days

Table 4.5. Conitnued

- SGS checking the thesis format	□			3-5 days
3. YÖK Thesis Center Entry (per student)	20 mins	0 days		PT = 20 mins/student LT = 30 mins/student
- Student enters YÖK & fills the form.	□			10 min
- Student gets the reference number, signs it and delivers it to GS.	□			10 min
4. Hardcover Copy (per student)	0.5 day	1.5 day		PT = 2 days/student LT = 4 days/student
- GS gives the student the thesis approval page used in hardcover.	□			0.5 day
- Student gets the signatures of jury members.		□	□	1-2 day
- Thesis is delivered to GS along with the required documents.		□	□	0.5 day
5. Discussion & Decision (per student)	3 days	0 day		PT = 3 days LT = 14 day
- The SGS Administrative Board makes its decision.	□			1 day
- The decision is sent to the SAO.	□			2 days

Table 4.5. Continued

6. Uploading the Thesis to YÖK	0.1 day	0.1 day		PT = 0.1 days LT = 20 day
- Student's thesis is named with the reference number obtained from the YÖK Thesis Center.		□	□	10 mins
- The electronic copy of the thesis is uploaded to the YÖK Thesis Center	□			10 mins

Student are considered the main customer of this process, since the whole aim of the process is to simplify the work of the student and to make the period of the thesis submission as short as possible from emailing the thesis for checking, until they graduate. The internal customers of the process are considered too, and they are kept in mind when working on this process.

4.4.2. Performance Indicators for Thesis Submission Process

Based on the timings observed from the previous section, Indicative Ratios are calculated for each major task in the process separately, each thesis goes through the process individually and must wait for the whole sub-processes to finish in order to move to the next one. The thesis submission process is one of the very high priority processes under the university, as a result, each thesis must be worked on separately.

Indicative Ratios, PCE and AR are measured to set the baseline for the process performance before applying lean, and to compare it to other processes studied. Krdžalić et al. (2020) claims that the PCE to be around 5%-10% before applying lean tools and techniques.

Table 4.6. Indicative Ratio for the Thesis Submission Process

Process Step	**Value Added Time**	**Non-Value-Added Time**	**Process Time**	**Lead Time**	**Wait Time**	**Position**	**Process Cycle Efficiency (VA/LT)**	**Process Activity Ratio (PT/LT)**
Language/Content Check	31 days	2 days	33 days	40 days	7 days	Writing Center, Assist. Prof. DIANE M PRANZO	77.50 %	82.50 %
Thesis Check	6 days	6 days	12 days	16 days	4 days	GS's staff & Library	37.50 %	75.00 %

Table 4.6. Continued

YÖK Thesis Center Entry	20 minutes	0 minutes	20 minutes	30 minutes	10 minutes	Student	66.67 %	66.67 %
Hardcover Copy	0.5 day	1.5 days	3 days	4 days	1 day	GS & Student	12.50 %	75.00 %
Discussion & Decision	3 days	0 days	3 days	14 days	11 days	GS Administrative Board	21.42 %	21.42 %
Uploading the Thesis to YÖK	0.1 day	0.1 day	0.2 days	20 days	19.80 days	GS	0.50 %	1 %
Total	45.8 days	4.6 days	50.4 days	94.3 days	43.9 days		48.56 %	53.44 %

4.4.3. Issues Found While Studying the Thesis Submission Process and Some Suggestions to Solve Them

The main aim of drawing the VSM is to provide an overview of how the whole process currently functions, and to highlight the issues that go unseen by the staff; some of the issues became very clear while drawing the map.

Legislations and Regulations: Thesis Submission Process goes under too many legislations and regulations that must be followed, that is why the processing times for the tasks are very huge comparing it to the processing time for the other two processes. Wait is considered as process time for the majority of the tasks which have a legal procedure to be done, which is the reason for the indicative ratios to be high too. For instance, the practical thesis check work takes around three hours without any interruptions or waits, and without the thesis correction on the student side. Each task from this process must be studies in more details to differentiate between the actual wait time and processing time, and to have more clear idea about the process in more detail.

CHAPTER V

DEVELOPMENT OF A PROPOSED FUTURE STATE

In this section, the seven questions proposed by Locher, (2016) are answered to develop a proposal for the future state of the process with some suggestions to improve the performance for the current processes.

1. What does the customer really need?
2. Which steps create value, and which generate waste?
3. How can work flow with fewer interruptions?
4. How will interruptions in the flow be controlled?
5. How will the workload and/or activities be leveled?
6. How will we manage the new process?
7. What process improvements will be necessary to achieve the future state?

Addressing these questions is very essential to future state map as they represent the key concepts of lean: value, waste, flow, pull, leveling, and managing continuity.

While working on the development of the future state of the processes, the university's mission and vision must be mentioned here to develop the suggestions with respect to the vision of the university. The university's mission is to be an international social science research university open to all sources of knowledge, prioritizing contribution to society. The vision of the university is to be an international authority and pioneer in the field of social sciences through the production of authentic knowledge and perspectives (Ibn Haldun University, 2020).

In the upcoming sections, the development of each process is mentioned under a specific section separately, with a suggested future map at the end of each section.

5.1. Application Process

5.1.1. What are the Real Needs of the Customer?

To understand this question properly, and to answer it in the perfect way to make the process more efficient, three sub-questions are to be answered first:

1. Who are the customers of the process? (customer)
2. What do they require? How often do they require it? (output)
3. What do they value from the output? (value)

Customers or beneficiaries of the process can be external or internal customers. The most important beneficiary of the process is the candidate themselves. The external applicants are the reason for this process to exist in the first place. There are some other internal beneficiaries for the process, such as, SAO, which are going to start the next registration process with the output of this process. The jury of each department are also internal customers for the system; they play a major role in the success of the application process.

For the applicants, what they require is their acceptance letters to be sent to them at the end of the process. SAO requires the documents of the candidates with their scholarship status for each candidate. Lastly, each jury is expecting a well-organized scientific evaluation exam to evaluate the applicants fairly.

The whole process has so many different outputs for each beneficiary, yet detailed research of what each beneficiary values from these outputs must be well looked at. If the process is looked at from the students' perspectives, they only interact with the department in three places. Firstly, when they do their application; the value over here is an easy and smooth application with less complexity. The second interaction is where it requires the students to attend the evaluation exam at the university, where cleanness of the exam places, overall organization of the exams, open and transparent evaluation procedures, interactions with the jury members are valued here. Last but not least, is when they receive their acceptance letters. At this stage, quick and on time delivery is appreciated.

SAO receives the acceptance list of the student with their submitted certificates and files. Correctness and accuracy play a major role in the efficiency of the work of the upcoming process. Accurate documents mean the registration process would perform in a faster manner rather than some time being wasted while requesting the students to provide these documents to start the next process.

The second main task in the process is the scientific evaluation exam. Each department is looking to evaluate the applicants in fair and useful way. The jury of each department value the accurate information provided to them by the head of department and the department secretary. Clear information regarding the location and the date of the evaluation exam makes a huge impact on this value.

To understand the value of each output of the process even better, this whole process can be split into three chunks, online application, scientific evaluation exam, and sending the acceptance letter.

5.1.2. Which Activities are the Value-Added and Non-Value-Added, Waste?

The value-added and non-value-added activities for the application process were identified and provided in the previous chapter, Table 3. Each sub-activity of the registration process was studied to see whether it adds value or not from the student's perspective, and whether the task can be eliminated when it is non-value-added and will not affect the final output of the process.

The major waste, which can be seen at first glance, and creates a huge waiting time and as a result very long lead time is excessive approvals. Decisions are usually taken during board meetings held on weekly basis. The wait until the next board meeting must be eliminated and looked at in the application process. Under the application requirements identification task only, three confirmations take place in order to announce the conditions and the calendar of the applications on the website. The management of the board of SGS agrees on the requirements, then shares these requirements during the board of SGS meeting, after that a third confirmation from the senate must be received to publish these conditions.

Another waste that leads to extra waiting time is the wait of the application call period to be over to process the documents of the applicants, these calls can reach up to two months until they are over, and the application check task starts.

5.1.3. How Can the Process Work Smoother, With Fewer Interruptions?

Fewer approvals and decisions for the application requirements identification task must be the first solution to be looked at if a more efficient process is needed. When the secretary of SGS was asked about these decisions, the answer was they are a must from the higher management. If so, then the form of the meetings in which the decisions are taken must be altered. These could be done with the use of technology surrounding us, a link for a survey or a short and quick online meeting can shorten the waiting time for this task.

5.1.4. How Interruptions Can Be Controlled?

These interruptions can be controlled by reducing them as much as possible and looking for other alternatives that lead to a reduction in the lead time. Rather than the management of the board of SGS finishing requirements early and waiting until the next board meeting, this waiting time can be used for deferent tasks that the management is responsible for, and a few days before the meeting, they might accomplish the requirements and prepare them. By doing so, the department is converting from a push system, where they do the task and wait for the next meeting, into a pull system, where the task is done exactly before the meetings, and the other time is consumed on other activities. So, in other words, allowing work to move forward only when the next task is ready to be worked at. Giving priorities to the task with respect to due date rather than First-in-First-out method that they are currently following.

5.1.5. How to Level the Workload Between the Activities?

The application process is a process that happens before each academic year once, which creates a huge amount of workload on the related departments. Currently, the

university is opening three calls for the candidates to apply. Yet, more emphasis on the early bird calls must be done to level the variation of the demand, which is usually happening during the main call. Scholarships and other offers must be advertised with the early call as early bird specials.

5.1.6. How to Manage the New Process?

Now, with the new process map drawn, and the suggested alternatives considered, this new process should be managed to make sure that the alternative actions are understood properly, and they are affecting the timing of the whole process positively. All the staff working under the Application Process must be gathered for a daylong meeting to explain these bottlenecks of the process and the alternatives suggested by this study. The team must be heard if they have any improvement suggestions other than what has been stated here, and an agreement at the end must be done. Additionally, a responsible person from the SGS should be assigned to be the controller of the process and keep comparing the Indicative Ratios of the previous map with the new one after these small changes.

5.1.7. Which Process Improvements Are Necessary to Achieve the Future State?

When looking at the proposed future state map of the application process, it is obvious that the use of software to perform the small tasks performed previously by a staff member of the SGS is one of the necessary improvements that must be done. Automating these tasks prevent mistakes and inaccuracy from happening, and it stops human errors from occurring.

The SGS may hire a programmer to develop a specialized software for the process. This process might be an extension to the current application system, which the department already has, or a totally different system working hand in hand with the Application System.

The System, which would be represented as the System of SGS from now on, would be programmed to send a notification to the head of each department to fill their

requirements in a specified format, the system then would gather these requirements and send them to each member of the board of Graduate Studies individually to get their confirmations, and then automatically to the senate for the final approval. In addition to that, the system must create the list of requirements, upload them to the website, and set the parameter of the application of each department on the Application System.

The system should be occupied with the specific format and the type of information needed from the applicants too. This feature allows candidates to submit their applications only if the documents and information are accurate and correct, software are able to do that if provided with the correct specifications. More details on the proposed System of SGS are provided in the next section.

5.1.8. A Proposal of the Future State of the Application Process.

With respect to the provided suggestions from the previous sections in this chapter, the future state map is drawn as it can be seen in Figure 7. Detailed description of each task is mentioned afterward.

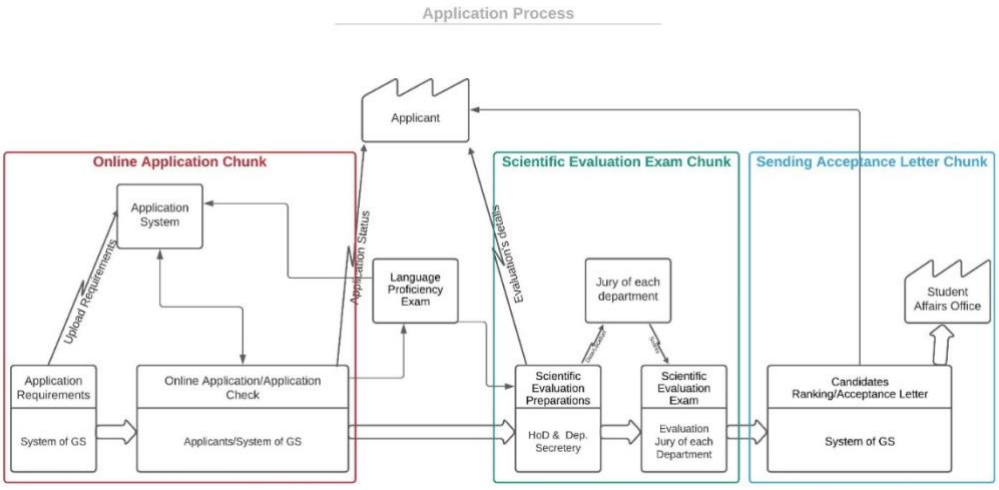

Figure 5.1. The Future State of the Application Process

AP.FS.S1: The Application Requirements Identification

The System of SGS sends a notification to all the head of departments to upload their application's requirements on the system, for the new academic year for which the

application is received, the calendar (application start-finish, scientific evaluation exams, the announcement of the results, sending the acceptance letters), and the evaluation jury consisting of the lecturers of that program per program, one month before the online application period. When the application requirements are filled by each department on the system, the SGS's Board members receive a notification by the system to check and confirm the application requirements online. After the decision has been taken by the SGS's Board members, the requirements are submitted to the University's Senate for approval of SGS's decision automatically by the system. When the electronic approval is taken by the senate using the SGS's system, the system announces the determined application conditions and calendar through the web pages and uploads the specified application conditions and calendar parameters to the application system.

By automating this task, the huge waiting time for the next board meeting is eliminated and substituted by electronic approvals of each board member using the system. By doing so, the lead time would be decreased from 30 days into one week as whole. The response from the board members would not take over a day, the requirements of the application would be represented in an easy-to-read format to shorten the period of the responses even more.

AP.FS.S2: Online Application/Application Check

Instead of the SGS's specialist setting the requirements on the application system, the system of SGS would upload all the parameters to the applications automatically, so the candidates can apply online using the application system.

During each call for applications, the candidate's responsibility is to provide the information and documents, which meet all the requirements. The application system would be programmed according to the list of application requirements created during the first step not to accept any certificate, which is not valid, or is not in the required format. The application system must not accept any application with missing documents or that is not valid to save the checking time later. The system must keep sending messages to the candidates to remind them to upload the required documents in the expected format, otherwise, the application will be on hold until all the required

information is provided properly. If the application is checked by the application system on the provided information, and it seems that all the information is correct and accurate, the name of the application with the related documents will be attached to the list of applicants.

The system would check the applications directly after submitting them. Applicants whose applications are deemed invalid are informed by e-mail about their application status by the system of GS. If the applicant has not got any English qualifications, the application will be sent to the Language School in order for the applicant to attend the language proficiency exam; otherwise, candidates whose applications are valid will receive an e-mail stating that the scientific evaluation exam program is announced on the web pages.

Language Proficiency Exam

This task is not under the scope of this research, so no suggestions would be provided for it in the future state map.

AP.FS.S3: Scientific Evaluation Preparations

The SGS receives the schedule (date and time) of the scientific evaluation exam, which consists of either written/oral exams from the head of departments depending on the announced calendar. The department secretary organizes the exam and informs the jury of each department and the applicants via mail about the evaluation's time and location. Most of the tasks performed under this step are done using emails, which is an effective way and fast way to communicate the dates and location of the evaluation exam. A small suggestion over here is to have a standardized online form, which is filled by the HOD and department secretary and sent automatically to SGS.

AP.FS.S4: Scientific Evaluation Exam

Each department arranges a distinctive evaluation according to the department requirements, some departments arrange a written exam and an interview after it. The only difference here is candidates participating in the exam are evaluated by the evaluation jury on the spot, their status would be uploaded to the system while they

are still at the university. The system would send the evaluation of the jury to each candidate at the end of the written/oral exam online to the SGS through the department secretary.

AP.FS.S5: Candidates Ranking/Acceptance Letter

Along with the written/oral exam scores determined by the evaluation jury, SGS system also calculates the scores of the other grades of the candidate (GPA, language score, ALES for Turks), ranks the winning candidates starting with the candidate with the highest score and creates an announcement list automatically as it is programmed. The same is carried out for candidates who could not win. Scientific evaluation exam results are announced on the SGS's web pages by a predetermined date through the system of SGS. Acceptance letters are sent to accepted candidates on the announcement list automatically after the ranking.

It is worth mentioning that the future state map is only shown to represent the best alternatives according to what the author sees, there is no single correct future state map, the team must always keep trying these alternatives until they reach their best performance possible.

5.2. Registration Process

5.2.1. What Are the Real Needs of the Customer?

To understand this question properly, and to answer it in the perfect way to make the process more efficient, three sub-questions are to be answered first:

1. Who are the customers of the process? (customer)
2. What do they require? How often do they require it? (output)
3. What do they value from the output? (value)

For the Registration Process, when you look at it as a whole you may only see one beneficiary of that process, which are students themselves. All the services and tasks are performed for the satisfaction of students and to make their enrolment procedure

as simple and easy as possible. Yet, there is another internal beneficiary of that process which is the SAO. One of the main important goals of the registration system is to collect students' documents and information to enroll them at the university, and to upload these documents on the Council of Higher Education's website.

Students require fast and fruitful procedures at the end of the day; they want their documents to be checked and handed back to them at the same day. They want to be registered under the university and their accounts and emails to be available at the same visit, and they also expect to receive their ID cards on that day. All these outputs are required to be accomplished at the same day, and the same visit.

SAO is organizing the enrolment week in order to get the original documents and the personal information of the students and upload them to the website of the Council of Higher Education as they require. The files, certificates, and information must be accurate and correct as requested per the Council of Higher Education, so the SAO must insure the validity and accuracy of these documents.

To understand the value of each output of the process even better, the whole process can be split into chunks and one preparation process before it, enrolment day, and the upgrading the registration guides process.

5.2.2. Which Activities are the Value-Added and Non-Value-Added, Waste?

The value-added and non-value-added activities for the registration process were identified and provided in the previous chapter, in Table 5. Each sub-activity of the registration process was studied to see whether it adds value or not from the student's perspective, and whether the task can be eliminated when it is non-value-added and will not affect the final output of the process.

When looking at the process from the students' perspective, preparations of the guides, scanning the documents, and sharing students' information between department are not considered as value-added-activities, students might not even know these activities are performed in the background of the process. On the other hand, these activities and tasks are very necessary and adds value from the university's perspective.

Table 5 shows that e-mail creation and the ID cards tasks have a noticeable huge lead time, and their indicative ratios are low too, and lastly, they happen on a totally different day, in bulk.

5.2.3. How Can the Process Work Smoother, With Fewer Interruptions?

The major two interruptions of the registration process are the last two activities of the process, which are usually performed on a separate day from the enrolment day. They are done for the list of the registered students at once, not individually. Performing these two tasks in small batches would save the time of students and the staff.

5.2.4. How Interruptions Can Be Controlled?

The last two steps must be modified and added to the enrolment day procedures, rather than postponing them for later time. A suggestion here would be to program the system to create the students emails automatically when the student's application is created, or to have a representative from the Information Services Department to create the students' emails on the spot, without any delay. In addition, printing the ID cards of the students is done on a small printing machine that can be put in the SAO, and an additional employee would be responsible to print these cards for each student after they have been registered at the university.

5.2.5. How to Level the Workload Between the Activities?

SAO already taken precautions for the enrolment day to not be crowded and not have bottlenecks during students' visits. According to the number of applicants, if the number of students exceeds 50 students per week, then an enrolment week must be organized, and the number of staff is increased to decrease waiting time for the students. This is an amazing way of managing the crowdedness of the students inside the office.

Another way to level the workload of the registration process tasks is to control the invitations of the students to the university. Students must be split beforehand. The

office must study the number of students they can handle per day without having bottlenecks or delays in the process, and then ask this amount of the students to come on one day, and the same amount but different students on another day. Alternatively, they might give specific time for each student to come during the day, for instance 15 students would be invited to come to the office in the morning of that day, another 15 students would come in the afternoon and would be served on time. By doing so, the office would be able to control the workload performed by them on that day, and no student would be queued outside of the office waiting for the office to be able to serve them.

5.2.6. How to Manage the New Process?

With the new process map drawn, the suggested improvements are considered. This new process should be managed to make sure that the alternative actions are understood properly, and they are affecting the timing of the whole process positively. All the staff working under the Registration Process must be gathered for a daylong meeting to explain these bottlenecks of the process and the alternatives suggested by this paper, the team must be heard if they have any improvement suggestions other than what has been stated here, and an agreement at the end must be reached. Additionally, a responsible person from the SAO should be assigned to be the controller of the process and keep comparing the Indicative Ratios of the previous map with the new one after these small changes. This person can be the most experienced staff with the Registration Process.

5.2.7. Which Process Improvements Are Necessary to Achieve the Future State?

In order to achieve the future state and maintain the process in the best practice, the office must consider the process as if it is to be done in cells, similarly to what a process would look like in a manufacturing setting. Each task must be performed as expected and, in the order, stated from the head of department, and no student must go to the next process unless the previous task is finished completely. The SAO might need to train specific employees and perform specific tasks in a specified way. This would make the process flow faster since each staff knows exactly the expected duties.

The SAO must have organized work areas by keeping the offices clean, being standardized and with items that are easily found as (Slack, N., Chambers, S., & Johnston, 2010) suggested by the 5S methodology. The office must sort away unnecessary items and papers and keep what is needed and straighten the most commonly used items by making sure they are reachable with an arm's length. Shining the office by keeping it always clean, standardizing the positions of the items in a specified place, and lastly sustaining the positive attitude toward the standards and taking pride performing them are also important.

5.2.8. A Proposal of the Future State of the Application Process

Overall, when looking at the indicative ratios from Table 6, it is clear that the Process Cycle Efficiency and Activity Ratio for all the tasks are high in positive manner, literature suggests that the PCE be around 5% of a process before applying lean, yet, in some of the tasks of the Registration Process this ratio reaches up 66.67%. This high efficiency is due to experienced employees under the SAO, and due to the repeatability of the same job over the years.

With respect to the provided suggestions from the previous sections in this chapter, the future state map is drawn as it can be seen in Figure 8. Detailed description of each task is mentioned afterward.

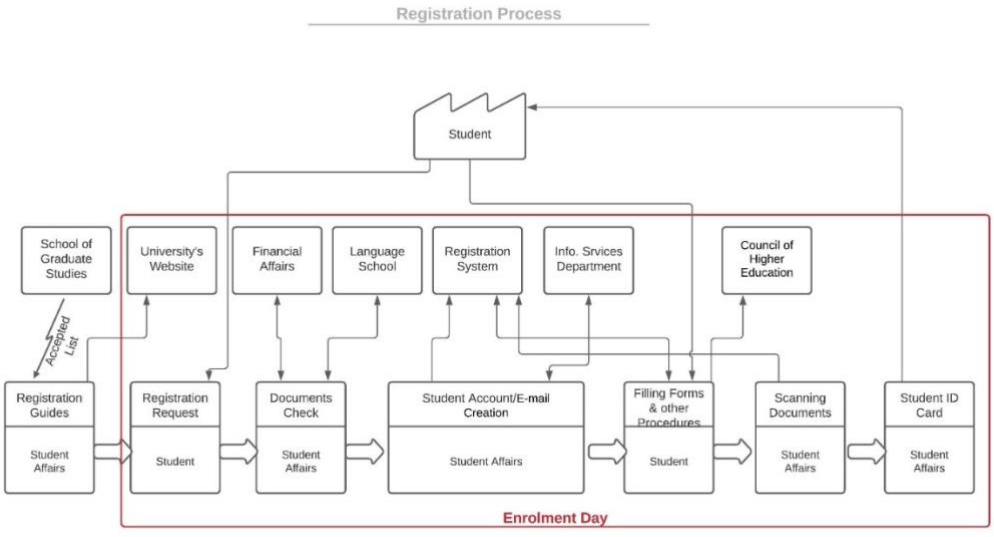

Figure 5.2. The Future State of the Registration Process

RP.FS.S1: Registration Guides

As suggested by the previous process, the SGS's system creates a list of accepted students and uploads it to the Electronic Document Management System with the information and the related documents of each student electronically. The registration guides published on the website are updated by the SAO after discussing it with other departments. Also in this task, a feasible suggestion would be to use the technology surrounding us instead of the typical meetings and discussions. A virtual meeting, or a link for the registration guides with place to leave a comment for discussion would conserve lots of time for the process and the staff where they would be able to work on other tasks.

RP.FS.S2: Registration Request (Enrolment Day)

On the dates specified for enrollment in the academic calendar, the student who will register, comes in person with the registration documents and declares the registration request. The rest of the steps must be done on the same day same visit to the SAO as the head of the department claims it to be.

RP.FS.S3: Document Check

While the student is still in the SAO, the documents are checked according to the acceptance criteria created by the SGS, and then approved by "Checked" or "True Copy" stamps and the student file is created. A checklist of the acceptance criteria is available on the system under the name of each student, if a document is missing, students would be notified and an email of the document that they must submit later would be sent.

Financial Affairs

The scholarship status of the student is checked and the students who are required to pay the fee, are directed to the payment process under Financial Affairs Office. This process is not under the scope of this study.

Language Exam

Students who do not have a language proficiency certificate are directed to the School of Languages to take a language exam. This process is not under the scope of this study too.

RP.FS.S4: Student Account Creation/Email Creation

For students whose documents are complete, a student account with the student number is created.

An employee from the Information Services Department should create an email for each student whose account has been created, the information of the email and other details must be sent to the student's email and handed to them over while they are in the SAO.

RP.FS.S5: Filling Forms & Military Procedures

It is ensured that the student fills in the required forms for registration through the system electronically. SAO would have their own tablets, give them to the students to fill the forms on them and give them back after they are done. These forms are asking for personal info of the students such as, parents contacting numbers, home location, work details and so on. For male students, military service procedures are completed through the system by SAO. Student information is entered into the YÖK system, and the registration process is completed. Students may get a student certificate after this step.

RP.FS.S6: Scanning Documents

Registration documents are scanned and uploaded to the student information system during registration period, under the student's file. Extra staff would be assigned to do this task on the day of enrolment to shorten the waiting time and to be more convenient for the students since they would not have to come back again to pick up their original documents.

RP.FS.S7: Student ID Card

Student ID cards are printed by SAO, while they are on their first visit, after a student is being registered to the system, the order of printing the student's ID card must be given on the same day and the same place, rather than compiling the names of all the student and printing their cards on a different day.

The SAO claims that the registration process is a one-day process, so in order to accomplish this, all the tasks and activities related to the enrolment of the student must be done on the same day. In the current state map, the last two steps do not follow this claim, and they are done in bulk rather than doing them individually for each student. Currently, the student must come another day to collect their certificates and original documents after they have been scanned and uploaded to the system, and also to receive their ID cards and sign for it. Furthermore, the list of registered students is emailed to the Information Services Department after the registration period. Yet, the future state proposes that all these steps must be done on the same day.

It is worth mentioning that the future state map is only shown to represent the best alternatives according to what the author sees, there is no single correct future state map, the team must always keep trying these alternatives until they reach their best performance possible.

5.3. Thesis Submission Process

5.3.1. What are the Real Needs of the Customer?

To understand this question properly, and to answer it in the perfect way to make the process more efficient, three sub-questions are to be answered first:

1. Who are the customers of the process? (customer)
2. What do they require? How often do they require it? (output)
3. What do they value from the output? (value)

The beneficiaries of the thesis submission process are the student, SAO, and the Council of Higher Education.

The students are requiring a quick and easy procedures to follow in order to submit the thesis. On the other hand, the SAO wants a clear decision to start the graduation process of the student on time, and all the information and details uploaded to the Council of Higher Education's website must be accurate and to legal requirements provided by them earlier.

The first two steps are checking steps, so they can be seen as one whole chunk to understand the process in a better way. In order to save a considerable amount of checking time, these two tasks must be performed the moment the student finishes writing the thesis and continues working with the other tasks for the thesis submission.

5.3.2. Which Activities are the Value-Added and Non-Value-Added, Waste?

The value-added and non-value-added activities for the thesis submission process were identified and provided in the previous chapter, Table 7. Each sub-activity of the registration process was studied to see whether it adds value or not from the student's perspective, and whether the task can be eliminated when it is non-value-added and will not affect the final output of the process.

When looking at the process from the students' perspective, most of the non-value-added activities are either sending the thesis for check or submitting a form to one of the offices of the university, even though they might seem not necessary from the student's perspective, yet they are significant procedures for the university and its regulations. The same issue in the application process of waiting for the next board meeting can be seen here in the thesis submission process in the fifth task. The same suggestions must be applied over here to propose an alternative for this.

Under the thesis check process, two check tasks are performed to each thesis, with corrections done from the student side. As stated earlier, the practical work on the thesis takes up to three hours without interruptions, and the rest of time is waiting on the student to make and corrections and send the thesis back.

Students collecting the signatures of the jury members is also one of the main non-value-added activities from their perspectives, some of the jury members are from a different university and a visit to that university is not preferable to students usually.

5.3.3. How Can the Process Work Smoother, With Fewer Interruptions?

The main two interruptions of the thesis submission process are collecting the jury's signatures and the SGS's board meeting for the decision on the thesis. On the other hand, the language and thesis checking processes are relatively long, due to the corrections, in comparison to the time of the whole process.

5.3.4. How Interruptions Can Be Controlled?

The aforementioned interruptions have to be addressed in order to perform the whole process more efficiently. As stated in the suggestions for the application process, these board meeting are causing the majority of the waiting time in the process, and an alternative for them would be holding these meeting online via the SGS's system.

Collecting the signatures of the jury members must be addressed too. Some theses have more than three jury members from outside the university, and each member must sign on the same form. This method must by altered by using electronic signatures, if the regulations and procedures allow that.

For the thesis check process, the library's check and SGS's format check must be initiated at the same time, the comments and corrections have to be sent online via email to make it easier for the student to implement the amendments. Furthermore, more details about each sub-activities must be studied to minimize the long processing time which occurs due to the corrections.

5.3.5. How to Level the Workload Between the Activities?

Most of the students work on their thesis during the academic year and submit their thesis toward the end of the year before the summer holiday, which leads to a huge

workload in terms of the thesis submission process. SGS and the thesis advisor must encourage the students to submit the thesis early before summer in order to level this workload across the whole year.

The writing center also is suggesting the students submit the thesis for language checks once the thesis is ready, without waiting for the thesis defense to be over. Meanwhile, submitting the thesis for the format check and following the comments and feedbacks from both SG and writing center also takes time.

5.3.6. How to Manage the New Process

With the new process map drawn, the suggested improvements are considered. This new process should be managed to make sure that the alternative actions are understood properly, and they are affecting the timing of the whole process positively. All the staff working under the thesis submission process must be gathered for a daylong meeting to explain these bottlenecks of the process and the alternatives suggested by this paper. The team must be heard if they have any improvement suggestions other than what has been stated here, and an agreement at the end must be reached. Additionally, a responsible person from the SGS should be assigned to be the controller of the process and keep comparing the indicative ratios of the previous map with the new one after these small changes. This person can be the staff member with the most experience of the whole process.

5.3.7. Which Process Improvements Are Necessary to Achieve the Future State?

Thesis submission process and application process both goes under the SGS department, so the same suggestions provided for SGS's office under the application process applies here too. The checking and correction procedures all must start at the same time by the related departments to minimize the lead time for the students.

The SGS's Office must be an organized work areas by keeping the office clean, standardized and items are easy to be found as Slack, N., Chambers, S., & Johnston (2010) suggested by the 5S methodology. The office must Sort away unnecessary

items and papers and keep what is needed; workers must Straighten the most commonly used items by making sure they are reachable at an arm's length; make the office Shine by keeping it always clean; the items must be in Standardized positions by placing them in specified places; and lastly Sustaining a positive attitude toward the standards and taking pride in performing them.

5.3.8. A Proposal of the Future State of the Thesis Submission Process

Overall, when looking at the indicative ratios from Table 8, it is clear that the PCE and AR for all the tasks are relatively high in positive manner, literature suggests that the PCE be around 5% of a process before applying lean. Yet, in some of the tasks of the thesis submission process this ratio reaches up 77.50%. These high-efficiency ratios are due to not diving into the process in more details to avoid complexity; for instance, the language check process and format check have more sub-activities under each task, further studying must be done regarding them to understand each task and movement these two processes contain.

With respect to the provided suggestions from the previous sections in this chapter, the future state map is drawn as it can be seen in Figure 9. Detailed description of each task is mentioned afterward.

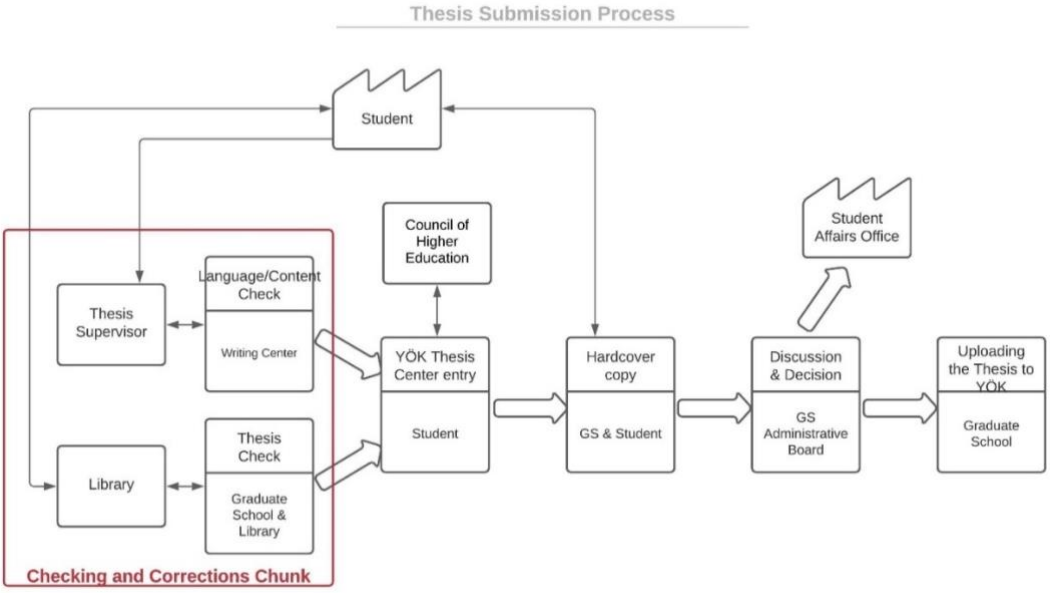

Figure 5.3. The Future State of the Thesis Submission Process

TSP.FS.S1: Language/Content Check

Rather than waiting until the thesis defense is over to send the thesis for English Check, which is a whole complete process that takes up to one month at least to check the content of one thesis, the Writing Center's manager suggests that the thesis should be sent to the Writing Center as soon as a student is done writing the thesis and has the approval from the thesis advisor. This process does not interfere with the other Thesis Submission Processes. Suggested modifications by the editor can be worked at while the thesis is undergoing the other processes. And by the end of the thesis submission process' period, the English Language check task would be done with the other processes.

TSP.FS.S2: Thesis Check

The student emails the defended thesis to the university's library to check the thesis in terms of the writing guide. The library checks the thesis and sends the student suggested corrections, if any. All these modifications must be done electronically rather than on a hard copy. After all the corrections have been done, the thesis is sent to the GS for the format check.

TSP.FS.S3: YÖK Thesis Center Entry

Student enters YÖK (Council of Higher Education) thesis center, fills Thesis Data Entry Form, gets the reference number, signs it and delivers it to SGS by hand. The suggestion over here is to send an email to the student which contains, the link to Council of Higher Education with visual instructions on how to fill the form and get the other requirements, since not all the students are familiar with the website.

TSP.FS.S4: Hardcover Copy

The SGS gives the student the thesis approval page used in hardcover. The student gets the signatures of jury members on three copies of Thesis Approval Page after thesis defense is successfully completed. The student submits the following to the

SGS: hardcover thesis with the approval page, the electronic format of the thesis on CD, and the Thesis Data Entry Form. This step must be performed as is, since all these procedures are requirements from the legal authorities.

TSP.FS.S5: Discussion & Decision

The SGS Administrative Board makes its decision electronically using the same software suggested in the application process. A virtual board's meeting of the SGS administration, will take place whenever a decision must be made to save the waiting time. The decision is sent to the SAO for graduation process.

TSP.FS.S6: Uploading the Thesis to YÖK

The electronic copy of the thesis has to be upload to the YÖK thesis center after the student graduates, by the SGS, with the publishing permission form (thesis can be hold from publishing it up to 6 months). Before the upload, the student's thesis is named with the reference number obtained from the YÖK Thesis Center.

No huge changes could be done on the thesis submission process due to the legal work and waiting for responses from official authorities. All the provided steps must be done as they are since they are required by Council of Higher Education

It is worth mentioning that the future state map is only shown to represent the best alternatives according to what the author sees, there is no single correct future state map, the team must always keep trying these alternatives until they reach their best performance possible.

CHAPTER VI

DISCUSSION AND CONCLUSION

The purpose of this thesis was to implement the Japanese lean principles at the operational level of a university, which has been used for decades at manufacturing settings to increase the efficiency and performance of an organization. Two departments, SGS and SAO, and three processes, Student Application Process, Registration Process, and Thesis Submission Process, were studied to understand and document how they are performed currently, to identify the issues and problems they are facing, and develop some suggestions and improvements to be implemented for more efficient processes in the future.

VSM was used as the main lean practice to draw the current steps of each process, identify the value added and non-value-added activities, and record the current KPIs for the processes. Additionally, VSM method was used to propose future states of the processes, develop some suggestions and improvements for better performance, and provide solutions for the issues the departments are dealing with.

Interviews were held to with the related staff to draw the initial state of VSMs. Observations and walkthroughs were of great help to identify value-added and non-value-added activities. Indicative ratios were calculated for the processes as a reference for the performance of the processes and to compare it after applying the suggestions.

In this thesis, the research questions are split into two sections, the first section is about discovering the suitability of lean in a university environment and what tools and principles can be used, while the second section of the questions is about the real-life implementation of lean at a university (case-study) to improve the main operations.

The first research question, “Q1: Is lean a suitable tool in a university setting?”, is answered under the second chapter of this thesis. The transformation of lean from

manufacturing into LHE was expressed and explained based on several studies from the literature, and tools and techniques used in LHE was summarized in Table 1 with the benefits achieved by the previous researchers. The second question, “Q2: Why lean university?”, was also answered by (Balzer,2010).

Three of the most effective processes under two departments of the university were studied as an answer for the third research question, “Q3: What are the most effective processes under SGS and SAO, which has the major impact on customer satisfaction?”. For each process, three of the research problems were addressed. “Q4: What does the process look like?”, was answered in Chapter 4 with VSMs depicting the current states. Additionally, “Q5: What problems does the process have?” was answered after each current state map in Chapter 4. Lastly, Chapter 5 answers the last research question of this thesis, “Q6: What improvements can be made to the current process to decrease the identified problems?”, by proposing a future state of the processes with improvement suggestions and a new process map of how the process should look like in the perfect settings.

For the first process studied, Application Process, which goes under the SGS, automating the process using a software was the most feasible alternative for the current tasks that goes under the process. The second process, Registration Process, was assumed to be one day process, but the current state of the process shows that the process takes more than that to be over. As a result, some suggestions were provided to make the whole registration process a one-day process again. The last process studied, and it is the last process a graduate student interferes with the university before graduating is Thesis Submission Processes. Suggestions for the huge delay that occurs in the process were provided, where more than one task should be performed simultaneously to accomplish the whole process at the same time.

It is worth mentioning that the proposed future states are initial proposals to improve the performances of the mentioned processes. The owners of the processes should work on them to realize continuous improvement principle of lean.

This thesis was written during the pandemic time (covid-19), which closed all the universities and offices and forced everyone to stay home. This led to some limitations

in the thesis such as finding the exact real duration of the activities such as processing time and lead time. Measuring these times should be done by observing the duration of the activity on different occasions and then taking the average of these measurements. Another issue is that the Work in Process (WIP) values were not measured and calculated, the unfinished tasks and services in the studied processes must be looked at in order to have a better understanding of the buffers occurring in the processes and to give better suggestions for a smoother flow and higher performance in the university.

For future researchers at the same university, I would recommend them to study each task that goes under the processes in more details, i.e., language check task under the responsibility of the writing center, and English examination task must be studied as whole process too. These two tasks contain too many procedures and steps that should be studied individually, and suggestions must be provided to them too to improve the performance of the most effective processes at the university even more. Durations of each task and activity should be measured by visiting the offices while they are performing the work, buffers occurring between tasks must be considered in the future research with some leveling to them if they are found in any process.

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APPENDIXES

APPENDIX A

Lean Indicators, for the structured interviews

Name: **Department:**

Role:

The following questions are designed to indicate the need of Lean Implementation at a Turkish university, please take your time answering them by Yes or No only.
These questions were introduced by Brigel & Olsson (2018)

Question	**Answer**
Is it normal to spend extra time (overtime) on an activity in the department?	
Is there frequently a need to rework something after considering it done?	
Do the staff of the department spend a lot of time on paperwork?	
Is there more than one way to perform a task?	
Do employees waste time by looking for the appropriate materials?	
When the department grew and moved to the new campus, were there any changes in the processes?	
Does the department have a standardized procedure?	
Does the department implement the best/optimum practices?	
Does every process have a manager or a responsible one?	
Do employees understand the impact that they make on the process?	
Do workers in the department communicate the right information to the right person at the right time?	

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