FACTORS FOR FIRM LEVEL LEARNING:

A CASE FROM THE DEFENSE INDUSTRY IN TURKEY

A THESIS SUBMITTED TO

THE GRADUATE SCHOOL OF SOCIAL SCIENCES

OF

THE MIDDLE EAST TECHNICAL UNIVERSITY

BY

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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR

THE DEGREE OF MASTER OF SCIENCE

IN

THE DEPARTMENT OF SCIENCE AND TECHNOLOGY POLICY STUDIES

JANUARY 2020

Approval of the Graduate School of Social Sciences

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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 Science.

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ABSTRACT

FACTORS FOR FIRM LEVEL LEARNING:

A CASE FROM THE DEFENSE INDUSTRY IN TURKEY

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Supervisor: Prof. Dr. Erkan Erdil

January 2020, 180 Pages

This thesis aims to figure out the main factors affecting organizational learning by using the case of a Turkish defense industry company. This thesis is based on the hypothesis that defense industry companies have both barrier and driver factors for organizational learning. For this end, the literature is reviewed in the area of knowledge, knowledge management, and organizational learning. After the basic research on key elements of organizational learning, a conceptualization study is conducted with forty-six factors that positively affect organizational learning were identified and associated with the literature. The main factors of organizational learning are evaluated through a questionnaire applied to categorized R&D engineers. In order to find the answer to how learning performance can be improved, the semi-structured interview that conducted to ten staff with different experiences and positions in related departments is analyzed. According to the results of the questionnaire and interview studies, it is observed that the firm has many factors supporting organizational learning, but there are also barriers that needed to be resolved. By analyzing both quantitative and qualitative results, strategies are proposed for the firm. After this study, the prepared questionnaire can be used in different studies as a supporting tool. The thesis can be continued in studies that investigate bachelor educations of R&D workers, and comprehensive R&D policy research for the government.

Keywords: Organizational Learning, Knowledge Management, Defense Industry

ÖZ

FİRMA SEVİYESİ ÖĞRENME FAKTÖRLERİ;
TÜRKİYE SAVUNMA SANAYİ ÖRNEĞİ

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Yüksek Lisans, Bilim ve Teknoloji Politikası Çalışmaları Bölümü

Tez Yöneticisi: Prof. Dr. Erkan Erdil

Ocak 2020, 180 Sayfa

Bu tez, bir Türk savunma sanayii firması ile yapılan vaka çalışması örgütsel öğrenmeyi etkileyen ana faktörleri bulmayı amaçlamaktadır. Çalışma, savunma sanayi şirketlerinin örgütsel öğrenme için engelleyici ve destekleyici faktörlere sahip olduğu hipotezine dayanmaktadır. Bu amaçla; bilgi, bilgi yönetimi ve örgütsel öğrenme alanında literatür araştırması yapılmıştır. Örgütsel öğrenmenin önemli temel unsurları üzerine yapılan araştırmalardan sonra, örgütsel öğrenmeyi olumlu etkileyen kırk altı faktör ile kavramsallaştırma çalışması tanımlanmış ve literatürle ilişkilendirilmiştir. Örgütsel öğrenmenin temel faktörleri, kategorize edilmiş Ar-Ge mühendislerine uygulanan bir anket aracılığıyla değerlendirilmektedir. Öğrenme performansının nasıl geliştirilebileceğinin cevabını bulmak için, ilgili bölümlerde farklı deneyimler ve pozisyonlara sahip on personele yapılan yarı yapılandırılmış görüşmeler analiz edilmektedir. Anket ve mülakat çalışmalarının sonuçlarına göre, firmanın örgütsel öğrenmeyi destekleyen birçok faktöre sahip olduğu, ancak çözülmesi gereken engellerin de olduğu görülmektedir. Hem nicel hem de nitel sonuçları analiz ederek firma için stratejiler önerilmektedir. Bu çalışmadan sonra, hazırlanan anket farklı çalışmalarda destekleyici bir araç olarak kullanılabilir. Ar-Ge çalışanlarının lisans eğitimlerini ve hükümet için kapsamlı Ar-Ge politika araştırmalarını inceleyen çalışmalarda tez devam ettirilebilir.

Anahtar Sözcükler: Örgütsel Öğrenme, Bilgi Yönetimi, Savunma Sanayi

To My Family

ACKNOWLEDGMENTS

For the rest who are not specifically mentioned here, thank you with all my heart for your encouragement, and understanding.

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LIST OF ABBREVIATIONS

CKO   Chief Knowledge Officer

CLO   Chief Learning Officer

HSEC   Human Subject Ethical Committee

KMS   Knowledge Management System

MIS   Management Information System

R&D   Research & Development

MSB   Ministry of National Defense

SME   Small and medium-sized enterprise

SSB   Presidency of the Defense Industry

TSK   Turkish Armed Forces

CHAPTER 1

INTRODUCTION

1.1 Aim of the Thesis

From the 18th century, when the industrial revolution occurred in Britain, science and technology have been becoming the more leading economic phenomena. As a consequence of scientific and technological studies, many inventions have been produced, and many of them have opened up markets that create opportunities for new inventions. This cycle has been helping to spread the industrial economy so far.

The effects on developing science and technology have varied for each sector at specific time intervals. Once-pioneer sectors in the development of technology can be just using the technology that other industries continue to develop and vice versa. A known example of this issue is that at the beginning of the industrial revolution, the textile sector has driven the technology, while its effect on technological developments in the 21st century is dropped off.

The main reasons for this trend of change are economic concerns and technological requirements. In respect of the economy, investors tend to choose the sectors that have a high return on investment. Like an infinite loop, investments accelerate technological development, and technological developments are increasing return on investment, as a result of the high demand for the inventions. Technologically, sectors may be dependent on some premise technologies that are not yet mature and may be unwittingly awaiting these technologies Additionally, an industry can have a multidisciplinary structure, and the development of this industry can feed many sectors technologically.

In this context, it is not surprising that one of the driven sectors of science and technology has been the defense industry for a century. After WW I and II, the national security perspective and importance have been changed for countries. While the new

perspective has been focusing on high technology to take superiority, governments have significantly raised the budget of national security. From communication to imaging detector, the defense industry is related to many different types of technology. Because of the high budget of the industry, related technologies have also been developing. As a result, defense industry studies have resulted in numerous inventions that we are using in daily life and that have billions of dollars of the economy.

This situation creates the dual-use concept, which is technological goods that can be consumed for both military and civilian uses. There are various examples of this special concept that has its own trade regulations. As an example, in the missile industry, both military rockets and satellites are produced in similar methods and technological tools. Similarly, while nuclear weapons are one of the brutal military weapons, nuclear technologies are providing huge amount of energy for civilian use. For the last instance, thermal cameras are used both in military operations to have night sight in the field and in medical imaging.

Humanity can sustain its life by producing and consuming existing products, but the desire for development and competition makes us find new problems and their solutions as well. Competition of nations in the new era is based on science and technology somehow because innovative products have the potential to dominate existing markets or create new ones.

Today, there are numerous companies and R&D workers in each science and technology sector, and it is easier than ever to acquire knowledge. It has become that the ability to obtain information rapidly is as vital as its usefulness. In this regard, private and organizational learning strategies for companies and for countries are contributing them to keep in state of the art of technological development. Thus, a firm's innovation policy that is focusing on learning is essential to not fall behind in the race of technology.

In the R&D studies where there is intense knowledge production, companies and individuals can create the knowledge themselves or obtain it from outside. Although the knowledge used can benefit in the short-term to institutions, the essential element is the learned knowledge by the institution. The concept of learning can provide firms

with longer-term and permanent achievements. The most important of these is that the company's knowledge capacity and market share can be increased as a consequence of stable and rising performance. Another critical result is to get rid of repeated efforts and money with the knowledge learned.

This thesis aims to figure out the factors to analyze drivers and barriers for the organizational learning process in a defense industry company. Additionally, to have a perspective about both the company and the potential improvements in culture, structure, and process of learning in the organization are investigated. In this context, this study is supposed to provide insights into the research questions mentioned below.

Research Question-1:
What are the factors to analyze the drivers and barriers for organizational learning in the defense industry company?

Research Question-2:
How to make organizational learning more efficient in the defense industry?

In terms of efficiency, the learning process of the organization will be investigated and will be improved to produce more target-oriented applications.

1.2 Theoretical Background

As a beginning, literature is reviewed in the area of <u>knowledge</u>. Concepts of knowledge and knowledge management are strongly related to organizational learning. The core value of organizational learning is knowledge; thereby, processes of learning in organizations associate the knowledge of peers. Knowledge can be seen as a building block of organizational learning. Strikingly, most of the organizational learning studies are investigating different phases of knowledge in the organizational structure. In the most general sense, organizational learning is all about creation, transferring, and retaining knowledge (Argote, 2011).

<u>Knowledge management</u> literature which is a mandatory ability to have a place in the knowledge economy is also reviewed. Not only companies but also countries are

ranked according to their knowledge. This era is unmerciful for the ones who can not handle their knowledge potential. Countless competitors and limitless knowledge resources can create newcomers for markets, and regardless of capital, they can come to the fore with a favorable knowledge management structure. Companies have to conduct their knowledge for their sustainability in business life.

Additionally, under the research questions, literature related to organizational learning is also reviewed. The most important part of the knowledge management is organizational learning phase. Without learning, knowledge and its management are just unsupported terms. The learning ability of organizations can define the direction of companies. While a successful learning system may bring companies to top, indefinite systems may cause their collapse.

The review of the related literature is presented in Chapter 2 of this thesis.

After the literature review, the thesis was completed in five steps.

Step 1: Conceptualization

In order to progress the research, conceptualization studies are conducted in accordance with the literature reviewed. General conceptualization is described in Section 3.1; this section describes how general and categorized variables are determined. As a result of this step, 41 variables are determined under six categories, and five general variables are generated under five of them. Variables defined in Section 3.2 are also used to generate both open-ended and interview questions. In this section, all of the 46 variables are described in relation to the literature. Questionnaire and interview questions are presented after the explanation part of each variable.

Step 2: Questionnaire

In the next step, the selection of questionnaire type and its advantages are highlighted. The first research question seeks drivers and barriers to organizational learning in the defense industry company. Because a Likert-Scale questionnaire is able to reveal the factors, questions are prepared systematically in this way. "9 Steps Involved in the

Development of a Questionnaire" of Crawford (1997) is used to design the questionnaire given in Appendix B.

Step 3: Interviews

The semi-structured interview section is conducted to find the answer to the second research question: How to make organizational learning more efficient in the defense industry? The question is generated as a complementary to the first question, but having its answers from the same method with the previous research question is not possible. Therefore, considering the advantages described by Harrell et al. (2009), it is decided to conduct a semi-structured interview. Questions are then designed with following the rules that Harrell et al. (2009) suggested. Interviewing is a challenging method to use because the execution phase after designing the questions is as critical as designing. To execute a useful interview section, we adhere to six fundamental rules of Dillon et al. (1994)

Step 4: Analysis

The demographic analysis for the participants of the questionnaire and the interview is presented in Section 4.1. Descriptive statistics of survey questions are given to conduct a comprehensive analysis, and the averages are interpreted in this context. The section where the statistics that stand out according to the categories of variables are highlighted continues with the verification section. As a tool of validation, the 3-scale results for each participant are derived by downing the "Agree" and "Strongly Agree" options to "Agree" and by downing the "Disagree" and "Strongly Disagree" options to "Disagree". In this context, the compatibility between the position of the mean of the responses given to 5-scale Likert results according to 3.00, which is the middle point, and the percentage distribution of 3-scale derived answers is examined.

Within the scope of qualitative analysis, two separate studies are performed. First, open-ended questions are analyzed by coding and grouping into more general concepts. Second, the responses to the interviews are coded and evolved into more general statements, and the assessments progress in this context. The six common questions in the interview are examined from a broad perspective. Optional questions

prepared for interview groups are analyzed separately in order to make comparisons with external situations.

Step 5: Strategy Recommendation

In Strategy Recommendations step, strategies to improve the efficiency of organizational learning performance of the company are proposed. Drivers and barriers to organizational learning of the company were taken into consideration during the strategy-making step.

1.3 A Brief Introduction to Defense Industry

Countries are obliged to protect their borders to ensure their continuity. In order to protect these boundaries, states must be able to obtain the necessary equipment for difficult situations, as well as the army of manpower, which can directly protect or use the necessary equipment. In the most general terms, the defense industry can be defined as the sector that provides the production of the tools and equipment needed in the national defense field.

The sector generally progresses in close control and coordination of states. Since national security is the most crucial priority of states, the importance given to the sector is tremendous. Countries allocate serious budgets by defining their defense industry strategies according to their geopolitical situations, economies, military structures, strategic goals, and technological competencies. Due to national security, not hesitating to allocate a high budget to the sector does not force the sector to be cost-effective; this allows very serious money to be spent.

The defense industry is engaged in the R&D and production of a variety of products that aim to give advantages to armies. Countries make high consistent R&D expenditures to meet their defense needs optimally. This high budget enables the advancement of technology by investing comfortably. Many breakthroughs are made as a result of the R&D investments and studies to help states to meet their defense needs while laying the foundations of systems that can be used in the civilian field.

Hence, defense industry studies have made numerous inventions that we are using in daily life and that have billions of dollars of the economy.

Since the defense industry has many similar features with the aerospace industry, it is often studied as Aerospace and Defense Industry. While countries entered a tight competition in this industry within their budgets, the amount of money spent by the United States, the most powerful country in the sector, to R&D alone was around 110 billion USD in 2018. Besides, 888,575 people are employed in the sector in the USA.[1]

The importance given to the defense industry in our country is constantly increasing because of the geopolitical issues. In addition to this, in Turkey where can adapt the trend of converting the basic method of defense based on the high number of soldiers to the use of technology, the defense industry is progressing under the control and coordination of the state as in developed countries. While the primary source of defense industry expenditures is the budget of the Ministry of National Defense (MSB), the most critical institution providing coordination is the Presidency of the Defense Industry (SSB).

In 2018, a turnover of 8.8 billion USD was achieved in Turkey, and 67,239 people were employed in the sector. The positive return of 1.4 billion USD spent on product and technology development within the scope of R&D activities is seen with increasing orders. In 2017, the amount of newly placed orders to the sector players' order books was 8 billion USD. A significant increase in this amount (51.51%) occurred, and the total number of orders received performed around 12 million USD.[2]

In order to develop a modern defense industry and ensure the modernization of the Turkish Armed Forces (TSK), the SSB performs the following master duties.[3]

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[1] 2019 Facts & Figures: U.S. Aerospace & Defense – The Aerospace Industries Association (AIA)

[2] SASAD Performans Raporu 2018

[3] https://www.ssb.gov.tr/website/contentlist.aspx?PageID=39&LangID=1

- To implement the decisions of the Executive Committee,

- To link the schedules of procurement to be given by project over the years to the order contract,

- To plan the production of needed modern weapons, tools and equipment in private or public institutions,

- To support new private, public or mixed investments, if necessary, provided that they are open to the outside,

- To identify research, development, production of prototypes, advance payments, long-term orders, and other financial and economic incentives for modern weapons, tools, and equipment.

The general operation of the defense industry in our country starts with the calls for proposals prepared after the SSB and MSB analyze the current and future needs of the TSK. Following the technical negotiations, the characteristics of the items of need are determined and it goes out to the tender; the winning companies undertake the project according to the terms of the contract. The projects tendered by the SSB are aimed at increasing the nationalization rate in line with Turkey's objectives and great importance is given to technology acquisition in this context. The knowledge and human resources profile of the companies has great importance in the tenders.

SSB contributes to the learning ecosystem by introducing a Technology Acquisition Obligation to some of its projects. It is aimed to develop technology with the joint work of SMEs and university/research institutions under the responsibility of the contractor in order to provide input to the final product with the Technology Acquisition Obligation. Within the scope of Technology Acquisition Obligation Projects, the sector is encouraged to develop unique and new technologies, and it is

aimed to increase the nationalization rate in the main systems by coordinating with the related departments within SSB.[4]

It is mandatory that all outputs of SSB R&D projects are delivered to the institution. All knowledge produced in this context is expected to be documented in the appropriate format and submitted to the SSB. The institution can act as a mediator between stakeholders by taking the initiative for technology transfer when necessary. In addition to this, the institution, which is responsible for creating the human resources profile of the sector independently of the projects, also establishes policies for meeting the training needs.

SSB projects are the biggest source of income for the defense industry companies. These projects can be either production or R&D projects, but as mentioned before, it is necessary to have sufficient human resources and knowledge to be able to take these projects. In particular, production projects increase turnover with high contract costs, and since these projects generally do not have R&D activities, they are easier to realize.

Companies try to make technological gains on their own initiative or on-demand from the government. They can use these gains to develop the capabilities of their existing products or to produce innovative products. While companies can contract R&D projects with the SSB, they also produce projects aimed at increasing their knowledge with their own equity. There are two main differences; firstly, in the short term, SSB Projects generate profits to the companies, while self-funded projects only increase expenses. Secondly, there is an obligation to meet schedule requirements in SSB R&D projects, while self-funded R&D projects, generally, have no any obligation from outside of the company.

The strong financial structure of the sector and companies facilitates the employment of qualified personnel. Owing to the quality of R&D works, employment conditions, and promising companies, the first target of many new graduates is defense industry companies. While the employees tend to continue their graduate education in parallel

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[4] 2018-2022 Savunma Sanayii Sektörel Strateji Dokümanı

with the R&D studies, 35 percent of the engineers working in the sector have graduate degrees.

According to the data in 2018, 16,040 out of 67,239 defense industry employees work as engineers in companies. Also, the fact that more than 20 percent of the sector's total employment belongs to the R&D departments shows the contribution of the sector to knowledge production and learning.[5]

1.4 Concluding Remarks

As the study examines organizational learning, it focuses on the areas where knowledge is most dynamic. There are many different divisions of the defense industry company that we examine such as production, quality, project management; and engineers and administrative staff works in these divisions. While knowledge acquisition, transfer, and usage are valid for all divisions, almost all of the work of the R&D departments is related to knowledge production. The most important knowledge actors in these departments are skilled engineers.

While many companies earn money with the products they produce and the sales they make, defense industry companies can also make money with the knowledge they produce. In the majority of its projects, R&D design activities occupy a large part, and very intense knowledge production takes place within the scope of these activities. Considering that organizational learning consists of knowledge production, transfer, and storage, R&D engineers are chosen as the target group in order to make the study more efficient. Therefore, questionnaire forms are distributed to R&D engineers, and interviews are also conducted with them.

Many studies in the literature explain and analyze organizational learning from different perspectives. The vast majority of the studies divide the organizational

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[5] SASAD Performans Raporu 2018

learning into steps and categories and illuminate the subject to provide transparent information.

This study constitutes some important contributions to the existing realm of knowledge and methodology. One of the most important contributions is the examination of organizational learning processes in detail by the study carried out with Turkey's leading R&D engineers, and comprehensive analysis is carried out using different methods in the same study. Another important contribution is that the thesis is proceeded with a continuous validation method both in quantitative and qualitative studies among themselves and between each other and gives the literature an innovative method.

CHAPTER 2

THEORETICAL BACKGROUND AND LITERATURE REVIEW

In competitive conditions, while firms focus on more macro indicators, organizational learning can be ignored. In order to analyze organizational learning and to find supportive factors, knowledge and knowledge management concepts are investigated. Besides, researching the concept of organizational learning enables us to propose strategies convenient in the literature.

2.1 Knowledge

Knowledge is one of the most ambiguous terms for the research. There is no mutual agreement on the definition of knowledge. Mostly, people defined knowledge as a derivation of information like Dixon (2000:13) says "knowledge is the meaningful links people make in their minds between information and its application in action in a specific setting," whereas Stonier (1990) defines it as classified information in people's heads.

Another type of definition is made by distinction, with information confused with knowledge. The well-known quote by Einstein is "Knowledge is the experience. Everything else is just information." Actually, we can deduce that he has also thought that knowledge comes from information. Additionally, Foskett (1982) defines knowledge as what person knows and information is what people know.

One of the most comprehensive definitions of knowledge is offered by Davenport and Prusak (2000). They define knowledge as a mixture of framed experience, contextual information, values, and expert perceptions that maintain a framework for the evaluation and inclusion of new experience and information. According to them, knowledge is created by a knower and *is applied in the minds of knowers (*Davenport and Prusak, 2000: 5). In terms of organizations, knowledge is not only included in

documents or repositories, but also in organizational routines, processes, operations, and standards. For the thesis, this point of view is supervisory, because it involves organizational knowledge and personal knowledge, which are foundation stones to be investigated. It is sufficient for many studies to produce, use and transfer information between individuals. However, with the experience and knowledge of individuals, the continuity of their work is as long as their life in the organization. The knowledge that organizations fail to absorb and can not use without a specific individual is not permanent for organizations and they need to learn that knowledge for sustainability. Therefore, organizations try to create routines, processes, operations, and standards as well as keeping documents and repositories.

As various disciplines study about knowledge, it has different classifications. Firstly, explicit and tacit knowledge is suggested by Polanyi (1966). Polanyi (1966: 4) expresses **tacit knowledge** as simple as possible: "We can know more than we can tell." In this view, we can not transfer all types of knowledge; we can ride a bike, but we can not express riding as we do to another person. Even if we do, all of our knowledge can not be transferred to him or her. Similarly, Nonaka and Takeuchi (1995) explain tacit knowledge as it is a knowledge that we do not recognize what we know. They claim that articulation of tacit knowledge is delicate, and it is generally expressible only through action.

However, there is a kind of knowledge that can be codified, stored, transferred, and accessed, which is called **explicit knowledge**. Polanyi (1966) mentions explicit knowledge as easy to acquire and can be exploited quickly. He regards tacit knowledge as a fine-grained phenomenon and provides meaning and a more profound understanding of explicit knowledge. Nanoka and Takeuchi (1995) explain explicit knowledge as conversely from tacit: it is a knowledge that we aware of what we know. Explicit knowledge can be articulated, codified, stored, transferred through documents.

Polanyi (1966) expresses these two terms as tacit knowledge is usually in the domain of subjective, cognitive, and experiential learning, whereas explicit knowledge deals with more objective, rational, and technical knowledge. Explicit knowledge is typically both well documented and accessible. Similarly, Nanoka and Takeuchi

(1995) assess tacit knowledge as subjective and explicit knowledge as objective. While they suggest knowledge of experience (body), simultaneous knowledge (here and now) and analog knowledge (practice) terms for tacit knowledge, knowledge of rationality (mind), sequential knowledge (there and then), and digital knowledge (theory) terms are generated for explicit knowledge.

Lundvall and Johnson (1994) offer another classification for knowledge. They improve knowing-how and knowing-what suggestions of Ryle (1945) and group the knowledge into four broad categories: "know-what", "know-why", "know-how," and "know-who". **Know-what** is close to what is typically called information, and it refers to facts about the world. **Know-why** refers to scientific laws concerning nature and society. This kind of knowledge is essential for technological developments and innovative markets. **Know-how,** the most commonly used one refers to how to use tools and concepts, and it is a term for practical knowledge on how to accomplish something. **Know-who** refers to specific and selective social relations. Know-who is not knowing who is the director or who is the manager, but it is about knowing who knows what. (Lundvall and Johnson, 1994)

2.2 Knowledge Management

Knowledge can be created, retained, transferred, and forgotten. (Argote, 2011) (Darr et al. 1995) These characteristics of knowledge are valid for both personal and organizational knowledge. Organizations have to manage their current, past, and future knowledge to survive.

Just as knowledge, knowledge management also has different definitions. Hedlund (1994) suggests that knowledge management is intended to produce, represent, store, transfer, transform, apply, embed, and protect organizational knowledge. He analysis multidimensional and network organizational structured companies in both individual and organizational aspects.

Harry Scarbrough et al. (1999:669) define knowledge management as "any process or practice of creating, acquiring, capturing, sharing and using knowledge, wherever it resides, to enhance learning and performance in organizations". They evaluate that

knowledge management is involved both stocking and flowing phases of knowledge. Codified knowledge in the organizational database is represented as a stock of knowledge, while flows considered as transferring knowledge from people to people and from people to organizations.

Dalkir (2005) summarizes that knowledge management was initially defined as the process of applying a method to the acquisition, structure, management, and diffusion of knowledge over the organization for working faster, reusing the best practices, and reworking from project to project. She explains knowledge management as a multidisciplinary study that has more than three different perspectives, and each of them leads to different definitions.

- From the business perspective; knowledge management is an activity of the business with two main aspects:

  1. Approaching the knowledge as a concern of business strategy, policy, and applications at the organization,

  2. Connecting an organization's intellectual assets, both explicit and tacit, with business results.

- From the cognitive or knowledge science perspective, knowledge is the main factor that makes personal, organizational, and intelligent behavior possible. Knowledge management is to encourage an organization's intelligent behavior. (Wiig, 1993)

- From the process/technology perspective; knowledge management transforms knowledge to be utilized in all levels of the processes of the organization, and technological developments. (Dalkir, 2005)

King (2009) defines knowledge management as is based on the suggestion that organizations are not capable of using the knowledge they have, analogously as humans are also unable to utilize the full potential of their brains. Organizations try to use knowledge as effectively as possible. Acquired useful knowledge and making it available for employees are essential for maximum organizational performance. He

suggests that if organizations can increase their efficiency to use knowledge, even insignificantly, more enormous benefits will follow.

King (2009:4) explains the knowledge management as also an aggregation *of planning, organizing, motivating, and controlling of people, processes, and systems in the organization to ensure that its knowledge-related assets are improved and effectively employed*. This explanation generates the roadmap of his study.

The knowledge-related assets contain both explicit and tacit knowledge. As explicit knowledge, technical reports, patents, and "best-practices" database can be counted, while knowledge of the best way to do of experienced works, embedded knowledge into processes and relationships, and rule of thumbs are involved in tacit knowledge.

King (2009) expresses the knowledge management processes as the continuum of acquisition, creation, refinement, storage, transfer, sharing, and utilization, of knowledge. The knowledge management function in the organization is managing these processes, developing procedures, and coordinating the system participants. Figure 1 shows the knowledge management cycle that started with knowledge creation or knowledge acquisition. As Nonaka et al. (2000) suggest, knowledge can be created in four-way: Socialization, Externalization, Combination and Internalization (the SECI model). The creation of knowledge or acquisition that can be made by searching, sourcing or grafting, produce the source of knowledge for the organization. After the creation or acquisition phase, knowledge management mechanism prepares the knowledge for memorizing. In the refinement part, pure knowledge is processed by indexing, cleaning, revising, encoding and various methods. The purpose of this refinement is to have suitable knowledge for long-run usability. The memory part refers electronic repositories that hold the usable knowledge for organizations' members. As the last step of the organizational learning in the knowledge management process transferring or sharing knowledge from the sender to receiver by purposeful or not. Unlike organizational learning processes, knowledge management examines the utilization of knowledge. In this step, the analysis of the problems related to the use of information and the improvements related to this are also examined. The last step of the cycle in Figure 1 depicts that knowledge has an impact on organizational performance.
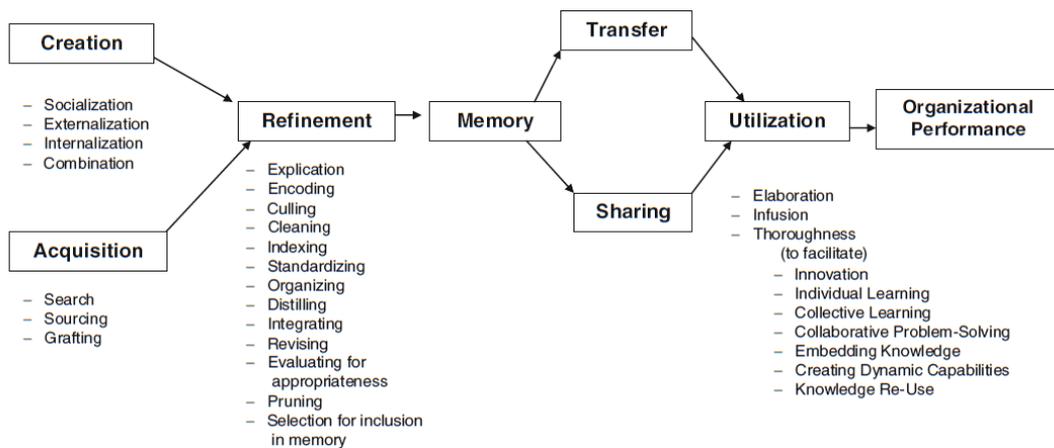
Figure 1: Knowledge Management Process Model (King, 2009)

As shown in Figure 2, the primary goal of knowledge management is improving the organization's intellectual assets to generate better knowledge applications, improved organizational behaviors, better decision-making mechanisms, and, once for all, improved organizational performance.
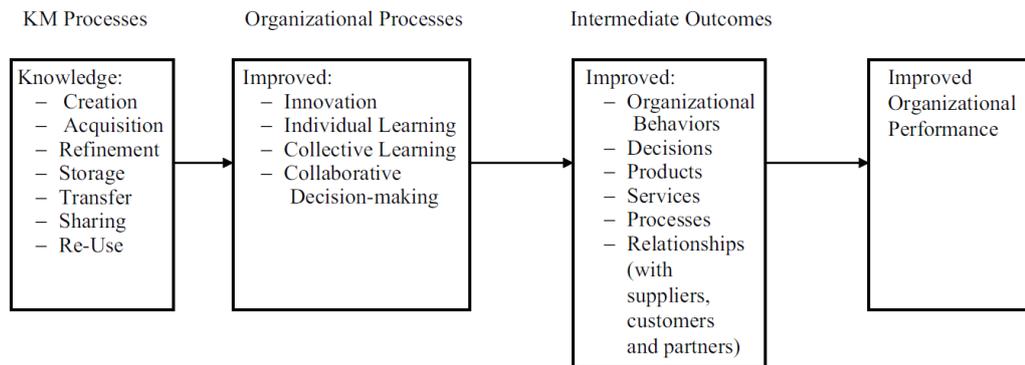
Figure 2: Knowledge Management in an Organization (King, 2009)

2.3 Organizational Learning

Organizational learning is a crucial factor in almost every successful company because of its sustainability role. The fact that organizations try to reach their goals by using ready-made information without interfering with them prevents continuity and decreases the usage efficiency of information. At this stage, the development of organizations' learning skills will not only open the sea of knowledge but also support their sustainability in development. As mentioned above, organizational learning is strictly correlative to knowledge management. It can be stated that knowledge

management differs from organizational learning only in relation to the utilization of knowledge.

King (2009) explains organizational learning as a continuum of result that embedding knowledge into the organizational processes for improving the practice and behaviors of the organization to chase its goals. Organizations have to survive for their economic, intellectual, and reputational sustainability. There are various factors to enhance the structures, processes, and returns of organizations.

Company acquisitions, taking fund, hiring experienced, and capable staffs are well-known methods for organization growth. However, some of these factors can become temporary solutions if the requirements for sustainability are not fulfilled. One of the most challenging elements of organizations possess is knowledge itself, and conventional processes may fail to persistence improvement. From this point, organizational learning is one of the essential ways in which the organization can sustainably enhance its exploitation of knowledge. Therefore, organizational learning is about to function what has been learned into the organization. (King, 2009)

Easterby-Smith and Lyles (2003) have an in-line view of the relationship between organizational learning and knowledge management with William R. King. They express organizational learning as a process in which knowledge management focuses on the content of organizational knowledge. Organizations acquire, create, process, and eventually use the knowledge they have. They relate the topics knowledge management and organizational learning by adding two crucial concepts: learning organization and organizational knowledge. As shown in Figure 3, Easterby-Smith and Lyles (2003) define organizational learning is more about an academic view of the learning process of organizations theoretically while learning organization is the ideal type of organization in which learning systems and knowledge usage are efficient.

```
                              Process
                                ↑
                                │
          Organizational        │    The Learning
          Learning              │    Organization
                                │
Theory  ←───────────────────────┼───────────────────────→  Practice
                                │
          Organizational        │    Knowledge
          Knowledge             │    Management
                                │
                                ↓
                             Content
```
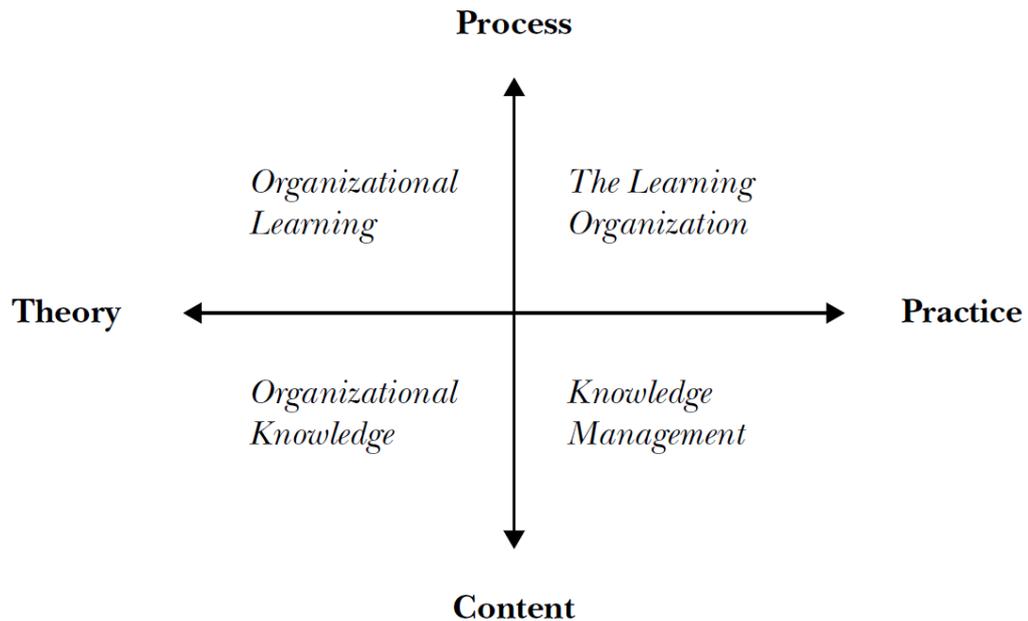
Figure 3: Mapping of the Key Topics of Organizations (Easterby-Smith et al. 2003)

Wilber (2000) and Laloux (2014) study level of consciousness of social communities with expressing the paradigms of human learning through color-coding. Accordingly, while the infrared and magenta stages, which are the first learning paradigms of humanity, do not have enough elements to form an organization; the red level, which is based on fear, power, and oppression, represents the most primitive level of consciousness among organizations. Laloux (2014) argues that mafia and street gangs belong to red organizations, saying that they grow in chaotic environments. Amber organizations have highly hierarchical structures, and there is a certaion stability. The main objective is to repeat what was done in the past. The Catholic Church, military, many government institutions, and public schools can be considered for this category.

The orange stage contains modern companies, charter schools. Innovation, meritocracy, and accountability come to the fore in this stage, for the first time. The category which in the many multinational companies are part, there is often the freedom on how to do things, but there are command and control of what happens. Continuity and effectiveness are essential in these organizations operating according to machine metaphor. For the green organizations, family metaphor is guiding. There is an intense belonging and commitment to organizations. For this reason, highly motivated employees put great effort into the culture and continuous development of

organizations. Collaboration, pluralism, teamwork and social responsibility are essential for these organizations.

The teal stage, which is the last stage of the consciousness level, also represents learning organizations. Laloux (2014:38) express that "every paradigm includes and transcends the previous." Teal organizations also involve intense collaboration and pluralism, while their evolutionary structure is based on the common welfare. While one of the main objectives of this phase is to achieve integrity, the perfect integration of individuals' learning flexibility and abilities into the learning performance of organizations is essential. Figure 4 shows the timeline of accelerating stages of human and organizational consciousness. As can be seen from the figure, the beginnings of the phases are getting closer, and new stages of consciousness may emerge in the coming years.
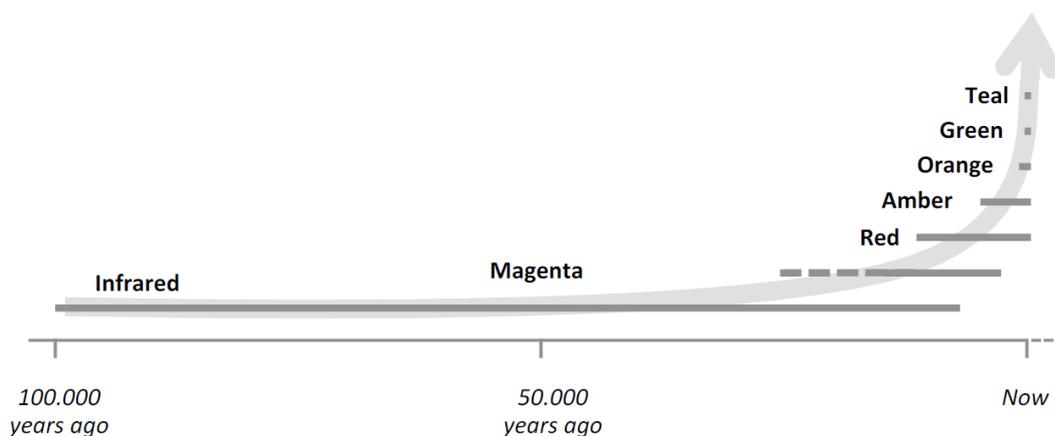
Figure 4: Stages of human and organizational. (Laloux, 2014:35)

Chiva (2017) defines learning organizations as those who reach the highest level of consciousness among firms. The study accepts the fact that the only way to success is not to be a learning organization, but argues that any company can become a learning organization. Chiva (2017) examined the consciousness and structure characteristics by categorizing organizations according to their learning skills.

While Marquardt (1996) argues that there is not a single and guaranteed way to become a learning organization and that each organization must follow a path according to its facts, he proposed 16 steps for organizations to become a learning organization:

20

- **Step 1: Commitment:** Top leaders need to be committed to transforming the company.

- **Step 2: Connection:** The leaders in a new learning organization must link their learning processes and products to the strategic goals of the organization.

- **Step 3: Assessment:** The strengths and weaknesses of the firm in the areas of learning, organization, human, knowledge, and technology should be comprehensively assessed.

- **Step 4: Communication:** A solid communication should be established with employees and stakeholders to make it easier for everyone to act jointly in the process of transformation into organizational learning.

- **Step 5: Recognition:** Employees in the company should be aware of the importance of systems thinking and systems action.

- **Step 6: Demonstration and Modeling:** On the way to learning, there must be leaders who demonstrate their support and model their commitment to the process.

- **Step 7: Transformation:** In order to become a learning organization, business models, working methods and organizational structure should be transformed.

- **Step 8: Strategy:** Steps should be taken to become a learning organization by developing strategies and tactics. For example, rewarding learning performance, encouraging creative work.

- **Step 9: Cut and Streamline:** Bureaucratic obstacles that kill creativity and energy must be eliminated.

- **Step 10: Empower and Enable:** Employees should be trusted, motivated and organizations should give the necessary freedom and make them authority in their work.

- **Step 11: Extend:** Learning efforts should be expanded for all stakeholders with potential sources of information and ideas, including suppliers and customers.

- **Step 12: Capture and Release:** All employees should be directed to produce new knowledge, take responsibility in line with their ideas and be supported in this direction. While it is always important to learn new knowledge, it is important for learning continuity to release existing knowledge to the ecosystem when necessary.

- **Step 13: Acquire and Apply Technology:** It is necessary to establish and use the essential technological infrastructure in order to assimilate knowledge and improve learning performance.

- **Step 14: Encourage, Expect and Enhance:** The individual worker, team and organization should be encouraged about continuous learning.

- **Step 15: Learn:** The concept of learning organization should be constantly monitored, and current events related to practices should be kept informed.

- **Step 16: Adapt and Improve:** Learning needs to be adopted and improvement must be continued with the awareness that the process will never end.

Levitt and March (1988) study organizational learning on presuming that organizations are seen the learning as a tool for encoding historical effectuation into routines that guide behavior. In this context, they interpret organizational learning based on three dimensions from behavioral studies of organizations:

1. Organizational behaviors are based on routines: behaviors are stemmed from a logic of appropriateness; they are generally not calculated actions, and the primary method to take action is matching the current situation with procedures, rules, and specific or general solutions successfully practiced.

2. Organizational actions are dependent on history: the source of routines is interpretation or absorption, of the situations experienced in the organization.

They evolve the feedbacks of sharp outcomes to experience, consciously, or unconsciously. Failure or success of a specific action can be valuable for the future; even organizations do not recognize at the moment of revealing the outcome whether this experience is likely to be useful.

3. Organizations are oriented to targets: behaviors of organizations are formed by the observations of outcomes and aspiration of the organization for these outcomes. Both failed or succeeded outcomes are leading this aspiration of the organization positively or negatively.

Within this perspective, they are detailing the topics for interpretation of organizational learning. Firstly, learning from direct experiences of organizations is investigated, such as trial and error experimentations, learning by doing, and capability of organizational search from their experience database. The topic of learning from others' experiences is then detailed by considering the diffusion of codified knowledge. They explain recording, conservation, and retrieval of experience under the topic of organizational memory.

Levitt and March (1988) explaine the interpretation of experience as a result of the judgments of individuals members of organizations. Lessons of experience are essential for companies as for an individual. Companies have to learn from their failures and successes to not spent time and money over and over. However, the difference between failure and success is not always clear; people may form interpretations of experiences as good or bad without computation. Because it is challenging to untangle of causality of events, codifying the lessons of experience is a complicated and troublesome process. These lessons include both technical and administrative history and also interpreted experiences formed by individuals.

Dalkir (2005) evaluates organizational learning with its relation to social capital from the perspective of society's collaboration and cooperation for mutual benefits. The primary purpose of organizational learning is providing organizational decision making more effective and efficient as well. Like many previous researchers, Dalkir (2005) defends that organizational learning is a process about social interactions, the creation of organizational knowledge, learning ability from past behaviors, usage, and

capturing of organizational knowledge. She proposes that, because the individual human mind is limited, collaborative working and learning activities are becoming essential, learning of individuals and organizations should be embedded as much as possible.

Fiol and Lyles (1985) suggest that organizational learning is not the sum of each member's learning. Organizations are developing and sustaining a learning system to improve both employees' and organizational knowledge and to build an organizational understanding of their environment to surviving strategies. They also investigate organizational learning as contextual factors. Four factors are defined that affect the learning probability; (Fiol and Lyles, 1985: 804)

1. Culture: organizational culture can come through in organizational behaviors and ideologies. The culture consists of collective beliefs, norms, ideologies, and history. Organizations can not define their strategies without consideration of their culture, and this makes organizational learning affected by organizational culture.

2. Strategy: organizational learning capacity is implicitly affected by the strategy. Organizations define their goals as a result of the strategy, and the strategy both affects and be affected by learning capacity. Be affected; because decision-makers have to know their learning capacity, and affects; because a strategy can effectuate a circumstance that learning capacity needs to be managed.

3. Structure: fundamentally, centralized and decentralized structures have different degrees of flexibility. Centralized structures tend to force past behaviors, while decentralized structures are easy to adapt to changing conditions. Structures can be designed to enhance organizational learning.

4. Environments: the internal and external environment affects learning processes. An appropriate balance is required for a reliable learning system. Stagnant organizations may struggle with dysfunctionality, while organizations in which too much change and turbulence happen may make it

difficult for their employees to map the environment. The learning process requires tension between constancy and change.

Argote (2011) investigates organizational learning from the perspective of past, present, and future. She emphasizes on the topic with three sub-processes of organizational learning: creation, retaining and transferring knowledge.

Argote (2011) divides previous research on organizational learning into three mainstreams. First, psychological studies about how defensive behaviors prevent learning in an organization. These studies rely on clinical cases. Then, sociological studies about how an alteration in an organization affects future routines. The last research are about the learning curve, which is primarily studied by economists and industrial engineers, and these generally rely on field studies.

The study continues with the analysis of present research in organizational learning. The present studies are divided into three groups: experience, context, and organizational learning processes. Argote (2011) defends that a detailed analysis of "experiences" can provide to characterize them, and learning from experience can be made more efficiently. In this context, she suggests that experience can be direct, vicarious, unique, or not. These and more can provide firm analysis.

Another present concern about organizational learning is "context." Researchers are studying organizational structures, behaviors, relations, members' safety feelings, balances of performing and leaning, and members' sense of belonging. These factors are crucial for comprehensive analysis.

"Processes" of organizational learning are one of the leading anxieties in present studies. Creating, retaining, and transferring knowledge are composing organizational learning. Research of creating knowledge are frequently based on experience. In the area of knowledge retention, researchers examine organizational knowledge in the aspects of cumulativeness, decay, forgetting, repository, information systems. Researchers also examine knowledge transfer in areas of barriers and facilitators, relational, cognitive, motivational, and emotional factors. (Argote, 2011)

Argote (2011) also expresses her opinions about future studies of organizational learning. In principle, she suggests that research of knowledge creation and organizational capabilities are needed to be continued for contributing the organizational learning.

2.4 Concluding Remarks

The chapter is about the theoretical background of the thesis. In the chapter where basic concepts are investigated for the purpose of the thesis, accepted opinions are presented by giving information about the concepts. In the study conducted within the framework of organizational learning, knowledge and knowledge management concepts are also examined extensively.

The first section of the chapter involves the literature survey about knowledge. In the section where the basic and changing definitions of knowledge are examined, information and knowledge concepts frequently mixed are explained. To the confusion, which is well summarized by Einstein, many researchers have given similar explanations: "Knowledge is the experience. Everything else is just information."

After that, classifications of knowledge are examined. Firstly, the concept of tacit and explicit knowledge, which holds a very important place in the concept of knowledge, is discussed. The taxonomy created by Polanyi (1966) examines the information according to its explainability. Accordingly, while explicit knowledge can be described as descriptive knowledge, it may be very difficult to transfer implicit knowledge to another. Lundvall and Johnson (1994) offer another classification that has four types of knowledge. Based on this classification; Know-what is the facts about the world, know-why is deep knowledge that investigates reasons, know-how is practical knowledge and know-who is knowing who knows what.

The second section is about knowledge management's literature. In the section where different approaches to knowledge management are explained, the relationship of the knowledge management with knowledge, learning, and organization is presented. One of the important views that shaped the thesis is King's (2009) view of knowledge

management. According to King, knowledge management examines the utilization of knowledge and the performance of the organization, including organizational learning.

The last section of the chapter is organization learning, which is the main subject of the thesis. In this section, while defining organizational learning from different perspectives, the relations of organizations with knowledge are examined in depth. In particular, Easterby-Smith and Lyles's (2003) diagram about organizational learning, organizational knowledge, learning organization, and knowledge management provides clear information about their relationship with each other. One of the foundations of the thesis is Argote's (2011) explanation of organizational learning. According to Argote (2011), organizational learning is the combination of three processes: creating, retaining, and transferring knowledge.

Because the thesis is investigating organizational learning in R&D departments, the literature is researched with the perspective of R&D. Most of the knowledge definitions is acceptable for the study, but Dixon's (2000) explanation is shown regard for the study because of its clearness and appropriation for R&D works. As Dixon (2000) does, we can define the knowledge as meaningful information in people's minds. While R & D studies require intensive knowledge, almost unlimited information can be obtained from open sources or paid systems. However, in order to use this information, combined and synthesized in a meaningful way, it must be understood first. Knowledge, which is the understood form of information, enables individuals and institutions to produce knowledge and make meaningful knowledge transfers.

Knowledge, which is one of the most fundamental concepts of humanity, has been the subject of research in many fields, especially philosophy. Polanyi (1966) who put forward the concept of implicit knowledge by successfully analyzing the philosophical studies on the application in business life, provides a better interpretation of the concept of knowledge transfer, which is one of the main concerns in this study. Besides, Lundvall and Johnson's (1994) know-how and know-who concepts, which express well the ability of information to be assimilated, re-used and interpreted, are one of the cornerstones of this study in terms of forming the basis of R&D studies.

From a broader perspective, King's (2009) concept of knowledge management is crucial for this thesis. In the study, in virtue of King (2009), who showed the place of organizational learning in knowledge management and its importance in company performance, in addition to examining organizational learning and its sub-components, we examine knowledge management, which is directly affected by organizational learning.

The concept of organizational learning the main subject of the study is investigating with two perspectives: organizational learning and learning organizations. We use the diagram expressed by Easterby-Smith and Lyles (2003) for clarifying the relation between these two terms, as shown in Figure 3. Accordingly, while organizational learning refers to the process as a theoretical and academic concept, learning organizations refer to institutions that can transform this process into real performance. Laloux's (2014) study of humanity's organizational consciousness is significant for this thesis in terms of categorizing organizations. Laloux (2014), which defines learning organizations as the last step in the Tail Stage, provides a clear picture of the characteristics that institutions must have to reach this step.

As mentioned before, the thesis is shaped around the definition of organizational learning made by Argote (2011): organizational learning is the process combines creating, transferring and retaining knowledge. We also divide organizational learning into these three elements in order to analyze in a more controlled and systematic way.

The outputs of the chapter are used throughout the thesis, especially in the methodology section.

CHAPTER 3

THE METHODOLOGY AND THE ORGANIZATION OF THE THESIS

This thesis is basically based on a single case study that aims to investigate the main factors of organizational learning in a defense industry company. Organizational learning culture and structure of the firm are also investigated. The relationship between the factors that positively affect organizational learning and literature is established and survey and interview questions are prepared. This section presents the methodology and organization of the dissertation.

3.1 General Conceptualization

After detailed research in knowledge, knowledge management, and organizational learning, general conceptualization is generated for finding out firm level learning factors of the defense industry. In this context, three categories were identified based on literature: creating knowledge, retaining knowledge, and transferring knowledge (Argote, 2011).

After identifying of categories, variables that make the study purposeful and related questions were identified. The aim of the determination of variables is that figure out which factors facilitate organizational learning and which ones obstruct it. For this purpose, these variables and questions are determined with a sense of suitability to analyze supporting and obstructing factors in the learning process of the firm.

Attention was paid in the preparation of variables according to the defense industry. This makes out near-synonymous variables that have different significance in the sector.

For having the analysis of firm level learning more effectively, the limit of organizational learning concept is slightly crossed. Variables about current knowledge and knowledge management are also generated. Even though it is not a part of

organizational learning, current knowledge issue is considered essential to unravel the employees' knowledge before or independent from the firm. Correspondingly, knowledge management needs to be assessed in terms of subsuming organizational learning.

Additionally, variables directly about organizational learning are also defined. These variables are not directly related to creating, transferring, or retaining knowledge, but they are concerned with the general concept of organizational learning instead.

As a result of this section, 41 variables are determined under six categories, and five general variables are generated under five categories as given in Table 1. Because general variables are about the general assessments of related categories, there is one variable for each category, except organizational learning.

Table 1: Factors Affecting Organizational Learning

Categories	Number of Related Variables	Number of General Variables
Current Knowledge	3	1
Knowledge Creation	13	1
Retaining Knowledge	7	1
Transferring Knowledge	10	1
Knowledge Management	3	1
Organizational Learning	5	-
TOTAL VARIABLES = 46	**41**	**5**

It is not identified as a general organizational learning variable separately because of two reasons:

1. Five variables about organizational learning already are presented in a general concept,

2. It is considered that the direct question about organizational learning, which is the primary purpose for analyzing in the thesis can be manipulative or unclear.

Furthermore, because qualitative inputs are required to have a comprehensive analysis of the current situation of the firm and to have an opinion about what to do for the improvement of the organizational learning system, variables are also used to generate both open-ended and interview questions. Literature relations of the concepts and categories are given in Table 2.

3.2 Detailed Conceptualization

Predominantly, organizational learning literature is reviewed to investigate the factors that affect firm level learning in the defense industry. As mentioned in various research, organizational learning can be conceivable as a composition of three main phases: Creating Knowledge, Retaining Knowledge and Transferring Knowledge. (Argote, 2011)

These three factors constitute the basis of the research, besides that, for a full understanding of the organizational learning structure of the firm, knowledge acquired before the current company or acquired from graduate studies is investigated in the **current knowledge** part in the questionnaire to figure out outlier factors for organizational learning. **Knowledge management** is also utilized as one of the main factors that affect organizational learning as a nature of the organizational structure. The factors unclassified but engaged in organizational learning are also examined in the **organizational learning** part of the questionnaire.

3.2.1 **Current Knowledge**

Above all, for having reliable analysis, the current knowledge has to be investigated. We consider it is crucial because the study examines organizational learning processes in detail. Even though current knowledge which those considered as acquired from outside of the organization before or during work time may be out of the scope of organizational learning, it worth for evaluation to analyze organizational knowledge comprehensively. We distinguish current knowledge into the three: firstly, because the study is being executed with R&D engineers, and the lowest level of technical knowledge is considered as the knowledge acquired from undergraduate. The knowledge acquired from graduate studies is considered as the next step for engineers those are graduated or student of a graduate degree. As the last case of current knowledge, we define a variable for engineers who have experience from another organization.

1	**Variable Keyword/Explanation**: Use of undergraduate knowledge

Question: I use the knowledge I acquired in my undergraduate studies intensively in my business life.

2	**Variable Keyword/Explanation**: Use of graduate knowledge

Question: I use the knowledge I acquired in my graduate studies intensively in my business life.

3	**Variable Keyword/Explanation**: Previous experience

Question: I use the knowledge that I acquired from the company or university that I worked before my current company.

4	**Variable Keyword/Explanation**: GENERAL - Existing knowledge

Question: In general, I use the information that I acquired outside the company (before or during my work) intensively in my business life.

3.2.2   **Creating Knowledge**

Knowledge creation is the beginning point of learning for both individuals and organizations. The individual is a kind of learning product like an organization because it continuously learns from the environment in its lifetime. The creation of knowledge refers to a new, created, transferred, or experienced knowledge for the organizations. Without this creation phase, it is impossible to discuss organizational learning.

One of the conventional methods for knowledge creation is training. (Allee, 1997) (Nonaka and Konno, 1998) (Mishra and Bhaskar, 2011) (Leiponen, 2010) Organizations intend to contribute to members' knowledge and indirectly on their owns. In terms of that, organizational training is target-oriented and easy to access; it is one of the most efficient methods for creating knowledge. Nonaka and Konno (1998) explain that individuals and organizations have both similarities and differences in learning. While they both can adopt explicit knowledge much more straightforward, tacit knowledge is intricate for organizations as opposed to individuals. Because training is the most straightforward method for adopting explicit knowledge, it is essential for organizations.

5	**Variable Keyword/Explanation**: Learning with company and career trainings
	Question: Career trainings that I attend through my company, increase my knowledge.

As mentioned in Section 1.3, the defense companies are fundamentally dealing with two types of R&D projects: contractual and self-funded. Contractual projects are effectuated on the condition of customer demand. They are more defined, and target-oriented projects and have great importance for a company's income. Self-funded projects are more undefined and have more attributions for the R&D phenomenon. Both contractual and self-funded R&D projects involve knowledge acquisition and "learning by doing". One of the most effective learning methods for individuals is the

practical application made in real work, called "learning by doing". (Epple, Argote, and Devadas, 1991)

| 7 | **Variable Keyword/Explanation**: Learning from Contractual R&D projects |

Question: Contractual R&D projects that I am working, increase my knowledge.

| 6 | **Variable Keyword/Explanation**: Learning from Self-funded R&D projects |

Question: Self-funded R&D projects that I am working, increase my knowledge

Kong et al. (2012) proposed two terms for investigating the intention of learning individually and collaboratively: *peer intrinsic motivation and peer extrinsic motivation.* They conclude that teammates are positively significant for the learning environment. Barrett, Samuel, et al. (2013) express that even with a limited knowledge environment, team works can enhance learning and contribute to knowledge acquisition.

| 8 | **Variable Keyword/Explanation**: Learning from teammates |

Question: Technical discussions with my teammates increase my knowledge.

Conferences are one of the most popular places where gather the knowledge holders and those in need of knowledge gather. (Louw and Zuber-Skerritt, 2011) As in academy, the defense industry also exploits knowledge from conferences. Innovations and state of the art developments are discussed in these areas for their validities and feasibility for industries. (Bathelt, Malmberg, and Maskell, 2004)

| 9 | **Variable Keyword/Explanation**: Learning from conferences |

Question: Conferences I attended increase my knowledge.

The defense industry needs R&D activities for its continuous development, so various methods are used to acquire knowledge. One of the most direct ways to gain and use the knowledge in existing and planned projects is working with consultants or academic staff. While consultants tend to use past experiences into industrial practices, academics are competent for converting theoretical knowledge into practices. (Van Helden, Aardema, ter Bogt, and Groot, 2010)

10	**Variable Keyword/Explanation**: Learning from consultants and academics
	Question: Studies with local/international consultants and/or university teachers increase my knowledge.

The large scale organizations do not overcome all the problems they faced by just themselves. One of the acknowledged procedures of this situation is using subcontractors and becoming a system manager for the coordination of the whole system. (Asheim, 2002) (Puga and Trefler, 2002) Even though using subcontractors has a potential risk that an organizational technology can spill over to others, its potential benefits on knowledge creation are more considerable than spillover risks. (Mayer, 2006)

11	**Variable Keyword/Explanation**: Learning from subcontractors
	Question: Works with subcontractors (given package works) (excluding consultancy service) increases my knowledge.

Technical reports are the foundation of the R&D documentation of organizations in the defense industry. These reports involve the know-how from specific studies to system-based products. Besides that, as we mentioned above, tacit knowledge can not be documented easily, but one of the closest points to reveal in a document is the technical reports. (Caloghirou, Kastelli, and Tsakanikas, 2004) (Euzenat, 1996)

12	**Variable Keyword/Explanation**: Learning from in-house technical reports
	Question: The current technical reports of my company increase my knowledge.

Schindler and Eppler (2003) investigate documented-based and process-based debriefing methods in the project lifecycle. Process-based methods are claimed better options to get key learnings. Bresnen et al. (2003) claim that tacit knowledge can be transferred better in social environments in which the project team meeting. Project reviews and progress meetings are one of the places in which intense R&D solutions are discussed.

13	**Variable Keyword/Explanation**: Learning from project review and progress meetings
Question: Project reviews and progress meetings increase my knowledge.	

Innovations come through the analysis of the current position of the technology. Technology that is owned or known to exist is crucial to determine what is novel or not. (Régibeau and Rockett, 2010) When organizations or individuals are deciding to embark a new technology reviewing is one of the proven methods. Besides, the aim of the patent system is knowledge spillovers as well as providing intellectual property rights. (Lupu and Hanbury, 2013)

14	**Variable Keyword/Explanation**: Learning from patents and literature reviews
Question: Patent and literature reviews increase my knowledge.	

In the globalizing world, organizations have been changing their structures, shareholders, and even their countries. The most prominent companies have become multinational structures, and many others collaborate to have more advantages in the market. Samaddar and Kadiyala (2006) highlight that knowledge creation is one of the most valid reasons for collaboration. Powell et al. (1996) express the idea that R&D knowledge is both sophisticated and thriving, and the source of knowledge spreads over the industry. Inkpen (1996, 1998) states that the number of strategic alliances has been increasing for technological and financial concerns.

15	**Variable Keyword/Explanation**: Learning from collaboration
Question: My company cooperates with different organizations to meet mutual needs.	

Individuals are critical elements of organizational learning. Argyris (1991) emphasizes that professionals can avoid learning because of performance evaluation concerns. The primary reason for this, they think that the learning process may deflect the time of the work they assigned. However, organizations that have members motivated to learn new solutions performed well in learning processes.

16	**Variable Keyword/Explanation**: Learning opportunity
Question: In my company, employees see problems at work as an opportunity to learn.	

Organizational learning is affected by both human-oriented and system-oriented factors. (Choi and Lee, 2002) Human-oriented factors are about motivational and social relations, generally. Nonaka et al. (2000) claim that socialization and internalization part in their SECI model need firm communication to have tacit knowledge. Eraut (2007) proposes that participating in activities and listening to others in work at work enhance both learning new practices and gaining tacit knowledge.

17	**Variable Keyword/Explanation**: Learning by listening to the opinions of others
Question: In my company, employees listen to the opinions of others before presenting their ideas.	

18	**Variable Keyword/Explanation**: GENERAL - Knowledge Creation
Question: Overall, I find my company's knowledge creation ability is successful.	

3.2.3 **Retaining Knowledge**

Knowledge economy needs a dynamic and sustainable knowledge flow. Retirements, resignations, and newcomers made it necessary for organizations to retain knowledge. (DeLong and Davenport, 2003) Especially large scale organizations have to manage lots of information on the purpose of their sustainability.

Nowadays, organizations are generally in competition with others for different reasons: to have more market share, to lead the sector, or to expand their scopes. Time is the most critical factor for this competition. In this context, a waste of time is the most undesirable factor. Organizations experience problems that some of them are solved successfully, and some are not. They tend to be successful as they can find the solution to the problem experienced from lessons learned immediately. (Levy, 2011) (Jarrar, 2002)

19	**Variable Keyword/Explanation**: Accessibility of lessons learned
Question: My company makes learned lessons accessible to all employees.	

Organizations need all the relevant knowledge for their purposes. One of the most valuable knowledge sources for organizations is their members. Employees have a significant amount of tacit knowledge, and this knowledge needs to be transferred into organizations as one of the main aims of the organizations. Companies try to make tacit knowledge explicit for accessibility and ease of use. Nonaka and Konno (1998) state its importance with "*When tacit knowledge is made explicit, knowledge is crystallized*". Van den Bossche et al. (2010) provide a study that proves the feedback mechanism enhances the training gains.

20	**Variable Keyword/Explanation**: Gathering knowledge from employees and making it available
Question: My company has all the technical knowledge I hold and make it available for other members.	

21	**Variable Keyword/Explanation**: Knowledge gained in field duty and trainings
Question: All the knowledge acquired in the tasks and trainings are transferred to the company so that they can be reused.	

As we mentioned before, subcontracting is one of the standard methods for large scale organizations. (Deardorff and Djankov, 2000) However, because they are different organizations and have different locations, some knowledge can be lost. (DeLong and Storey, 2004) As a nature of subcontracting in the defense industry, created knowledge belongs to the main company.

22	**Variable Keyword/Explanation**: Accesssing knowledge on subcontractors
Question: I have full access to the knowledge generated by the subcontractors during a given job.	

Knowledge can be stored in organizations by or on accessible areas by external sources. The notion of knowledge management requires the effective use of knowledge. Successful organizations eager to access the knowledge they need and will need, and they make available the knowledge for their members. (Dyer and Nobeoka, 2000)

23	**Variable Keyword/Explanation**: Accesssing patents and literature databeses
Question: My company gives me easy access to patents and literature databases around the world.	

The source of the solution can be critical in organizational concerns. Problems faced can spillover; hence, this can create knowledge spillover to competitors as well. (Argote and Ingram, 2000) Besides that, seeking in-house answers enhances the organizational learning culture. Because while new solutions are sought in-house, transferring, creating, and retaining knowledge activities can be experienced. (Hansen, 2002)

24	**Variable Keyword/Explanation**: Routing to in-house solutions
Question: My company encourages employees to seek in-house answers while solving problems.	

Large scale organizations can have thousands of employees with different expertise, experiences, and personalities. In this context, Human Resource Management is an essential application for organizations to find the right people to the right task and analyze the current and future needs of the workforce. (Sure, Maedche, and Staab, 2000)

25	**Variable Keyword/Explanation**: Retaining of skill database

Question: My company maintains an up-to-date database of employee skills.

26	**Variable Keyword/Explanation**: GENERAL - Retaining Knowledge

Question: Overall, I find my company's knowledge retention ability is successful.

3.2.4 **Transferring Knowledge**

As in the creation and the retention phases of knowledge, human-oriented and system-oriented factors exist in transferring knowledge. Additionally, social and motivation-based variables have a key role in the flow of information. (Argote, 2011)

Despite the fact that human-sterile systems can be more reliable for sustainability, today's condition of R&D makes humans the most critical knowledge creation and transfer source. Nevertheless, organizations, especially those which are large scale and multiunit, desire that all the created knowledge is stored in a repository; correspondingly, knowledge of members has to transfer to organizations. (Hansen, 2002)

27	**Variable Keyword/Explanation**: Motivating to document knowledge

Question: My company provides appropriate motivating conditions for documenting information (time, accessibility, appreciation, etc.).

Dyer and Nobeoka (2000) state that a highly interconnected network of team members catalyzes the diffusion of tacit knowledge transfer. They propose two primary reasons for this argument: firstly, the abundance of network ties makes it easy to reach tacit

knowledge, and secondly, strong networks create a trusted environment which in members are motivated to share tacit knowledge.

28	**Variable Keyword/Explanation**: Trusting environment for sharing knowledge
Question: I feel an environment of trust where I can share my technical knowledge comfortably within the company.	

As we mentioned above, transferring tacit knowledge is highly related to members' motivations. (Hansen, 2002) Argote and Ingram (2000) state that the motivations of members affect the knowledge transfer from training to contexts. Chennamaneni and Teng (2011) claim that tacit knowledge transfer is required day-to-day contact of members and secure communication.

29	**Variable Keyword/Explanation**: Having motivation to share tacit knowledge
Question: Employees are motivated to share their tacit knowledge.	

In most of the organizations, the smallest clusters are teams. Thus, teams are the first interaction points for members just after personal interactions. Dyer and Nobeoka (2000) demonstrate Toyota's organization that prefers small teams to maximize knowledge flow because managing small scale knowledge is essential to reach secure large scale knowledge transfer. Yih-Tong Sun and Scott (2005) also support the idea of transferring knowledge in teams is crucial. As shown in Figure 5, they also study barriers of knowledge transfer that organizations and the team have to overcome for a productive knowledge environment.

30	**Variable Keyword/Explanation**: Having motivation to share knowledge with the team
Question: I have enough motivation for the strong flow of information within the team.	

Sources of barriers	Individual to the team	Team to individual
Individual imperatives	✔	
Competencies	✔	✔
Team climate	✔	✔
Team relationships	✔	✔
Team structuring		
Team norm	✔	✔
Organizational climate	✔	✔
Organizational relationships		
Organizational systems and structures		✔

Figure 5: Summary of the impact of the sources on the learning levels (Yih-Tong Sun and Scott, 2005)

After the team relations, the next step of the knowledge transfer is between teams and between project stakeholders as well. The most tender spot of the knowledge transfer between teams is face-to-face meetings. (Koskinen, Pihlanto, and Vanharanta, 2003) For the collective benefit of organizations, each team has importance as a source and transfer point of organizational knowledge. As a valuable opportunity, teams should feed each other in large scale organizations to overcome unnecessary reworks. (Hansen, 2002)

31	**Variable Keyword/Explanation**: Having motivation to share knowledge with the project stakeholders

Question: I have enough motivation for a strong flow of information between project stakeholders.

32	**Variable Keyword/Explanation**: Having motivation to share knowledge between teams

Question: I have enough motivation for a strong flow of information between teams.

Knowledge can be transferred in different conditions, from mandatory reasons to the natural process of innovative activities. Each condition defines the extent of transfer and the effectuation process. When members of the organizations are motivated to overcome a critical problem, one of the intensive places which in technical discussions situate is brainstorming meetings. Brainstorming can provide knowledge creation,

while technical discussions present unique opportunities for transferring tacit knowledge. (Argote, Ingram, Levine, and Moreland, 2000) (Yih-Tong Sun and Scott, 2005) Most of the creative solutions are generated in brainstorming meetings because analyzing a large number of ideas creates an environment for generating and transferring new knowledge. (Chennamaneni and Teng, 2011)

33	**Variable Keyword/Explanation**: Brainstorming
	Question: In my company, there are activities where employees from different experience and expertise come together and produce ideas.

Meetings are compulsory activities for organizations. Productivity is as crucial as the context for meetings because large scale organizations have a large number of meetings in different cases. Social relations should be concerned to make productivity better. (Gilbert and Cordey-Hayes, 1996) (Argote and Ingram, 2000) Superior-subordinate communications should be feedback-oriented, and subordinates should submit a proposal without feeling oppression. Gilbert and Cordey-Hayes (1996) state that feedbacks enhance creativeness in technological innovation. Similarly, Van den Bossche et al. (2010) emphasize that feedbacks can play a part in fostering the motivation of knowledge transfer. Feedbacks can be both positive and negative, but the sore spot is that members should believe that given feedbacks are honest and not for contempt.

34	**Variable Keyword/Explanation**: Confidence in submitting proposals
	Question: In my company, there is a culture of the meeting where employees can make suggestions without any experience or title differences.

35	**Variable Keyword/Explanation**: Giving feedback
	Question: In my company, employees give open and honest feedback to each other.

As we mentioned, the key factor of knowledge transfer is social relations. In successful learning organizations, members share common goals and internalize the idea of behaving collectively. (Li, 2005) Holste and Fields (2010) establish that knowledge sharing is increasing while mutual care between members increases. Sankowska (2013) finds that a trusting environment provides the appropriate condition for knowledge creation, knowledge transfer, and better innovative processes. Trustworthiness is essential for strong social relations in organizations, and providing this environment needs social effort. Spending time between team members contributes to trustworthiness organizations need. (Levin and Cross, 2004)

36	**Variable Keyword/Explanation**: Creating an environment of trust

Question: In my company, employees spend time with each other to create an environment of trust.

37	**Variable Keyword/Explanation**: GENERAL - Transferring Knowledge

Question: Overall, I find my company's knowledge transfer ability is successful.

3.2.5 **Knowledge Management**

Large scale organizations can not manage knowledge without valid information systems. Lots of information should become available in a certain order and system for their members. Management Information System (MIS) and Knowledge Management System (KMS) make knowledge accessible for all those needs to use it with a little difference. (Lin, Chang, and Tsai, 2016) (Alavi and Leidner, 1999) Meso and Smith (2000) indicate that instant access to knowledge can make organizations more commanding on technology management.

38	**Variable Keyword/Explanation**: Efficiency of knowledge management system

Question: My company enables employees to get the information they need quickly and easily anytime.

KMS awareness has a determining role in knowledge management. Organizations are negatively affected by a lack of awareness of KMS in cases of creating, transferring, and retaining knowledge. (Saad et al. 2005) Chandran and Raman (2009) indicate that one of the common problems that obstruct KMS is awareness.

39	**Variable Keyword/Explanation**: Awareness of existing knowledge management system
Question: Company employees are aware of the use of the existing knowledge management system.	

Management of knowledge is a complicated and drastic business. Notably, large scale organizations have numerous concerns in different areas, from technology creation to security issues. In this context, knowledge privacy is a controversial issue for companies; they can not open all the knowledge to all of their members in concern of privacy, and this may create obstacles to reach knowledge for developing the technology. In an optimum circumstance, organizations make knowledge available right members of theirs with not breaching privacy.

40	**Variable Keyword/Explanation**: Absence of bureaucratic barriers
Question: I do not face bureaucratic obstacles to access internal knowledge.	

41	**Variable Keyword/Explanation**: GENERAL - Knowledge Management
Question: Overall, I think my company's knowledge management ability is successful.	

3.2.6 Organizational Learning

In the study, we define three subcategories of organizational learning, which are creating, retaining, and transferring knowledge. Also, current knowledge is added to analyze the source of acquired knowledge. Knowledge management is also investigated in the study as an inclusive structure of organizational learning. However, the uncategorized items that are relevant to organizational learning also exist.

As we mentioned before, organizational learning has both human-oriented and system-oriented issues. Members perceived as the key factor of knowledge are defining organizational learning performance. Cabrera and Cabrera (2002) put forward that group identity contributes public good. Organizations benefit maximum from members who feel committed to the company and share the common vision.

42	**Variable Keyword/Explanation**: Superior identity of the company (Personal)

Question: I adopt the superior identity of the company, and I feel committed to the company.

43	**Variable Keyword/Explanation**: Superior identity of the company (General)

Question: I think that employees generally adopt the company's superior identity and are committed to the company.

Companies have more than one concern in business life. While they are trying to increase their incomes, they hire skillful employees, develop technology, and do marketing reviews. The performance of companies defines their short term positions in the market. However, even lots of companies neglect organizational learning for short term concerns; it is the most vital driver of the knowledge economy. Continuous and systemized learning can contribute to organizations' visions in mid, long, or even short term.

44	**Variable Keyword/Explanation**: Focusing on learning

Question: I think my company has a learning-oriented structure rather than performance.

The determining skill for a job is as important as giving the right people to the right job. For minimizing organizational time and money loss, companies try to hire or assign the right peoples for jobs. (Sure, Maedche, and Staab, 2000) Besides that, the current employees of organizations should be aware of skill-job relations for their improvement. Individuals' skill analysis for future works is one of the extreme points

of organizational learning. It requires both organizational transparency and an appropriate learning environment to provide personal development.

45	**Variable Keyword/Explanation**: Identifying future skills needs of staff
	Question: In my company, employees determine the skills they need for future work.

Depending on the skill analysis, being aware of training needs is valuable for both organizations and individuals. Organizations can not realize the instant or minor training needs, but individuals who work in R&D projects are aware of what they need to learn. As one of the direct knowledge creatin methods, training contributes to organizational learning. (Van den Bossche et al. 2010) Hence, supportive organizations for training enhance both members' motivations and learning environment.

46	**Variable Keyword/Explanation**: Training support
	Question: My company supports the training demands of its employees.

3.2.7 Open-Ended and Interview Questions

Kim (1998) states that organizations are not dependent on any specific individual, but they depend on individuals to learn. All the knowledge organizations have created and learned by individuals; hence, there is a crucial link between organizational learning and individual learning. Subtle aim of every R&D organization is that absorbing all the knowledge that its members hold. Thus, private learning has the lion's share of organizational learning and knowledge management, as well.

Open-Ended Question - 2

What kind of processes should be implemented for the development of personnel learning? (Private Learning)

Interview Question - 1

What problems do you see regarding the learning processes of the staff?

* What can be done to solve these problems?

Knowledge economy makes organizations eager for knowledge. Even though knowledge management is the primary aim for organizations, the source of this management is the most unrepudiated phenomenon: knowledge. The great variety and scale of knowledge cause managerial concerns; however, it is preferred against lack of knowledge that brings exility in many processes. This dilemma makes the organizational learning process more dynamic and extends the potential acquisition. (Nonaka et al. 2000)

Interview Question - 4

What kind of applications can be initiated in the organization that can increase?

Liebowitz (2008) explains that knowledge retention is mainly about the memory of organizations. From lessons learned archive to technical knowledge that acquired but not experienced yet. Issues on the retention process of knowledge can be determining factors for organizations' futures. Retaining knowledge is the most balanced process of organizational learning between human and system sides. Hence, this situation increases the potential risks and gain for knowledge management.

Interview Question - 5

What are the problems with the process of keeping the knowledge in the organization?

* What can be done to solve these problems?

Creating and transferring phases of organizational learning are human-oriented processes even they have lots of system interactions. The transferring of these is beyond to be being human-oriented; it is the multi-human-oriented process. As Cabrera and Cabrera (2002) mention, knowledge sharing studies interact with sociological research, mostly. As human interaction increases, both problems and creative solutions are multiplying in any organization.

What are the problems with the transfer of knowledge in the organization?

* What can be done to solve these problems?

Open-Ended Question - 3

What can be done to make knowledge sharing more functional in the organization?

Organizational learning is an issue that performance measurement can not be presented by numerical values. (Goh and Richards, 1997) Its success and failure may show up in the mid or long term, and in-house solutions may not serve the purpose, all the time; even they do results may be taken in a long time. Goh and Richards (1997) compare organizations learning capability by consideration of their organizational learning processes. They claim that benchmarking is one of the useful tools that help to develop organizational learning.

Optional Interview Question - 1

What kind of practices are there in your previous company that you think will improve the learning processes if implemented in your current company?

Optional Interview Question - 2

Optional-2. Are there cultural barriers to learning processes compared to abroad? How can these barriers be minimized in the corporate environment?

Optional Interview Question - 3

Optional-3. Are there examples of good practice that can be integrated into your company from the learning processes at the academy? What?

As we mentioned above, organizational learning is a non-numeric managerial process. There are lots of inputs that affect learning processes. Fiol and Lyles (1985) suggest that there are mainly four elements that affect organizational learning; culture, strategy, structure, and environment. These are descriptive factors, and it is not possible to measure them through qualitative methods. Every organization has distinctive features arising from the same factors that Fiol and Lyles (1985) present. The culture and environment may make it complicated that analyze organizational learning from outside of the company. Similarly, Levitt and March (1988) claim that organizational learning involves encoding historical effectuation into routines that guide organizational behavior. This process is not transparent for an outsider looking in, so analyzing organizational learning requires immense theoretical knowledge incorporated with the experience or inside information from experienced members of organizations who know the historical events that affect the learning structure of the company.

Open-Ended Question - 1

What applications should be established for the development of the learning processes of the organization? (Company Learning)

Open-Ended Question - 4

What are the barriers that arise in the learning processes of the organization? (Company Learning)

* What should be done to overcome these obstacles? What kind of applications would you do if you were authorized?

Interview Question - 2

What problems do you see with the organization's learning?

* What can be done to solve these problems?

Interview Question - 3

What innovative applications can be established for the development of the organization's learning processes?

3.3 Questionnaire

The first research question of this dissertation was as follows: What are the factors that support and obstruct organizational learning in the defense industry company? For the purpose of reaching the answer to this question, it is decided that the best opinion to have this response is to prepare a questionnaire.

In this study, a Likert-Scale questionnaire is selected due to several advantages that such questionnaires have: (Crawford, 1997):

- Because we do not want to force the interviewee to choose yes or no option, we give them a space that they can place themselves,

- Outcomes of Likert-scale are utilized very effectively and can be interpretable,

- Likert-Scale surveys give applicability with different communication methods.

But also, they have disadvantages by nature of closed questions:

- Questions prevent respondents from expressing their ideas,

- Questions can be new for respondents, so that they did not consider it before.

For overcoming this situation, open-ended questions are placed in the questionnaire. Open-ended questions are considered necessary for comprising potential answers that can not be taken from closed questions.

In the process of preparing questions, attention was paid for those questions to be suitable for both descriptive and statistical analysis. It is decided that the best method to have the adaptation of this flexibility and having a meaningful questionnaire is to use nine steps of Crawford (1997), that shown in Figure 6.
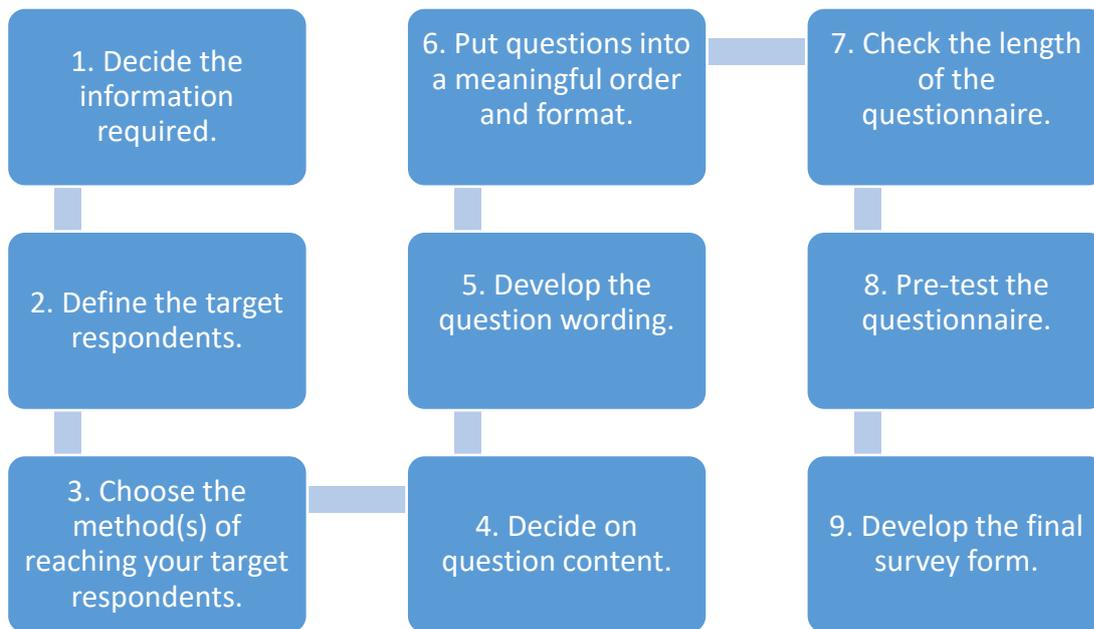
Figure 6: 9 Steps Involved in the Development of a Questionnaire (Crawford, 1997)

3.3.1 **Deciding on the Required Information**

The primary purpose of this dissertation was defined to figure out the firm level learning factors of the defense industry. As a first part of the thesis, the first research question is prepared to investigate current due diligence about the organization and its learning system and culture.

Investigating of supporting and obstructing factors of organizational learning approach is found to be useful to figure out the current situation of the firm. In this way, an assessment of organizational learning culture can be done by comparing the strengths and weaknesses of the firm. It is considered that knowing what obstructs the organizational learning performance can be critical for making provision for knowledge management. In a similar way, supporting factors of the firm on organizational learning can be used to have more effective strategies for the learning system.

As explained in 2.1, information about current knowledge, knowledge creation, retaining knowledge, transferring knowledge, knowledge management, and organizational learning of the firm is required. In this context, variables are determined

in [4.4](#) to have useful information for evaluating organizational learning of the defense industry.

3.3.2   **Defining the Target Respondents**

The chosen firm for this research is composed of different types of R&D departments. Departments having activities to advance new technologies for both the firm and the country is chosen for the questionnaire instead of departments practicing routine activities. In this context, five departments are chosen to apply the questionnaire.[6]

R&D engineers play a significant role in the company's learning processes. They are most open to learning because they are interested in research and development rather than routine work.

Because of these concerns, R&D engineers from the related departments are defined as respondents for having the opportunity for meaningful comparisons and assessments.[7]

3.3.3   **Choosing the Method(s) of Reaching Your Target Respondents**

It is decided that the best method to reach the target respondent is being in personal interaction. For executing this method, all prepared questionnaires are handed out, and the purpose of the thesis is described to **140** respondents, even though the cover page of the questionnaire gives this information.

The online survey method is also considered, but in the sense of the potential low rate of response and privacy concerns, this method is abandoned.

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[6] Department names are not given due to confidentiality.

[7] The total number of R&D engineers in the company is not given due to confidentiality.

3.3.4 **Deciding on Question Content**

After completion of the conceptualization, identified variables are acquired. Variables are related to literature, and as a natural consequence of this, they represented general situations. For the purpose of gathering questions for interrogating for supporting and obstructing factors of organizational learning, sector experts were asked to help generate questions in accordance with the defense industry.

Questions are prepared by taking into consideration the availability of analyzing supporting and obstructing factors of organizational learning. With this method, it is considered to have purposive current due diligence that can be obtainable.

As explained before, questions about current knowledge, knowledge creation, retaining knowledge, transferring knowledge, knowledge management, and organizational learning of the firm are prepared. 46 different questions are generated for 46 variables.

3.3.5 **Developing the Question Wording**

All questions in the questionnaire are prepared with a perspective of "What do we want to do with the answer?". Thus, it is thought that the responses to be obtained will provide appropriate analysis.

It is focused on preparing suitable questions for the survey. As shown in Figure 7, a particular pathway is followed to have appropriate questions. (SkillsYouNeed, 2018)
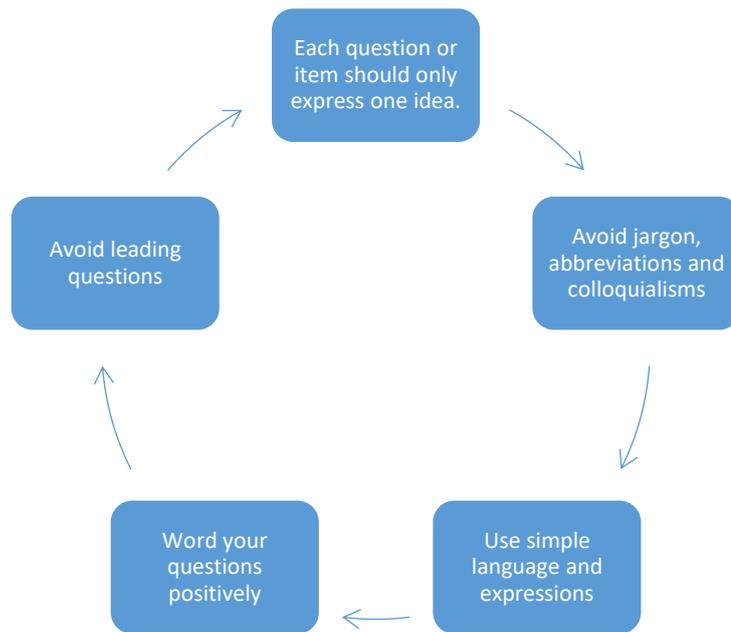
Figure 7: Steps of Question-Wording (SkillsYouNeed, 2018)

1. *Each question is generated to express only one idea.*

   - Having only one idea is considered that provide more comprehensible questions. Questions are cleared from hidden suggestions that make respondent validate the truth of them unwittingly.

2. *Using terminology, abbreviations, and colloquial expression are avoided.*

   - Jargon is avoided to use in surveys because they create potential unclarity of questions. When questions are not understood, they become invalid.

   - It is considered that the used word "tacit" may not be known by some participants. To overcome this situation, the explanation of "tacit knowledge" is made just below the questionnaire.

3. *Attention was paid for using simple language and statements.*

   - Similarly, declared in the previous step, simple language is considered as essential to creating comprehensible questions, and it makes us confident that our respondents have made out the questions correctly.

4. *Questions are expressed in a favourable manner.*

- It is avoided to confuse respondents with directive or tricky questions. Questions are prepared with positive meaning that if respondents feel good about the phenomenon of the question, they agree or strongly agree with it. This is assumed essential to preventing that people may choose the wrong way in Likert-Scale. The best solution to this situation is to make the difference visible.

5. *Leading questions are avoided.*

- Researcher opinions are not allowed to lead the respondents' answers. For this purpose, it is avoided by leading questions that impose the researcher's view to respondents.

3.3.6 **Putting Questions into a Meaningful Order and Format**

After the generation phase, questions are sorted in meaningful order by considering the entire questionnaire. Opening questions are from easiest and ones with answerable in comfort. It is focused on giving respondents an accurate and suggestive impression with the first questions because of their impact on the entire questionnaire.

After that, a meaningful flow of questions is designed. Questions are started with current knowledge to understand what has been the resource of knowledge that inherited before the company. Shortly after, questions about knowledge creation relatively starting point of organizational learning are asked. Retaining knowledge questions are then placed. Because after acquiring knowledge, the first thing is storing what created. Questions are continued with transferring knowledge. It is only possible to transfer knowledge if creation and retention are completed. Organizational learning and knowledge management questions are placed toward to end, because of their comprehensiveness.

Questions are not separated by their categories with sharp lines. For maintaining a meaningful order, some questions are sprinkled into other categories.

3.3.7 **Checking the Length of the Questionnaire**

It is thought that having a high rate of response in a questionnaire that study with the limited participant is indispensable. Each question and the questionnaire itself have to be optimum length. Questions shorter than they should be may fail to evaluate the phenomenon, while lengthy questions can make respondents bored and distracted.

All of the questions in the resource are designed to be devoured and responded to. Similarly, the questionnaire itself is kept in length to be finished in 15 minutes.

3.3.8 **Pre-testing the Questionnaire**

The draft questionnaire is presented to four persons close profiles with target respondents. They are asked to response all questions and interpret all of them;

- If questions, as they are expressed, will fit for the purpose,

- If questions are sorted in a meaningful order,

- If questions are understandable,

- If additional questions are needed to import,

- If the instructions to respondents are satisfactory.

Feedback is gathered from each of them, and corrections are then made. Completion durations are also collected to verify the applicable length of the questionnaire.

3.3.9 **Developing the Final Survey Form**

After the previous eight steps, the questionnaire form is finalized. Procedural descriptions and instructions for interviewees completed. Afterward, page layout and physical appearance of the form are consummated, as given in Appendix B.

The questions were prepared in five different types considering that more comprehensive results could be obtained. In order to evaluate the current situation

independently, questions of the "**Usage of External Knowledge**" type are aimed to find out whether the knowledge gained from the company is used in business life. "**Knowledge-Enhancing**" questions help to identify which factors increase or do not increase the technical knowledge of the staff. "**Employee-Related**" questions examine the effects of company employees on organizational learning, while "**Company-Related**" questions investigate situations under the responsibility of the company. As mentioned in Section 3.1, "**General Evaluation**" questions for five of six variable categories are included in the questionnaire as the last type. The question-type relationship is given Table 6.

3.4 Quantitative Analysis

Within the scope of the survey, 100 out of 140 forms distributed are received and a return rate of 71.4% is achieved. The answers to the questions prepared according to the Likert scale of the questionnaire are examined in detail in 4.1. Demographic information of the participants of the questionnaire was extracted, and examinations were made about the profiles. The questions in the survey were defined together with the variables to which they were connected.

Descriptive statistics of survey questions are given to conduct a comprehensive analysis, and the averages were interpreted in this context.

The section where the statistics that stand out according to the categories of variables are highlighted continues with the verification section.

The 5-point Likert questionnaire, which is designed to help participants better position themselves, provides more alternatives to the employees than "Agree", "Disagree" and "Neutral". While the employees can comfortably mark their answers with plenty of options, responses are examined at background whether they agree or not agree with the questions. On the assumption that the cases having means above three are agreed, a validation study is conducted to test the participants' responses for compliance with agreeing status.

Because respondents have different experiences, and different expertise the differences between the choices of the Likert-scaled questions for the participants may be at different levels. For example, the difference between "Agree" and "Neutral" may be much more or less than the difference between "Agree" and "Strongly Agree". Besides, while "Neutral" is understood as an option for neither "Agree" nor "Disagree" by some participants, some might not have an opinion about the question.

As Figure 8 shows, as a tool of validation, the 3-scale results for each participant are derived by downing the "Agree" and "Strongly Agree" options to "Agree" and by downing the "Disagree" and "Strongly Disagree" options to "Disagree".

The distribution of the percentages of the participants to the questions according to the derived results is examined, and their compatibility with the descriptive table is evaluated.
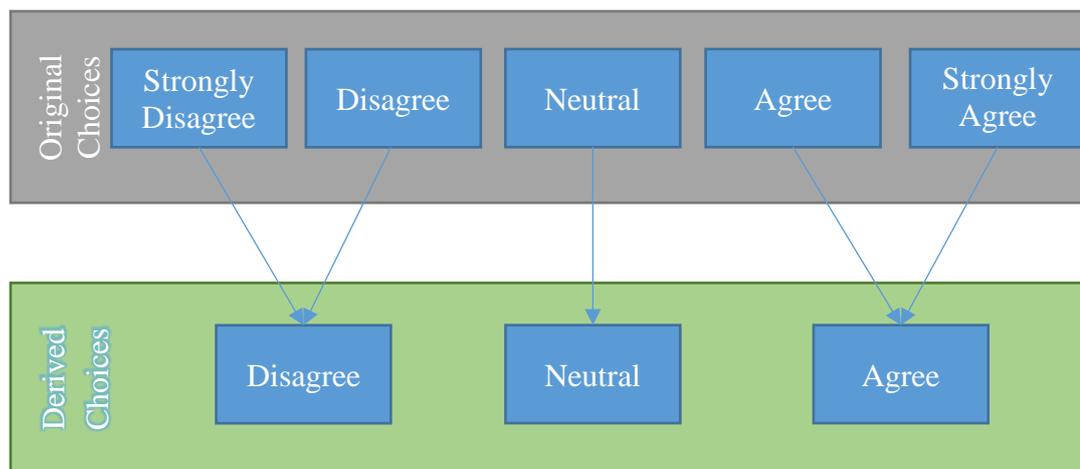
Figure 8: Derivation of the Likert-Scale Choices

3.5 Semi-Structured Interviews

The second research question of the dissertation is: How to make **organizational learning more efficient** in the defense industry? This question is generated as complementary to the first question to elicit what actions should be taken to improve firm level learning system.

A Likert-scale questionnaire is used to resolve the first research question. Open-ended questions are also used to obtain more detailed information about the organization's learning structure.

It is decided to use the interview method to figure out the answer to the second question because of the advantages it has. (Harrell and Bradley, 2009)

- More detailed information can be obtained by interview,

- Contradictory information can be resolved,

- Emphasizing can be put on the critical points,

- Time can be used more freely,

- Because of not being a pen-and-paper survey, people can pay more attention,

- The sensitivity and classification of the issue can be taken care of by the interview.

The semi-structured interview is selected because adequate information (opinions, perceptions, attitudes, expert knowledge, facts, descriptions of processes) can be acquired, and a questionnaire was already used that can give all information a structured interview can give.

3.5.1 **Designing of the Interview**

To design the interview, the process Harrell et al. (2009) suggested is followed. The second research question is probed, just after selecting the interview type. The main concern is, what do we hope to learn from interviewees. To figure out the ways to make organizational learning more efficient, knowledge creation, retaining knowledge, and transferring knowledge performances of the firm are determined as the focused concern. These three topics are placed on analyzing the current situation and on taking opinions for improving the system.

The source of information is then considered to decide the target groups. Because of the main actors of R&D processes are engineers, they are considered as the best sources to give opinions to the organizational learning structure. Five different participant types are determined to have more inclusionary results, which are:

1. Experienced and worked in another company (first type),

2. Experienced and worked in the academy (second type),

3. Experienced and lived in abroad (third type),

4. Experienced and worked in only the current company (fourth type),

5. Inexperienced/semi-experienced (fifth type).

A criterion is defined for ten years of total work-life for experienced personnel, and it is five years for inexperienced ones at most.

As mentioned above, all participants are interviewed to take opinions about the current structure of organizational learning of the firm and suggestions to make it more efficient. Furthermore, each of the first, second, and third types have an additional comparison question about their past experiences.

Finally, we determine the number of people needed to perform the interview as the last step of framing. It is decided to conduct an interview with 10 participants, two for every five types.

After the consideration of the all essential points to design an interview, the questions and the draft of the interview are completed as given in Appendix C.

3.5.2   Execution of the Interviews

Interviewing is a challenging method to use because the execution phase after designing the questions is as critical as designing. As shown in Figure 9, to execute a useful interview section, we adhere to six fundamental rules of Dillon et al. (1994)
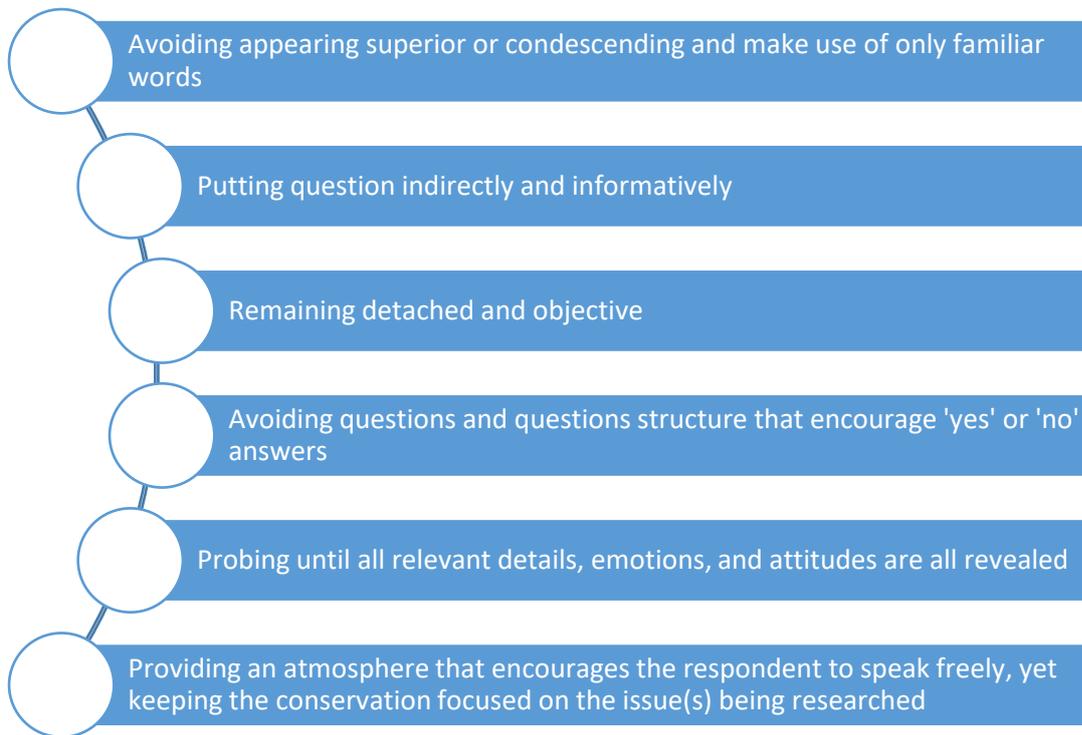
Figure 9: Six Fundamental Rules the Interviewer Must Adhere to (Dillon et al. 1994)

1. To avoid appearing superior and make use of familiar words, we stay away from terminology and jargon, and we generate interviews at the same level as respondents.

2. To put questions indirectly and informatively, we describe questions while asking them to be sure if we are in the same case with respondents.

3. To remain detached and objective, we do not comment on the question asked, and moreover, we do not give examples to avoid leading to interviewees.

4. To avoid encouraging yes or no answers, we design questions designed to take respondents' opinions detailed. We dispatch any questions that encourage yes or no answers.

5. To probe until all relevant details, emotions, and attitudes are all revealed, we do not pass any question to another until all the detailed answers wanted are taken. We try to insist on going detail in responses.

6. To provide an atmosphere to encourages the respondents to speak comfortably and keeping the interview focused on the issue, we propose tape-recording to the respondent before the conversation, but we do not insist on to make respondents comfortable. We execute the interviews at the meeting rooms for the same reason. We involve responses when we think the answers will get off the point.

3.6 Qualitative Analysis

The answers given to the open-ended questions at the end of the questionnaire were evaluated among themselves as the following method:

1. All of the answers to the wrong question, which resulted from the misunderstanding of the question, eventually moved to their right places,

2. All responses were analyzed and encoded,

3. More understandable inclusive groups were identified,

4. According to the coded and grouped answers, the most frequently taken answers for each question were listed, and the five most commonly answered responses were analyzed.

The common questions in the interview are examined from a broad perspective. Particular questions prepared for interview groups are analyzed separately in order to make comparisons with external situations.

3.7 Strategy Recommendations

After analyzing both quantitative data from Likert-Scale questions and qualitative data from both open-ended and interview questions, results are interpreted to find out the research questions' answers.

After identifying drivers and barriers to organizational learning of the company, strategies to improve the learning structure of the company have been proposed considering these factors.

3.8 Concluding Remarks

The chapter is about the methodology and the organization of the thesis. While the methodology is being described, organization of the thesis is paid attention. This chapter begins with the short introduction part that informs readers about the basic methods of the dissertation is using both qualitative and quantitative instruments.

After that, general conceptualization is described in Section3.1; this section describes how general and categorized variables are determined. As a result of this section, 41 variables are determined under six categories, and five general variables are generated under five of them. Organizational learning is not generated as a general variable because it is thought that it might create confusion.

In the Detailed Conceptualization section, all of the 46 variables are described in relation to the literature. Questionnaire and interview questions are presented after each explanation part of the variables.

Table 2: Factors Affecting Organizational Learning Based on the Empirical Literature

Variable Group	Relevant Literature	Keywords/Explanations
Current Knowledge		Use of undergraduate knowledge
		Use of graduate knowledge
		Previous experience
		GENERAL - Existing knowledge
Knowledge Creation	Leiponen (2010), Nonaka and Konno(1998), Allee (1997), Mishra and Bashkar (2011)	Learning with company training, career training
	Epple, Argote, and Devadas (1991)	Learning from Self-funded R&D projects
	Epple, Argote, and Devadas (1991)	Learning from Contractual R&D projects
	Barrett, Samuel et al. (2013), Kong et al. (2012)	Learning from teammates
	Louw and Zuber-Skerritt (2011), Bathelt et al. (2004)	Learning from conferences
	van Helden et al. (2010)	Learning from advisors, university teachers
	Asheim (2002), Puga and Trefler (2002), Mayer (2006)	Learning from subcontractors
	Caloghirou, Kastelli, and Tsakanikas (2004), Euzenat (1996)	Learning from in-house technical reports
	Bresnen et al. (2003), Schindler and Eppler (2003)	Learning from project review and progress meetings
	Régibeau and Rockett (2010), Lupu and Hanbury (2013)	Learning from patents and literature reviews
	Samadda and Kadiyala (2004), Powell et al. (1996), Inkpen (1998), Inkpen (1996)	Learning from collaboration
	Argyris (1991)	Learning opportunity
	Eraut (2007), Nonaka et al. (2000), Choi and Lee (2002)	Learning with listening for opinions of others
		GENERAL - Knowledge Creation

Table 2 (continued)

Variable Group	Relevant Literature	Keywords/Explanations
Retaining Knowledge	De Long and Davenport (2003), Levy (2011), Jarrar (2002)	Accessibility of lessons learned
	Nonaka et al. (2000)	Gathering knowledge from employees and making it available
	Bossche, Segers, and Jansen (2010), Nonaka et al. (2000)	Knowledge gained in field duties and training
	Deardorff and Djankov (2000), DeLong (2004)	Accessing knowledge on subcontractors
	Dyer and Nobeoka (2000)	Accessing patents and literature databases
	Hansen (2002), Argote and Ingram (2000)	Routing to in-house solutions
	Sure et al. (2000)	Retaining of skill database
		GENERAL - Retaining Knowledge
Transferring Knowledge	Hansen (2002)	Motivating to document knowledge
	Dyer and Nobeoka (2000)	Trusting environment for sharing knowledge
	Chennamaneni and Teng (2011), Hansen (2002), Argote and Ingram (2000)	Having the motivation to share tacit knowledge
	Sun and Scott (2005), Dyer and Nobeoka (2000)	Having the motivation to share knowledge with the team
	Koskinen et al. (2003), Hansen (2002)	Having the motivation to share knowledge with the project stakeholders
	Koskinen et al. (2003), Hansen (2002)	Having the motivation to share knowledge between teams
	Argote et al. (2000), Sun and Scott (2005), Chennamaneni and Teng (2011)	Brainstorming
	Gilbert and Cordey-Hayes (1996), Van den Bossche et al. (2010)	Confidence in submitting proposals
	Gilbert and Cordey-Hayes (1996), Van den Bossche et al. (2010), Argote and Ingram (2000)	Giving feedback

Table 2 (continued)

Variable Group	Relevant Literature	Keywords/Explanations
Transferring Knowledge	Levin and Cross (2004), Li (2005), Holste and Fields (2010), Sankowska (2013)	Creating a trusted environment
		GENERAL - Transferring Knowledge
Knowledge Management	Lin et al. (2016), Meso and Smith (2000), Alavi and Leidner (1999)	The efficiency of the management information system
	Saad et al. (2005), Chandran and Raman (2009)	Awareness of existing management information system
	De Long and Fahey (2000)	Absence of bureaucratic barriers
		GENERAL - Knowledge Management
Organizational Learning	Cabrera and Cabrera (2002)	Superior identity of the company (Personal)
	Cabrera and Cabrera (2002)	Superior identity of the company (General)
		Focusing on learning
	Sure et al. (2000)	Identifying the future skills needs of staff
	Bossche et al. (2010)	Training support

The selection of questionnaire type and its advantages are remarked in Section 3.3. The first research question seeks drivers and barriers for organizational learning in the defense industry company. Because a Likert-Scale questionnaire can gather the factors, questions are prepared systematically in this way. "9 Steps Involved in the Development of a Questionnaire" of Crawford (1997) is used to design the questionnaire as a whole, as given in Appendix B.

For Quantitative Analysis of the thesis, demographic analysis for the participants of the questionnaire and the interview is presented in Section 4.1. Descriptive statistics of survey questions were given to conduct a comprehensive analysis, and the averages were interpreted in this context. The section where the statistics that stand out according to the categories of variables are highlighted continues with the verification section. As a tool of validation, the 3-scale results for each participant are derived by

downing the "Agree" and "Strongly Agree" options to "Agree" and by downing the "Disagree" and "Strongly Disagree" options to "Disagree". The distribution of the percentages of the participants to the questions according to the derived results is examined, and their compatibility with the descriptive table is evaluated.

The Semi-Structured Interview section is to find the answer to the second research question: How to make **organizational learning more efficient** in the defense industry? The question is generated as complementary to the first question, but having its answers from the same method with the previous research question is not possible. Therefore, a semi-structured interview is decided to reach answers by consideration of the advantages Harrell et al. (2009) defined. Questions are then designed with following the rules that Harrell (2009) suggested. Interviewing is a challenging method to use because the execution phase after designing the questions is as critical as designing. To execute a useful interview section, we adhere to six fundamental rules of Dillon et al. (1994)

Within the scope of qualitative analysis, two separate studies were performed. First, open-ended questions are analyzed by coding and grouping into more general concepts. Second, interview outputs are exqmined. The common questions in the interview are examined from a broad perspective. Particular questions prepared for interview groups are analyzed separately in order to make comparisons with external situations.

In Strategy Recommendations Part, strategies to improve the efficiency of organizational learning performance of the company are proposed. Drivers and barriers to organizational learning of the company were taken into consideration during the strategy-making stages.

CHAPTER 4

ANALYSIS

The research consists of two main phases conducted to different attendees. First, the questionnaire that has both Likert-scale and open-ended questions is carried out. Second, semi-structured interviews are applied.

As stated before, Likert-scale questions are analyzed to have a comprehensive assessment of the current situation of the company in organizational learning. Afterwards, open-ended questions and interviews are analyzed for having more detailed arguments.

A return of 100 people is obtained from the questionnaire forms distributed to 140 people with a 71.4% response rate.

4.1 Quantitative Analysis

4.1.1 Demographic Analysis

As a result of Chapter 3, a 46-variable survey that each variable has its own question is generated conducted to R&D Engineers. (Appendix B). The demographic analysis of the respondents is given in Table 3.

The questionnaire is distributed to five departments that perform intense R&D activities. The respondents are R&D engineers (including both physicists and chemists that work as engineers). Since there is no selected group, except R&D engineers, respondents' demographic structures give insights about the human resources profile of related departments.

The fact that the industry has a high male population is also seen in the research: 16.0% of respondents are female. Only 20.0% of engineers has just a Bachelor's Degree and

aren't studying any graduate program. 13.0% of them have already a Ph.D., and 13.0% more are studying it. Potentially, 80.0% of respondents will have a graduate degree. 61.0% of respondents are younger than 35 years old, and only 7.0% of respondents older than 45. Almost half of the participants are Electrical and Electronics Engineers: 48.0%. 12.0% of participants graduated in Physics and Chemistry.

The highest rate in the title category belongs to Engineer A with 22.0%. 37.0% of respondents are Engineers E and F who can be called experienced engineers. The rate of the participants working in the current firm for less than one year is 11.0%. 67.0% of the respondents are working for the company one to ten years, and only 4.0% of them are working for the company for over 20 years.

In the category of total experience, 4.0% of participants have professional experience for less than one year. 77.0% of respondents have experience as a professional for one to fifteen years.

As we mentioned, the questionnaire distributed to five departments, and all of them have a different number of workers. 39% of participants are working for Department A. Rate of respondents working for Departments of B, C, D, and E are 15.0%, 18.0%, 15.0%, and 13.0% respectively.

We conducted interviews with ten R&D Engineers categorized by experience types. Four of these types represent experienced engineers, and one of them represents inexperienced/semi-experienced as given in Table 4. We have rated the employees who worked for more than ten years, as experienced.

Table 3: Demographic Analysis of Respondents of Questionnaire

		Distribution	Percentage
Gender	Female	16	16.0%
	Male	84	84.0%
Education Level	Bachelor's Degree	20	20.0%
	Master's Student	16	16.0%
	Master's Degree	38	38.0%
	Ph.D. Student	13	13.0%
	Ph.D.	13	13.0%
Age	Under 25	7	7.0%
	25-34	54	54.0%
	35-44	32	32.0%
	45 and Older	7	7.0%
Bachelor's Graduation	Aerospace Engineering	7	7.0%
	Physics	10	10.0%
	Electrical and Electronics Engineering	48	48.0%
	Mechanical Engineering	23	23.0%
	Metallurgical and Materials Engineering	10	10.0%
	Chemistry	2	2.0%
Title	Engineer A	22	22.0%
	Engineer B	7	7.0%
	Engineer C	17	17.0%
	Engineer D	17	17.0%
	Engineer E	21	21.0%
	Engineer F	16	16.0%
Experience in Current Firm	Less than 1 year	11	11.0%
	1-5 years	33	33.0%
	6-10 years	34	34.0%
	11-15 years	11	11.0%
	16-20 years	7	7.0%
	More than 20 years	4	4.0%
Total Experience	Less than 1 year	4	4.0%
	1-5 years	25	25.0%
	6-10 years	31	31.0%
	11-15 years	21	21.0%
	16-20 years	11	11.0%
	More than 20 years	8	8.0%
Department	Department A	15	15.0%
	Department B	18	18.0%
	Department C	39	39.0%
	Department D	15	15.0%
	Department E	13	13.0%

Table 4: Profile of Interviewees

Experience Type	Type Definition	Total Experience	Number of Interviewees	No. of Interviewee
1	Experienced and worked in another company	>10 years	2	1-2
2	Experienced and worked in the academy	>10 years	2	3-4
3	Experienced and lived in abroad	>10 years	2	5-6
4	Experienced and worked only in the current company	>10 years	2	7-8
5	Inexperienced/semi-experienced	<10 years	2	9-10

4.1.2 **Definition of Variables for Quantitative Analysis**

As described in Chapter 3, 46 variables were generated in the line of literature about organizational learning and knowledge. All variables have a positive impact on their variables group theoretically. The relation between literature and variable definitions and variable groups was given in Table 2. The variables with their questions are described in the questionnaire in Table 5.

For having useful and meaningful variable names, numbers are designated after abbreviated variable names based on the following mapping:

CK - Current Knowledge

KC - Knowledge Creation

RK - Retaining Knowledge

TK - Transferring Knowledge

KM- Knowledge Management

OL - Organizational Learning

Table 5: Definitions of the Drivers and Barriers of Organizational Learning

Variable Group	Variable	Definition	Question
Current Knowledge	CK-1	Use of undergraduate knowledge	1- Intensively, I use the knowledge I acquired in my undergraduate studies in my business life
	CK-2	Use of graduate knowledge	2- Intensively, I use the knowledge I acquired in my graduate studies in my business life
	CK-3	Previous experience	3- I use the knowledge that I acquired from the company or university that I worked before my current company
	CK-General	GENERAL - Existing knowledge	4- Generally, I use the information that I acquired outside the company (before or during my work) intensively in my business life
Knowledge Creation	KC-1	Learning with company training, career training	5- Career courses that I attend through my company, increase my knowledge
	KC-2	Learning from Self-funded R&D projects	6- Self-funded R&D projects that I work increase my knowledge
	KC-3	Learning from Contractual R&D projects	7- Contractual R&D projects that I work increase my knowledge
	KC-4	Learning from teammates	8- Technical discussions with my teammates increase my knowledge
	KC-5	Learning from conferences	9- Conferences I attended increased my knowledge
	KC-6	Learning from advisors, university teachers	10- Studies with local / international consultants and / or university teachers increase my knowledge

Table 5 (continued)

Variable Group	Variable	Definition	Question
Knowledge Creation	KC-7	Learning from subcontractors	11- Works with subcontractors (given package works) (excluding consultancy service) increases my knowledge
	KC-8	Learning from in-house technical reports	12- The current technical reports of my company increase my knowledge
	KC-9	Learning from project review and progress meetings	13- Project review and progress meetings increase my knowledge
	KC-10	Learning from patents and literature reviews	14- My patent research and literature searches increase my knowledge
	KC-11	Learning from collaboration	15- My company cooperates with different organizations to meet common needs
	KC-12	Learning opportunity	16- In my company, employees see problems at work as an opportunity to learn
	KC-13	Learning with listening for opinions of others	17- In my company, employees listen to the opinions of others before presenting their ideas
	KC-General	**GENERAL - Knowledge Creation**	**43- Overall I find my company's knowledge creation ability successful**
Retaining Knowledge	RK-1	Accessibility of lessons learned	19- My company makes learned lessons accessible to all employees
	RK-2	Gathering knowledge from employees and making it available	21- My company has all the technical knowledge I have and keeps it available

Table 5 (continued)

Variable Group	Variable	Definition	Question
Retaining Knowledge	RK-3	Knowledge gained in field duties and training	22- The information acquired in the tasks and trainings are completely transferred to the company so that they can be used
	RK-4	Accessing knowledge on subcontractors	24- I have full access to the knowledge generated by the subcontractors (knowledge on the subcontractor)
	RK-5	Accessing patents and literature databases	25- My company gives me easy access to patents and literature databases around the world
	RK-6	Routing to in-house solutions	26- My company encourages employees to seek in-house answers while solving problems
	RK-7	Retaining of skill database	42- My company maintains an up-to-date database of employee skills
	RK-General	**GENERAL - Retaining Knowledge**	**44- Overall I find my company's ability to retain knowledge successful**
Transferring Knowledge	TK-1	Motivating to document knowledge	27- My company provides appropriate motivating conditions for documenting information (time, accessibility, appreciation etc.)
	TK-2	Trusting environment for sharing knowledge	28- I feel a trust environment where I can share my technical knowledge comfortably within the company
	TK-3	Having the motivation to share tacit knowledge	29- Employees are motivated to share their tacit knowledge
	TK-4	Having the motivation to share knowledge with the team	30- I have enough motivation for the strong flow of information within the team

Table 5 (continued)

Variable Group	Variable	Definition	Question
Transferring Knowledge	TK-5	Having the motivation to share knowledge with the project stakeholders	31- I have enough motivation for a strong flow of information between project stakeholders
	TK-6	Having the motivation to share knowledge between teams	32- I have enough motivation for a strong flow of information between teams
	TK-7	Brainstorming	33- In my company, there are activities where employees from different experience and expertise come together and produce ideas.
	TK-8	Confidence in submitting proposals	34- In my company, there is a culture of meeting where employees can make suggestions without any experience or title differences
	TK-9	Giving feedback	35- In my company, employees give open and honest feedback to each other
	TK-10	Creating a trusted environment	36- In my company, employees spend time with each other to create trust
	TK-General	**GENERAL - Transferring Knowledge**	**45- Overall I find my company's knowledge transfer ability successful**
Knowledge Management	KM-1	The efficiency of the management information system	18- My company enables employees to get the information they need quickly and easily anytime
	KM-2	Awareness of existing management information system	20- Company employees are aware of the use of the existing management information system
	KM-3	Absence of bureaucratic barriers	23- I do not face bureaucratic obstacles to access internal knowledge

Table 5 (continued)

Variable Group	Variable	Definition	Question
Knowledge Management	KM-General	**GENERAL - Knowledge Management**	**46- Overall I think my company's knowledge management ability successful**
Organizational Learning	OL-1	Superior identity of the company (Personal)	37- I adopt the superior identity of the company and I feel committed to the company
	OL-2	Superior identity of the company (General)	38- I think that employees generally adopt the company's superior identity and are committed to the company
	OL-3	Focusing on learning	39- I think my company has a learning-oriented structure rather than performance
	OL-4	Identifying the future skills needs of staff	40- In my company, employees determine the skills they need for future work
	OL-5	Training support	41- My company supports the training demands of its employees

Table 6: Question-Type Mapping for Questionnaire

Question Type	Variable Group	Variable
Usage of External Knowledge	Current Knowledge	CK-1
		CK-2
		CK-3
Knowledge-Enhancing	Knowledge Creation	KC-1
		KC-2
		KC-3
		KC-4
		KC-5
		KC-6
		KC-7
		KC-8
		KC-9
		KC-10
Company-Related	Knowledge Creation	KC-11
	Retaining Knowledge	RK-1
		RK-2
		RK-3
		RK-4
		RK-5
		RK-6
		RK-7
	Transferring Knowledge	TK-1
		TK-7
		TK-8
	Knowledge Management	KM-1
		KM-3
	Organizational Learning	OL-3
		OL-5
Employee-Related	Knowledge Management	KM-2
		KC-12
		KC-13
	Transferring Knowledge	TK-2
		TK-3
		TK-4
		TK-5
		TK-6
		TK-9
		TK-10
	Organizational Learning	OL-1
		OL-2
		OL-4
General Evaluation	Current Knowledge	CK-General
	Knowledge Creation	KC-General
	Retaining Knowledge	RK-General
	Transferring Knowledge	TK-General
	Knowledge Management	KM-General

4.1.3 Descriptive Analysis

Table 7 gives descriptive statistics of the questionnaire result. All variables in Current Knowledge have means greater than 3,50. This indicates that engineers are carrying their knowledge from outside factors of the company. Especially employees who have experience in graduate studies (CK-2) and/or different companies (CK-3) use their external knowledge in the current company. There are two main reasons for this result; first, employees start graduate programs after they work in the sector, and they specialize in their area, academically. Second, the company prefers the employees who have worked in the sector or in the field about their R&D activities.

In the Knowledge Creation Group, all variables' means are greater than 3,00, which is called the neutral point. Among all variables in the questionnaire, this is the group that has some variables' means greater than 4,00. Creating knowledge from technical discussions with teammates (KC-4) has the highest mean of the study. Because learning from interaction with teammates is one of the most efficient ways to create tacit knowledge, this result is not surprising. (Barrett et al., 2013) (Kong et al., 2012) As shown in results, conferences are one of the influential knowledge sources for R&D engineers (KC-5). In general, engineers attend conferences that they related to, and most of these meetings present advanced knowledge in an area. As a matter of course, R&D workers face many different problems for not only themselves but also for the team. At those moments, engineers need to find solutions and alternative ways to achieve their goals. According to survey results, patent and literature review is one of the common ways to reach knowledge to find solutions for the R&D Engineers (KC-10). As in many areas of lifetime, "learning by doing" is an essential method for gaining knowledge in R&D activities as well. The primary purpose of the employment of R&D engineers is to conduct R&D projects of the company. There are two types of R&D projects: Self-funded and Contractual. Both variables' means of Learning from Self-funded (KC-2) and Contractual (KC-3) projects are greater than 4,10. Self-funded projects are slightly higher because the time limitation of the Contractual projects can make R&D Engineers respond faster so that some learning opportunities can be missed to solve the problem in time. Learning from advisors, university teachers, (KC-6), and collaboration (KC-11) with different organizations are other high rated knowledge

creation sources as the questionnaire results. Similar to the answers in the group, respondents have positive opinions about the company's ability to create knowledge. (KC-General)

Five of eight means of variables in Retaning Knowledge Group is less than 3,00. As supportively to KC-10, employees are satisfied with the company's facilitation to access patents and literature databases (RK-5). According to the survey, the respondents think that the company does not make learned lessons accessible to all employees (RK-1). This result shows that workers suffer from finding the solution to a problem experienced before. The lowest mean among the answers belongs to the variable about maintaining an up-to-date database of employee skills (RK-7). For preventing unnecessary time consumption and duplicated jobs, it is essential to know "who knows what" in organizations. (Lundvall & Johnson, 1994) Although the general question about retaining knowledge has a mean slightly below 3,00, it is the closest mean to the neutral point (RK-General). Thus, we can say that there is a hesitation in employees about the company's ability of the Retaining Knowledge.

In the Transferring Knowledge Group, it is notable that different means of variables between similar questions. The highest mean of the variable belongs to "having the motivation to share knowledge with the team" (TK-4). "Motivation to share knowledge between teams" (TK-6) follows the TK-4, and to share between project stakeholders (TK-5) is the last among similar questions. The result shows that devotion to the team is higher than the projects. Transferring knowledge is mainly about personal interactions, and the result supports this phenomenon because team members are spending more time to enable knowledge trade with each other. One of the variables that have a mean less than the neutral point is brainstorming (TK-7). Respondents think that there are no sufficient systematic brainstorming meetings that gather the different levels of experienced employees. Motivating to document knowledge (TK-1) has the lowest mean among variables in the group. When considered that this question is related to providing appropriate motivating conditions (time, accessibility, appreciation) for documenting technical knowledge, respondents anticipate better conditions. Because it is the lowest mean in the general questions, the ability of the company to Transferring Knowledge can be considered insufficient (TK-General).

The Knowledge Management Group is one of the low rated parts of the questionnaire. Although respondents admit that the company enables employees to get the information they need quickly (KM-1), they claim that the company fails to make employees aware of existing MIS (KM-2). The definition of this discrepancy is that the company has a capable MIS but not systematically informs the employees about what it is capable of in detail. Most of the employees think that they face bureaucratic barriers to access the required knowledge (KM-3). The notion of the defense industry can be an argument in this situation because of classified information. However, it obstructs to access the required knowledge. In general, the Knowledge Management ability of the company is not found successful (KM-General).

As the last group, Organizational Learning has high rates for its variables. Superior identity of the company is asked in two different versions; the first question is asked respondents for themselves, whether they adopt the superior identity of the company and they feel committed to the company (OL-1). And then the same question for other employees of the company (OL-2). As a result, OL-1 is notably higher than OL-2. Respondents think that they are more committed to the company than others. Due to the high rate of "Training support" (OL-5), we can conclude that supporting the training demands of employees is appreciated. The only variable that has a mean below the neutral point is focusing on learning (OL-3). Respondents have clear thoughts that the company has a performance-oriented structure rather than learning.

Table 7: Descriptive Statistics of Variables

	Valid	Missing	Mean	Mode	Median	Std. Deviation	Minimum	Maximum
CK-1	100	0	3.63	4	4.00	.981	1	5
CK-2	80	20	3.83	4	4.00	1.156	1	5
CK-3	50	50	3.82	5	4.00	1.155	1	5
CK-General	100	0	3.52	4	4.00	1.059	1	5
KC-1	87	13	3.64	4	4.00	1.248	1	5
KC-2	93	7	4.22	5	4.00	.858	2	5
KC-3	91	9	4.19	5	4.00	.930	1	5
KC-4	100	0	4.41	5	5.00	.805	1	5

Table 7 (continued)

	Valid	Missing	Mean	Mode	Median	Std. Deviation	Minimum		Maximum
KC-5	87	13	4.25	4	4.00	.852	1	5
KC-6	78	22	4.13	4	4.00	.873	1	5
KC-7	75	25	3.39	3	3.00	1.126	1	5
KC-8	100	0	3.37	3	3.00	.981	1	5
KC-9	100	0	3.43	4	4.00	1.075	1	5
KC-10	100	0	4.32	5	4.00	.777	2	5
KC-11	100	0	4.03	4	4.00	.771	2	5
KC-12	100	0	3.24	3	3.00	.976	1	5
KC-13	100	0	3.32	3	3.00	.984	1	5
KC-General	100	0	3.45	4	4.00	.957	1	5
RK-1	100	0	2.70	3	3.00	1.040	1	5
RK-2	100	0	2.94	3	3.00	1.108	1	5
RK-3	100	0	2.86	3	3.00	1.110	1	5
RK-4	71	29	3.06	3	3.00	1.068	1	5
RK-5	100	0	3.82	4	4.00	.869	1	5
RK-6	100	0	3.39	4	4.00	.863	1	5
RK-7	100	0	2.50	3	3.00	.905	1	4
RK-General	100	0	2.97	3	3.00	1.068	1	5
TK-1	100	0	2.58	2	2.50	1.093	1	5
TK-2	100	0	3.51	4	4.00	1.078	1	5
TK-3	100	0	3.00	3	3.00	1.092	1	5
TK-4	100	0	3.83	4	4.00	1.025	1	5
TK-5	100	0	3.53	4	4.00	1.039	1	5
TK-6	100	0	3.63	4	4.00	1.031	1	5
TK-7	100	0	2.93	2	3.00	1.217	1	5
TK-8	100	0	3.32	4	3.00	1.118	1	5
TK-9	100	0	3.03	3	3.00	1.218	1	5
TK-10	100	0	3.34	4	3.00	.956	1	5
TK-General	100	0	2.86	3	3.00	1.035	1	5
KM-1	100	0	3.20	4	3.00	1.082	1	5
KM-2	100	0	2.80	3	3.00	.910	1	5
KM-3	100	0	2.76	3	3.00	.986	1	5
KM-General	100	0	2.88	3	3.00	.998	1	5
OL-1	100	0	3.82	4	4.00	1.009	1	5
OL-2	100	0	3.36	4	3.00	.948	1	5
OL-3	100	0	2.66	3	3.00	1.037	1	5
OL-4	100	0	3.21	3	3.00	.967	1	5
OL-5	100	0	3.43	4	4.00	1.037	1	5

4.1.4 Validation of the Questionnaire

As described in Section 3.4, the differences between the choices of the Likert-scaled questions for the participants may be at different levels. For example, the difference between "Agree" and "Neutral" may be much more or less than the difference between "Agree" and "Strongly Agree". To increase the reliability of the study, a table is prepared for verification purposes by combining the "disagree" with the "strongly disagree", then "agree" with "strongly agree". Percentages of "Neutral", "Disagree" and "Agree" are given in Table 8. To show the differences more clearly, the difference between the "Agrees" and the "Disagree" is presented in a separate column.

Alike to the predecessor table, the high agree rate of the questions prepared in the category of Knowledge Creation is remarkable. The six questions with the highest rate of Agrees are also the "Knowledge-Enhancer" type. RK-1, RK-3, TK-1, TK-7, and OL-3 are the variables that the rates of Neutral are the superiors, and all these variables are "Company-Related" type questions. Similarly, four out of the five highest rates of Disagreed answers are among "Company-Related" types.

The Mean column in Table 7 and the Differences column in Table 8 were compared, and the difference was expected to be positive for the variables above the average of 3.00. Among all the questions, three of them gave different results with Table 7. The differences in KC-12 and RK-4 are respectively -4.00% and -11.3%; however, the means of them were above 3.00. Additionally, the positive difference of the TK-7 contradicts the average of less than 2.00. It is observed that two tables are compatible for all other variables.

Table 8: Percentages of Combined Results of the Questionnaire

Variable	Valid	Missing	% of Neutral	% of Disagree and Strongly Disagree	% of Agree and Strongly Agree	Difference
CK-1	100	0	16.0%	19.0%	**65.0%**	46.0%
CK-2	80	20	17.5%	12.5%	**70.0%**	57.5%
CK-3	50	50	16.0%	16.0%	**68.0%**	52.0%
CK-General	100	0	18.0%	22.0%	**60.0%**	38.0%

Table 8 (continued)

Variable	Valid	Missing	% of Neutral	% of Disagree and Strongly Disagree	% of Agree and Strongly Agree	Difference
KC-1	87	13	19.5%	18.4%	**62.1%**	43.7%
KC-2	93	7	6.5%	8.6%	**84.9%**	76.3%
KC-3	91	9	7.7%	8.8%	**83.5%**	74.7%
KC-4	100	0	3.0%	8.0%	**89.0%**	81.0%
KC-5	87	13	4.6%	5.7%	**89.7%**	83.9%
KC-6	78	22	5.1%	12.8%	**82.1%**	69.2%
KC-7	75	25	18.7%	36.0%	**45.3%**	9.3%
KC-8	100	0	15.0%	39.0%	**46.0%**	7.0%
KC-9	100	0	20.0%	27.0%	**53.0%**	26.0%
KC-10	100	0	3.0%	10.0%	**87.0%**	77.0%
KC-11	100	0	2.0%	22.0%	**76.0%**	54.0%
KC-12	100	0	20.0%	**42.0%**	38.0%	-4.0%
KC-13	100	0	19.0%	36.0%	**45.0%**	9.0%
KC-General	100	0	16.0%	28.0%	**56.0%**	28.0%
RK-1	100	0	41.0%	**35.0%**	24.0%	-11.0%
RK-2	100	0	32.0%	**35.0%**	33.0%	-2.0%
RK-3	100	0	36.0%	**33.0%**	31.0%	-2.0%
RK-4	71	29	26.8%	**42.3%**	31.0%	-11.3%
RK-5	100	0	8.0%	21.0%	**71.0%**	50.0%
RK-6	100	0	14.0%	35.0%	**51.0%**	16.0%
RK-7	100	0	44.0%	**45.0%**	11.0%	-34.0%
RK-General	100	0	30.0%	35.0%	35.0%	0.0%
TK-1	100	0	50.0%	**30.0%**	20.0%	-10.0%
TK-2	100	0	17.0%	22.0%	**61.0%**	39.0%
TK-3	100	0	33.0%	33.0%	**34.0%**	1.0%
TK-4	100	0	11.0%	17.0%	**72.0%**	55.0%
TK-5	100	0	16.0%	25.0%	**59.0%**	34.0%
TK-6	100	0	13.0%	24.0%	**63.0%**	39.0%
TK-7	100	0	41.0%	25.0%	**34.0%**	9.0%
TK-8	100	0	21.0%	32.0%	**47.0%**	15.0%
TK-9	100	0	31.0%	34.0%	**35.0%**	1.0%
TK-10	100	0	21.0%	31.0%	**48.0%**	17.0%
TK-General	100	0	35.0%	**37.0%**	28.0%	-9.0%
KM-1	100	0	26.0%	31.0%	**43.0%**	12.0%
KM-2	100	0	35.0%	**44.0%**	21.0%	-23.0%
KM-3	100	0	37.0%	**40.0%**	23.0%	-17.0%
KM-General	100	0	34.0%	**39.0%**	27.0%	-12.0%
OL-1	100	0	10.0%	19.0%	**71.0%**	52.0%

Table 8 (continued)

Variable	Valid	Missing	% of Neutral	% of Disagree and Strongly Disagree	% of Agree and Strongly Agree	Difference
OL-2	100	0	17.0%	34.0%	**49.0%**	15.0%
OL-3	100	0	43.0%	**36.0%**	21.0%	-15.0%
OL-4	100	0	20.0%	39.0%	**41.0%**	2.0%
OL-5	100	0	18.0%	26.0%	**56.0%**	30.0%

4.2 Qualitative Analysis

4.2.1 Open-Ended Questions

The questionnaire form has two-part; Part A includes Likert-scale questions, while Part B comprises open-ended questions (Appendix B).

As stated in Section 3.3, open-ended questions are designed to overcome the following disadvantages of closed questions:

- Questions prevent respondents from expressing their ideas,

- Questions can be new for respondents, so that they did not consider it before.

Part B has five different questions to figure out the organizational learning structure and to gather the opinions of employees.

Question 1 - What applications should be initiated for the development of the learning processes of the organization? (Organizational Learning)

57 of respondents answered the first question. the five most common answers to enhance organizational learning is given in Table 9. 18 of 57 employees states that "Documenting should be encouraged", and it makes the answer the most popular suggestion. This suggestion involves that the organization should prepare a suitable environment to make documenting the primary goal for employees. Some incentives can be given to those who provide regular technical documents after their R&D activities, and continuous documentation should be examined and expected for all

employees. Additionally, writing technical reports can be evaluated as a performance measurement.

The second most common answer to enhance organizational learning is "Systematization of the training process", with ten responses. Employees should not be drivers of finding educations, detecting a deficiency of social skills of teams or training to become a system player. Instead of that, the organization has to prepare a comprehensive training system focusing on both the technical and social skills of employees by considering organizational culture and vision.

Table 9: The Five Most Common Answers to Enhance Organizational Learning

Actions to Enhance Organizational Learning	Number of Answers	Percentage
Documenting should be encouraged	18	31.6%
Systematization of the training process	11	19.3%
Creating a learning road map and knowledge taxonomy	3	5.3%
Working with international consultants	3	5.3%
Recording of the lessons learned	3	5.3%

Three of the remaining answers have three responses for each. "Creating a learning road map and knowledge taxonomy" is the next common answer to the first question. Respondents claim that R&D works have a complex structure; therefore, engineers can miss the learning needs while they are trying to solve technical problems. A learning road map may help both the engineers who are struggling with R&D activities in technical knowledge and the organization itself to improve the quality of human resources. Besides, it might help have rational plans in the technological development of the company.

Another suggestion is "Working with international consultants". This method is suggested as one of the easiest ways to acquire technical knowledge. Advance scientific or technological experts can transfer target-oriented knowledge with presenting on-the-job. By using consultants, organizations can gain new know-how

and transform the experience into the practice in the applications with minimal extra effort.

The last but not least answer is "Recording the lessons learned". The organization experiences limitless and different kinds of issues each day. These issues can be in the areas of administrative, technical, and communication, but irrespective of areas, most of them are not recorded. Employees generally learn issues considered critical, but the knowledge held by persons may not be useful for the organization in the long run. Especially, the recording of negative experiences can prevent huge losses of time. For instance, answers to "How did the company have problems with which company?", "What methods have engineers failed?", and "Which companies' materials are more qualified?" "can prevent unnecessary waste of time.

As shown in Figure 10, 33.3% of those responding to this question offer solutions that are different from the actions mentioned above. The answers received less popular support are the following:

- Increasing private education budgets for employees,

- Presenting processes to all employees in an explanatory way,

- Participating in more training and seminars,

- Encouraging to write publications,

- Evaluation of learning after each project,

- Recording technical meetings outputs,

- Increasing University-Industry cooperation,

- Benefiting from collective expertise in the company,

- Transferring of experts from all over the world within the scope of the technologies that need to be acquired,

- Managers should receive useful feedback on technical issues,

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- Evaluating the technical and management skills of the managers objectively, and preparing necessary training plans accordingly,

- Assigning knowledge flow supervisors before projects, and organizing the process of flow.
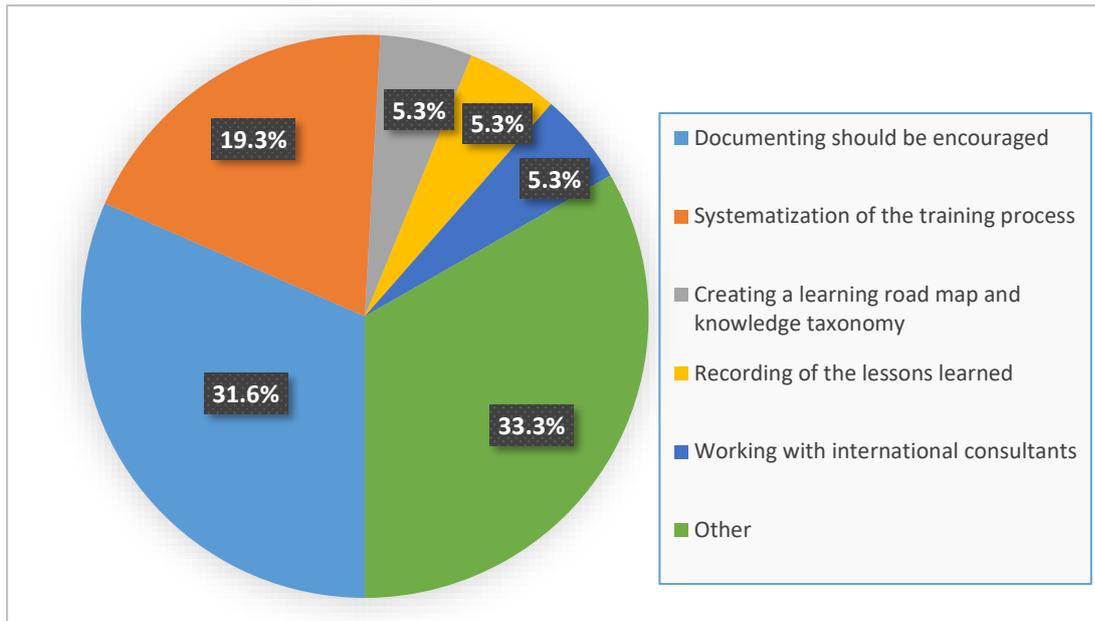
Figure 10: Percentage of Answers to Enhance Organizational Learning

Question 2 - What kind of processes should be implemented for the development of personnel learning? (Private Learning)

Eighty-four of employees responded to the second question that tries to figure out the methods to enhance private learning. Table 10 presents the five most common answers to enhance private learning. According to responses, "Increasing number and quality of training" is the most crucial action to improve private learning. Within this answer, engineers suggest building more target-oriented training while increasing diversity. They offered a changeover of the education system that selection, presentation methods, and storage of courses need to be re-evaluated.

The next popular suggestion is that "Employees should become trainers". Based on this idea, experienced engineers can quickly transfer the tacit knowledge, rules of thumb, lessons learned to team members who can practice by mentorships of trainers.

As a generally accepted phenomenon, the knowledge that needs to be taught to someone else can be better absorbed. If the system directs employees to become trainers, the recognition of the value of the knowledge will be increased.

Table 10: The Five Most Common Answers to Enhance Private Learning

Actions to Enhance Private Learning	Number of Answers	Percentage
Increasing number and quality of training	32	38.1%
Employees should become trainers	18	21.4%
Private education plan	14	16.7%
Private orientation trainings for beginners	5	6.0%
Increasing brainstorming events	4	4.8%

"Private education plan" is also one of the popular answers. Employees want to plan their personal development with the help of the company. These plans should include the technical and administrative trainings.

Responders of the "Private orientation trainings for beginners" claimed that the earlier employees' working awareness increases, the better their learning skills develop. If the employees are informed early about the company culture, working methods, future studies, and the information that will be needed, it will be easier for them to position themselves in the company and start progressing.

The fifth of the most common answer to enhance private learning is "Increasing brainstorming events". The fact that employees with different experiences and knowledge come together to find solutions to problems will give participants the ability to think differently and enable them to learn continuously. They state that if brainstorming activities become widespread and the routine of the company, a tool is provided to keep employees' learning desires alive.

As shown in Figure 11, the rest of the answers cover 13.1% of the solution suggested as follows:

- Assigning the right person to the right job,

- Stress-free working environment,

- Camera-recorded courses by employees,

- Supporting more to staff in graduate education,

- University courses for basic sciences,

- Separation of management and technical career paths and subjecting people to specialized training according to the road they will follow,

- Providing on-the-job trainings.
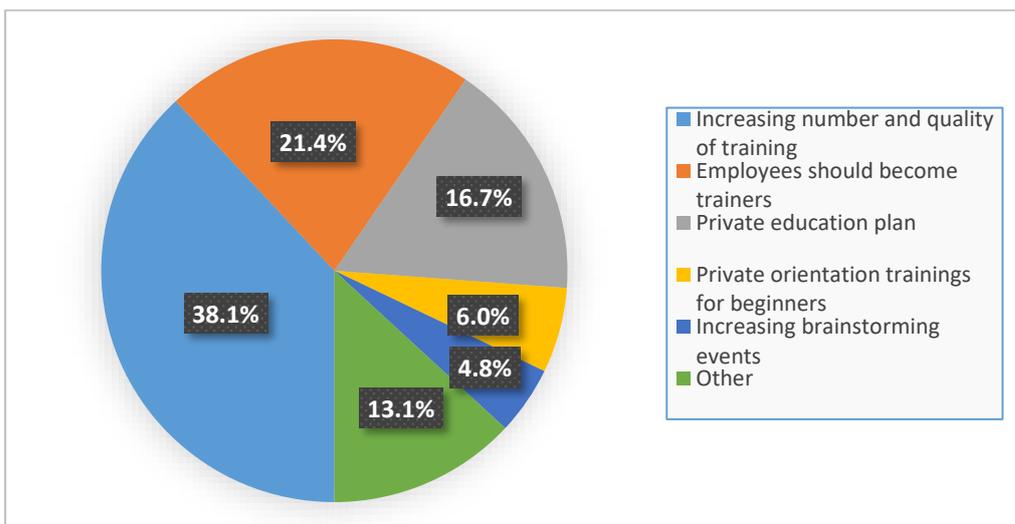
Figure 11: Percentage of Answers to Enhance Private Learning

Question 3 - What can be done to make knowledge sharing more functional in the organization?

As in the previous question, the number of respondents is 84. Among all open-ended questions, "Easily accessible and useful electronic library" was the most popular answer as seen in Table 11. Nearly half of the employees think that comprehensive solutions in this direction can increase knowledge transfer. The main solutions proposed in this context are to provide a platform with a good user interface, up-to-date information, practical, technical and administrative training documents, and to

prepare content for all levels with different tools. The essential feature of the electronic library to be created should be easily accessible. It is thought that the platform, which will enable the company to quickly upload the lessons learned and make them accessible for those concerned, will make the transfer of knowledge on technical and administrative matters more beneficial.

Another answer that the engineers offer intensively is "Special meetings for knowledge transfer". Engineers think that having regular meetings to share periodic developments between teams who execute similar technical works increase knowledge transfer, claim that strengthening of communication between groups will be an essential development in this direction.

Table 11: The Five Most Common Answers to Make Knowledge Transfer More Functional

Actions to make knowledge sharing more functional in the company	Number of Answers	Percentage
Easily accessible and useful electronic library	37	44.0%
Special meetings for knowledge transfer	16	19.0%
Organizing technical workshops within the company	9	10.7%
Online discussion platform	5	7.1%
Know-Who database	4	6.0%

The employees who argue that the technical depth of the company is sufficient, indicate that the internal activities will have a positive effect on the transfer of information. The solution they propose in this context: "Organizing technical workshops within the company". Organizing a workshop in which different teams, departments, and sectors dealing with similar issues can share lessons learned will increase the speed of finding solutions for employees. The event may include seminars about state of the art developments and benchmarking studies. Creating an environment where professors, experts, experienced and inexperienced staff meet regularly will increase the flow of information.

Engineers evaluate communication as the cornerstone of knowledge transfer. Creating an online discussion platform by taking advantage of the technology can also be a valid method for efficient knowledge transfer. In this context, the "Online discussion platform" has been one of the five most common responses. Regular use of a discussion platform where the staff can write down their problems and search for answers and solutions to the difficulties experienced before will increase the knowledge mobility.

Engineers believe that not knowing "who knows what" and hence not being aware of what can be learned from whom, may make the transfer of knowledge ambiguous. So, they express that establishing the "Know-Who database" will make knowledge transfer more functional.
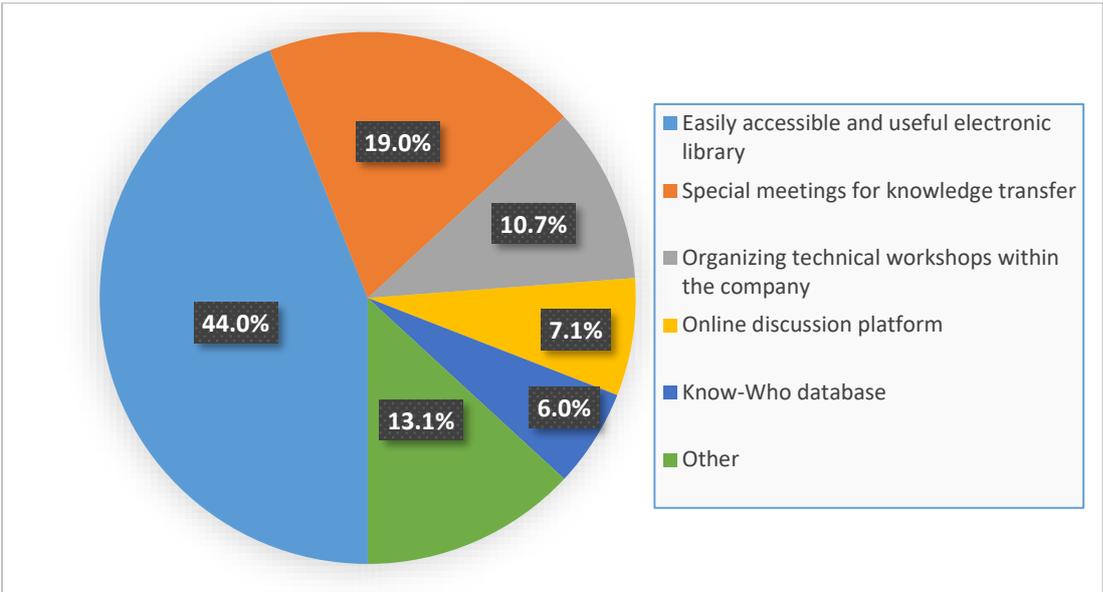
Figure 12: Percentage of Answers to Make Knowledge Sharing More Functional

Also as shown in Figure 12, other suggestions for actions to make knowledge sharing more functional in the company generate 13.1% of the total.

- Evaluation of technical documents by teams,

- Joint studies can be carried out on issues requiring similar expertise in different departments within the company,

- Mandatory presentations after conferences, workshops, and training

- Clarification of job descriptions,

- Removal of unnecessary confidentiality procedures,

- The habit of referring to the information sources used.

Question 4 - What are the barriers that arise in the learning processes of the organization? (Organizational Learning)

Fifty-nine responses were received to the question where the barriers in learning processes in the company were questioned. The most frequently mentioned barrier was the "Lack of efficiency in storing knowledge" as can be seen in Table 12. Employees gave comprehensive answers about the difficulty of storing information. They state that the company does not provide employees with appropriate time and favorable conditions to record the knowledge, and the knowledge stays with them. This situation creates two problems; the knowledge may be forgotten over time, or it obliges them to stay attached to an employee. Both situations have a damaging impact on organizational learning processes.

Table 12: The Five Most Common Answers to Barriers That Arise in the Learning Processes

Barriers that arise in the learning processes of the company	Number of Answers	Percentage
Lack of efficiency in storing knowledge	24	40.7%
Lack of the system that allows the transfer of tacit knowledge	7	11.7%
Lack of communication between teams	3	5.1%
Lack of awareness about the system to access information	3	5.1%
Lack of analysis of employees' learning need	2	3.4%

As stated in Section 2.1, the articulation of tacit knowledge is delicate, and it is generally expressible only through action. Engineers who have experienced this situation have expressed that there is no system for the transfer of tacit knowledge as being one of the problems with organizational learning. The complete transfer of tacit knowledge, which constitutes the major part of the knowledge, may not be possible,

but the lack of a system to facilitate the transfer of tacit knowledge is considered a significant loss.
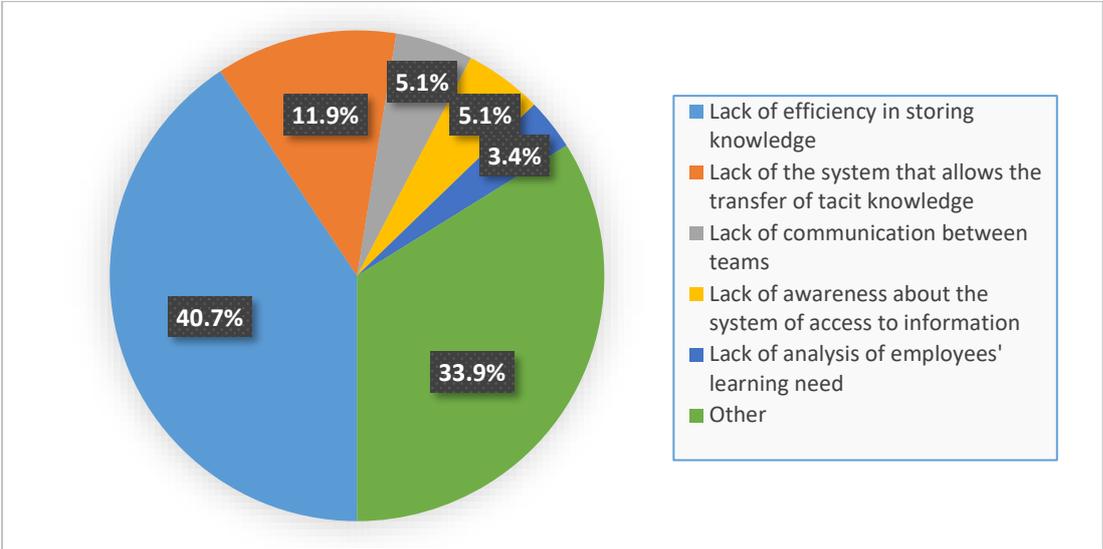
Figure 13: Percentage of Answers to Barriers That Arise in the Learning Processes

Parallel to the answers to the previous questions, engineers are disturbed by the lack of communication between departments and teams. This problem can lead to many possible solutions being disregarded and to repeat errors that another team has already lessons learned. The loss of time due to lack of communication not only brings financial burden to the company but also reduces opportunities for personnel to improve themselves.

Another problem with organizational learning was described as the "Lack of awareness about the system to access information." The company has a system in which technical information is installed and accessed, but because of the current working style and the difficult accessibility of the system, employees lack awareness of access to information. The lack of awareness of the current system may lead to disregard of useful information.

Engineers who think that the company's inability to determine the training needs of their staff and the lack of a learning plan adversely affect the company's learning remark the problem as "Lack of analysis of employees' learning need".

As shown in Figure 13, the remaining organizational learning problems, which account for 33.9% of the answers, are as follows:

- Lack of learning desire of managers,

- Lack of sufficient financial resources for learning,

- Unnecessary confidentiality procedures,

- Lack of learning-based processes,

- Not saving lessons learned,

- Limited contribution of technical staff to the learning environment,

- Lack of in-team teaching mechanisms,

- Lack of adopting the super identity of the company,

- Lack of knowledge about "who knows what",

- Lack of specific organization/order/control in the learning processes,

- Existence of managers who do not care about learning processes,

- Existence of departments that are not aware of each other,

- Lack of transfer of knowledge to the company,

- Lack of undertaking the failure,

- Lack of feedback to employees.

Question 5 - What should be done to overcome the barriers that arise in the learning processes of the organization?

Thirty-nine people proposed solutions for overcoming barriers related to organizational learning. One out of five respondents presented the improvement of "resource and project management" processes as a solution. Table 13 shows, the combination of schedule and delivering pressure due to project planning errors and the excessive workload caused by improper resource planning oblige staff to "save the day" continuously. Engineers predicted that the solution to this problem would improve the staff better in technical and administrative learning.

Employees argue that the solution to communication problems and improvements in this direction will make the learning infrastructure of the company much more efficient. Creating an environment where employees are aware of each other and can ask technical problems without hesitation will overcome many learning barriers.

Table 13: The Five Most Common Answers to Overcome the Barriers of Organizational Learning

Action to overcome the barriers of organizational learning	Number of Answers	Percentage
Better project and resource management	8	20.5%
Create an environment for better communication	5	12.8%
Adopt the super identity of the company	4	10.3%
Regular feedback to employees	4	10.3%
Audits on teaching performance of experienced employees	3	7.7%

Some of the engineers stated that to ensure not concealing knowledge, increasing teamwork and sacrificing for common goals can be achieved by "adopting the superior identity of the company". In addition to saving the day, creating the awareness that the company's interests are in line with the benefits of the personnel, organizational learning can be improved by making the right plans for the future of the company.

The engineers, who argue that regular feedback should be given to the employees, claim that the staff can improve themselves more consciously with this method.

Making the feedback mechanism a routine in the company and providing to give objective and constructive criticism for all personnel will make them feel valued and motivated for their development. Engineers who proposed this solution, claim that the lack of awareness of the employees about personal development for both technical and administrative matters is one of the crucial learning problems in the company.
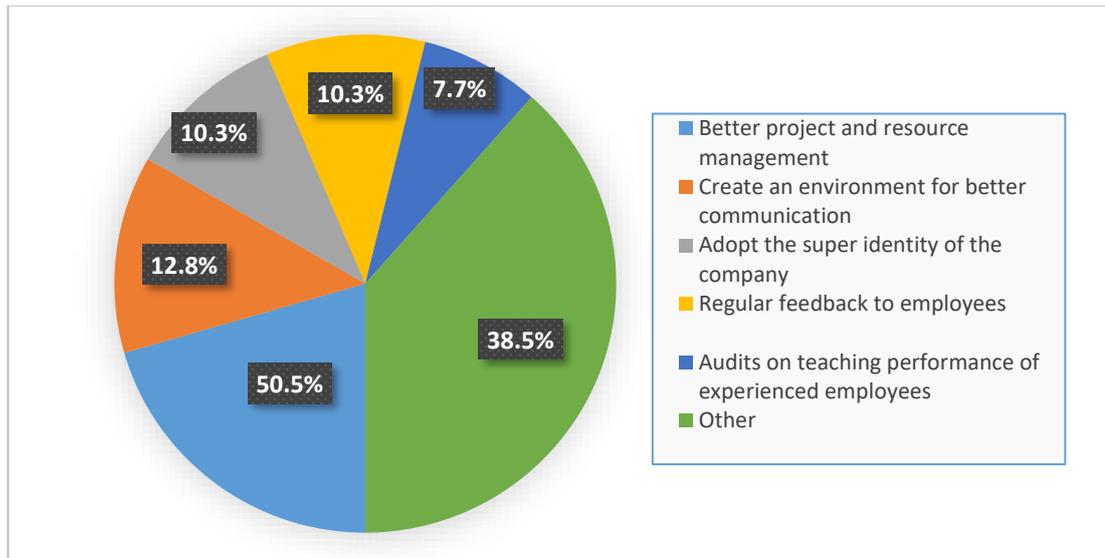
Figure 14: Percentage of Answers to Overcome the Barriers of Organizational Learning

Engineers who see it as an essential problem that experienced employees do concentrate on just their jobs and not train the next generations, claim that "auditing the teaching performance of experienced staff", and applying incentives in this direction will solve the problem. The fact that the tacit knowledge is bound to the carrier and a severe experience will be lost in a possible separation, requires that this information be transferred to the new personnel as much as possible. Thus, both the development of new staff and the loss of knowledge can be prevented.

As can be seen in Figure 14, 38.5% of those who answered the last question presented different solutions from the answers above. Other answers given are as follows:

- Training for managers on learning,

- Create learning teams with more design backgrounds,

- Know both the creator and the user of the knowledge,

- Applications to ensure keeping the knowledge on record always,

- Audits on learning performance of employees,

- Reward employee for their technical success

- Bring together individuals with verbal and numerical backgrounds in case studies,

- Audits on documentation performance of employees,

- Increasing financial resources to learning,

- Mandatory reporting of all acquired knowledge,

- Prioritizing participation in training.

4.2.2 **Semi-Structured Interview Questions**

As presented in Table 4, interviews were conducted by a total of ten engineers. To have detailed and target-oriented answers, four of the interview categories are devoted to experienced personnel. For the remaining category, interviews were held with semi-experienced and inexperienced engineers.

The central part of the interview study consists of six main questions and four connected questions. From the three optional questions, a question was directed to the participants according to the characteristics of the group to which they were bound.

1. What problems do you see regarding the learning processes of the staff?

1.1 What can be done to solve these problems?

In the first question, general problems of private learning of the engineers are discussed. The participants presented their suggestions for the solution of these problems within the context of the connected question. Table 14 shows summarized answers for the first interview question.

Table 14: Summarized Answers for Question-1

No.	Q - 1	Q – 1.1
1	Stressful work conditions	Better project and resource management
2	Lack of learning flow between junior and senior engineers	Employees should become trainers
3	Lack of vocational orientation training, Difficulties on accessing information	Implementation of vocational training as standard procedure, Establishing knowledge libraries with a user-friendly interface
4	Non-backup of critical personnel, Lack of documentation culture	Assign junior engineers to support all critical personnel Documents to be integrated into the natural flow of work through the system
5	Loss of motivation due to difficult access to information	Follow-up of continuous training of personnel and finding solutions to knowledge needs
6	Lack of vocational orientation training	Preparation of beginning-intermediate-advanced checklists on vocational training and control progress
7	Lack of defined expertise objectives, Lack of focus on defining career goals	Determining the long-term technical skills of juniors, and demonstrating the capacity that they will have at that level
8	Insufficient useful knowledge creation	Directing design processes to learn and making engineers adopt that documentation is at the heart of the work
9	Failure to internalization of training by staff	Preparation of vocational training with considering different generations (Generation-X,Y,Z)
10	Design processes depending on delivery pressure	Evaluating the designed products as a team and individually

2. What problems do you see with the organization's learning?

2.1 What can be done to solve these problems?

Within the scope of the second question, general problems in organizational learning were questioned. The participants presented their suggestions for the solution of these problems within the context of the connected question as given in Table 15.

Table 15: Summarized Answers for Question-2

No.	Q - 2	Q – 2.1
1	Failure to find detailed knowledge in a large ocean of information	Categorization of the knowledge
2	Lack of access to information in personnel and departments, failure to be aware of this information	Periodic gathering of technical teams from similar disciplines
3	Failure to share tacit knowledge	Documenting tacit knowledge by methods such as video
4	Failure to operate "lessons learned" effectively	Collecting technical and administrative feedback from staff at specific frequencies and arranging them as available in the system
5	Inability to renew old methods on learning	IT should find and try modern solutions on learning
6	Lack of documentation of lessons learned	Better integration and follow-up of documentation in work process
7	Inability to prepare training plans with the desired accuracy	Define boundaries in precision in job descriptions
8	Lack of R&D gurus working in design teams	Create sources of motivation to ensure that experienced personnel remain in the company
9	Lack of comprehensive awareness of the need for knowledge	Mapping for R&D activity and knowledge
10	Inefficient learning process of juniors, lack of awareness of transferring knowledge to the company	Training programs, including the company's culture, information methods, and information theory should be prepared for the new staff

3. What innovative applications can be initiated for the development of the organization's learning processes?

In the context of the third question and regardless of relevant problems, it was questioned what kind of practices could make organizational learning more effective. Table 16 gives summaries of ideas of participants for improving organizational learning efficiency.

Table 16: Summarized Answers for Question-3

No.	Q - 3
1	Each R&D engineer should prepare and present at least one academic publication, patent or saturated technical report in five years
2	Assigning knowledge manager (as a new term) to each project
3	Incentives for staff who are successful in tacit knowledge sharing
4	Overcoming company blindness by rotation, Expanding the distribution network of knowledge
5	Organizing camps to find the solutions of significant problems and to make preparatory study for new areas of work with academicians
6	Carrying out project work in a common network, including intermediate outputs, Preparation of documents in the clear format
7	Presentation of technical reports and articles prepared in periodical workshops within the company
8	Provide theoretician to guide in the design process by employing them under fair conditions, Create a career path for experienced personnel to become theorists
9	Routine works which are created after R&D activities should be abandoned to spin-offs founded by the company
10	Knowledge in the organization should be followed at a high level (Chief Knowledge Officer (CKO), Chief Learning Officer (CLO)) and policies should be developed

4. What kind of applications can be initiated in the organization that can increase knowledge creation?

The fourth question is asked to figure out which ways knowledge production can be increased in the company. Table 17 summarizes answers for the fourth interview question.

Table 17: Summarized Answers for Question-4

No.	Q - 4
1	Dynamic technical feedback to staff
2	Customized education plan and periodic updates and evaluations
3	Preventing repeated efforts by avoiding the work of different units on the same subject
4	Use the question of "Why?" as the main factor in solving problems
5	Financial support of knowledge production
6	Increasing the motivation of the personnel related to R&D learning processes through practices such as incentive, Assign the right person to the right job
7	Free R&D time and budget can be allocated to the personnel and the outputs of their works can be collected in appropriate formats
8	Ensure the planned and focused work of the staff (Project and resource management improvements)
9	Establishment of trial hand-on workshops where the knowledge defined by the departments as basic knowledge can be acquired
10	Issues encountered in R&D projects and postponed solutions should be given to the staff as homework, and the related reward system should be established

5. What are the problems with the process of keeping the knowledge in the organization? (Organizational Memory)

5.1 What can be done to solve these problems?

The fifth question is asked to find out general problems in knowledge retention. As it can be seen in Table 18, the participants presented their suggestions for the solution of these problems within the context of the connected question.

Table 18: Summarized Answers for Question-5

No.	Q - 5	Q – 5.1
1	Absence of "Who-knows-what" database	Keeping up-to-date information of the personnel in the system, continuously updating their success and technical skills in projects in a categorized manner
2	Failure to access knowledge that has lost its confidentiality in-time	Updating of confidentiality content on a regular basis
3	Failure to make documentation in the appropriate format	Increasing corporate awareness
4	Lack of version management Lack of efficient information management tool	Establishing an information management system that can access information classified by keywords, Documents to be integrated into the natural flow of work through the system
5	Failure to make documentation in the appropriate format	Documentation should be based on the knowledge transfer, not the storage of information
6	Loss of knowledge by resignations and changing departments	Check the lucidity of documents by experts, Backup of critical personnel
7	Information is kept in disorganized, independent areas	Build libraries that comply with the strategic plan and technology roadmap, while adhering to privacy and security concerns
8	Lack of knowledge of how to access existing sources of information	Raising awareness through in-service training, Define in-house, in-department and in-team training
9	Lack of easily accessible and useful information in the system	Check the lucidity and usefulness of the outputs produced by teams
10	Bonding of knowledge to individuals, Lack of awareness of access to information management system	Managers should check whether the information produced by the staff is stored, Establishment of an easily accessible and easy to use information system (category based)

6. What are the problems with the transfer of knowledge in the organization?

6.1 What can be done to solve these problems?

In the sixth question, knowledge sharing is questioned for related problems. The participants presented their suggestions for the solution of these problems within the context of the connected question. Table 19 summarizes answers for both problems and solutions proposed for knowledge transfer.

Table 19: Summarized Answers for Question-6

No.	Q - 6	Q – 6.1
1	Considering the sharing of knowledge as unnecessary procedure	In departments and directorates, keep a database of knowledge transfer log, and question those who do not share knowledge
2	Lack of awareness of the necessity for technical knowledge to be owned by the company	Adopting the company's super-identity to everyone
3	Concealment of information by departments and staff	Identify strategies to prevent groups and individuals from competing in top-down the company hierarchy
4	Concealment of information	Designing a system where staff's teaching deficiencies can be tolerated
5	Concealment of information	Abandonment of performance scoring based on pool system
6	Trying to manage the R&D activities with heroes, but not with the system, Lack of intellectual property awareness	Adopting the company's super-identity to everyone
7	Concealment of information	Contributing to information dissemination should have a positive performance effect, Owner of the knowledge can be cited in the technical reports and can be ranked in a system
8	Concealment of information, Lack of awareness of the necessity to document knowledge	Planning the career path of juniors and adopting that information concealment has no place in this career
9	Lack of knowledge transfer awareness	Evaluation of knowledge transfer success as performance index
10	Lack of oral and written communication skills of some engineers	Education and career plan should be made by personalized evaluations

Optional Questions

The last three questions are asked to three types of experienced employees that have two interviewees for each. Interviewees expressed the opinions about the question they were related to. Table 20 gives summarized answers for optional questions.

- Type 1: Personnel who have worked in different companies

  - Question: What kind of practices are there in your previous company that you think will improve the learning processes if implemented in your current company?

- Type 2: Personnel who have worked in academy

  - Question: Are there examples of good practice that can be integrated into your company from the learning processes at the academy? What?

- Type 3: Personnel who have lived abroad.

  - Question: Are there cultural barriers to learning processes compared to abroad? How can these barriers be minimized in the corporate environment?

Table 20: Summarized Answers for Optional Questions

Type	Answer 1	Answer 2
1	Morning stand-up meetings to make team members aware of the jobs done Professional management of lessons learned in communicational, technical and administrative Professional distribution of useful information	Technically good staff earn high income without being a manager Different departments attend benchmarking studies regularly
2	Adapting the course note culture to design studies Bell system technical journal	Encouragement of patent studies, introduction of citation system in information creation, wisdom grading according to teaching performance

Table 20 (continued)

Type	Answer 1	Answer 2
3	Here, career promotions resemble the military order. There are more flexible and fair promotions abroad, Alternative technical career paths to the year-based hierarchy system	Here, feedback are offending employees because of different perception of feedback mechanism Solutions are based on the system; here, they remain based on people.

CHAPTER 5

RESULTS

5.1 Result of the Questionnaire

5.1.1 Analysis of the Likert-Scale Questions

As a result of the survey conducted within the scope of the search for answers to the research questions of the thesis, a return of 100 people was obtained from the forms distributed to 140 people. The survey questions turned in with 71.4% return rate were divided into six different categories, and general evaluation questions were added at the end of five sections. Besides, to make a more meaningful interpretation among the questions, they were divided into five different types according to the way they were structured.

All responses to the Current Knowledge questions indicate that external information is used in technical studies. The difference between CK-1 and CK-2 shows that graduate studies are more widely used in business life. Even though the general assessment question for the current category of information has a mean of less than three related questions, the average of 3.52 is above the other general assessment questions. Within the scope of these facts, it can be concluded that **graduate studies** are among the drivers of organizational learning.

The mean of the general assessment question of Knowledge Creation is 3,45 that makes it the second-highest in this type of question. The staff, who think that the company's knowledge-producing performance was positive, responded in this direction to the questions in the category. Apart from general evaluation, there are three types of questions in this category. Knowledge Enhancer type questions have a much higher average than the others: 3.91.

KC-4 was the most prominent among the questions of Knowledge Enhancer type and questioned **learning from teammates**. KC-10, which proves that **patent and literature reviews** are useful in creating knowledge, and KC-5, which shows that the **knowledge acquired in conferences** is used in business life, also arise as factors that drive the company's learning performance. The results of the questionnaire revealed with high averages that both self-funded and contractual projects increased R&D knowledge. In this context, **learning by doing** also has to be considered as a supporting factor.

KC-11 is the only question of the category in the Company-Related type. The variable has the highest mean among the questions of Company-Related type and is also above the average of the Knowledge Creation category. In this context, it is understood that the **learning by cooperation** is a driver for organizational learning performance of the company.

All the questions in the Retaining Knowledge category consist of Company-Related questions. The categories' highest average response shows that the company makes it available to access patent and literature databases easily, as a response to Rk-5. As mentioned above, patent and literature review has proven to have a positive impact on company learning.

RK-7, which has the lowest average of both the category and Company-Related questions, shows that a proper **database of the skills of the staff** is not maintained, and this has a negative impact on organizational learning. It is understood from the responses to RK-1 that one of the obstacles is that the **company's lessons learned are not kept** or accessed. On the other hand, one of the factors that negatively affect organizational learning is that the **knowledge gained from field tasks is not fully transferring** to the company as a result of KC-3. It is seen from the responses to RK-2 that the company does not **have all the technical information in the personnel**, which is an obstructive factor.

Respondents by answering the general assessment question of this category with a mean lower than the average value of 3.00, which shows the average value, show that they do not find the retaining knowledge performance of the company as sufficient.

Knowledge transfer questions consist of both "Company-Related" and "Employee-Related" questions. Although the answers of the category were generally positive, the general evaluation question regarding the transfer of knowledge obtained the lowest mean among the evaluation questions with a mean of 2.86. In other words, employees think that the company's ability to transfer information is the most insufficient.

From the "Company-Related" questions, TK-1 measures whether the company provides the **appropriate conditions for the documentation** to its personnel. As one of the most apparent results, respondents think that the company does not provide the requirements for the documentation (time, accessibility, appreciation). This issue is one of the factors that obstruct the company from learning. TK-7 is another variable that has the mean under 3.00. This variable investigates whether there are activities where employees from different experiences and expertise come together and produce ideas. Despite the average of less than 3.00, the total number of people who think that brainstorming is done is more than those who do not, as shown in Table 8. When this uncertainty is examined, it is seen that the answers differ according to the experience in the company; it is understood that new employees think brainstorming activities are performed while experienced employees do not believe in that. The blue line in **Error! Reference source not found.** show the mean of the variable based on experience, and the green histogram columns represent the number of people with the relevant experience. As can be seen in the figure, the idea that brainstorming activities are performed tends to decrease as the years of experience increase. Figure 15 brings out an idea that this difference might have resulted from the different point of view to the concept of brainstorming; because the new staff absorbs knowledge more, and they consider the meetings they have attended as brainstorming events.
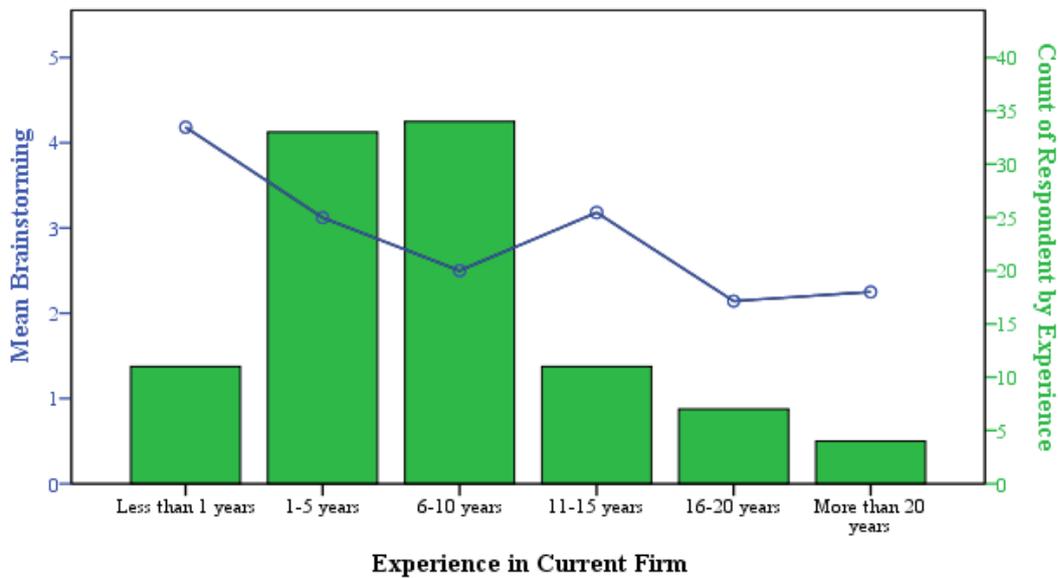
Figure 15: Means of Brainstorming Variable by the Experience in the Current Company

Among the "Employee-Related" questions, TK-4 examines the motivation to share information within the team, TK-5 explores the motivation to share information with the project stakeholders, and TK-6 investigates the motivation to share information among the teams. While all these variables attract attention with their high means, it is seen that **motivation to share knowledge** is one of the factors that positively affects the learning performance of the company. Besides, the high rate of TK-2, which examines whether the trust environment is felt for knowledge sharing, proves that the **trust environment** is a driving factor for the firm.

Knowledge Management performance of the company is found insufficient by the respondents. The mean of 2,88 points out that some improvements should be made. The KM-2, which is the "Employee-Related" question, proves that employees **are not aware of the current MIS** of the company, and this issue creates a barrier for the organizational learning structure of the company. Besides, the KM-3 investigates whether there is a bureaucratic barrier to reach knowledge. Based on responses received, engineers face **bureaucracy** while they are trying to reach the information needed.

Organizational Learning as a comprehensive category includes "Company-Related" and "Employee-Related" questions. With OL-1, which is questioned to figure out whether the company's **super identity** is adopted or not, it is observed that this variable

has a driver effect on the learning performance of the company. Support of the training by the company is questioned with the variable of the OL-5; according to the answers, **supporting the training** demands of the employees has a positive impact on the learning performance of the company. However, OL-3, which investigates orientation of the company, revealed out that the company has a performance-oriented structure rather than learning. Not **focusing on learning** can create many barriers to the company's learning.

5.1.2   Analysis of the Open-Ended Questions

Four of the open-ended questions focused on the improvement and problem-solving suggestions by the engineers, while the Question-4 gathered respondents' opinions about the problems of organizational learning in detail. The question that answered by approximately three out of every five participants aimed at finding out the barriers to organizational learning. Section 4.2.1 discusses the outputs of Table 12, which contains the five most frequently answered responses.

From this study, the **storage system of knowledge** can be added as the first factor that obstructs organizational learning. The most frequent answer to Question-4 was the lack of efficiency in storing knowledge. The reason that employees spot the most significant barrier of organizational learning is the absence of a functional mechanism for transforming the lessons learned into soft documents.

The **transfer of tacit knowledge** is one of the most common problems in organizational learning studies. This situation is also approved according to the answers gathered by the employees. The reason why the tacit knowledge can be considered as one of the factors obstructing the learning of the company is that companies can produce relevant policies by ensuring this knowledge is absorbed and shared.

Another problem of sharing knowledge is found as the lack of **communication between teams**. In the organization, which conducts intensive R&D activities on many different subjects, the lack of regular communication between the employees in the fields of similar expertise causes the learning process to be interrupted. This situation

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affects organizational learning negatively for two reasons. First: a waste of time caused by dealing with problems already solved by other departments. Second: to miss the opportunity to increase the speed and possibility of finding solutions from different perspectives of other departments.

By way of different sources of information, such as technical solutions, outputs of meetings and conferences, significant problems encountered are already made accessible by the company. But the presence of different information sources in the system does not mean that the information can be used or absorbed, directly. Responses gathered from engineers show that **lack awareness of the information system** is a barrier to the organization's learning performance.

The fact that the company employs many engineers in many fields creates a compelling issue in the planning of employees. Different reasons, including the concern of being able to execute projects in time, can cause some of the needs of the engineers to be ignored. As a result of the answers to Question-4, the most crucial factor affecting learning among these needs was the lack of **analysis of the employee's learning needs**.

As mentioned above, the remaining four open-ended questions examine the processes that can be taken to develop different issues related to organizational learning. The common point of these four questions is that it also questions how organizational learning can become more effective.

The first question is seeking on how organizational learning performance can be enhanced. As the results shown in Table 9, 31.6% of respondents suggest that **documenting should be encouraged**, and favorable conditions should become available. Additionally, engineers advocating a more systematic training process, are claiming that the **preparation of a learning roadmap and knowledge taxonomy** will make organizational learning processes more efficient.

Individuals who are one of the most critical factors in increasing knowledge production of the organization take part in organizational learning structure as well. 34 of 84 respondents think that the **educational opportunities and the quality of training**

should be increased within the scope of the second question, where the propositions to enhance private learning are collected. Within this suggestion, engineers propose building more target-oriented training while increasing diversity. They offered a changeover of the education system that selection, presentation methods, and storage of courses need to be rethought. Another high-rated answer is that **engineers should become trainers**. Participants claiming that individual learning will accelerate if experienced personnel train new employees on technical issues think that teaching the acquired knowledge to teammates will also make the flow of information much more efficient. The other proposal of the participants is that the **preparation of private education plans** will also contribute to maximizing the individual learning performance of the personnel.

44.0% of the most defended views in the third question seeking suggestions for improving knowledge transfer, which is one of the critical components of organizational learning is the **creation of a dynamic, easily accessible, and useful electronic library**. An electronic library involves acquired knowledge that employees can easily upload and access, discussion platforms, and learned lessons can make knowledge transfer more functional. **Organizing meetings with a focus on knowledge transfer** is also one of the common recommendations by engineers. Engineers think the strengthening of communication between groups is essential to gather the different teams and provide an environment for sharing technical knowledge. According to 10.7% of respondents, the **periodical organizing workshops** in which different teams, departments, and sectors dealing with similar issues can share lessons learned will make knowledge transfer more functional. The event may include seminars about state of the art developments and benchmarking studies. Creating an environment where professors, experts, experienced and inexperienced staff meet regularly will increase the flow of information.

Although the last question is to provide solutions to existing problems, the suggestions are to increase the efficiency of organizational learning. As the most inclusive answer in solving existing problems; improvements of **project and resource management** are collected. The participants who argued that the working methods of the staff are generally irregular, think that the overload of the work due to the schedule pressure

prevented the engineers from finding opportunities to learn. The necessity of **strengthening communication** and **adopting the company's super-identity** was also suggested by the respondents. Another valuable solution is to keep the learning process alive with **regular feedback** from the staff. Making the feedback mechanism a routine in the company and providing to give objective and constructive criticism for all personnel will make them feel valued and motivated for their development.

5.2 Result of the Interview

The interview questions aim to get answers for the second research question. Questions were designed to figure out the strategies that enhance the organizational learning performance of the company, and some redirections were made to stay in focus of the study during the interviews.

The first question investigates the problems of private learning and their potential solutions. Different problems are defined for this question, but the proposed solutions are converging. The participants think that there are problems related to private learning due to the **difficulty of access to information** and as a result of this, the employees lose motivation and time. Hence, engineers can find alternative solutions to the problems that are already faced and solved by other workers in the company by wasting time. Besides, they argue that the **lack of efficient planning of vocational training** and **lack of documentation culture** are problems for personal learning. One of the main problems in documentation is the lack of awareness that documentation should be done for knowledge transfer, not for a procedural process. Therefore, the fact that the author of the document is not aware that someone else should understand this information adversely affects efficient knowledge production and private learning. The **lack of an effective link between junior and senior engineers** in knowledge transfer and the **failure to internalization of training** by staff are the other problems presented.

The participants offer solutions to overcome the defined problems. They suggest that **more functional integration of documentation into design processes** and **evaluation of documents by the team** will enhance the document culture and quality.

Improving resource and project management quality can provide better conditions for planning private education. The project pressure and the lack of time for improvement in private learning can be solved by preventing from overloading engineers and managing resources by considering their knowledge needs. They also claim that knowledge transfer between junior and senior engineers can be enhanced by **making experienced engineers become trainers**. **Preparing vocational trainings by considering methods for internalization of knowledge** is proposed to improve efficiency of trainings. The classic methods may fail in learning process because of recent conditions. Especially, Generation-Y demands for more target-oriented educations that are not long and monotone.

The second question is consideration of general problems in organizational learning. **Difficulty to access knowledge** is the most common answer to the problem in organizational learning. The lack of access to information channels and **the lack of efficiency in storing and using the lessons learned** are seen as the most fundamental problems of organizational learning. Especially, not recording and storing lessons learned may cause potential waste of times, because the teams that work on similar tasks tend to encounter similar problems. Participants also claim that **tacit knowledge is not transferred** efficiently. Most of the knowledge is held by engineers tacitly and failure to the transfer this knowledge limits the organizational learning and causes a great deal of lost knowledge.

Categorizing the knowledge and creating an R&D works-based knowledge map are some of the suggestions participants have offered. By this solution, it is expected that engineers can find spot-on knowledge for their R&D problems, thus using the fresh knowledge in their activities will make knowledge more permanent. To overcome the problems about lessons learned, **documentation should be integrated into every possible step in work activities** and be reviewed by upper management. The control of the lessons learned by the upper management will increase the awareness of the company about such cases and will enable more precise strategies to be developed. The interviewees also suggest to adopt **new models for tacit knowledge presentation** such as video tapes. By using this method, the company can facilitate the transfer of undocumented knowledge.

The third question investigates the innovative applications for enhancing organization's learning processes. Participants offer different innovative methods, such as **assigning knowledge managers to all the projects**, because highlighting the importance of knowledge by this method can increase the awareness of the knowledge creation, transfer and storage. Additionally, **following the knowledge at the high level** (CKO, CLO) of the organization can enhance the awareness of the knowledge-based behaviors. As another suggestion, **routine works created after R&D activities should be abandoned to spin-offs** founded by the company. Abandoning the studies where the level of learning falls and giving importance to innovative studies can keep the desire to learn alive. Interviewees are also suggesting that **each R&D engineer should prepare and present at least one academic publication**, patent or technical report every five years. By organizing periodic workshops, the acquired knowledge can be diffused over the company.

The fourth interview question examines the application that can increase the knowledge creation. Engineers propose that **financial support on knowledge production** can be efficient for creating knowledge, because engineers are also assigned to some responsibilities so they may not be motivated to create extra knowledge, even if it does not consume lots of time. R&D engineers generally struggle with solving problems. Having knowledge about the solving related problems can be enough for saving the day. For improving knowledge creation participants suggest that, **solutions should aim to reach the answer for "why",** instead of "how". A deeper learning infrastructure can be established by going into details of the problems. Another suggestion is that **free R&D time and budget can be allocated** to the personnel and the outputs of their works can be collected in appropriate formats. Engineers can acquire knowledge with their R&D backgrounds, and these can be used for different studies held by the company. **Improving project and resource management** is also suggested to make creation of knowledge better. The staff can use the time much more efficiently by knowing their study in the project, and the time they need for self-improvements will be available.

The fifth question is considering problems in knowledge retention. The answers are similar to this question. Majority of the interviewees claims that **appropriate**

documentation is failing in general. Documentation is seen like an extra work that consume a valuable time by engineers, and formats may not be appropriate to be understood by others. The other common problem is the **lack of an easily accessible and useful information database**. Engineers need a useful information system that they can upload and reach the knowledge to continue their activities. This deficiency creates other sub-problems such as loss of knowledge by resignation and changing departments.

Participants' answers for the solution of knowledge storage problems are also similar. The most crucial solution is **the establishment of a robust knowledge database** that allows uploading knowledge in various methods, to manage knowledge by versions, and to present staff portfolios by their knowledge. The managers should check whether the knowledge produced by the staff is stored in this information system. The engineers also suggest that **documentation should be reviewed periodically** and systematically. Checking the intelligibility and usefulness of the outputs by teams will improve the quality of the documents and knowledge retention ability.

The sixth question is about the problems faced with knowledge transfer. Most of the problems presented by the participants are motivational factors. The most common issue about knowledge transfer is **concealment of knowledge**. This problem is presented by the result of two main factors; first is job security that engineers may think that if the knowledge remains by them, their position may be safer or their prospects for promotion will increase. Another reason for knowledge concealment is the lack of awareness that if others need the knowledge, or it is expected to share the knowledge.

As solutions for knowledge sharing problems, the participants suggest different models. **Adopting the super-identity** of the company to every employee is suggested to overcome knowledge concealment problems. If the employees know that they will rise along with the company then the company can utilize knowledge better. **Reviewing knowledge transfer as a performance index** can also enhance knowledge transfer. If the MIS log the knowledge transfer, and managers question those who do not share knowledge, awareness of knowledge transfer can be supported. Another suggestion is that **defining career paths** can improve knowledge sharing because if

engineers know that knowledge concealment has no place for promotion, and teammates should not be rivals but be supporters, they will feel a trusted environment and share knowledge for mutual benefits.

The first optional question investigates the best practices that can be applied to the company from the former companies of interviewees. The first interviewee for this optional question recommends that **morning stand-up meetings** can be helpful to make team members be aware of the jobs done. As experienced in former company, general awareness about works carried out can be increased and learning needs can be revealed easily by this method. The other suggestion is to **keep and manage lessons learned** in every possible case, from the communications between companies to a failure in a specific design activity. The former company particularly forces the feedbacks for all the work done. By this way, they save a great deal of time and effort. The last suggestion is **distribution of related information to every possible shareholder**. For example, a new invention from the rival company or a new regulation should be distributed to every possible actor along with noticeable warnings. The second interviewee points out that his former company gives **employees the opportunity to earn high incomes without being a manager**. He claims that staying in technical work without promotion concerns will make employees focus on their self-improvements and so learning performance of the company will increase significantly. The other suggestion from the former company is **the periodic benchmarking activities against different departments**. Departments can show the methods they use in design problems from their own perspectives and benchmark the other solutions carried out by a different team. By this way optimum solutions are more likely to be revealed.

The next optional question examines the methods used in the academy that can be transferred to defense industry companies for R&D activities. The first ex-academician interviewee presents the idea that students are in learning mode in courses and they take notes of what they see, read and hear. The notes that they take according to their understanding methods produce their learning systems. The interviewee claims that if engineers approach R&D activities as learning opportunities and start **taking notes with their methods**, the learning system will be improved. Another suggestion is

transferring publication culture from the academy. Like the Bell system technical journal, the company can provide a **platform for publications of R&D activities**. Employees who know that their R&D activities have academic value qualified to be published in a journal can improve themselves by this motivation. The other interviewee explains that **citation** is a robust motivational phenomenon in the academy. If knowledge creation can be recorded by the name of authors and citations become compulsory, the number of usable knowledge creation will be increased. This system can be integrated with patent works, and finally a dynamic wisdom ranking can be created. This knowledge challenge can be rewarded with different methods.

The last optional question is asked to other two interviewees who have an abroad experience. The question investigates the cultural barriers to learning processes compared to abroad. The first such interviewee claims that **we have a strict year-based hierarchy system** at organizations. However, skilled employees can climb career steps more rapidly abroad without experience concerns. This creates additional motivations for younger employees. The other interviewee puts forward that **we tend to be offended by negative feedback** as a difference from abroad. The aim of the feedback is for improvements; however, if feedback is perceived personally, different problems may arise, and conflicts may begin. Another assertion is that **our solutions are people-based rather than system-based**. Generally, we are looking for a "hero" to solve problems, but foreigners trust and manage the system for problems. Trusting on the system makes it more robust, and in this way, employees can easily adopt the super-identity of the company. Adopting the company can support organizational learning in many areas, especially knowledge sharing.

This thesis is based on the hypothesis that there are barriers and drivers for organizational learning in defense industry companies. Within the scope of this hypothesis, all of the defined variables that positively affect organizational learning are revealed by the conceptualization study. In line with the answers to the questionnaire and interview questions formed by using the determined variables, the existence of barrier factors is provided, as well as the factors that drive organizational learning in the defense industry company. As shown in Table 22 in the next chapter, a total of ten barriers and eighteen drivers are revealed.

The common goal of the questionnaire and interview studies used in the thesis is to answer the research questions. As shown in Figure 16, while both open-ended and Likert-scale questions are investigating the barriers which are the subjects of the first research question, drivers are investigated by Likert-scale questions only. In addition to the interview study conducted to examine methods of increasing organizational learning efficiency, open-ended questions contribute significantly to the suggestions. While the interview study generally proceeds on the solution of existing problems, open-ended questions directly question the methods that increase organizational learning efficiency. Nevertheless, many of the responses to the interview study and open-ended questions examining suggestions to improve organizational learning efficiency overlap with each other. In particular, all the answers given to the open-ended questions with the highest rate are presented by different participants within the scope of the interview study.
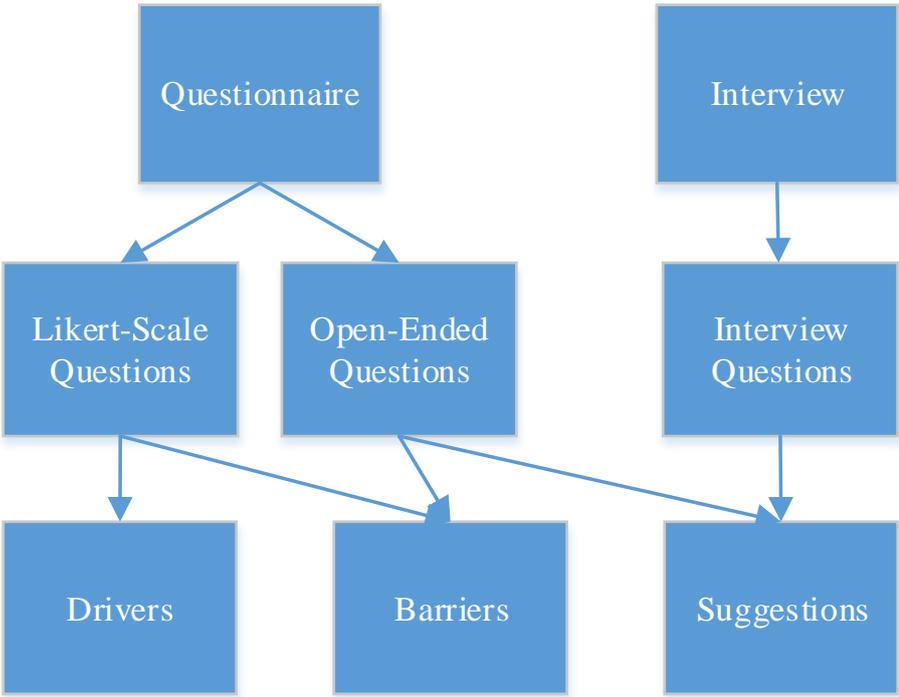
Figure 16: Relationship Between Questionnaire and Interview Studies

A total of six barriers are identified within the scope of the Likert questions in the questionnaire, besides, these barriers are confirmed by the answers obtained from 4th open-ended question. In Table 21, six variables identified as barriers within the scope of the answers given to Likert-scale questions, and their explanations are presented. The reason why the explanations are positive is that all the questions prepared are in a

positive direction. In the last column of the table, there are related answers to the 4th open-ended question, which validate each of the variables identified as a barrier for organizational learning.

Table 21: Validation of Barriers Obtained from Likert-Scale Questions

Variable	Explanation	Related Answer to the 4th Open-Ended Question
RK-1	Accessibility of lessons learned	Not saving Lessons Learned
RK-7	Retaining of skill database	Lack of knowledge about "who knows what"
TK-1	Motivating to documenting knowledge	Lack of efficiency in storing knowledge
KM-2	Awareness of existing management information system	Lack of awareness about the system of access to information
KM-3	Absence of bureaucratic barriers	Unnecessary confidentiality procedures
OL-3	Focusing on learning	Lack of learning-based processes

CHAPTER 6

DISCUSSION

6.1 Research Findings and Recommendations for Firm Level Strategies

This thesis aims to reveal the factors of analyzing the driving forces and barriers in the organizational learning process in a defense industry company in search of the answer to the first research result, besides the second research question examines how organizational learning can become more productive in the company. Along with the conceptualization study conducted in line with these objectives, categories were identified, and open-ended and closed survey questions and interview questions were prepared. The questions aim to have a perspective on potential improvements, organizational learning, culture, structure, and learning process as well as to find drivers and barriers to organizational learning.

After the literature search, three basic concepts were determined as the basis of organizational learning: knowledge creation, knowledge retention, and knowledge transfer. (Argote, 2011) In the conceptualization section, in addition to these categories, existing knowledge, knowledge management, and organizational learning have been added to examine more general factors. 46 variables supporting organizational learning from different aspects were determined in accordance with the literature, as given in Table 2. After defining variables, questions were prepared in five different types and under six categories. The preparation of the questions by different types has increased the variety of questions and provided a more accurate evaluation.

The answers given to part A of the questionnaire were especially inputs to the first research question. All the questions prepared to assess the current situation have a positive meaning and the high scores given to them represent success in organizational learning issues. In addition, a question in part B asks the obstructing factors of organizational learning performance in the company and provides answers to the first research question.

Research Question-1:

What are the factors to analyze the drivers and barriers for organizational learning in the defense industry company?

In the Likert-scale questions, averages above the value of three defined as the neutral point were assumed to be the supportive factor and the rest below were considered as barriers. Afterward, because the fact that the difference between each score does not mean the same value for everyone, the answers of "strongly agree" with "agree" and "strongly disagree" with "disagree" were combined to form Table 8 to validate Table 7. In the context of the validation study, the percentages of "Agree" and "Disagree" responses to variables were compared, and the prevailing side was premised as the state of the variable. After validation, the values exceeding the mid-point in both tables were considered as drivers and those below in the two tables were considered as barriers.

The results of the quantitative analysis given in Chapter 4 shown that the most of the variables are drivers for organizational learning in the company. Notably, the answers given to the questions of the "Knowledge-Enhancing" type are very high; because claiming that positive phenomenon does not increase knowledge, requires a negative and significant experience about it. Another high-rated type is "Usage of External Knowledge" which has questions that investigate the usage of knowledge acquired from outside of the company. The main reason for this high rate is that the company, which takes care of the quality of its personnel, ensures that the academic knowledge of its employees is used in the company.

The lowest rate of answers belongs to "Company-Related" type. This set of questions that question the opportunities that the company provides or cannot provide is an indication that the company needs to make improvements in some areas. Another rate, which can be considered low, belongs to the "General Evaluation" type, which questions the general views of the company on organizational learning.
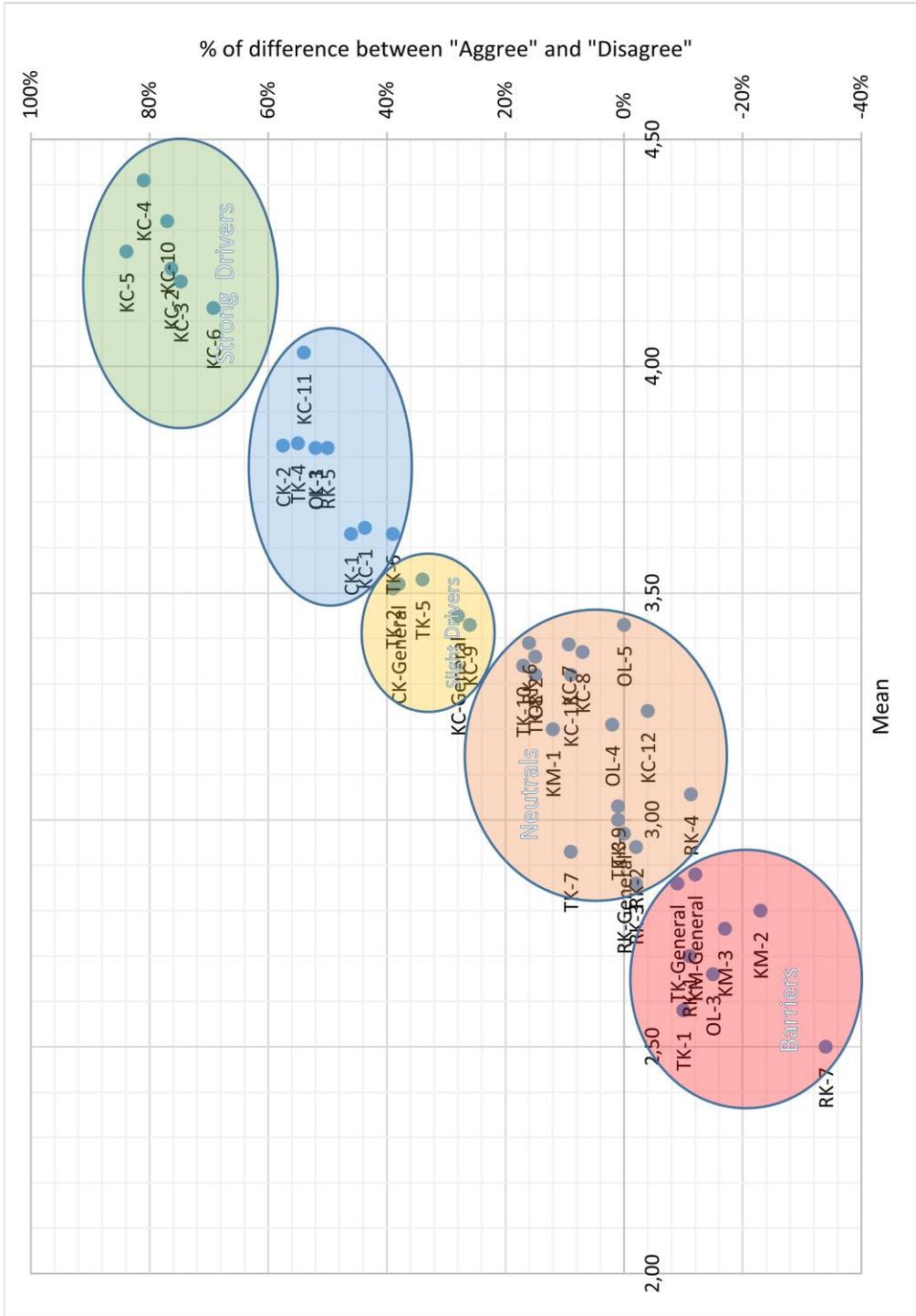
Figure 17: Validation of Likert Questions

As mentioned before, the validation of the means of the variables was performed by reducing the Likert-Scale questions answers to "Agree", "Neutral", and "Disagree". The vertical axis of Figure 17 shows the differences of the percentage between "Agree" and "Disagree" for all variables with respect to the reduced answers obtained, the horizontal axis represents the average of the variables. According to the distribution of variables on Figure 17, drivers and barriers of organizational learning are divided into five different groups. In making this distinction, variables with similar averages and differences were clustered. Variables that lie below both axes of the origin and are not very close to the origin were evaluated as barriers. While those around the origin are grouped as neutral clusters, the upward ones are considered as driver factors. Driver factors were divided into three groups with the concern that the groups were more homogeneous and the differences could be seen better.

In the thesis, barriers and drivers of organizational learning are determined as the answer to the first research question. Variables of the "General Evaluation" type are removed from the final list in this thesis, while preventive opinions given to open-ended questions are added to the table. A total of eighteen driving factors, six of which are strong drivers, are identified in the company, where a total of ten factors are barriers to organizational learning, as given in Table 22.

Table 22: Drivers and Barriers of Organizational Learning in the Company

Strong Drivers	Drivers	Slight Drivers	Neutrals	Barriers
Learning from teammates	Learning from collaboration	Having the motivation to share knowledge with the project stakeholders	Training support	Lack of awareness of existing management information system
Learning from patents and literature reviews	Having the motivation to share knowledge with the team	Trusting environment for sharing knowledge	Routing to in-house solutions	Existence of bureaucratic barriers
Learning from conferences	Use of graduate knowledge	Learning from project review and progress meetings	Learning from subcontractors	Lack of accessibility of lessons learned
Learning from Self-funded R&D projects	Previous experience		Learning from in-house technical reports	Not focusing on learning

Table 22 (continued)

Strong Drivers	Drivers	Slight Drivers	Neutrals	Barriers
Learning from Contractual R&D projects	Accessibility to patents and literature databases		Superior identity of the company (General)	Not motivating to document knowledge
Learning from advisors, university teachers	Superior identity of the company (Personal)		Creating a trusted environment	Not keeping skill database
	Learning with company training, career training		Learning with listening for opinions of others	Lack of efficiency in storing knowledge
	Use of undergraduate knowledge		Confidence in submitting proposals	Lack of the system for transfer of tacit knowledge
	Having the motivation to share knowledge between teams		Learning opportunity	Lack of communication between teams
			Identifying the future skills needs of staff	Lack of analysis of employees' learning need
			The efficiency of the management information system	
			Accessing knowledge on subcontractors	
			Giving feedback	
			Having the motivation to share tacit knowledge	
			Gathering knowledge from employees and making it available	
			Brainstorming	
			Knowledge gained in field duties and training	

The answers given to part B of the questionnaire and interview questions provided solutions for the second research question. The different questions posed to the participants revealed ideas that could directly or indirectly support organizational learning. Some of the questions gathered solutions for the existing problems, some of

them received answers about the increase in productivity independent of the problems. As a result, all the answers collected about the second research question were evaluated as a strategy-making tool.

Research Question-2:

How to make **organizational learning more efficient** in the defense industry?

In an age of high competition, the most important factor for companies is to use quality time. Companies have to present their best output to the market in a limited time for survival. Production and sales are the essential elements for the survival and growth of companies, but the continuity of R&D activities and the ability to outperform competitors with technology levels can be a more permanent and powerful source of income.

Many competing companies in the ongoing technology and economic competition have a versatile and strategic management approach. As it's supposed to be, while pioneer companies carry out their production activities in a quality manner, they produce and learn new information through R&D activities, thus gaining great advantages in meeting the needs of tomorrow. Although it may be seen as a short-term obstacle to the company's direct monetization processes, in order to proceed with R&D activities in a sustainable manner and to produce knowledge reliably, the learning system needs to be well established.

As Laloux (2004) points out, the most advanced organizations are the learning organizations. The learning organization at the last level of the stages of consciousness represents unity, common goals, and high cooperation. While these organizations stand out with their strong corporate memories and knowledge stores, they should have flexible learning and development skills like a human being. Just like humans, in the perfect learning organizations, every brain cell and sense organ should work in full synchronization with the continuous development goal. The impossibility of achieving the perfect provides the learning organizations and the organizations that move along the learning path with elements they need to develop at all times.

Investments in learning processes and strategies contribute significantly to the future of the company and its staff. Investing the learning processes can make organizations in the civil sector renounce their production and sales performance, but because of the different nature of the defense industry, what is waived is not production but other R&D activities. Companies in the defense industry generally carry out intensive R&D studies by ordering procedures. They continue to R&D works with the methods they determine. Proposing learning strategies in the defense industry is a sensitive issue as learning processes that disrupt these determined methods may cause serious harm to companies.

The proposed strategies are grouped under two headings. The first of these is the "General Improvement Strategies", which deal with general improvements and more fundamental issues. The other heading is "Innovative Strategies", which include strategies that are thought to will improve organizational learning performance if the company makes it operative, regardless of the existing problems.

6.1.1 **General Improvement Strategies for Enhancing Organizational Learning**

The company can improve its learning performance and productivity by upgrading its existing methods and capabilities. Many issues and significant deficiencies are considering, and the company is currently able to offer specific solutions to these; however, significant learning acquisitions can be achieved by rearranging and developing these solutions. The suggested improvement strategies are presented as follows.

- One of the most significant improvements is to have a well-designed, user-friendly, and capable online knowledge platform that has a library, discussion pages, and a know-who database. Employees should be able to search for the information they need through keywords, find discussion pages about similar keywords, or start new discussions. Besides, personnel with relevant knowledge should be able to be found in the system and present their experiences about these keywords. For all employees, a database containing

the knowledge they have along with their level, enables them to be automatically informed of the online discussions on the subject and to assist those in need. This improvement will open a comfortable and practical channel for access to knowledge.

- Documentation is one of the essential elements for the learning processes of the company and is the current solution of saving information to the system. It can be eliminated the environment in which it is neglected due to the perception that the process is unnecessary by establishing an integrated structure with the design processes. By increasing the document frequency, the scope can be reduced. The preparation of documents in a way that someone else understands and the accuracy of the content can be reviewed and directed together at short and frequent meetings of design teams. The collective management of the knowledge presented in the documents and the establishment of sequential relationships with each other is an essential factor that will facilitate access to information.

- The first method that comes to mind about learning is education and training. The choice of classroom training lasting a few days, and testing of learning situations with exams at the end of the training may prevent efficiency. Continuing the training more interactively and questioning the learning situation with periodic reminders and tests after the training will help the personnel to internalize the training. Learning by doing, which is one of the most successful methods of internalization of knowledge, can be realized by an atelier established for this purpose; engineers can make mistakes as what-if scenarios at the atelier and learn without the effect on real systems.

- In the company which has quite a large number of projects and personnel, the distribution of the personnel to the projects and the schedules of the projects directly determine the workload of the engineers. Personnel is often overloaded in environments where workloads are not well adjusted. Employees will be provided sufficient time for themselves and their learning through regular calendars and acceptable workloads. Therefore, improving project and

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resource management will contribute to the learning performance of staff and the company.

- Learning is a process that demands motivation. The motivation of the organization and employees drives learning and absorption of knowledge. Employees can be motivated by receiving training on the topics they want to improve. The fact that the company develops personalized learning plans according to the career goals of employees and follows the process of these training will improve the learning processes by sustaining high motivation. During this process, providing continuous feedback to the personnel and progressing in line with the learning plan will bring significant benefits to the company.

- The knowledge shared with the preparation of technical reports do not cover most of the knowledge held by personnel. Adapting the citation system in the academy to the company's R&D system will enable a more efficient sharing of knowledge in the personnel. In this context, it is necessary to record the source of the information used in each step of R&D processes. It is expected that the knowledge used from the current technical reports will be referenced to these documents and the number of citations of the author of the document will increase. With this method, it is possible to create an environment in which the ranking of the individuals' knowledge (authors of knowledge documents) can be followed and the competition to create and share knowledge can be provided. The evaluation of knowledge sharing as a performance index integrated with this method will also increase the learning awareness in the company.

- Companies want to meet their knowledge needs and complete the projects in the most optimum way possible without wasting time on existing and planned projects. The requirements of the projects and related R&D activities; since the personnel is only expected to learn information within this scope, can limit learning processes. In order to solve this problem, the personnel should be provided with free time and budget, if necessary, independent of the projects,

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and should be able to conduct research that may improve themselves in accordance with the objectives of the company. Periodically reporting and documenting the results of their research and studies to the company in an appropriate format will enable the company to produce different types of projects.

- One of the principles in the formation of knowledge is the mistakes made. Errors may indicate methods that should not be retried, and the missing information about the past may cause them to be repeated. Clearly recording errors in the design process together with their causes will facilitate the analysis of the lessons learned. Keeping the learned lessons in a system that is easily accessible and understandable along with the cause and effect relationship will contribute to the company in terms of time and money.

6.1.2 **Innovative Strategies for Enhancing Organizational Learning**

In addition to improvements to the existing system, more innovative strategies can make organizational learning processes more effective. While improvements can make the work that is already useful to more effective, it is more difficult to predict the potential benefits of innovative solutions. The suggested innovative strategies are presented as follows.

- The company, which tries to proceed planful, especially in terms of technology management, follows its strategic plan and technology roadmap in line with its targets. The planning of learning, which is an abstract concept, is ignored. The creation of a learning roadmap that will be in line with the company's strategic plan and technology roadmap will increase awareness and efficiency in the learning process. In order to do this, knowledge taxonomy should be prepared, and the knowledge should be classified as hierarchical. A learning roadmap should then be prepared by analyzing the knowledge needs of the targeted technologies.

- Providing training solutions from the inside of the company will make it more economical and time-efficient. Currently, many experienced staff in the

departments can transfer their knowledge to junior employees by not a system but with personal attention. If engineers can become trainers as a career step and financially encouraged, they will be able to absorb the knowledge better. Because learning to transfer knowledge to someone else is one of the most permanent methods. After a particular experience, if a system in which employees can become trainers by taking various exams and will control the teaching performance is established will contribute to the learning processes.

- Not all engineers working in the R&D department carry out innovative R&D projects. Some of the employees do routine work that does not require serious R&D knowledge. By transferring the works that can be considered as routine to the spin-offs, the company can employ its existing personnel in more R&D intensive jobs. Together with this employment, knowledge production and learning need will increase and the learning structure will be driven to improve.

- To publish an in-house scientific journal in which R&D works and experimental studies of employees can be published will encourage employee motivation to produce and record information. The journal can be published according to advances in the broad field of the defense industry to support scientific disciplines and engineering disciplines applied in the company.

- Workshops can be organized regularly as a solution to the problems of sharing information in the company where departments are dealing with similar technical issues. The sharing of knowledge can be facilitated by organizing a workshop in which the methods of solving the problems encountered during the period can be discussed, and patents and academic studies can be presented by engineers. The participation of academicians, consultants, and experts in the organization will increase efficiency.

- Throughout the project work, monitoring of information and learning, such as following up the schedule and technical tasks, will contribute to the processes. The fact that knowledge tracking in projects is carried out by a changing knowledge manager in each project will continuously increase the number of personnel who know both theoretical and practical knowledge and learning.

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The head of knowledge, who will check that the knowledge documents are produced correctly, will be responsible for entering this knowledge into the system with the right relationships.

- Another way to increase awareness and the importance given to knowledge is to follow the knowledge by the highest level of the company. By assigning CKO to the organization, the company can establish a strong structure that is responsible for the learning processes and ensures that the strategy is produced and audited. Continuous monitoring and supervision of learning will also improve the efficiency of the company's learning processes.

- As a conventional method, the only way for employees to rise is to take on administrative positions, in other words, to become managers. The main reason for this is that the managers earn much better than the employees because the management level has more potential to rise sharply further from the technical career path. Although it is not unreasonable for managers to gain more within the scope of responsibility, it poses risks for the technical career path. Technically successful employees think that there is an end to their career path and that being a manager opens up a much better way for them. By removing the limit on the technical career path of the employees, the transition from experience-based promotion to a more performance-based promotion model will increase the technical skills of the company and keep the learning motivation of the staff alive at all times. Thus, knowing that the person who does not want to be a manager and enjoys working on technical issues can also gain high earning by staying in this lane will contribute to the R&D culture. In addition to this, the promotion of the employees according to the measurable performance criteria and the abandonment of the promotion model directly related to the experience will contribute to the learning system. As a system, for instance, the point where a regular employee can reach in five years can be targeted for the next step, and the promotion can be made regardless of how many years it has been reached.

- Reorganizing career paths is an important solution that will contribute to the learning culture through structural change. There are system and design engineers directly involved with R&D and project management engineers that indirectly affects R&D activities. All types of engineers have a different role in the system and their qualifications are also different. In the current system, design and system engineers are getting promotions in their career lanes based on experience and performance. Even though there is no relationship between these business families directly, they do the R&D work together. Design engineers deal with the pure R&D side of the business, while system engineers carry out higher levels of planning and execution. One of the suggestions received intensively within the scope of the thesis study is that the company should have its internal trainers. By revising the existing system and adding training engineer's lanes to the career path, a learning problem can be solved by inside trainers while ensuring the projects are not be hindered. As can be seen in Figure 18, the suggested method will work as follows;

  - Engineers who want to work directly at R&D will only be able to be employed as a design engineer and will be offered three career options to continue their careers after a particular performance. The first of these is to continue to work as a design engineer and to perform R&D activities. The second and the best salary promising is to become engineer trainers and to be responsible for the training of design engineers while continuing their design work. To become engineer trainers, it is necessary to pass challenging exams and be subjected to be continuously audited the performance as trainers as it goes on this career path. The third career choice for design engineers should be to continue their career as a system engineer. No R&D employee should be assigned as a system engineer without experience and performance because the failure or inefficiency of the system engineering at the upper level of the pure R&D activities can create a domino effect on the design works. After a certain performance in this path, a two-way career option must be offered to system engineers, as well: becoming system trainers or continuing as system engineers. As with design

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trainers, system training should be a career path that promises more salaries.

o   With provided that the experience of the employees is not deleted, the transition between R&D departments and project management should be allowed. However, if the employees from the project department do not have any R&D experience, they should start from the beginning. On the project side, employees should start working as analysts or schedule planners and should be allowed to pursue careers as project manager trainers, project managers, or project analysts after a particular performance. Employees wishing to move from R&D departments to project should also start from the beginning if they do not have related experience.
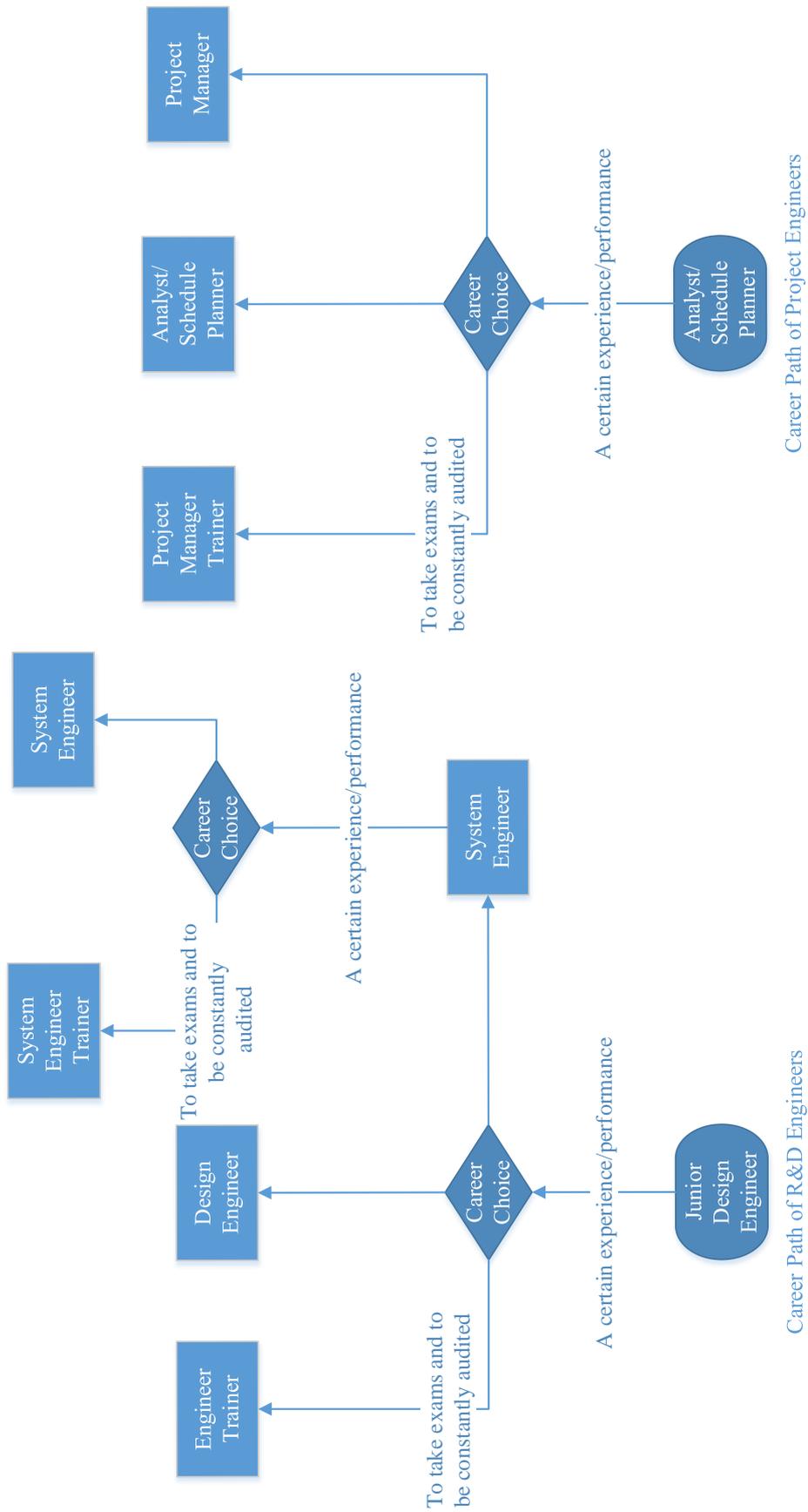
Figure 18: Career Path Suggested for both Design and Project Engineers

6.2 Limitations of the Thesis and Suggestions for Future Research

This thesis is a case study and conducted at the firm level. Therefore, the results of the thesis are suggestive and may vary in different firms, in different sectors or in different countries.

The questionnaire was distributed to 140 people and 100 people completed the questionnaire. Although the survey has a good return rate, we do not know who did not return because the participants were asked not to write their names. Therefore, we do not know whether those who do not return have certain common characteristics such as experience, educational level, and gender. Although the number of participants can be considered as sufficient, strong statistical conclusions cannot be made between the groups, especially due to the concentration in the areas of experience and gender. There were participants who did not answer open-ended questions. While some of those who did not answer did not have any experience on the subject, there were those who had experience and left these questions blank. In particular, the lack of return by some experienced staff may have prevented many issues from being revealed.

The interviews were conducted to a total of five categories, each of which had two respondents. The participants gave different, broad and deep answers to the questions. The fact that the number of categories is limited to five and the number of participants is ten, can limit the number of comprehensive responses that can be received.

Since questionnaire and interview studies were conducted only with R&D engineers, only the issues related to R&D studies of company level learning were discussed. Hence, the learning processes of technicians and administrative personnel working in the R&D department are not examined and the personnel working in departments such as production, quality, and general management are also excluded. The absence of participants from the top management obstructs the analysis of highly evaluated learning problems.

Since the thesis covers different subjects from knowledge theory to knowledge management, this study can be continued on different topics in detail. The "knowledge creation" and "current knowledge" categories in the study examine private knowledge

and learning. This study can be carried out retrospectively by researching the outcomes of the undergraduate and graduate education of the staff and the learning cultures in the academy.

As mentioned above, the study was conducted only with R&D engineers and only the learning related to R&D was examined. A more comprehensive study can be carried out by examining different areas of expertise and departments. The in-depth knowledge from interviewees and open-ended questions was much more saturated and suggestive than the close-end questions. Interview studies by increasing the number of participants on detailed R&D issues will help to reach very deep knowledge and will help to determine the strategies that will provide spot-on solutions. Besides, the studies that can be conducted to become a learning organization in the defense industry and different sectors can be examined by using the outputs of this thesis. In this process, alternative solutions and optimization studies of barriers that are hard to overcome can be investigated by different disciplines, as well.

As a broader study, research on public policies can be carried out as a continuation of this thesis. In particular, studies to improve stakeholder knowledge-sharing methods will make the innovation ecosystem more functional. Coordinating the sharing of knowledge created in the defense industry with the academy and the different sectors has the potential to make significant contributions to the national economy. Similarly, the integration of knowledge in the academy to the defense industry will save time and money for the country and may result in creating different projects.

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APPENDICES

A. APPROVAL OF METU HUMAN SUBJECTS ETHICS COMMITEE

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01 AĞUSTOS 2019

Konu: Değerlendirme Sonucu

Gönderen: ODTÜ İnsan Araştırmaları Etik Kurulu (İAEK)

İlgi: İnsan Araştırmaları Etik Kurulu Başvurusu

Sayın Prof.Dr. Erkan ERDİL

Danışmanlığını yaptığınız **Mehmet Furkan AKAR'ın "Firma Seviyesi Öğrenme Faktörleri: Türkiye Savunma Sanayi Örneği"** başlıklı araştırması İnsan Araştırmaları Etik Kurulu tarafından uygun görülmüş ve **294 ODTÜ 2019** protokol numarası ile onaylanmıştır.

Saygılarımızla bilgilerinize sunarız.

Prof. Dr. Tülin GENÇÖZ
Başkan

Prof. Dr. Tolga CAN
Üye

Doç.Dr. Pınar KAYGAN
Üye

Dr. Öğr. Üyesi Ali Emre TURGUT
Üye

Dr. Öğr. Üyesi Şerife SEVİNÇ
Üye

Dr. Öğr. Üyesi Müge GÜNDÜZ
Üye

Dr. Öğr. Üyesi Süreyya Özcan KABASAKAL
Üye

This study was conducted by Mehmet Furkan AKAR, a graduate student of the Department of Science and Technology Policy Studies, Middle East Technical University, under the supervision of Prof. Dr. Erkan ERDİL. This form is designed to inform you about the research conditions.

What is the purpose of the study? The research aims to determine firm level learning factors in the defense industry.

How do we ask you to help us? If you agree to participate in the research, you are expected to answer a series of questions on the rating scale and answer five open-ended questions briefly. Participation in this study takes an average of 15 minutes.

How will we use the information we collect from you? In the survey, you are not asked for identity and institution-specific information. Your answers will be kept entirely confidential and will only be evaluated by the researcher. Information obtained from the participants will be assessed collectively and used in scientific publications.

What you need to know about your participation: In general, the study does not include questions that may cause personal discomfort.

> # After completing the survey, you can leave it to the secretariat or notify Mehmet Furkan AKAR.

Thank you in advance for participating in this study. For more information about the research, please contact:

Researcher: **Mehmet Furkan AKAR** (E-mail: furkan.akar@metu.edu.tr)

Thesis Advisor: **Prof. Dr. Erkan ERDİL** (E-mail: erdil@metu.edu.tr)

DEMOGRAPHIC INFORMATION FORM

1- How many years have you been working in your current company?_____

2- How long have you been in your working life? ____

3- Gender (   ) Female   (   ) Male

4- Birth Year ___

5- Education Level   ( )   Undergraduate

                              ( )   Master Student   ( )   Graduate

                              ( )   Doctoral Student   ( )   Doctorate

6- Department of Graduation/ Current Study

     Undergraduate

     Graduate

     Doctorate

7-

     Department _____

8- Position

     ( )   Engineer A   ( )   Engineer B   ( )   Engineer C

     ( )   Engineer D   ( )   Engineer E   ( )   Engineer F

A. Rating Questions: Please tick the option closest to you.

Note: If you do not have any experience with the question, tick N/A.

Questions	N/A	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1 – Intensively, I use the knowledge I acquired in my undergraduate studies in my business life.	■	1	2	3	4	5
2 - Intensively, I use the knowledge I acquired in my graduate studies in my business life.	N/A	1	2	3	4	5
3 - I use the knowledge that I acquired from the company or university that I worked before my current company.	N/A	1	2	3	4	5
4 – In general, I use the information that I acquired outside the company (before or during my work) intensively in my business life.	■	1	2	3	4	5
5 - Career trainings that I attend through my company, increase my knowledge.	N/A	1	2	3	4	5
6 - Contractual R&D projects that I am working, increase my knowledge.	N/A	1	2	3	4	5
7 - Self-funded R&D projects that I am working, increase my knowledge.	N/A	1	2	3	4	5
8 - Technical discussions with my teammates increase my knowledge.	■	1	2	3	4	5
9 - Conferences I attended increased my knowledge.	N/A	1	2	3	4	5
10 - Studies with local/international consultants	N/A	1	2	3	4	5

and/or university teachers increase my knowledge.						
11 - Works with subcontractors (given package works) (excluding consultancy service) increases my knowledge.	N/A	1	2	3	4	5
12 - The current technical reports of my company increase my knowledge.		1	2	3	4	5
13 - Project reviews and progress meetings increase my knowledge.		1	2	3	4	5
14 - Patent and literature reviews increase my knowledge.		1	2	3	4	5
15 - My company cooperates with different organizations to meet mutual needs.		1	2	3	4	5
16 - In my company, employees see problems at work as an opportunity to learn.		1	2	3	4	5
17 - In my company, employees listen to the opinions of others before presenting their ideas.		1	2	3	4	5
18 - My company enables employees to get the information they need quickly and easily anytime.		1	2	3	4	5
19 - My company makes learned lessons accessible to all employees.		1	2	3	4	5
20 - Company employees are aware of the use of the existing knowledge management system.		1	2	3	4	5
21 - My company has all the technical knowledge I hold and make it available for other members.		1	2	3	4	5
22 - All the knowledge acquired in the tasks and trainings are transferred to the company so that they can be reused.		1	2	3	4	5

23 - I do not face bureaucratic obstacles to access internal knowledge.		1	2	3	4	5
24 - I have full access to the knowledge generated by the subcontractors during a given job.	N/A	1	2	3	4	5
25 - My company gives me easy access to patents and literature databases around the world.		1	2	3	4	5
26 - My company encourages employees to seek in-house answers while solving problems.		1	2	3	4	5
27 - My company provides appropriate motivating conditions for documenting information (time, accessibility, appreciation, etc.).		1	2	3	4	5
28 - I feel an environment of trust where I can share my technical knowledge comfortably within the company.		1	2	3	4	5
29 - Employees are motivated to share their tacit knowledge.		1	2	3	4	5
30 - I have enough motivation for the strong flow of information within the team.		1	2	3	4	5
31 - I have enough motivation for a strong flow of information between project stakeholders.		1	2	3	4	5
32 - I have enough motivation for a strong flow of information between teams.		1	2	3	4	5
33 - In my company, there are activities where employees from different experiences and expertise come together and produce ideas.		1	2	3	4	5
34 - In my company, there is a culture of the meeting where employees can make suggestions		1	2	3	4	5

	1	2	3	4	5
without any experience or title differences.					
35 - In my company, employees give open and honest feedback to each other.	1	2	3	4	5
36 - In my company, employees spend time with each other to create an environment of trust.	1	2	3	4	5
37 - I adopt the superior identity of the company, and I feel committed to the company.	1	2	3	4	5
38 - I think that employees generally adopt the company's superior identity and are committed to the company.	1	2	3	4	5
39 - I think my company has a learning-oriented structure rather than a performance.	1	2	3	4	5
40 - In my company, employees determine the skills they need for future work.	1	2	3	4	5
41 - My company supports the training demands of its employees.	1	2	3	4	5
42 - My company maintains an up-to-date database of employee skills.	1	2	3	4	5
43 – Overall, I find my company's knowledge creation ability is successful.	1	2	3	4	5
44 – Overall, I find my company's knowledge retention ability is successful.	1	2	3	4	5
45 – Overall, I find my company's knowledge transfer ability is successful.	1	2	3	4	5
46 – Overall, I think my company's knowledge management ability is successful.	1	2	3	4	5

B. **Open-ended Questions:** Please answer the following open-ended questions briefly. If there is insufficient space for your answers, you can use the back of the paper by typing the question number. Your responses in this section may be used in the policy determination stage after the thesis.

1- **What applications should be initiated for the development of the learning processes of the organization? (Organizational Learning)**

2- **What kind of processes should be implemented for the development of personnel learning? (Private Learning)**

3- **What can be done to make knowledge sharing more functional in the organization?**

4- **What are the barriers that arise in the learning processes of the organization? (Organizational Learning)**

- **What should be done to overcome these obstacles? What kind of applications would you do if you were authorized?**

C. SEMI-STRUCTURED INTERVIEW QUESTIONS (ENGLISH)

1. What problems do you see regarding the learning processes of the staff?

   - What can be done to solve these problems?

2. What problems do you see with the organization's learning?

   - What can be done to solve these problems?

3. What innovative applications can be initiated for the development of the organization's learning processes?

4. What kind of applications can be initiated in the organization that can increase knowledge creation?

5. What are the problems with the process of keeping the knowledge in the organization? (Not Forgetting)

   - What can be done to solve these problems?

6. What are the problems with the transfer of knowledge in the organization?

   - What can be done to solve these problems?

Questions to be added in regard to the participant

Personnel who have worked in different companies	What kind of practices are there in your previous company that you think will improve the learning processes if implemented in your current company?
Personnel who have lived/trained abroad	Are there cultural barriers to learning processes compared to abroad? How can these barriers be minimized in the corporate environment?
Personnel who have worked as academic	Are there examples of good practice that can be integrated into your company from the learning processes at the academy? What?

ARAŞTIRMAYA GÖNÜLLÜ KATILIM VE BİLGİLENDİRME FORMU

Bu araştırma, Orta Doğu Teknik Üniversitesi, Bilim ve Teknoloji Politikası Çalışmaları Bölümü yüksek lisans öğrencisi Mehmet Furkan AKAR tarafından, Prof. Dr. Erkan ERDİL danışmanlığında yürütülen bir çalışmadır. Bu form sizi araştırma koşulları hakkında bilgilendirmek için hazırlanmıştır.

Çalışmanın Amacı Nedir? Araştırmanın amacı savunma sanayiinde firma düzeyi öğrenme faktörlerini tespit etmektir.

Bize Nasıl Yardımcı Olmanızı İsteyeceğiz? Araştırmaya katılmayı kabul ederseniz; sizden beklenen, ankette yer alan bir dizi soruyu derecelendirme ölçeği üzerinde yanıtlamanız ve beş açık uçlu soruyu kısaca cevaplandırmanızdır. Bu çalışmaya katılım ortalama olarak 15 dakika sürmektedir.

Sizden Topladığımız Bilgileri Nasıl Kullanacağız? Ankette, sizden kimlik ve kurum belirleyici bilgi istenmemektedir. Cevaplarınız tamamıyla gizli tutulacak, sadece araştırmacı tarafından değerlendirilecektir. Katılımcılardan elde edilecek bilgiler toplu halde değerlendirilecek ve bilimsel yayımlarda kullanılacaktır.

Katılımınızla ilgili bilmeniz gerekenler: Çalışma, genel olarak kişisel rahatsızlık verecek sorular içermemektedir.

> **Anketi tamamladıktan sonra sekreterliğe bırakabilir ya da Mehmet Furkan AKAR'a haber verebilirsiniz.**

Bu çalışmaya katıldığınız için şimdiden teşekkür ederiz. Araştırma hakkında daha fazla bilgi almak için aşağıdaki isimlerle iletişim kurabilirsiniz.

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Tez Danışmanı: **Prof. Dr. Erkan ERDİL** (E-posta: erdil@metu.edu.tr)

DEMOGRAFİK BİLGİ FORMU

1- Mevcut şirketinizde kaç senedir çalışıyorsunuz?

2- Toplam profesyonel çalışma süreniz kaç senedir?

3- Cinsiyetiniz: Kadın   Erkek

4- Doğum yılınız:

5- Eğitim Durumunuz

    ☐ Lisans

    ☐ Yüksek Lisans Öğrenci   ☐ Yüksek Lisans Mezun

    ☐ Doktora Öğrenci   ☐ Doktora Mezun

6- Mezun Olduğunuz/   Lisans
   Okuduğunuz Bölüm
                          Yüksek Lisans   _____

                          Doktora   _____

                                               _____

7- Müdürlüğünüz:

                    _____

8- Unvanınız

    ☐ Mühendis A   ☐ Mühendis B   ☐ Mühendis C

    ☐ Mühendis D   ☐ Mühendis E   ☐ Mühendis F

A. Derecelendirme Soruları: Lütfen kendinize en yakın gelen şıkkı işaretleyiniz.

Not 1: Eğer soru ile ilgili bir deneyiminiz bulunmuyorsa "Mevcut Değil" şıkkını işaretleyiniz.

Not 2: Sorulardaki bilgi ve bilgi birikiminden kasıt, **teknik bilgidir.**

Sorular	Mevcut Değil	Kesinlikle Katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Kesinlikle Katılıyorum
1 - Lisans eğitimimde öğrendiğim bilgileri iş hayatımda yoğun olarak kullanıyorum	■	1	2	3	4	5
2 - Lisan<u>üstü</u> eğitimimde öğrendiğim bilgileri iş hayatımda yoğun olarak kullanıyorum	-	1	2	3	4	5
3 - Mevcut şirketimden önce çalıştığım firma/üniversitede edindiğim bilgiyi yoğun olarak kullanmaktayım	-	1	2	3	4	5
4 - **Genel olarak şirket dışı edinmiş olduğum (işe başlamadan önce veya devam ederken) bilgileri iş hayatımda <u>yoğun olarak</u> kullanmaktayım**	■	1	2	3	4	5
5 - Şirketim vasıtasıyla aldığım kariyer eğitimleri bilgi birikimimi artırmaktadır	-	1	2	3	4	5
6 - Çalıştığım öz kaynaklı Ar-Ge projeleri bilgi birikimimi artırmaktadır	-	1	2	3	4	5
7 - Çalıştığım sözleşmeli Ar-Ge projeleri bilgi birikimimi artırmaktadır	-	1	2	3	4	5

8 - Takım arkadaşlarımla teknik tartışmalar bilgi birikimimi artırmaktadır		1	2	3	4	5
9 - Katıldığım konferanslar bilgi birikimimi artırmaktadır	-	1	2	3	4	5
10 - Yurtiçi/yurtdışı danışmanlarla ve/veya üniversite hocalarıyla yapılan çalışmalar bilgi birikimimi artırmaktadır	-	1	2	3	4	5
11 - Alt yüklenicilerle beraber yapılan çalışmalar (verilen paket işler) (danışmanlık hizmeti hariç) bilgi birikimimi artırmaktadır	-	1	2	3	4	5
12 - Şirketin mevcut teknik raporları bilgi birikimimi artırmaktadır		1	2	3	4	5
13 - Proje Gözden Geçirme ve İlerleme Toplantıları bilgi birikimimi artırmaktadır		1	2	3	4	5
14 - Yaptığım Patent araştırmaları ve literatür taramaları bilgi birikimimi artırmaktadır		1	2	3	4	5
15 - Şirketim ortak ihtiyaçları karşılamak için farklı kuruluşlarla işbirliği yürütür		1	2	3	4	5
16 - Şirketimde, çalışanlar işlerinde yaşadıkları problemleri öğrenme fırsatı olarak görüyorlar		1	2	3	4	5
17 - Şirketimde, çalışanlar fikirlerini sunmadan önce başkalarının görüşlerini dinliyor		1	2	3	4	5

18 - Şirketim, çalışanların ihtiyaç duydukları bilgileri istedikleri zaman hızlı ve kolay bir şekilde almalarını sağlar		1	2	3	4	5
19 - Şirketim, tecrübe edinilen olumlu/olumsuz teknik çalışmalarla (lessons learned) ilgili bilgileri tüm çalışanlar için erişilebilir kılar		1	2	3	4	5
20 - Şirket çalışanlarının mevcut bilgi yönetim sisteminin kullanımına dair farkındalıkları vardır		1	2	3	4	5
21 - Şirketim bendeki teknik bilgiye tamamen sahiptir ve bunu kullanılabilir olarak saklamaktadır		1	2	3	4	5
22 - Gidilen görevler ve eğitimlerde edinilen bilgi, kullanılabilecek şekilde şirkete tamamen aktarılıyor		1	2	3	4	5
23 - Şirket içi bilgiye ulaşabilmek için bürokratik engellerle "**karşılaşmıyorum**"		1	2	3	4	5
24 - Alt yüklenicilere verilen paket işlerin sonucu üretilen bilgiye (alt yüklenicide olan bilgi) tamamıyla erişebilmekteyim	-	1	2	3	4	5
25 - Şirketim bana dünya üzerindeki patent ve literatür veritabanlarına kolayca erişim imkanı sağlamaktadır		1	2	3	4	5
26 - Şirketim; çalışanları sorunları çözerken kurum içinden yanıt aramaya teşvik eder		1	2	3	4	5

27 - Edinilen bilginin dokümante edilebilmesi için motive edici uygun şartlar sağlanmaktadır (zaman, erişilebilirlik, takdir vb)	1	2	3	4	5
28 - Teknik bilgimi şirket içinde rahatça paylaşabileceğim güven ortamını hissediyorum	1	2	3	4	5
29 - Çalışanlar sahip oldukları **örtük bilgiyi*** paylaşma motivasyonuna sahiptir	1	2	3	4	5
30 - Ekip içi bilgi akışı kuvvetli bir şekilde işlemesi için yeterli motivasyonum vardır	1	2	3	4	5
31 - Proje paydaşları arası bilgi akışı kuvvetli bir şekilde işlemesi için yeterli motivasyonum vardır	1	2	3	4	5
32 - Ekipler arası bilgi akışının kuvvetli bir şekilde işlemesi için yeterli motivasyonum vardır	1	2	3	4	5
33 - Şirketimde farklı tecrübe ve uzmanlıklardan çalışanların bir araya gelerek fikir ürettikleri etkinlikler yapılmaktadır	1	2	3	4	5
34 - Şirketimde; tecrübe ve unvan farkı olmaksızın, çalışanların motivasyonu kırılmadan öneri sunabilecekleri toplantı kültürü vardır	1	2	3	4	5
35 - Şirketimde, çalışanlar birbirlerine açık ve dürüst bir şekilde geri bildirimde bulunuyorlar	1	2	3	4	5

36 - Şirketimde, çalışanlar güven ortamı oluşturabilmek adına birbirleriyle zaman geçiriyorlar	1	2	3	4	5
37 - Şirketimin üstün kimliğini benimsiyor ve kendimi şirkete bağlı hissediyorum	1	2	3	4	5
38 - Çalışanların genel olarak, şirketin üstün kimliğini benimsediğini ve şirkete bağlı olduklarını düşünüyorum	1	2	3	4	5
39 - Şirketimin, performanstan daha çok öğrenme odaklı bir yapısı olduğunu düşünüyorum	1	2	3	4	5
40 - Şirketimde, çalışanlar gelecek çalışmalarda ihtiyaç duyacakları becerileri belirlerler	1	2	3	4	5
41 - Şirketim, çalışanlarının eğitim taleplerini desteklemektedir	1	2	3	4	5
42 - Şirketim, çalışanların becerileri konusunda güncel bir veri tabanı tutmaktadır	1	2	3	4	5
43 - Genel olarak şirketimin bilgi üretme yeteneğini başarılı buluyorum	1	2	3	4	5
44 - Genel olarak şirketimin bilgiyi depolama yeteneğini başarılı buluyorum	1	2	3	4	5
45 - Genel olarak şirketimin bilgi transferi yeteneğini başarılı buluyorum	1	2	3	4	5
46 - Genel olarak şirketimin bilgiyi başarılı bir şekilde yönettiğini düşünüyorum	1	2	3	4	5

B. Açık Uçlu Sorular: Lütfen aşağıdaki açık uçlu soruları kısaca cevaplayınız. Yanıtlarınız için verilen alan yetersiz kalması durumunda kağıdın arkasını soru numarasını yazarak kullanabilirsiniz. Bu bölümdeki cevaplarınız tez sonucu politika belirleme aşamasında kullanılacaktır.

5- **Organizasyonun öğrenme süreçlerinin gelişimi için ne gibi uygulamalar yapılmalıdır? (Şirketin Öğrenmesi)**

6- **Personelin öğrenmesinin gelişimi için ne tür süreçler hayata geçirilmelidir? (Kişisel Öğrenme)**

7- **Şirket içi bilgi paylaşımın daha işlevsel hale gelmesi için neler yapılabilir?**

8- **Organizasyonun öğrenme süreçlerinde ortaya çıkan engeller nelerdir? (Şirketin Öğrenmesi)**

- **Bu engellerin aşılması için neler yapılmalıdır? Bu konuda yetkili siz olsanız ne gibi uygulamalar yapardınız?**

E.   SEMI-STRUCTURED INTERVIEW QUESTIONS (TURKISH)

MÜLAKAT SORULARI

1- Personelin öğrenme süreçleri ile ilgili gördüğünüz problemler nelerdir?

1.1-   Bu problemlerin çözümü için neler yapılabilir?

2- Organizasyonun öğrenmesi ile ilgili gördüğünüz problemler nelerdir?

2.1-   Bu problemlerin çözümü için neler yapılabilir?

3- Organizasyonun öğrenme süreçlerinin gelişimi için **yenilikçi** ne gibi uygulamalar yapılabilir?

4- Organizasyonda bilgi üretimini artırabilecek ne gibi uygulamalar yapılabilir?

5- Organizasyonda bilginin tutulması (unutulmaması) konusunda ne gibi problemler vardır?

5.1-   Bu problemlerin çözümü için neler yapılabilir?

6- Organizasyonda bilgi transferi konusunda ne gibi problemler vardır?

6.1-   Bu problemlerin çözümü için neler yapılabilir?

Katılımcıya Göre Eklenecek Sorular:

Farklı firmada çalışmış	Önceki firmanızda olup, mevcut şirketinizde uygulandığı takdirde şirketin öğrenme süreçlerini geliştireceğini düşündüğünüz ne tür uygulamalar vardır?
Yurtdışında yaşamış/eğitim görmüş	Yurtdışı ile kıyaslandığında öğrenme süreçleri ile ilgili kültürel engellerimiz var mıdır? Varsa bu engeller şirket ortamında nasıl minimize edilir?
Akademik Kariyer yapmış	Akademideki öğrenme süreçlerinden şirketinize entegre edilebilecek iyi uygulama örnekleri var mıdır? Nelerdir?

18. yüzyıldan Britanya'da başlayan sanayi devriminden itibaren bilim ve teknoloji daha önde gelen ekonomik olgular haline gelmektedir. Bilim ve teknolojik çalışmalar sayesinde birçok buluş üretilmekte ve ortaya çıkan bu buluşların çoğu yeni buluşlar için fırsatlar yaratan pazarlar açmaktadır. Bu döngü sanayi ekonomisinin yayılmasına yardımcı olmaktadır.

Bilim ve teknolojinin ilerlemesine olan etkiler, belirli zaman aralıklarında her sektör için farklılık göstermiştir. Teknoloji gelişiminde bir zamanlar öncü olan sektörler günümüzde sadece diğer sektörlerin geliştirmeye devam ettiği teknolojileri kullanıyor olabilirken, bilim ve teknoloji tarihinde önemli yerleri olmayan bazı sektörler bugün teknolojinin ilerlemesinde çok ciddi görevler üstlenebilmektedir. Bu durumun bilinen bir örneği, sanayi devriminin başlangıcında, teknolojiyi yönlendiren tekstil sektörünün, 21. yüzyıldaki teknolojik gelişmeler üzerindeki etkisinin giderek azalmasıdır. Bu değişim trendinin temel nedenleri ekonomik kaygılar ve teknolojik gereksinimlerdir. Ekonomi açısından, yatırımcılar yüksek yatırım getirisi olan sektörlere yönelme eğilimindedir. Sonsuz bir döngüde, yatırımlar teknolojik gelişmeyi hızlandırırken ve teknolojik gelişmeler, buluşlara olan yüksek talebin bir sonucu olarak yatırım getirisini arttırmaktadır.

Teknolojik olarak, sektörler henüz olgunlaşmamış bazı öncül teknolojilere bağımlı olabilir ve bu teknolojileri farkında olmadan bekliyor olabilirler. Bununla birlikte, herhangi bir sektör çok disiplinli bir yapıya sahip olabilir ve diğer sektörleri de bu kapsamda teknolojik olarak besleyebilir. Bu bağlamda, son yüzyılda bilim ve teknolojiyi ilerleten sektörlerinden birinin savunma sanayi olması şaşırtıcı değildir. I. ve II. Dünya Savaşı sonrasında ülkeler için ulusal güvenlik perspektifi önemli ölçüde değişti. Yeni bakış açısı ile hükümetler üstünlük elde etmek için yüksek teknolojiye odaklanırken, ulusal güvenlik bütçesini önemli ölçüde artırdı. Savunma sanayi, iletişimden teknolojilerinden görüntüleme dedektörüne kadar, birçok farklı teknoloji ile ilgilidir. Endüstrinin yüksek bütçesi nedeniyle ilgili teknolojiler de hızlı şekilde

gelişmektedir. Sonuç olarak, savunma sanayii çalışmaları sayesinde, günlük hayatta kullandığımız ve milyarlarca dolarlık ekonomiye sahip sayısız icat ortaya çıkmıştır.

Bu durum hem askeri hem de sivil kullanımlar için tüketilebilecek teknolojik ürünleri ilgilendiren çift kullanım konseptini yaratmaktadır. Aynı zamanda kendine has ticaret düzenlemeleri olan bu özel kavramın günümüzde çeşitli örnekleri bulunmaktadır. Örnek olarak, füze endüstrisinde hem askeri roketler hem de uydular benzer yöntemlerle ve teknolojik araçlarla üretilmektedir. Benzer şekilde, nükleer silahlar acımasız askeri silahlardan biri olsa da nükleer teknolojiler sivil kullanım için büyük miktarda enerji sağlıyor. Son olarak, termal kameralar hem sahada gece görüş için askeri operasyonlarda hem de ve tıbbi görüntüleme için sağlık alanında kullanılmaktadır.

İnsanlık, var olan mevcut ürünleri üreterek ve tüketerek hayatını sonsuza kadar sürdürebilir, ancak gelişme ve rekabet arzusu yeni sorunlar ve bu sorunların çözümlerini bulmamızı sağlar. Ulusların yeni çağdaki rekabeti bir şekilde bilim ve teknolojiye dayanmaktadır çünkü yenilikçi ürünler mevcut pazarlara hükmetme veya yenilerini yaratma potansiyeline sahiptir.

Bugün, bilim ve teknoloji ile ilgili birçok sektöründe çok sayıda şirket ve Ar-Ge çalışanı var ve bilgiye ulaşmak her zamankinden daha kolay. Hızla bilgi edinme yeteneği, en az bilginin kullanışlılığı kadar hayati bir hale gelmiştir. Bu bağlamda, şirketler ve ülkeler için kişisel ve örgütsel öğrenme stratejileri teknolojik gelişme konusunda güncel kalmalarına katkıda bulunmaktadır. Bu nedenle, bir firmanın öğrenmeye odaklanan inovasyon politikası, teknoloji yarışında geride kalmaması için olmazsa olmazıdır.

Yoğun bilgi üretimi yapılan Ar-Ge çalışmalarında şirketler ve bireyler bilgiyi kendileri oluşturabilir veya dış kaynaklardan elde edebilirler. Kullanılan bilgi kurumlara kısa vadede fayda sağlayabilse de en önemli unsur bilginin kurum tarafından öğrenilmesidir. Öğrenme kavramı, firmalara daha uzun vadeli ve kalıcı kazanımlar sağlayabilir. Bunlardan en önemlisi istikrarlı ve artan performansın sonucu olarak şirketin bilgi kapasitesi ve pazar payının artırılabilmesidir. Bir diğer kritik sonuç ise öğrenilen bilgilerle tekraren harcanan çaba ve paradan kurtulmaktır.

Bu tez, bir savunma sanayi firmasında örgütsel öğrenme süreci için itici güçleri ve engelleri analiz eden faktörleri bulmayı amaçlamaktadır. Ek olarak hem şirket hakkında hem de organizasyondaki öğrenme, kültür ve öğrenme sürecindeki potansiyel gelişmeler hakkında bir perspektife sahip olmak araştırılmaktadır. Bu bağlamda, bu çalışmanın aşağıda belirtilen araştırma sorularını cevaplaması amaçlanmıştır.

Araştırma Sorusu-1:
Savunma sanayi şirketinde örgütsel öğrenmenin itici güçlerini ve engellerini analiz eden faktörler nelerdir?

Araştırma Sorusu-2:
Savunma sanayiinde örgütsel öğrenmeyi nasıl daha verimli hale getiririz?

Savunma Sanayi

Ülkeler sürekliliğini sağlamak için sınırlarını korumak zorundadırlar. Bu sınırları korumak için devletler, zor durumlar için gerekli ekipmanı ve gerekli ekipmanı doğrudan koruyabilen veya kullanabilen ordu personeline sahip olmalıdır. En genel anlamda savunma sanayi, ulusal savunma alanında ihtiyaç duyulan alet ve ekipmanların üretimini sağlayan sektör olarak tanımlanabilir.

Sektör genellikle devletlerin yakın kontrolü ve koordinasyonunda ilerlemektedir. Ulusal güvenlik devletlerin en önemli önceliği olduğundan sektöre verilen önem çok büyüktür. Ülkeler savunma sanayi stratejilerini jeopolitik durumlarına, ekonomilerine, askeri yapılarına, stratejik hedeflerine ve teknolojik yeterliliklerine göre tanımlayarak ciddi bütçeler tahsis etmektedir. Ulusal güvenlik nedeniyle, sektöre yüksek bir bütçe ayırmaktan çekinmemek, sektörü maliyet-etkin olmaya zorlamaz; bu çok ciddi paralar harcanmasına olanak sağlar.

Savunma sanayi, ordulara avantaj sağlamayı amaçlayan çeşitli ürünlerin Ar-Ge ve üretimine odaklanmaktadır. Ülkeler savunma ihtiyaçlarını en iyi şekilde karşılamak için yüksek tutarlı Ar-Ge harcamaları yapmaktadır. Bu yüksek bütçe, rahatlık bir şekilde yatırım yapılarak teknolojinin ilerlemesini sağlar. Sivil alanda kullanılabilecek sistemlerin temellerini atarken devletlerin savunma ihtiyaçlarını karşılamalarına

yardımcı olmak için Ar-Ge yatırımları ve çalışmaları sonucunda birçok buluş ortaya çıkmıştır.

Savunma sanayi, havacılık ve uzay endüstrisi ile birçok benzer özelliğe sahip olmasından dolayı, genellikle Havacılık ve Savunma Sanayi olarak birlikte incelenmektedir. Ülkeler bütçeleri dahilinde bu sektörde sıkı bir rekabete girerken, sektörün en güçlü ülkesi olan ABD'nin sektörde sadece Ar-Ge'ye harcadığı para miktarı 2018 yılında 110 milyar dolar olarak gerçekleşmiştir. Bunula birlikte ABD'de Havacılık ve Savunma Sanayi sektöründe 888,575 kişi istihdam edilmektedir.

Ülkemizde savunma sanayine verilen önem, jeopolitik durumlar nedeniyle sürekli olarak artmaktadır. Bununla birlikte, çok sayıda askere dayanan temel savunma yöntemini teknoloji kullanımına dönüştürme eğilimini özümseyebilen Türkiye'de, savunma sanayi gelişmiş ülkelerde olduğu gibi devletin kontrolü ve koordinasyonu altında ilerlemektedir. Savunma sanayi harcamalarının birincil kaynağı Milli Savunma Bakanlığı'nın (MSB) bütçesi olmakla birlikte, koordinasyon sağlayan en kritik kurum Savunma Sanayi Başkanlığı'dır (SSB).

Türkiye'de Savunma Sanayi sektöründe, 2018 yılında 8.8 milyar USD ciro gerçekleştirilmiş ve 67,239 kişi istihdam edilmiştir. Ar-Ge çalışmaları kapsamında ürün ve teknoloji geliştirmeye harcanan 1.4 milyar ABD doları pozitif getiri artan siparişler ile görülmektedir. 2017 yılında sektör oyuncularının sipariş defterlerine yeni verilen siparişlerin tutarı 8 milyar USD'dir. Bu tutarda önemli bir artış (51.51%) meydana geldi ve alınan toplam sipariş sayısı 12 milyon USD civarında gerçekleşti.

Ülkemizde savunma sanayinin genel işleyişi, SSB ve MSB'nin TSK'nın mevcut ve gelecekteki ihtiyaçlarını analiz etmesinin ardından yapılan teklif çağrılarıyla başlamaktadır. Teknik görüşmeler sonrasında ihtiyaç duyulan kalemlerin özellikleri belirlenerek ve ihaleye çıkılmakta; ihaleyi kazanan şirketler projeyi sözleşme şartlarına göre üstlenmektedirler. SSB'nin ihale ettiği projeler, Türkiye'nin hedefleri doğrultusunda millileştirme oranını artırmayı hedeflemektedir ve bu bağlamda teknoloji kazanımına büyük önem verilmektedir. Ayrıca, ihalelerde şirketlerin bilgi ve insan kaynakları profili büyük önem taşımaktadır.

SSB, bazı projelerine Teknoloji Kazanım Yükümlülüğü getirerek öğrenme ekosistemine katkıda bulunmaktadır. Teknoloji Kazanım Yükümlülüğü ile nihai ürüne girdi sağlamak amacıyla ana yüklenicinin sorumluluğu altındaki KOBİ'lerin ve üniversite/araştırma kurumlarının ortak çalışmaları ile teknoloji geliştirilmesi hedeflenmektedir. Teknoloji Kazanım Yükümlülüğü Projeleri kapsamında sektörün benzersiz ve yeni teknolojiler geliştirmesi teşvik edilmekte ve SSB bünyesindeki ilgili bölümlerle koordinasyon içinde ana sistemlerde millileştirme oranının artırılması hedeflenmektedir.

SSB Ar-Ge projelerinin tüm çıktılarının kuruma verilmesi zorunludur. Bu bağlamda üretilen tüm bilgilerin uygun biçimde belgelenmesi ve SSB'ye sunulması beklenmektedir. Kurum, gerektiğinde teknoloji transferi için inisiyatif alarak paydaşlar arasında arabuluculuk yapabilmektedir. Ayrıca, projeden bağımsız olarak sektörün insan kaynakları profilini oluşturmaktan sorumlu olan kurum, eğitim ihtiyaçlarını karşılamaya yönelik politikalar da belirlemektedir.

SSB projeleri savunma sanayi şirketleri için en önemli gelir kaynağıdır. Bu projeler üretim ya da Ar-Ge projeleri olabilmektedir, ancak daha önce de belirtildiği gibi, bu projeleri alabilmek için yeterli insan kaynağına ve bilgiye sahip olmak gerekmektedir. Özellikle, üretim projeleri yüksek sözleşme maliyetleri ile şirket cirolarını önemli bir şekilde artırmaktadır ve bu projelerin genellikle Ar-Ge faaliyetleri olmadığından gerçekleştirilmesi daha kolaydır.

Şirketler kendi inisiyatifleriyle veya hükümetten talep üzerine teknolojik kazanımlar elde etmeye çalışırlar. Bu kazanımları mevcut ürünlerinin yeteneklerini geliştirmek veya yenilikçi ürünler üretmek için kullanabilmektedirler. Şirketler Ar-Ge projelerini SSB ile sözleşmeli olarak yapabilirken, kendi öz kaynakları ile de bilgilerini artırmaya yönelik projeler de üretebilmektedirler. Bu projeler arasında iki ana fark vardır; birincisi, kısa vadede SSB Projeleri şirketlere kar sağlarken, öz kaynaklı projeler sadece giderleri artırmaktadır. İkinci olarak, SSB Ar-Ge projelerinde takvim gereksinimlerini karşılama yükümlülüğü vardır, ancak öz kaynaklı Ar-Ge projelerinin genellikle şirket dışından herhangi bir takvim yükümlülüğü bulunmamaktadır.

Sektörün ve şirketlerin güçlü finansal yapısı nitelikli personel istihdamını kolaylaştırmaktadır. Ar-Ge çalışmalarının kalitesi, istihdam koşulları ve gelecek vaat eden şirketler nedeniyle birçok yeni mezunun ilk hedefi savunma sanayi firmaları olmaktadır. Çalışanlar Ar-Ge çalışmalarına paralel olarak lisansüstü eğitimlerine devam etme eğilimindeyken, sektörde çalışan mühendislerin yüzde 35'i yüksek lisans derecesine sahiptir.

2018 yılı verilerine göre 67.239 savunma sanayi çalışanından 16.040'ı şirketlerde mühendis olarak çalışmaktadır. Ayrıca, sektörün toplam istihdamının yüzde 20'sinden fazlasının Ar-Ge departmanlarına ait olması, sektörün bilgi üretimi ve öğrenimine katkısını göstermektedir.

Bu çalışma için başlangıç olarak, bilgi alanında literatür araştırması yapıldı. Bilgi ve bilgi yönetimi kavramları örgütsel öğrenme ile güçlü bir şekilde ilişkilidir. Örgütsel öğrenmenin temel değeri bilgidir; dolayısıyla örgütlerdeki öğrenme süreçleri de iç paydaşların bilgisi ile ilişkilidir. Bilgi, örgütsel öğrenmenin yapıtaşı olarak görülebilir. Dikkat çekici bir şekilde, örgütsel öğrenme çalışmalarının çoğu örgütsel yapıdaki farklı bilgi aşamalarını araştırmaktadır. En genel anlamda örgütsel öğrenme, bilginin yaratılması, aktarılması ve tutulması bütünüyle ilgilidir (Argote, 2011).

Bilgi ekonomisi içerisinde yer alması zorunlu olan bilgi yönetimi literatürü de gözden geçirildi. Sadece şirketler değil, ülkeler de bilgilerine göre sıralanmaktadır. Bulunduğumuz dönem, bilgi potansiyellerini ele alamayan aktörler için acımasız olabilmektedir. Sayısız rakip ve sınırsız bilgi kaynağı; pazarlar için, sermayeden bağımsız olarak, uygun bir bilgi yönetimi yapısıyla ön plana çıkabilecek yeni oyuncular yaratabilmektedir. Şirketler sürdürülebilirlik konusundaki bilgilerini iş hayatında yürütmek zorundadır.

Ayrıca araştırma soruları doğrultusunda örgütsel öğrenmeye ilişkin literatür de gözden geçirilmiştir. Bilgi yönetiminin en önemli kısmı örgütsel öğrenme aşamasıdır. Öğrenme olmadan, bilgi ve bilginin yönetimi kavramları eksik ve devamlılığı olmayan terimler olarak kalmaktadır. Örgütlerin öğrenme yeteneği şirketlerin pozisyonlarını ve ilerleme yönlerini tanımlayabilir. Başarılı bir öğrenme sistemi şirketleri zirveye taşırken, belirsiz öğrenme sistemleri organizasyonların sonunu getirebilir.

Literatür taramasından sonra tez beş adımda tamamlanmıştır.

Adım 1: Kavramsallaştırma

Araştırmayı ilerletmek için, gözden geçirilmiş literatüre uygun olarak kavramsallaştırma çalışmaları yürütülmüştür. Genel kavramsallaştırma Bölüm 3.1'de açıklanmıştır; bu bölümde genel ve kategorize edilmiş değişkenlerin nasıl belirlendiği açıklanmaktadır. Bu adımın sonucunda altı kategori altında 41 değişken belirlenmiş ve bu altı kategorinin beşi için genel değerlendirme kapsamında beş değişken oluşturulmuştur. Bölüm 3.2'de tanımlanan değişkenler hem açık uçlu hem de mülakat sorularını oluşturmak için de kullanılmıştır. Bu bölümde 46 değişkenin tamamı yapılan geniş literatür araştırmasına göre oluşturularak ayrı ayrı açıklanmıştır. Anket ve mülakat soruları her değişkenlerin her açıklama kısmından sonra sunulmuştur.

Adım 2: Anket

Bir sonraki adımda, anket tipi seçimi ve bu seçimin avantajları belirtilmiştir. İlk araştırma sorusu, savunma sanayi şirketinde örgütsel öğrenmeyi engelleyen ve destekleyen faktörleri araştırmaktadır. Likert Ölçekli anket sayesinde bu faktörler ortaya çıkartılabildiği için sorular sistematik olarak bu yöntemle hazırlanmıştır. Crawford'un (1997) "Anketin Geliştirilmesinde Yer Alan 9 Adım" Ek B'de verilen anketi tasarlamak için kullanılmıştır.

Adım 3: Mülakatlar

Yarı yapılandırılmış mülakat bölümü ikinci araştırma sorusunun cevabını bulmak için gerçekleştirilmiştir: Savunma sanayiinde örgütsel öğrenmeyi nasıl daha verimli hale getiririz? Bu araştırma sorusu, ilk soruyu tamamlayıcı olarak oluşturulmuştur, ancak bu sorunun cevaplarının önceki araştırma sorusunda kullanılan aynı yöntemle elde edilmesi mümkün değildir. Bundan dolayı, Harrell ve arkadaşlarının (2009) tanımladığı avantajları göz önünde bulundurarak yarı yapılandırılmış mülakat uygulamaya karar verilmiştir. Daha sonra sorular Harrell ve arkadaşlarının (2009) önerdiği kurallara göre oluşturulmuştur. Mülakat yöntemi zorlu bir yöntemdir çünkü soruları tasarladıktan sonraki süreç olan yürütme aşaması da soruların tasarımı kadar

kritiktir. Verimli mülakatlar gerçekleştirebilmek için Dillon ve arkadaşlarının (1994) sunduğu altı temel kurala uyulmuştur.

Adım 4: Analiz

Anket ve mülakat katılımcıları için demografik analiz Bölüm 4.1'de sunulmuştur. Kapsamlı bir analiz yapmak için anket sorularının tanımlayıcı istatistikleri verilmiş ve değişkenlerin ortalamaları bu bağlamda yorumlanmaktadır. Değişken kategorilerine göre öne çıkan istatistiklerin vurgulandığı bölüm, doğrulama bölümü ile devam etmektedir. Bir doğrulama aracı olarak, 5 ölçekli Likert soruları 3 ölçekli olarak düzenlenerek "Katılıyorum", "Kesinlikle Katılıyorum" seçenekleri " Katılıyorum" ve "Katılmıyorum", "Kesinlikle Katılmıyorum" seçenekleri "Katılmıyorum" olarak değiştirilmiştir. Böylece Şekil 1'de de görülebileceği üzere, her değişken için 3 ve 5 ölçekli Likert sonuçları değerlendirilerek doğrulama yapılmıştır. Bu kapsamda, her değişken için 5 ölçekli Likert sonuçlarına verilen yanıtları ortalamasının orta nokta olan 3.00 değerine göre pozisyonu ve 3 ölçekli türetilmiş cevapların yüzdesel dağılımının uyumluluğu incelenmiştir.
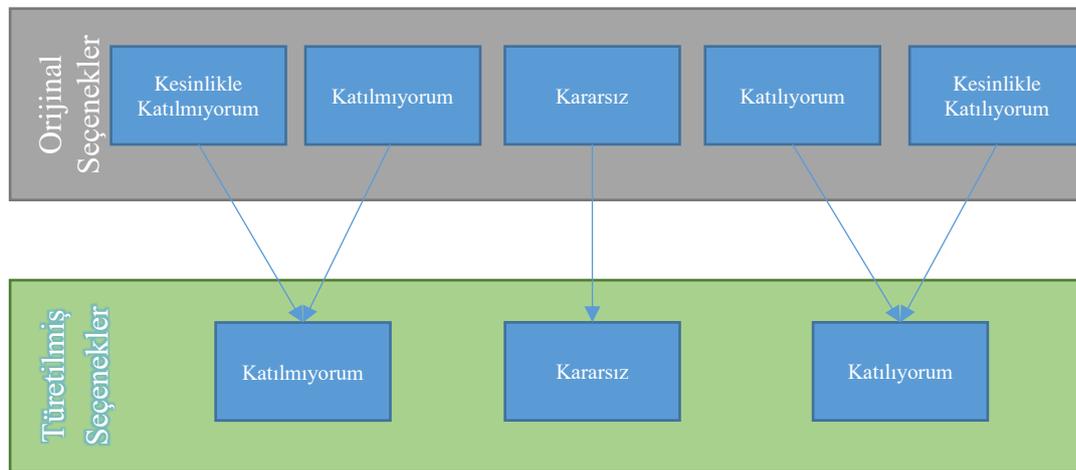
Şekil 1: Likert Ölçekli Seçimlerin Türetilmesi

Tez'de nitel analiz kapsamında iki ayrı çalışma yapılmıştır. İlk olarak, açık uçlu sorular kodlanarak genel kavramlar oluşturulmuş ve gruplandırılarak analiz edilmiştir. İkincisi, mülakatlarda alınan yanıtlar nitel olarak incelenmiştir. Açık uçlu sorulara benzer olarak verilen cevaplar kodlanmış ve daha genel ifadelere dönüştürülerek değerlendirmeler bu bağlamda ilerletilmiştir. Mülakatta bulunan altı temel soru geniş

bir perspektiften incelenmiştir. Mülakat katılımcı profillerine göre hazırlanan ek sorular, dış durumlarla karşılaştırma yapmak için ayrı ayrı analiz edilmiştir.

Adım 5: Strateji Önerileri

Strateji Önerileri adımında, şirketin örgütsel öğrenme performans verimliliğini artıracak stratejiler önerilmektedir. Strateji oluşturma aşamasında şirketin örgütsel öğrenmesinin önündeki itici güçler ve engeller dikkate alınmıştır.

Tezin araştırma sorularına cevap arama kapsamında uygulanan anket çalışması sonucunda dağıtılan 140 kişiye dağıtılan formlardan 100 geri dönüş sağlanmıştır. Anketin 71.4'i ile iade edilen sorular altı farklı kategoriye ayrıldı ve beş kategori için genel değerlendirme soruları eklendi. Ayrıca sorular daha anlamlı yorum yapabilmek için soruluş tiplerine göre beş farklı türe ayrılmıştır. Açık uçlu sorulardan dördü mühendislerin iyileştirme ve problem çözme önerilerine odaklanırken, bir açık uçlu soru katılımcıların örgütsel öğrenmenin sorunları hakkında görüşlerini ayrıntılı olarak topladı. Her beş katılımcıdan yaklaşık üçünün cevapladığı soru, örgütsel öğrenmenin önündeki engelleri bulmayı amaçlamıştır.

Mülakat soruları ikinci araştırma sorusuna cevaplar almayı amaçlamaktadır. Sorular, şirketin örgütsel öğrenme performansını artıracak stratejileri anlamaya yönelik olarak tasarlandı ve görüşmeler sırasında çalışmaya odaklanmak için yönlendirmeler yapılmıştır.

Şekil 1'de görülebileceği üzere, tezde sorulan Likert Ölçekli sorular ile destekleyici ve engelleyici unsurlar ortaya çıkarılmaya çalışılmıştır. Sorulara beş puan üzerinden verilen yanıtlar ile her bir değişkenin şirkette engelleyici mi destekleyici mi olduğu incelenmiştir. Anket çalışmasındaki açık uçlu sorular örgütsel öğrenmeyi engelleyen unsurları sorgulamakla birlikte, şirketin öğrenme performansını artırabilecek çalışmaları da sorgulamıştır. Mülakat soruları ise mevcut problemlere değinmiş olsa da şirketin örgütsel öğrenme performansını artırmak üzere öneriler toplamıştır.
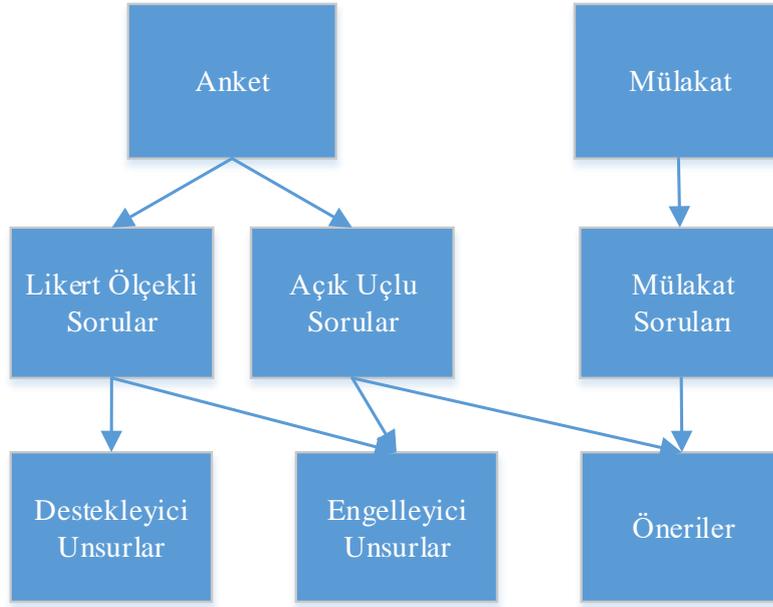
Şekil 2: Anket ve Mülakat Çalışması Arasındaki İlişki

Laloux'un (2004) belirttiği gibi, organizasyonlar arasında en gelişmiş olanı öğrenen organizasyonlardır. Bilinç aşamalarının son seviyesindeki öğrenen organizasyonlar, birliği, ortak hedefleri ve yüksek iş birliğini temsil etmektedir. Bu kuruluşlar güçlü kurumsal hafızaları ve bilgi depolarıyla öne çıkarken, insan gibi esnek öğrenme ve gelişim becerilerine sahip olmalıdırlar. Tıpkı insanlar gibi, mükemmel öğrenme organizasyonlarında her beyin hücresi ve duyu organı, sürekli gelişim hedefi ile tam senkronizasyonda çalışmalıdır. Mükemmelliğe ulaşmanın imkansızlığı, öğrenen organizasyonlara ve öğrenme yolunda ilerleyen organizasyonlara her zaman geliştirmeleri gereken unsurlar sağlamaktadır.

Öğrenme süreçlerine ve stratejilerine yapılan yatırımlar şirketin ve çalışanlarının geleceğine önemli ölçüde katkıda bulunmaktadır. Öğrenme süreçlerine yatırım yapmak, sivil sektördeki kuruluşların üretim ve satış performanslarından vazgeçmelerine anlamına gelebilirken, savunma sanayinin farklı doğası nedeniyle, feragat edilen konu üretim veya satış değil, diğer Ar-Ge faaliyetleri olmaktadır. Savunma sanayiindeki şirketler genellikle belirlenen prosedürler ile yoğun Ar-Ge çalışmaları yürütmektedir ve Ar-Ge çalışmalarına belirledikleri yöntemlerle devam etmektedirler. Savunma sanayiinde öğrenme stratejileri önermek hassas bir konudur,

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çünkü bu belirlenmiş yöntemleri bozan öğrenme süreçleri şirketlere ciddi zarar verebilir.

Önerilen stratejiler iki başlık altında toplanmıştır. Bunlardan ilki, genel iyileştirmeler ve daha temel konularla ilgilenen "Genel İyileştirme Stratejileri"dir. Diğer başlık, mevcut sorunlara bakılmaksızın, şirketin faaliyete geçirmesi durumunda örgütsel öğrenme performansını geliştireceği düşünülen stratejileri içeren "Yenilikçi Stratejiler"dir.

Genel İyileştirme Stratejileri

Şirket, mevcut yöntemlerini ve yeteneklerini iyileştirerek öğrenme performansını ve verimliliğini artırabilir. Birçok sorun ve önemli eksiklikler hali hazırda değerlendirilmektedir ve şirket şu anda bunlara özel çözümler sunabilmektedir; ancak, bu çözümleri yeniden düzenleyerek ve geliştirerek önemli öğrenme kazanımları elde edilebilir. Önerilen iyileştirme stratejileri aşağıdaki gibidir.

- En önemli iyileştirmelerden birisi, kütüphanesi, tartışma sayfaları ve teknik bilgi veri tabanı olan, iyi tasarlanmış, kullanıcı dostu ve kapsamlı bir çevrimiçi bilgi platformuna sahip olmaktır. Çalışanlar, ihtiyaç duydukları bilgileri anahtar kelimelerle arayabilmeli, benzer anahtar kelimelerle ilgili tartışma sayfalarını bulabilmeli veya yeni tartışmalar başlatabilmelidir. Ayrıca, ilgili bilgiye sahip personel sistemde bulunabilmeli ve bu anahtar kelimeler hakkındaki deneyimlerini sunabilmelidir. Tüm çalışanlar için, düzeyleri ile birlikte sahip oldukları bilgileri içeren bir veri tabanı, konuyla ilgili çevrimiçi tartışmalardan otomatik olarak haberdar olmalarını ve ihtiyaç sahiplerine yardımcı olmalarını sağlar. Bu iyileştirme bilgiye erişim için rahat ve pratik bir kanal açacaktır.

- Dokümantasyon, şirketin öğrenme süreçleri için temel unsurlardan biridir ve bilgiyi sisteme kaydetmenin mevcut çözümüdür. Tasarım süreçleri ile entegre bir yapı kurarak sürecin gereksiz olduğu algısı nedeniyle ihmal edildiği ortam ortadan kaldırılabilir. Doküman sıklığını artırarak kapsam azaltılabilir. Belgelerin bir başkasının anlayacağı şekilde hazırlanması ve içeriğin

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doğruluğu, tasarım ekiplerinin kısa ve sık toplantılarında birlikte incelenebilir ve yönlendirilebilir. Belgelerde sunulan bilgilerin toplu olarak yönetilmesi ve birbirleriyle ardışık ilişkilerin tesis edilmesi, gerekli bilgiye erişimi kolaylaştıracak önemli bir faktördür.

- Öğrenme hakkında ilk akla gelen yöntem eğitim ve öğretimdir. Birkaç gün süren sınıf içi eğitim seçimi ve eğitim sonunda sınavlarla öğrenme durumlarının test edilmesi verimliliği önleyebilir. Eğitimin daha etkileşimli olarak sürdürülmesi ve eğitimden sonra öğrenme durumunun periyodik hatırlatmalar ve testlerle sorgulanması, personelin eğitimi içselleştirmesine yardımcı olacaktır. Bilginin içselleştirilmesinin en başarılı yöntemlerinden biri olan öğrenme, bu amaçla kurulmuş bir atölye vasıtasıyla gerçekleştirilebilir; mühendisler atölyede hata senaryoları deneyebilir ve gerçek sistemleri etkilemeden öğrenebilirler.

- Çok sayıda proje ve personele sahip olan şirkette, personelin projelere dağıtılması ve projelerin takvimleri mühendislerin iş yükünü doğrudan belirler. Personel, iş yüklerinin iyi ayarlanmadığı ortamlarda genellikle aşırı yüklenmeye maruz kalır. Çalışanlara düzenli takvimler ve kabul edilebilir iş yükleri aracılığıyla kendileri ve öğrenmeleri için yeterli zaman tanınacaktır. Bu nedenle, proje ve kaynak yönetiminin iyileştirilmesi, personelin ve şirketin öğrenme performansına katkıda bulunacaktır.

- Öğrenme motivasyon gerektiren bir süreçtir. Şirketin ve çalışanların motivasyonu, bilginin öğrenilmesini ve özümsenmesini sağlar. Çalışanlar, geliştirmek istedikleri konularda eğitim alarak motive edilebilirler. Şirketin çalışanlarının kariyer hedeflerine göre kişiselleştirilmiş öğrenme planları geliştirmesi ve bu eğitim sürecini takip etmesi, yüksek motivasyonu sürdürerek öğrenme süreçlerini geliştirecektir. Bu süreçte personele sürekli geri bildirim sağlamak ve öğrenme planı doğrultusunda ilerlemek şirkete önemli faydalar sağlayacaktır.

- Teknik raporların hazırlanmasıyla paylaşılan bilgi, personel tarafından tutulan bilgilerin çoğunu kapsamamaktadır. Akademideki atıf sisteminin şirketin Ar-

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Ge sistemine uyarlanması, personelde bilginin daha verimli bir şekilde paylaşılmasını sağlayacaktır. Bu bağlamda, Ar-Ge süreçlerinin her adımında kullanılan bilgilerin kaynağını kaydetmek gerekmektedir. Sistem, mevcut teknik raporlarda kullanılan bilgilerin ilgili belgelere atıfta bulunulmasını ve belge yazarının atıf sayısının artmasına dayanmaktadır. Bu yöntemle, bireylerin bilgilerinin sıralamasının (bilgi belgelerinin yazarları) takip edilebileceği ve bilgi yaratma ve paylaşma rekabetinin sağlanabileceği bir ortam yaratmak mümkündür. Bilgi paylaşımının bu yöntemle entegre bir performans endeksi olarak değerlendirilmesi, şirketteki öğrenme bilincini de artıracaktır.

- Şirketler mevcut ve planlanan projelerde zaman kaybetmeden bilgi ihtiyaçlarını karşılamak ve projeleri mümkün olan en iyi şekilde tamamlamak istiyor. Projelerin gerekleri ve ilgili Ar-Ge faaliyetleri; personelin sadece bu kapsamdaki bilgileri öğrenmesi beklendiğinden, öğrenme süreçlerini sınırlayabilir. Bu sorunu çözmek için personele projeden bağımsız olarak serbest zaman ve bütçe sağlanmalı ve şirketin hedefleri doğrultusunda kendilerini geliştirebilecek araştırmalar yapabilmelidir. Araştırma ve çalışmalarının sonuçlarını şirkete uygun bir biçimde periyodik olarak raporlamak ve belgelendirmek şirketin farklı türde projeler üretmesini sağlayacaktır.

- Bilgi oluşumundaki ilkelerden biri yapılan hatalardır. Hatalar yeniden denenmemesi gereken yöntemleri gösterebilirken ve geçmiş ile ilgili eksik bilgiler bu hataların tekrarlanmasına neden olabilir. Tasarım sürecinde hataları nedenleriyle birlikte açıkça kaydetmek öğrenilen derslerin analizini kolaylaştıracaktır. Öğrenilen derslerin neden-sonuç ilişkisi ile birlikte kolayca erişilebilir ve anlaşılabilir bir sistemde tutulması şirkete zaman ve para açısından katkıda bulunacaktır.

Yenilikçi Stratejiler

Mevcut sistemdeki iyileştirmelere ek olarak, daha yenilikçi stratejiler örgütsel öğrenme süreçlerini daha etkili hale getirebilir. İyileştirmeler hali hazırda mevcut

çözümleri daha etkili hale getirirken, yenilikçi çözümlerin potansiyel faydalarını tahmin etmek daha zordur. Önerilen yenilikçi stratejiler aşağıdaki gibidir.

- Özellikle teknoloji yönetimi anlamında planlı ilerlemeye çalışan şirket, hedefleri doğrultusunda stratejik planını ve teknoloji yol haritasını takip ediyor. Soyut bir kavram olan öğrenmenin planlaması is göz ardı edilebilmektedir. Şirketin stratejik planı ve teknoloji yol haritasına uygun bir öğrenme yol haritasının oluşturulması, öğrenme sürecinde farkındalığı ve verimliliği artıracaktır. Bunu yapabilmek için bilgi taksonomisi hazırlanmalı ve bilgi hiyerarşik olarak sınıflandırılmalıdır. Daha sonra hedeflenen teknolojilerin bilgi ihtiyaçları analiz edilerek bir öğrenme yol haritası hazırlanmalıdır.

- Şirket içinden eğitim çözümleri sunmak, onu daha ekonomik ve zaman açısından verimli hale getirecektir. Şu anda, departmanlardaki birçok deneyimli personel, bilgilerini bir sistem tarafından değil, kişisel ilgi ile genç çalışanlara aktarmaktadır. Mühendisler kariyer adımı olarak eğitici olabilir ve finansal olarak da buna teşvik edilirse, bilgiyi daha iyi özümseyebilirler. Çünkü bilgiyi başkasına aktarmayı öğrenmek en kalıcı yöntemlerden biridir. Belirli bir deneyimden sonra, çalışanlar çeşitli sınavlara girerek eğitici olabilirlerse, öğretim performansını kontrol edecek bir sistemin kurulması öğrenme süreçlerine katkı sağlayacaktır.

- Ar-Ge departmanında çalışan tüm mühendisler yenilikçi Ar-Ge projeleri yürütmemektedir. Bazı çalışanlar ciddi Ar-Ge bilgisi gerektirmeyen rutin işler yapmaktadır. Şirket rutin sayılabilecek işleri kendi himayesinde kuracağı şirketlere devrederek mevcut personelini daha Ar-Ge yoğun işlerde kullanabilir. Bu istihdamla birlikte bilgi üretimi ve öğrenme ihtiyacı artacak ve öğrenme yapısı gelişmeye yönlendirilecektir.

- Çalışanların Ar-Ge çalışmalarının yayınlanabileceği kurum içi bilimsel bir dergi yayınlamak çalışanların bilgi üretme ve kaydetme motivasyonunu teşvik edecektir. Dergi, şirkette uygulanan bilimsel alanları ve mühendislik

disiplinlerini desteklemek için savunma endüstrisinin geniş alanındaki gelişmelere göre çıkarılabilir.

- Çalıştaylar, bölümlerin benzer teknik sorunlarla uğraştığı şirkette bilgi paylaşımı sorunlarına bir çözüm olarak düzenli olarak organize edilebilir. Bilgi paylaşımı, dönem boyunca karşılaşılan sorunların çözülme yöntemlerinin tartışılabileceği ve patentler ve akademik çalışmaların mühendisler tarafından sunulabileceği bir çalıştay düzenlenerek kolaylaştırılabilir. Akademisyenlerin, danışmanların ve uzmanların bu organizasyonlara katılımı verimliliği artıracaktır.

- Proje çalışması boyunca, takvim ve teknik görevleri takip etmek gibi bilgi ve öğrenmenin izlenmesi süreçlere katkıda bulunacaktır. Projelerde bilgi izlemenin, her projede değişen bir bilgi yöneticisi tarafından yapılması hem teorik hem de pratik bilgi ve öğrenme kavramını bilen personel sayısını sürekli olarak artıracaktır. Bilgi dokümanlarının doğru bir şekilde üretilip üretilmediğini kontrol edecek olan bilgi yöneticisi, bu bilgiyi doğru ilişkilerle sisteme girmekle sorumlu olacaktır.

- Bilinci ve bilgiye verilen önemi artırmanın bir başka yolu da bilgiyi şirketin en üst düzeyinde de takip etmektir. Kuruluşa Bilgiden Sorumlu Genel Müdür Yardımcısı (CKO) tahsis ederek, öğrenme süreçlerinden sorumlu olan ve bu yönde stratejinin üretilmesini ve denetlenmesini sağlayan güçlü bir yapı oluşturulabilir. Öğrenmenin sürekli izlenmesi ve denetlenmesi de şirketin öğrenme süreçlerinin verimliliğini artıracaktır.

- Geleneksel bir yöntem olarak, çalışanların yükselmesinin tek yolu idari pozisyonlara gelmek diğer bir deyişle yönetici olmaktır. Bunun temel nedeni, yöneticilerin çalışanlardan çok daha iyi kazanmalarıdır, çünkü yönetim seviyesinin teknik kariyer yolundan keskin bir şekilde daha fazla yükselme potansiyeli bulunmaktadır. Yöneticilerin sorumluluk kapsamında daha fazla kazanmaları mantıksız olmasa da teknik kariyer yolu için risk oluşturmaktadır. Teknik açıdan başarılı çalışanlar kariyer yollarının sona erdiğini ve yönetici olmanın onlar için çok daha iyi bir yol açtığını düşünmektedirler. Çalışanların

teknik kariyer yolundaki sınırı ortadan kaldırarak, deneyime dayalı terfiden daha çok performansa dayalı terfi modeline geçiş, şirketin teknik becerilerini artıracak ve personelin öğrenme motivasyonunu her zaman canlı tutacaktır. Böylece yönetici olmak istemeyen ve teknik konularda çalışmaktan hoşlanan kişinin de bu yolda kalarak yüksek kazanç elde edebileceğini bilmesi Ar-Ge kültürüne katkı sağlayacaktır. Buna ek olarak, çalışanların ölçülebilir performans kriterlerine göre yükselmesi ve deneyimle doğrudan ilgili terfi modelinin terk edilmesi öğrenme sistemine katkıda bulunacaktır. Örneğin bir sistem olarak, normal bir çalışanın beş yıl içinde ulaşabileceği performans noktası bir sonraki adım için hedeflenebilir ve bu performansa kaç yılda ulaşıldığına bakılmaksızın terfi uygulanabilir.

- Kariyer yollarının yeniden düzenlenmesi, yapısal değişim olarak öğrenme kültürüne katkıda bulunacak önemli bir çözümdür. Ar-Ge faaliyetlerini doğrudan etkileyen sistem ve tasarım mühendisleri ve ayrıca Ar-Ge faaliyetlerini dolaylı olarak etkileyen proje yönetim mühendisleri bulunmaktadır. Her tür mühendisin sistemde farklı bir rolü vardır ve nitelikleri de farklıdır. Mevcut sistemde, tasarım ve sistem mühendisleri tecrübe ve performansa dayalı terfi almaktadırlar. Bu iş aileleri arasında doğrudan bir ilişki olmamasına rağmen, Ar-Ge çalışmalarını yoğun olarak beraber gerçekleştiriyorlar. Tasarım mühendisleri işin saf Ar-Ge tarafı ile ilgilenirken, sistem mühendisleri daha yüksek seviyede planlama ve yürütme gerçekleştirmektedir. Tez çalışması kapsamında yoğun olarak alınan önerilerden biri de şirketin kendi iç eğitmenlerine sahip olması gerektiğidir. Mevcut sistemi gözden geçirerek ve kariyer yoluna eğitim mühendisi basamakları ekleyerek, projelerin engellenmemesini sağlarken, eğitmenler tarafından bir öğrenme sorunu çözülebilir. Önerilen yöntem aşağıdaki gibi çalışacaktır;

  o Doğrudan Ar-Ge işlerinde çalışmak isteyen mühendisler sadece tasarım mühendisi olarak istihdam edilebilecek ve belirli bir performanstan sonra kariyerlerine devam etmeleri için üç kariyer seçeneği sunulacaktır. Bunlardan ilki tasarım mühendisi olarak çalışmaya ve Ar-

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Ge faaliyetlerine devam etmektir. İkincisi ve en iyi maaş sunanı, mühendis eğitmeni olmak ve tasarım çalışmalarını sürdürürken tasarım mühendislerinin eğitiminden sorumlu olmaktır. Mühendis eğitmeni olmak için, zorlu sınavları geçmek ve bu kariyer yolunda ilerlerken eğitmen olarak performansların sürekli olarak denetlenmesi gerekir. Tasarım mühendisleri için üçüncü kariyer tercihi, sistem mühendisi olarak kariyerine devam etmek olmalıdır. Hiçbir Ar-Ge çalışanı, deneyim ve performans olmadan bir sistem mühendisi olarak işe başlatılmamalıdır, çünkü saf Ar-Ge faaliyetlerinin üst seviyesinde bulunan sistem mühendisliğinin başarısızlığı veya verimsizliği tasarım çalışmaları üzerinde domino etkisi yaratabilir. Bu yolda belirli bir performansın ardından, sistem mühendislerine de iki yönlü bir kariyer seçeneği sunulmalıdır: sistem eğitmeni olmak veya sistem mühendisi olarak devam etmek. Tasarım eğitmenlerinde olduğu gibi, sistem eğitimi de daha fazla maaş vaat eden bir kariyer yolu olmalıdır.

o Çalışanların deneyiminin silinmemesi şartıyla, Ar-Ge departmanları ile proje yönetimi arasında geçişe izin verilmelidir. Ancak, proje departmanındaki çalışanların Ar-Ge deneyimi yoksa, en baştan başlamalıdırlar. Proje tarafında, çalışanlar analist veya takvim planlayıcı olarak çalışmaya başlamalı ve belirli bir performanstan sonra proje yöneticisi eğitmenleri, proje yöneticileri veya proje analistleri olarak kariyer yapmalarına izin verilmelidir. Ar-Ge departmanlarından projeye geçmek isteyen çalışanlar, proje yönetimi ile ilgili tecrübeleri yoksa, bu sürece en baştan başlamalıdır.

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