T.C.
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CRITICAL SUCCESS FACTORS FOR UNIVERSITY-INDUSTRY- GOVERNMENT (TURKISH LAND FORCES) COLLABORATION: THE CASE OF ASELSAN's TRANSPORTABLE DIRECTION FINDING SYSTEM (DFINT-3T)

by

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LIST OF ABBREVIATIONS

AMC	Army Material Command
AR-GE	Araştırma-Geliştirme
ArInC	Army-Industry Collaboration
CAs	Cooperative Agreements
CII	American Construction Industry Institute
CRADAs	Cooperative Research and Development Agreements
DARPA	Defense Advanced Research Project Agency
DFINT-3T	Transportable Direction Finding System
DoD	Department of Defense
DoDGARs	Department of Defense Grant and Agreement Regulations
FMS	Foreign Military Sale
FTTA	Federal Technology Transfer Act
GDP	Gross Domestic Product
GDPM	Goal Directed Project Management
GMS	Graphical Modeling System
KOSGEB	Küçük ve Orta Ölçekli İşletmeleri Geliştirme ve Destekleme İdaresi Bşk.
KPSO	Knowledge, People, System, Organization
MARCO	Microelectronics Advanced Research Corporation
MEDEA	Pan-European Microelectronic Development for European Applications
METU	Middle East Technical University
MoD	Ministry of Defense
MoIT	Ministry of Industry and Trade
MP	Multiple Perspective
NAMSA	North Atlantic Maintaining and Supply Agency

NATO	North Atlantic Treaty Organization
NTTAA	National Technology Transfer Act of 1995
ONR	Office of Naval Research
OT	Other transactions
OYTEP	10 years' procurement plan (On yıllık tedarik planı)
PERT	Program Evaluation Review Technique
PSO	People-System-Organization
R&D	Research and Development
SADER	Savunma İmalatçıları Derneği
SGP	Strategic Goal Planning
SPA	System Planning and Analysis
SSM	Savunma Sanayi Müsteşarlığı (Undersecretariat for Defense Industries)
TAF	Turkish Armed Forces
TESİD	Türk Elektronik Sanayicileri İşadamları Derneği
TLF	Turkish Land Forces
TLF HQ's	Turkish Land Forces Headquarters
TTCA	Technology Transfer Commercialization Act of 1997
TÜBİTAK	Türkiye Bilimsel ve Teknik Araştırmalar Kurumu
TÜSİAD	Türk Sanayici ve İşadamları Derneği
UnArC	University-Army Collaboration
UnIArC	University- Industry-Army Collaboration
UnIC	University-Industry Collaboration
UnIG	University-Industry-Government
WBS	Work Breakdown Structure
YÖK	Yüksek Öğretim Kurulu

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ABSTRACT

This study is designed to propose a model for University-Industry-Government (Turkish Land Forces) Collaboration. (UnIG) In defense management area, there are three key actors. These actors are University, Industry, and Government. There is a necessity for these there key actors; in the new millenium, they must act together to decrease their R&D costs and duplicative works.

In this study, one proposed a model for effective University-Industry-TLF collaboration. Many developed countries developed UnIG collaboration models, but today, in Turkey there is not yet such a model. TLF and Turkish Armed Forces must find new methods and ways which will support University-Industry-TLF collaboration. Collaboration, by its nature, requires to work in a project team. Goal Directed Project Management (GDPM) methodology is a tool which support project works. Proposed model is also analyzed with Goal Directed Project Management (GDPM) methodology. Today, GDPM is a necessity for these all types of projects.

Another used methodology is Graphical Modeling System (GMS) methodology. By using this methodology it is hoped to present TLF, a practical way to select technology investment decisions for required complex weapon systems.

Since ASELSAN's transportable direction finding system was a good case for University-Industry-TLF collaboration, field study is done on this case. One examined University-Industry- TLF point of views for DFINT-3T project. As a university member Middle East Technical University (METU) Electrical-Electronically Engineering Department, as producer/Contractor ASELSAN, and as owner TLF are examined.

Harvard Business School Case Writing Methodology is used to understand successes and problems of DFINT-3T project case. It can be said easily that DFINT-3T case, is the unique and best case for University-Industry-TLF collaboration. TLF and its potential partners (Universities, and defense industry firms) must develop and support collaboration activities such as DFINT-3T.

DFINT-3T was a beginning point for collaboration, but not will be end.

ÖZET

Bu çalışma, Üniversite-Sanayi-Devlet (Türk Kara Kuvvetleri) işbirliği için bir model önermek maksadıyla hazırlanmıştır. Savunma yönetimi alanında, üç anahtar oyuncu vardır. Bu aktörler, Üniversite, Sanayi, ve devlettir. Bu aktörler için, bir zorunluluk vardır; yeni bin yılda AR-GE maliyetlerini ve duplikasyonu azaltmak için birlikte davranmak.

Bu çalışmada, Üniversite-Sanayi-Türk Kara Kuvvetleri için etkili bir ortak çalışma modeli önerildi. Birçok gelişmiş ülke Üniversite-Sanayi-Devlet işbirliği modelleri geliştirdiler, ama, bugün Türkiye'de henüz böyle bir model yoktur. Türk Silahlı Kuvvetleri ve Türk Kara Kuvvetleri, Üniversite-Sanayi-Türk Kara Kuvvetleri işbirliği modelini destekleyecek yeni yollar ve metotlar bulmak zorundadır. İşbirliği, doğası gereği, bir proje takımı içerisinde çalışmayı gerektirir. Hedef Yönlendirmeli Proje Yönetimi metodolojisi, proje çalışmalarını destekleyen bir araçtır. Önerilen model aynı zamanda Hedef Yönlendirmeli Proje Yönetimi metodolojisi ile de incelendi. Bugün, Hedef Yönlendirmeli Proje Yönetimi tüm proje çalışmaları için bir gerekliliktir.

Kullanılan bir diğer metodoloji ise, Grafik Modelleme Sistemi metodolojisidir. Bu metodolojiyi kullanmakla, Türk Kara Kuvvetlerine, ihtiyaç duyduğu kompleks silah sistemleri için vereceği teknoloji yatırım kararlarında, pratik bir yol sunma amacı hedeflendi.

Üniversite-Sanayi-Türk Kara Kuvvetleri işbirliği modeli için ASELSAN'ın taşınabilir telsiz kestirme sistemi (DFINT-3T) iyi bir örnek olduğu için, alan çalışması bu vaka üzerinde yapıldı. Alan çalışmasında, DFINT-3T projesi için tarafların bakış açıları incelendi. Üniversite üyesi olarak Orta Doğu Teknik Üniversitesi Elektrik-Elektronik Mühendisliği bölümü, üretici/tedarik firması olarak ASELSAN, işin sahibi olarak da Türk Kara Kuvvetleri incelendi.

Harvard İş Okulu Vaka yazma metodolojisi , DFINT-3T projesinin başarı ve problemlerini anlamak maksadıyla kullanıldı. DFINT-3T vakasının Türkiye'nin tek ve en iyi Üniversite-Sanayi-Türk Kara Kuvvetleri işbirliği örneği olduğu söylenebilir. Türk Kara Kuvvetleri ve muhtemel iş ortakları (üniversiteler, savunma sanayi firmaları) DFINT-3T gibi işbirliği projelerini desteklemeli ve geliştirmelidirler.

DFINT-3T işbirliği için bir başlangıç noktasıydı, ama son olmayacaktır.

1. INTRODUCTION

The motivation of this thesis stems from the rapid change in the business environment faced by the defense industries in Turkey and worldwide due to the deceleration of the arms race in worldwide and the shrinking defense budgets.

In the new millenium, all countries want to lead technologically other countries and to become more advantageous by help of their technological superiority. Maintaining the technological superiority is expensive. All countries must find innovative ways to conduct their researches to maintain technological superiority. A University-Industry-Government (Turkish Land Forces) (UnIG) collaboration is a promising innovative approach which can help the country's level of technological superiority. UnIG collaboration is a tool to achieve this national goal.

Today, in the new millenium, business environment, by help of new way of thinking and computer technology, executed a lot changes. These changes are related with both military and civil sectors. Business environment searched new ways to produce both civil and military products together to decrease its research and development costs. And concept of dual technology entered to literature. With the use of dual technology, business environment found new ways to decrease their R&D spending. It is required new types of processes to overcome new problems of this dual structure. Collaboration is a new application and process to overcome problems, and decrease R&D cost of business environment.

Universities want to expose students and faculty members to practical problems. These problems are in business environment. Universities also want to have additional fund for basic researches. They can have access to extra funds by collaboration with industry and Armed forces.

Armed Forces, generally, in all over the World, are interested in the technological superiority and technological innovations because of their requirements. They need complex weapon systems to defend their countries. Since the cold war era finished, there is a deceleration of the arms race and defense budgets are decreasing year by year in many countries.

A decrease in the defense budget will not be a surprise also for TLF. TLF will have many difficulties with a shrinking budget. Armed forces need complex weapons systems and to

produce these systems, sensitive manufacturing techniques, specific quality standards, competent brainpower, adequate quantity of investments, and high level R&D spending are required. TLF's budget will be shrinking, but with this shrinking budget, TLF must procure high quality, complicated weapon systems. Collaboration will help TLF and Turkish Armed Forces (TAF) to procure high quality weapons systems at low cost.

1.1. Description Of Research

This research is prepared to propose a collaboration model among University – Industry - Government (TLF).

1.1.1. Title

The title of this thesis is ;

Critical Success Factors For University – Industry - Government (Turkish Land Forces) Collaboration: The Case of Aselsan's Transportable Direction Finding System (DFINT-3T).

1.1.2. Purpose

The thesis' purpose is exploring innovative ways to acquire successful collaboration strategies/tools among University – Industry - Government (TLF) by the help of Harvard Business School's case writing methodology, Goal Directed Project Management (GDPM), Graphical Modeling System (GMS) methodologies and a questionnaire.

It is hoped that this thesis will have some supportive influences in the direction of:

1. Enhancing relevant parties' organizational learning capacity, and prevent duplicative works with the proposed collaboration model.
2. Increasing collaboration capacity among Universities - Industry – Government (TLF) by using Aselsan's DFINT-3T successful case.
3. Helping parties to decrease their R&D budgets, and to use cost-effective methods.

TLF's expectations from this kind of collaborations can be given as:

- High quality products,
- Use of new technologies,
- Cost-effectiveness,
- Educated manpower,
- Dual use of new technologies and products,

- Increased capacity for competition with other countries' armies.

1.1.3. Why?

Today, in many areas, countries must use high technology. There is a need to use high technology for defense of the countries too. Having high technology is very expensive and risky. Collaboration and cost sharing are methods to reduce expenses and risks of having high technology.

In this thesis, Goal Directed Project Management (Andersen, Grude, and Haug, 1996) , Graphical Modeling System (Kostoff, and Zurcher,1999) and Harvard Business School (Linder, 1994; Gentile, 1990; Corey, 1996) case writing methodologies and a questionnaire have been used.

1.2. Definitions Of Terms

The thesis will be more understandable with the definitions of the key terms. It is important to know differences among definitions of basic research, development, and applied research for determining successfully university's, industry's, and army's role in a collaboration.

Collaboration is any innovation-based relationship whereby actors (University – Industry - TLF) jointly contribute financial, research, human and infrastructure resources, either directly or in kind.

Basic Research is a systematic study to gain knowledge or understanding of the fundamental aspects of phenomena and observable facts without specific applications toward processes or products in mind.

Applied Research is a systematic study directed toward greater knowledge or understanding necessary to determine the means by which a recognized and specific need may be met.

Development is the application of knowledge toward the production of useful materials, devices, and systems, or methods, including design, development and improvement of prototypes and new processes to meet specific requirements.

1.3. Methodologies

1.3.1. Graphical Modeling System (GMS)

Graphical modeling system is a computer-based process to generate roadmaps. GMS is a tool to generate and analyze roadmaps, which link research to technology and eventually to capabilities/requirements. GMS offers some advantages and capabilities as given below;

1. It graphically portrays relationships between research and potential applications.
2. It helps to accelerate science conversion by promoting champion interest in further research development.
3. It shows the node-link relationships of a network project/capabilities/requirements structure.
4. It treats nodes (projects/capabilities/requirements) as multi-valued quantities which are allowed o exist in many different research requirement pathways simultaneously.
5. It promotes communications.
6. It identifies science and technology gaps.
7. It identifies obstacles to rapid and low-cost technology development. (Kostoff, 1999)

GMS' algorithmic component is based on a direct graph/network model of research/ technology/capabilities/requirements. It uses latest relational database/hypertext technology to identify the potential pathways which link research to higher development categories and specific requirements / targets of interest.

GMS adds a crucial new capability, termed Multiple Perspective (MP). In GMS, the nodes (project / capabilities / requirements) are treated as multi-valued (multi-attributed) quantities, and are allowed to exist in many different research / requirement pathways simultaneously. This MP capability provides a more accurate depiction of the multi-application nature of most research and technology.

Graphical modeling system is developed by for the Office of Naval Research (ONR) by the Systems Planning and Analysis Inc. (SPA)

The program is written in Visual Basic. For running of the program, there are some requirements. It requires Windows, 16 MB RAM, Mouse, 4 MB Hard Disc storage, ½ Hard Disc storage to portray the least complex R&D programs and their related requirements.

The GMS depiction of the science conversion process is assembled in a two-stage process:

1.3.1.1. Construction of a graphical model

Model construction consists of identifying the project and requirements (nodes) for the

roadmap, then identifying the relationships (links) among the projects and requirements. There are two main stages for this level.

1. Identifying Types of Projects and Requirements

R&D projects and requirements are partitioned according to the phase of the development of the R&D projects and to the level of specificity of the requirements. While the actual graphical models used employ a half-dozen or more bands for subdividing project and requirement types, for purposes of demonstration simplicity the roadmaps shown here have for levels: research, development, capability, requirements.

2. Identifying Links Between Projects and Requirements

Once the full complement of nodes has been identified, the next step is to graphically and quantitatively depict the relationships among the nodes. One node is represented as linked to another node when the results emanating from the first node are assumed to have some impact on the achievement of targets of the second node.

1.3.2. Goal Directed Project Management

In today's business environment, there has been a dramatic increase in the use of project management in many areas. Since the concept of project management was introduced, there has been an interest in improving the tools and techniques for management of one-time management.

As a result of technological advancement, and sophisticated customer demands and competitive pressure, companies need to continuously improve their product and service or bring new products or services to the market as soon as possible. Rather than only a few ongoing projects, companies are dealing with large numbers of ongoing projects. Today, for being successful in these all ongoing projects, it is useful to determine mutual language. This language is Goal Directed Project Management approach.

GDPM is a project management methodology developed by E. Andersen, K.V. Grude, and T. Haug. (1996) It contains procedures and tools which support project management. GDPM shows how to organize resources in an organizationally complex situation. GDPM, provides to determine goals, and break each goal down into controllable sub-goals. Lastly, GDPM provides monitoring all activities to achieve the main goal.

Goal Directed Project Management is a methodology for manage projects successfully. Project management with special emphasis on human and organizational sides of the

projects is important for both public organizations and private companies, if they desire to achieve their goals. As for sustained and measurable improvement, GDPM starts with a business or organizational goal and directs the whole management process towards the achievement of that goal. GDPM, in its central focus on developing understanding, involvement and commitment amongst those involved, is a key ingredient in managing successful and lasting change.

Goal directed project management provides the philosophy to direct changes towards a predefined goal. The concentration on intermediate and final results (milestones) ensures the effectiveness of the project. The characteristics include;

1. Clear formulation of objectives, split up into sub-goals,
2. Result oriented objectives,
3. Description of required changes relating to People, System and Organization goals,
4. Focus not only on planning, but also on managing,
5. Providing the simplest possible information regarding the plan as well as the control and the organization of the project.

The project manager not only focuses on changes in the technical aspect (System Implementation) but also on changes in aspect such as People and Organization (Business Improvement). By describing responsibilities and roles at each level, task allocation becomes more apparent to each party, resulting in more effective communication. This leads to full integration within organization.

1.3.2.1. People-System-Organization Concept

The greater part of project literature concerns technical projects, such as construction of bridges, roads, airports or oil platforms. But there should be a broader perspective for project management. PSO stands for people, system and organization. PSO projects are projects where development of a "system" (a physical product or object), and development of "people" and "organizations" will occur simultaneously. This can be called as PSO way of thinking in project management.

The PSO concept emphasizes the importance of balancing all elements, people, system and organization. "S" stands for technical aspects of the project. It often represents what one can "touch and feel" in the project. For example, in a construction project, the new building is the "S". The most common failing in project work is to focus too strongly on

the technical content.

In typical organizational development projects the situation is reverse. These are only concerned with developing people in the organization and relationships between them. There is not enough emphasis on developing systems (e.g. routines and procedures) which will support the changes required in the organization. PSO projects are projects where the result should be a composite "product", goals should be achieved in all "P", "S" and "O".

One of the most important and characteristic aspect of project work is the extent to which people involved in the project (who will use the results are invited to participate in the work. One extreme, is the "purely specialist project" ,the other extreme is the "purely process-oriented project".

In purely specialist projects all the work is performed by specialists without any form of cooperation or consultation with the end users. There is no place for user cooperation. In purely process-oriented projects, on the contrary everyone is encouraged to become involved and the project is allowed to be dominated by whatever problems and possibilities the participants see as being most important at any given time. The process itself determines the progress of the project.

All PSO projects are "mixed" projects. They contain elements both from the process-oriented approach and from the specialist project.

Purely Specialist Projects

Purely Process-Oriented Projects (person focused manager development)

Figure 1.1: Different Types Of Project (Andersen, Grude, and Haug, 1996)

1.3.3. Harvard Business School Case Writing Methodology

Cases describe actual business situations. In that respects, dealing with these cases are like dealing with the problems that managers encounter daily. As writing the case, Harvard Business School case writing methodology is selected. (Gentile,1990; Corey, 1996; Linder, 1994) Since all parties of the case (Middle East Technical University (METU), ASELSAN and TLF) are in Turkey and it is believed that it will very useful to write the case in Turkish, for this case's parties and new case writers, the case is not given in the main body of the thesis, but in ***Appendix A.***

1.3.4. Research Methods

It is used literature review, internet survey, and questionnaire methods.

1.3.4.1. Literature review

There are many books, articles, papers, conferences, dissertations about collaboration and public-private collaboration. Since University-Industry-TLF collaboration is a new method in Turkey there aren't enough data about this topic. Literature review is the second chapter of this thesis. It is explained in Chapter II.

1.3.4.2. Internet survey

As internet survey, search engines such as Yahoo, Altavista, Web Crawler etc. are used to obtain some data about collaboration. And it is obtained plenty of data about collaboration. These data are also available in Chapter II.

1.3.4.3. Questionnaire

A questionnaire is designed (adapted from Tishler et al. 1996) to determine Aselsan's Transportable Direction Finding System (DFINT-3T) performance.

1.3.4.3.1. Aim of the Questionnaire

The main goal of the questionnaire is to determine different ideas of the project parties (METU, ASELSAN, and TLF) about the case (ASELSAN's transportable direction finding system-DFINT-3T). As a model of a collaboration, the case includes three different parties. It is normal that these parties have different ideas about same work.

1.3.4.3.2. Target Population

There are 3 different parties and target populations. But all of these parties worked in this project. As a target population, there are 27 people. Seven senior researchers from METU, eight officers from TLF, and twelve engineers from ASELSAN. Because all of these people are in project work, and because all of them are specialist, it is possible to accept target population as whole population. METU's senior researchers are all specialist in Microwave Systems. TLF's project members are from different departments of the TLF HQ's. All of twelve ASELSAN's project members are engineer. One person of the target population is female, 26 of them are male.

1.3.4.3.3. Data Collection Method

Two of the questionnaires were performed by e-mail, other questionnaire were performed by the way of face to face interviews.

1.3.4.3.4. Preliminary Data Gathering

To identify the broad problem area one started to literature survey and interviews with people from different organizations (University side, industry side and government side) who have experiences and knowledge about the collaboration.

In literature survey phase, many different collaboration studies are found. One of them was interesting. This was a work performed in Israel by Tishler et al. in 1996. These researchers analyzed 110 defense projects executed in Israel between 1976-1996. They described 400 critical factors for successful defense project, and they derived 20 factors from them. This thesis' questionnaire is adapted from this work.

There was a defense and weapons systems fair in Ankara in November 1999. During this fair, one found a chance to know Turkey's and other countries' firms and their products in defense industry. Many face to face interviews were done in fair. ASELSAN was one of these firms. One analyzed DFINT-3T transportable direction finding system in fair. This system was awarded from TESİD (Turkish Electronically Businessmen's Association) in 1999, and to produce this system, University (METU), TLF, and ASELSAN were worked together. It can be said that an University-Industry- TLF collaboration was used in this project. One did many interviews with ASELSAN's, METU's and TLF's project members after the fair too. As a result, DFINT-3T system was selected for the questionnaire in the thesis.

1.3.4.3.5. Hypothesis

It is believed that as a successful case of collaboration, three different parties of the DFINT-3T project have related opinions about it. The goal of the questionnaire is to determine differences and similarities of the scope of parties.

1.3.5. Software

As a software one used Excel and SPSS 5.0 for analyzing questionnaire, and U.S. Office of Naval Research's Graphical Modeling System (GMS). (Chapter 4)

2. LITERATURE REVIEW

Collaboration is a principal method to overcome today's academic, public and business environment problems. Generally, collaboration implementations are successful in developed countries. Use of collaboration increases today in developing countries too. As a developing country, Turkey also must use collaboration methods. As the largest service within the TAF, TLF must guide this process.

In this chapter, literature survey of collaboration is analyzed to understand its conceptual basics. It is preferred to use a conceptual sequence to analyze literature survey.

2.1. Definitions of Collaboration

There are many kinds of definition of collaboration. In a simple manner, collaboration is working with someone else for a specific purpose or purposes. In a collaboration, parties should share their financial, research, human and infrastructure resources.

Collaboration is built on teamwork, conflict (and conflict resolution) management, trust, mutual goals, and objective development among parties. Collaboration is a technique for reducing complexity and generating creativity. As synonyms of collaboration it can be used cooperation, partnership, or teamwork.

American Construction Industry Institute (CII) defined partnering as *"a long-term commitment between two or more organizations for the effectiveness of each participant's resources. The relationship is based upon trust, dedication to common goals, and an understanding of each other's individual expectations and values. Expected benefits include improved efficiency and cost effectiveness, increased opportunity for innovation, and the continuous improvement of quality products and services."* (Wilson, Songer, Diekmann, 1995) Some other definitions of collaboration can be given as follows:

"Collaboration is a process through which parties who see different aspects of problem can constructively explore their differences and search for solutions that go beyond their own limited vision of what is possible." (Gray, 1989)

"Collaboration is the activities where two or more partners contribute differential resources and know-how to an agreed complementary aim" (Dodgson, 1993)

Depending on purpose organizations are engaging in collaboration with other organizations in different form such as joint R&D, cross licensing, consortia, strategic alliances, joint

venture etc. According to Baarton (1995), The general purposes of collaboration include:

1. improving the development process,
2. enhancing efficiency in the production chain,
3. merging previously discrete technologies and disciplines,
4. learning through information exchange,
5. corporate strategies,
6. public policies.

To become successful in a collaboration, the first condition is being willing for it. The other important factor is sharing cost. Without these two mutual points, collaborations will not be successful.

United States Army Material Command (AMC), described partnership as a bridge on which parties walk together as given in Table 2.1.

Table 2.1: The Bridge to Partnership (AMC, 1999, p.6)

Separate Government & Contractor Teams	Partnered Team
Us versus Them	We are in this together
Win-Lose	Win-Win
Surprises	Effective communication
Your problem	Our Problem
Individual Government & Contractor Response	Team response
Separate Goals & Objectives	Common goals & Objectives

As it's can be seen in the Table 2.1., in a separate work there is only a team's vision, goals and benefits, but in a collaborative work there is shared vision, goals and objectives. In separate work there is only one winner, in collaborative work all parties are the winners, because in a partnership parties aren't rivals. There aren't surprises in the collaborative work by help of effective communication. Problems are "our problem", not "their problem". As a consequence, in order to be successful organizations need to collaborate.

2.2. Reasons For Collaboration

If one searches benefits of collaboration, one can see easily that there are many advantages to partnering.

"*In the past, companies have been hesitant to enter into cooperative arrangement either with other industry members or with government for a host of reasons: potential loss of proprietary or highly competitive technology, loss of decision making power and control, fear of antitrust litigation, and perception of low benefits. However, legislative changes to loosen restriction on collaborating, combined with market realities, have made collaboration a part of day-to-day business.*" (Resetar et al., 1999, p.15) Today, there is many successful collaborative work, by help of this change.

As it can be seen in Figure 2.1, the personal capacity is minimum as Team's capacity is at the high level. And organizational capacity is greater than team's capacity and smaller than collaborative capacity. It is possible to see the effect of synergy in the figure.

"Rapid technological change, shorter product life-cycles and more intense global competition have combined to radically transform the current competitive environment for most firms." (Santoro, Chakrabarti, 1999) Today all firms must collaborate with a firm, university or government to have competitive advantage over their rivals.

According to Carayannis and Alexander (1999), today significant University-Industry-Government (UnIG) strategic partnerships have been formed around the world, including the Microelectronics Advanced Research Corporation (MARCO) in the United States, Pan-European Microelectronic Development for European Applications (MEDEA) consortium based in France, and the Fraunhofer Gesellschaft in Germany. These partnerships are examples of new trans-organizational knowledge structures to facilitate the flow of ideas, information, and innovation between sectors of the economy. They also represent a new key asset to corporate and national competitiveness in the knowledge economy.

Santoro and Chakrabarti (1999) report that it is important to make clear the university's, industry's and army's strategic objectives to establish a University-Industry-Army technological collaboration and to examine the differences of these strategic objectives among firms, universities and army.

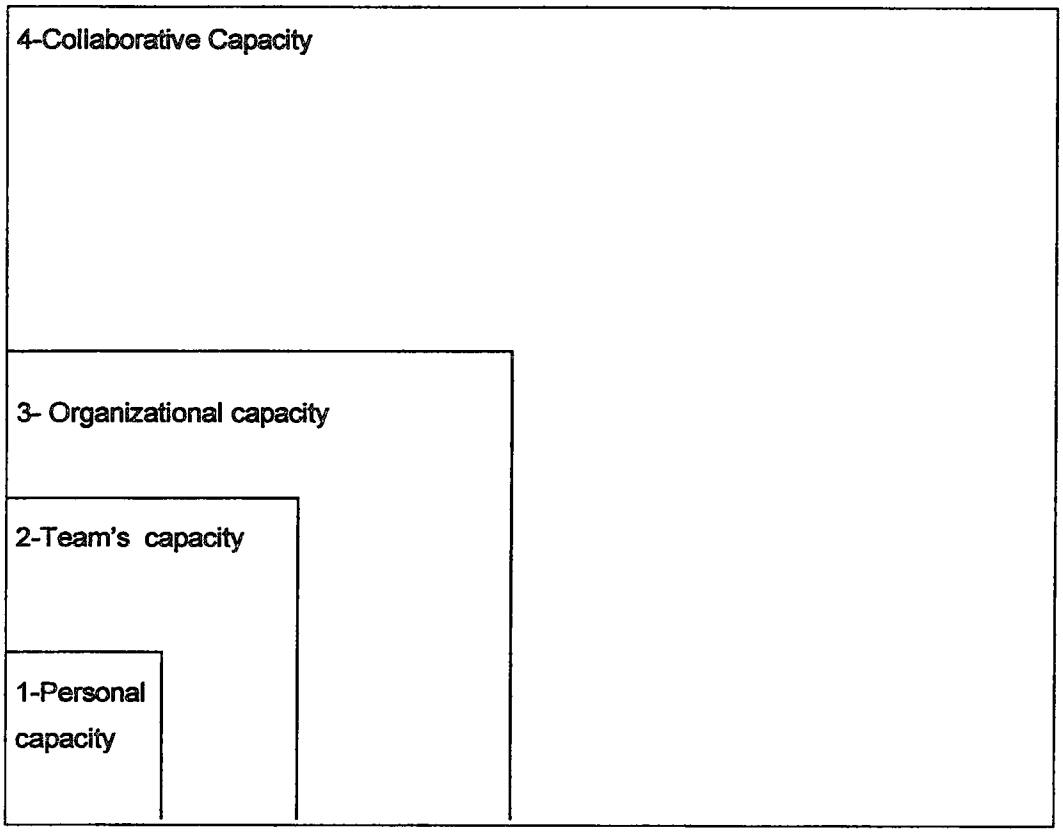

Figure 2.1: Comparative Capacity Levels

In the world, generally Army's budget continues to shrink as one see in Table 2.2 (Ziylan et al., 1998, p.22). Army must collaborate with Industry and Universities to reduce Research and Development (R&D) cost and to obtain new methods to accomplish its R&D goals.

According to Wong (1998); *"By collaborating the Army can exploit their technological leads and achieve technological advances for itself both faster and cheaper. And Army may not have enough money to adequately fund the efforts required to achieve its R&D goals in all technologies."*. Army may lead to some technology but to some others collaborating is the best solution.

Universities also want to collaborate, because, university's mission is doing basic researches and universities want to collaborate for decreasing R&D monies spent. Another important factor is, by partnering with Army and industry, university's research will accelerate Country's success on science and technology.

Table 2.2: World Defense Spending, GDP, Military Load (Defense spending/GDP), GDP Per capita and Defense Spending Per Person (Ziylan et al, 1998, p.22)

Years	Defense Spending (as Billion $)	GDP (as Billion $ and 1995's prices)	Defense Spending / GDP (%)	Defense Spending Per Person ($)	($) GDP Per Capita
1985	1330,8	25370	5,2	275	5246
1986	1359,0	26150	5,2	276	5317
1987	1360,0	27010	5,0	272	5397
1988	1348,7	28230	4,8	265	5546
1989	1304,8	29160	4,5	252	5634
1990	1270,6	29670	4,3	241	5618
1991	1158,9	29720	3,9	217	5558
1992	1047,5	29030	3,6	193	5346
1993	956,5	29410	3,3	174	5337
1994	900,8	30200	3,0	161	5402
1995	864,5	30960	2,8	153	5459

Industrial firms want it to gain competitive advantage over their rivals as collaborate. For mutual benefits the Army, Industry and University can design and collaborate in activities.

2.3. Benefits Of Collaboration

Collaboration has benefits at two levels. One of them is general benefits (such as organizational, educational, financial and research benefits.) The other one is special benefits. For example in collaboration, army has different priorities than universities and industry. It is possible also to define benefits under Knowledge-People-System-Organization (KPSO) dimensions.

2.3.1. General Benefits

The major benefit of collaboration is the increased ability to:

1. Better accomplish participant's overall and mutual goals: This avoids the "us versus them" mentality that often characterizes UnIAr relations.
2. Be innovative: New partners are new ideas, new knowledge, and new experimentation. By help of new partners' ideas the other parties can overcome easily its problems.
3. Develop long term objectives: By help of collaboration, parties work on larger projects than they individually do. This encourages parties to interest long-term projects and long-term objectives.
4. Clearly and successfully identify and solve problems: Power of synergy creates a new capability. This capability can be call as "group thinking capability". Group thinking serves to successfully identify and solve problems. For example brainstorming is a tool for a collaborative work. The parties have different point of view. This difference may will create new solution methodologies during collaboration.
5. Ease of make decision: "None of us, as good as all of us".In a collaborative work, make decision is easier than in a separate work. It is possible to use power of synergy in the make decision session.
6. Prevent higher R&D cost and uses "Dual Technology" (Cost effectiveness): Dual use is defense terminology for an item with both military and civilian applications.
7. Create power of synergy: When people work closely together with a common purpose they learn from each other, generate new ideas, minimize bias and maximize objectivity, and create a collective judgement and perspective that is significantly better than each acting separately.
8. Working in a team: This comes from the collaborative interactions among team members by taking advantage of their diversity, competence and the mutual reinforcement of ideas and knowledge.
9. Knowledge transfer: Such collaborative research programs increase the importance of the research opportunities, results and knowledge transfers between the participating government's foundations, firms and universities.
10. Reduce the risk of failure: Because, all of the "key actors" are in the project. It is more difficult to lose with all of these key actors.
11. Reduce the risk of investment. Collaborative works include all "key parties" naturally. In a collaborative work the probability of success is more than separate works.

12. Create a win-win-win solution: According to Vasconcelos, Ferreira and Abreu (1999), collaboration provides in a "power game" win/win/win solution. Otherwise it is impossible to create another situation in which all partners have equal benefits.

13. Add value by enhancing shared knowledge: Collaboration enhances the ability to share both individually and organizationally.

14. Promote national innovation capability: In a National Innovation work, there are parties such University-Industry- Government. The collaborative works increase the ability to work mutually. This capability can be used also in a broad work. It is important also for National Innovation System.

15. Increase benchmarking capability: It is possible to focus on R&D process of the partners. The parties can redesign their internal process by help of other party's successful internal process.

16. Reduce the risk of duplicating works that has already been done by other partners: Partners will carry their experiences during the collaboration. This prevents duplications.

17. Build trust and encourages open communication (AMC, 1999): At the beginning of their contractual relationship, the parties establish communication channels designed to promote openness, trust and efficient contract administration.

18. Help the parties eliminate surprises: Increased communication on various subjects means that the parties are less likely to be surprised by events that occur during contract performance. Surprises result in schedule delays and additional costs, often leading to disputes and litigation.

19. Enable the parties to anticipate and resolve problems: The partners proactively anticipate problems and design an "action plan" addressing low those problems will be jointly identified and resolved or avoided.

20. Avoid disputes through informal conflict management procedures: At the outset of the relationship, the parties determine how they will manage any conflicts that might arise. This is often accomplished through a conflict escalation procedure. This procedure identifies the roles and responsibilities of the individuals.

21. Avoid litigation through the use of alternative dispute resolution: The commitment to resolve disputes informally at the earliest opportunity minimizes the necessity for litigation in administrative and judicial forums. Avoiding the considerable expense and delay attributable to litigation frees the partnering participants to concentrate their efforts on successful and timely contract performance.

22. Reduce paperwork: When the parties focus on contract performance rather than case building and "documenting the file", paperwork can be significantly reduced.

23. Reduce administration and oversight: With increased communication and empowerment by senior management, the partners find a significant reduction in the need for layers of administration and oversight.

24. Improve safety: Taking joint responsibility for ensuring a safe work environment for Contractor and government employees reduces the risk of hazardous work conditions and avoids workplace accidents.

25. Generate harmonious business relations: Enhanced communication, the identification of shared goals and objectives, the recognition that problems will arise, and the agreement to address those problems through a specially-designed procedure will facilitate creating and maintaining harmonious business relations. (U.S. AMC, 1999)

UnIAr collaboration benefits can be grouped under Knowledge-People-System-Organization (KPSO) classification (Table 2.3). As it's known, PSO is the Goal Directed Project Management's People-System-Organization (PSO) approach. To this, knowledge has been added by Öner and Başoğlu. (Öner, Başoğlu, 1999). Today, in the literature, there aren't any classification of Collaboration Benefits with KPSO approach. It is possible to define means of KPSO dimensions as given below:

Knowledge: Which knowledge one must to be careful about, in this project.

People: Development of the people,

System: Development of the system,

Organization: Development of the organization.

KPSO methodology will be useful if these all four dimensions are given together in a collaborative project work. These four dimensions will give to parties all critical key factors in this work.

2.3.2. Special Benefits

Although there are many general benefits of collaboration, there are also special benefits to parties. In an UnIAr collaboration, parties must take these different benefits into consideration to understand each other's idea about collaboration.

Table 2.3: Benefits with KPSO dimensions

Knowledge Benefits	People Benefits	System Benefits	Organization Benefits
• Collaboration adds value by enhancing shared knowledge • Increases the importance of the research opportunities, results and knowledge transfers between parties	• Be innovative • Clearly and successfully identify and solve problems • Power of synergy • Builds trust.	• Prevent higher R&D cost and use dual technology • Advantages as working in a team • Reduces risk of failure • Reduces risk of investment • Provide win/win/win solution • Promotes National Innovation System • Benchmarking capability • Reduces risk of duplicating works • Helps the parties eliminate surprises • Avoids disputes through informal conflict management procedures • Avoids litigation through the use of alternative dispute resolution • Improves safety	• Better accomplish participant's overall and mutual goals. • Develop long term objectives • Clearly and successfully identify and solve problems • Ease of make decision • Enables the parties to anticipate and resolve problems • Reduces paperwork • Reduces administration and oversight • Generates harmonious business relations

2.3.2.1. Army's Benefits

Army's basic benefits include cost sharing and leading other country's Armies. Other benefits can be classified as given below:

1. By collaborating the Army can exploit their technological leads and achieve technological advances both faster and cheaper.
2. Partnering with industry and university can also introduce new sources of R&D money to the Army through cost sharing.
3. Army can pool resources with industry to accomplish objectives that are too expensive to accommodate in its own R&D budget.
4. Army may also be able to recoup some its R&D costs through recovery of funds, which

is allowed under recently introduced instruments.

5. Increase Private sector's R&D spent on research of interest to the Army.

6. Commercial firms now hold the technological lead in many areas important to the army. (Wong, 1998, pp. 1-2)

7. Army has significant opportunities to more effectively achieve its R&D goals through collaboration with the private sector.

8. Leverage its assets, reduce capital investments, reduce costs, or decrease outlays to achieve infrastructure, intellectual property or financial arrangement goals.

9. Increase the value of its property or other assets.

10. Create new capabilities or assets that help the Army accomplish its military mission.

11. Influence technology early and thereby get equipment fielded earlier and/or possibly at lower cost.

12. Receive a stream of revenue to fund projects that help the Army accomplish its military mission. (Chang et al., 1999)

13. Army wants to have high quality weapons systems,

14. By collaborate Army wants have educated manpower,

15. Dual use of new technologies and products,

16. Finally and the most important thing is compete with other countries' armies.

2.3.2.2. University's Benefits

University's benefits from collaboration with industry and Army generally include increases of brain power, knowledge level and basic researches. It is possible to list University's benefits as follows:

1. They interact in order to raise additional funds, particularly for basic research.

2. Universities want to expose students and faculty members to practical problems, create employment opportunities for university graduates and gain access to applied technological areas. (Wong, 1998) A student's capabilities are directly enhanced by being involved in partnership. Knowledge about career paths and research skills are increased. (Kotnour, 1999)

3. Partnership adds value by enhancing faculty, producing knowledgeable students. (Kotnour, 1999)

4. Funding opportunities such as fellowships, research assistantships and other education programs (e.g. cooperative education or internship) are provided to student. (Kotnour, 1999)

5. Qualified manpower.
6. Increase knowledge stock. (Vedovello, 1998)
7. Ability to do world-class research, and participation in high-technology areas, (Scott, 1998)
8. See the transfer of research into useful products. (Scott, 1998)
9. Quality publications. (Scott, 1998)

2.3.2.3. Industry's Benefits

Industry, generally, wants to have capable personnel, enhance knowledge and technology transfer from other sides within a collaboration. Ticknor (1999) reports that many technology intensive companies are reducing their internal R&D spending. Some corporations are doing this to reduce costs, some because of competitive pressures, others because of increased emphasis on product development rather than fundamental research. Still others are doing so because of the increasing technological complexity of their requirements.

The best solution to reduce internal R&D spending is to collaborate with industry, government or with both or them. *"At the same time, companies are facing the need to shorten the cycle time for product development and to accelerate the rate of new product introduction. To meet these challenges requires the timely and effective use of the R&D solutions generated by sponsored research and external partners."* (Ticknor, 1999).

Industry's benefit as collaborating can be defined:

1. Industrial firms gain access to highly trained students, professors, facilities and new technologies (Santoro, Chakrabarti, 1999) and first-class employees (graduates). (Scott, 1998)
2. Firms can enhance their image and reputation. (Wong, 1998)
3. Collaboration supports the creation of a common technological "vision" within an industry.
4. Access to the newest technologies. (Scott, 1998)
5. Improved knowledge creation and transfer. (Scott, 1998). Collaboration facilitates and accelerates the transfer of research results from universities to industry. The knowledge produced by faculty research helps solve problems and can lead to technology transfer to the industrial partner.
6. Both future and current employee needs are met through degree programs and training

offerings. (Kotnour, 1999)

7. Improving innovative ability and capacity and hence competitive performance. (Vedovello, 1998)
8. Reduced product-process development time and cost. (Scott, 1998)
9. Leveraged funding from the government and other corporations. (Scott, 1998)

2.4. Barriers To Collaboration

As it is known, collaboration has many benefits. Contrarily there are some barriers too. In order to be successful in the UnIAr collaboration there is a need to remove these barriers. The barriers to be faced during works are described below:

1. The first barrier is related to different orientations and cultures. (Vasconcelos, Ferreira, Abreu, 1999). For example, while industry focuses on the profit, on the short time and on the improvement of the product, university focuses on basic research and army on decreasing R&D cost and lowering costs of weapons systems.
2. *"The second barrier is focused in the conflict of aspirations with regard to the collaboration, that is, the right of publishing demanded by the university versus the need to protect the propriety of the information, defended by the industry"* (Vasconcelos, Ferreira, Abreu, 1999) and maybe the need to secrecy defended by the Army.
3. Business, University and Army's specialists have their own jargon and priorities that may conflict with other specialist's beliefs. Thus, information gap and tunnel vision among team members may make collaboration difficult.
4. Lack of supporting facilities and/or technology can be a hidden barrier. The team may not realize the contribution adequate facilities and shared space can make to team productivity and interaction effectiveness.
5. High level of conflict between team members may negatively affect project's success.
6. Team size also is important for collaboration. Large teams may hinder open communication and the well-established interpersonal relations.
7. The different priorities of the foundations may negatively affect to collaboration. All foundations will want to maximize their returns. The important things are to set up clearly the team's goals and objectives at the beginning.

2.5. Conditions For Collaboration

Collaboration made by teams. These teams must have some characteristics. It is possible to define these characteristics as conditions, because without these characteristics

collaboration will not be successful. There are five basic conditions for collaboration.

2.5.1. Preparation

First of all, the parties must understand what collaboration is. Collaboration will only works in organizations that are culturally prepared accept changes.

At the preparation stage, as Gemünden and Lechler (1999), pointed out in their research, which is on R&D cooperation, partners fit on progress is important. (Figure 2.2.) In their work, they built a theoretical framework. Related with their study, better starting condition affect project progresses and projects success.

According to their works the meanings of the measure of the starting conditions are given below;

1. Goal clarity: Include statements about desired functionality of the prototype and its performance characteristics, clarity and measurability of the project objectives and the contributions of the individual partners.
2. Goal Compatibility: Include conflicts regarding technical objectives, distribution of budgets and work packages, and exploitation of results. Includes also level of partner's pressure to push their objectives and to what extent some partners imposed their objectives at the expense of others.
3. Competence: Overall assessments of technological competence and the capabilities of all partners to fulfil the requirements of the project, and specific questions regarding the competencies of the developers and users, which participated in the project. Three other items measure the perceived qualities of references, infrastructure and employees.
4. Synergy: Include different aspect of resources complementary. They measure if the contributions of all partners were necessary for the project.
5. Trust: Include to what extent they (participants to project) perceived their partners as reliable, benevolent, honest and open.
6. Commitment: The partner's willingness to invest time, money and extra effort into a good proposal. And the willingness of the partners to meet their obligations.

And related their research they found that the total effect of trust, project management quality, and changes of goals are substantial but much lower. Goal clarity and escalation of conflicts shows a small influence.

As a result, it can be say that the starting condition of a collaboration work influences the project success.

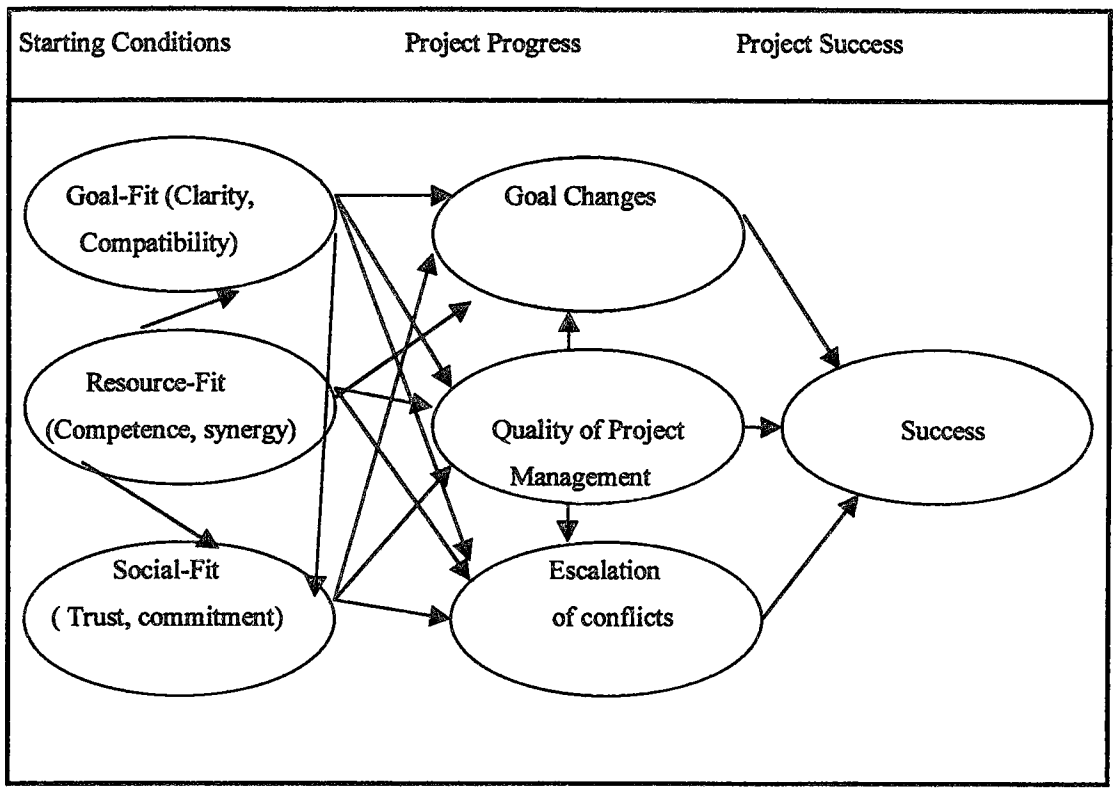

Figure 2.2: The Conceptual Framework (Gemuenden, Lechler, 1999)

2.5.2. Shared Vision

Building shared vision is a way to create a common purpose in the team. Shared vision is a vehicle for building shared meanings. Vision is a picture the future you seek to create described in the present tense, as if it were happening now.

A statement of "our vision" shows where they want to go, and what they will be like when they get there. In a collaborative work it is important to know where they want to go and what they will be like when they get there. The other important element of shared vision is the keeping the vision fluid. Because visions are always evolving. (Senge et al., 1997, p.298-305)

2.5.3. Team member competence

Team member must have a desire and willingness to work together to achieve a common purpose. (http://www.acq-ref.navy.mil/ipt). Team members must possess good experience and deep knowledge of their individual disciplines for effective collaboration. Lack of such experience makes it difficult to collaborate effectively. Open-minded and innovative team

members have ability to influence collaboration's success. The variety of team members' academic discipline also is important to get best results from collaboration. Because all knowledge areas of a problem or decision must be represented on the team.

2.5.4. Environment

The physical environment has a significant impact on the degree of collaboration. (http://www.acq-ref.navy.mil/ipt) The environment must be conducive to effective interaction and collaboration. Rotation of team members, turnover of team leaders, level of team member empowerment, the level of communication, the culture of the organizations plays important roles on the work. Even proximity of meeting rooms, the equipment in the rooms, the shape of the table all plays a role on collaboration.

2.5.5. Shared Space

Shared space is more important than is usually recognized because one tends to think normal conversation and communication is adequate. Unfortunately, a word or a phrase, an idea or a concept stated at one time is easily to forgotten or distorted within several minutes as the conversation rolls on. And, if it is remembered, it is remembered in the way it was heard, not necessarily the way the sender intended. One solution to this problem is shared space. (http://www.acq-ref.navy.mil/ipt)

Shared space is anything that keeps information in front of the team while they are interacting, and records their results. With shared space, everyone can observe, manipulate, suggest and address the same, common concept. This overcomes the problems of jargon and functional disciplines seeing the world differently.

Shared spaces should be dynamic, capable of being changed and updated, and capable of being frozen in time to create a chronological history of work/team progress. Shared space should be interactive, adaptable and continuously accept new information. It can be as simple as flipchart with butcher paper, electronic whiteboards, to sophisticate computer three-dimensional projections or GroupWare system. (Özkan, 1999) In any case, teams need a common place to put their ideas, concerns and issues for all others to see, and to serve as a focal point for team attention.

Shared spaces close the gap between language and symbols. Some people learn and think better using words; others think more in terms of concepts and visual imagery. The shared spaces combine these two ways of thinking and as serving as common reference objects for

team members to discuss, analyze and contemplate they influence the process of collaboration.

Other than basic conditions there are some others too for a successful collaboration (Vasconcelos, Ferreira, Abreu, 1999):

1. Need of the establishment of clear objectives, that should be defined in common agreement by the partners.
2. Clear reciprocal understanding of the qualification and skills of the parts.
3. Definition of the responsibilities of the parts, that is well-defined roles for the different actors.
4. Definition and implementation of an internal organization, including coordination and administration system, norms, accompaniment methodology and evaluation of the results.
5. Appropriate implementation of the management model.
6. Definition of the budgetary schedule of the project involving the partners' resources and of other financing sources, if applicable.
7. Definition of the general schedule of the project, with goals and times.
8. Definition of the flow of information inside of the project.
9. Establishment of the spreading way and appropriation of the results.

2.6. Types Of Collaboration

At a general level, collaboration can be classified into 2 groups according to characteristics of actors involved and types of collaboration.

2.6.1. Characteristics Of Actors Involved

There are 3 actors in the UnIAr collaboration. These actors can collaborate with each other and they can build a threesome partnership.

2.6.1.1. University-Industry Collaborations (UnIC)

According to Vedovello (1998), University-Industry collaboration is not new, but since the 1970s it has become more formal, frequent and planned. And UnIC is not only for mutual benefits, it improves also countries' industrial competitiveness. Today, UnIC is a key factor to meet business goals.

Scott (1998) claims that in a UnIC some basic concepts are keys to success. These are;

1. Working together: First of all groups of scientists and engineers must work together without regard to affiliation (problem oriented). The perspective is that the group members

will work on a problem-focused.

2. Set goals: It is essential that the group address the issue of shared goals for the particular project.

3. Establish directions: The group will mutually agree on the directions of the research proposed and the focus of the efforts of the individual team members.

4. Agree on distribution of effort: Individuals, whether from the university or industry, will participate on the basis of understood distribution of effort that can contribute to the total research project.

As Hacker (1997) pointed out, there are 4 stages in a UnIC. The first one is to establishing the research proposal. Second, obtaining research funding, third is to conducting the research, and final stage is satisfying the sponsor. The key to create "win-win" university-industry partnerships is in creating an overlap between the industrial sponsor's purpose and the researcher's purpose as illustrated in the Figure 2.3.

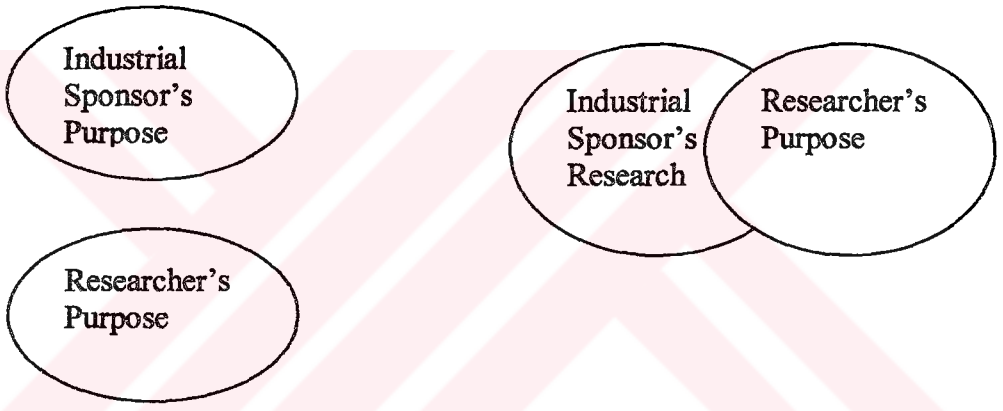

Figure 2.3: Mutual benefit of industrial sponsors and researchers (Hacker, 1997)

Three main factors to explain the increase in university collaboration with industry are;

1. The need for universities to look for non-governmental sources of funds.

2. The need for industry, spurred by competition and shorter time horizons for R&D, to access a broader science base than available in-house.

3. The push for greater returns from government support for R&D.

University faculty conduct research which produces the knowledge for use in education/training, for use by organizations to develop products and services, and for solving problems through technical assistance.

An industrial partner supports collaboration by providing real-world problems for research and technical assistance. Research is also supported by the industrial partner providing laboratory equipment and research funding to conduct the research activities.

Kotnour (1999), reports that industrial partner supports the educational mission by providing such things as fellowships or scholarships for students; research and technical assistance projects for faculty which enhances their skills; and real-world cases, guest lectures, adjunct professors, or tours to enhance the classroom experience.

According to Vasconcelos, Ferreira and Abreu (1999), the companies are showing a new behavior in the sense of approximating themselves to research centers and universities looking for cooperation for the technological development.

1. Faculties' capabilities are enhanced from being engaged with an industrial partner through research grants or technical assistance efforts. (Kotnour, 1999)
2. Graduate students' internships at the company enable students to obtain industrial working experience, interact with industrial researchers, and be exposed to relevant knowledge, which can be applied to their studies and research thesis.
3. The role that students play in a university-industry collaborative research program is often neglected, but can be vital to the success of the program. The company agent can assist the student in finding the right group in the company to work with (matching research background and interest to the positions available), as well as liaising with the university researchers to target potential students, and coordinating efforts with the corporate recruiters.
4. Opportunities for networking and exchange of knowledge such as seminars, workshops, short courses and paper presentations serve to sustain a long-term relationship and provide a means of information dissemination. (Bloedon, Stokes, 1994)

In the UnIC one can define 4 types collaboration. These are;

1. Research Support: Research support is the contribution of both money and equipment made to universities by members of the corporate community. (Santoro, Chakrabarti, 1999)
2. Cooperative Research: Cooperative research reflects close interactions through institutional agreements, group arrangements, institutional facilities and informal interactions. Institutional agreements such as individual investigator contract research, grants to individual professors, and graduate fellowship support are specific ways which formulize industry/university research endeavors. Individual investigator contract research is the most frequently used technique. Individual investigator contract research usually

involves one university faculty member working with a single industrial firm on a specific research project and is generally for the purpose of addressing an immediate industry problem.

Group arrangements include special purpose affiliate programs and research consortia. Special purpose affiliate programs and research consortia emphasize contact between the member organizations and the university's faculty, staff, and students. Industrial organizations often affiliate with a university in order to gain easy access to the current student body and its alumni.

A third way in which there is cooperative research between universities and industry is through institutional facilities such as technology research centers, university based institutes, and joint ventures. Institutional facilities like technology research centers help to attract industrial partners by providing a coordinated research agenda and access to equipment and facilities.

Informal cooperative research occurs in such ways as the co-authoring of research papers and informal conversations. (Santoro, Chakrabarti, 1999)

3. Knowledge transfer: Encompass a variety of different processes emphasizing on-going personal interactions, cooperative education, and personal exchanges. Knowledge transfer activities are often a necessary foundation for stimulating larger scale cooperative university-industry research programs, such as research consortia and joint ventures.
4. Technology transfer: Programs capitalize on joint industry-university research and aim to integrate university driven research into applied initiatives for the development and commercialization of new technologies. According to Santoro and Chakrabarti (1999), technology transfer usually includes; addressing a specific research problem, providing technical expertise to companies seeking to develop new products or processes, assisting entrepreneurs in start-ups, providing technology patent or licensing services, and creating science parks and spin-off companies.

2.6.1.2. Army-Industry Collaboration (ArInC)

Resetar et al. (1999, p.22) report that one of the major advantages of partnerships is that they are effective mechanisms for bringing diverse technological capabilities together quickly to find solution to problems. Public private partnerships can improve information flow between government (Army) and industry, and they can, if managed well, eliminate duplication of effort, facilitate technology acceptance, and speed technology diffusion.

Collaboration constitutes a mutual commitment by the parties on how they will interact during the course of the contract, with the primary objective of facilitating improved contract performance through enhanced communications.

Collaboration provides a flexible framework for army and industry team members to work together to solve problems and informally resolve disputes. This helps reduce program costs and speeds the fielding of Army equipment. This type of collaboration is a commitment between Army and industry to improve communications and avoid disputes.

A key aim of Army programs to fund industry consortia, is to reduce the technical risks and induce firms to bear the remaining commercial risks which correspond to their market strategies.

There are many kinds of possible army-industry collaboration examples. It is possible to collect these types of collaborations into 3 main group; infrastructure, intellectual property and financial arrangements.

Infrastructure collaboration includes leasing out facilities and assets, fee for use of services and facilities, joint ownership of non-critical assets, joint employees, timesharing of facilities or equipment, and co-use of Army laboratories / R&D assets,

Intellectual property collaboration includes third party with established programs, design modularly for retrofit or cost, design with lower-cost substitute, or design for cost, other transactions joint venture, army equity fund, leasing technology with option to buy, research fund, and incubator arrangement

Financial arrangement includes negotiate discount, negotiate exchange privileges, nontraditional cost sharing, auctions, army affinity credit card, purchasing rights, project finance, army information broker service, army loan program, army real estate investment trust. (Chang et al., 1999, pp. 59-72) It is possible to find all explanations of these types of collaboration in ***APPENDIX-B*** and to find possible collaborations among parties in different levels in ***APPENDIX-C.***

2.6.1.3. University-Army Collaboration (UnArC)

The main areas of collaboration between Army and university are as follows;

1. Consultant: Service of consultant in technology management, forecasting technology, data gathering, total quality management, research and development management, project management, research, acquisition management, exchange of researchers,

2. Training: Such as graduate – post graduate education, training program development, training of trainers, certificate programs, production of training documents
3. Technology: Technology adaptation, technology development, technology production,
4. Acquisition: R&D for acquisition, project management in acquisition services, R&D based acquisition.

Related with university-army collaboration there are many implementation in Turkey as well as in the world do. In 2000, Institute(s) of Defense Technologies will be inaugurated. By help of this institute(s) university-army collaboration will gain more important.

2.6.1.4. University-Industry-Army Collaboration (UnIArC)

The basic need for a successful collaboration is to build up a true partnership. The most true partnership type is UnIArC collaboration. By help of these key actors collaboration can have gain a manner. And these key actors must share information and be flexible during the collaboration session.

There is some focus differences among university-industry and army. The important key success factor is to focus on mutual points not on differences. To describe mutual benefits differences must be known. Vedovello (1998) described University-Industry differences as given in Table 2.4.

Table 2.4: Differences Between University-Industry (Vedovello, 1998)

Typical aspect	University	Industry
Focus on research	Basic research	Applied research
Basic rationale	Advance Knowledge	Increase Efficiency
Aim	New ideas	Profits
Characteristics	Idea centered	Product centered
Framework	Open	Closed
Evaluation	By peers	By boss
Schedule	Open ended	Tight
Recognition	Science honors	Salary increase

They have different focuses on research. Basically University make basic research as industry does applied research. University's aim is invent new ideas, as industry's aim makes more profits over their rivals. University members work under open-ended schedule as industry's members doing it tightly. Army also has differences from these two parties.

Army differentiates from University and Industry related with its basic rationale, aim, characteristics, evaluation, and recognition. (Table 2.5) The most important things are basic rationale and aim. Army wants to have high quality weapons systems at a lower cost. And Army's aim is to secure National security.

UnIArC collaboration must start with overcome of these obstacles. Different focuses will help mutual benefits if collaboration is made on safe bases. First of all, the parties must build their expectations from the collaboration.

Table 2.5: Army's approaches

Typical aspect	Army
Focus on research	Development
Basic rationale	High quality products at a lower cost
Aim	National security
Characteristics	Success centered
Framework	Open
Evaluation	By rules
Schedule	Tight/Predetermined
Recognition	Rank / Better position

2.7. Legal Basis For Public-Private Partnership

UnIArC collaboration is a public-private partnership. Till today this type of partnership demonstrated many levels. As a leader of technologies of Armed Forces USA is avant-garde of this process. It is useful to examine USA's process of Public-Private Partnership to understand applications.

2.7.1. Legal Basis for Public-Private Partnership in USA

According to Chang et al. (1999) in USA barriers that have previously kept the government and industry from collaborating have steadily been reduced through legislation. The legislative changes have made it much easier and more lucrative for the military to enter in public-private partnerships.

2.7.1.1. Contracts

Prior the 1980's the accepted means of procuring military equipment and services was a standard contract.

2.7.1.2. Stewenson-Wydler Technology Innovation Act of 1980

Brody (1996) reports that although not an instrument to contract for goods and services, the Stewenson-Wydler Act authorized all federal laboratories to take an active role in transferring federally funded technologies to non-government entities. Stewenson-Wydler granted broad authority to the Department of Commerce *"to enhance technological innovation for commercial and public purposes..."* including a strong national policy supporting domestic technology transfer and utilization of the science and technology resources of the federal government.

In addition to leveraging the economic impact of federal R&D investments, Stevenson-Wydler act directed the federal government to conduct a wide range of research and cooperative activities to assess and improve American technological competitiveness.

2.7.1.3. Grants

As a dictionary term grants are a sum of money given by the government to a person or organization for a special purpose. In the 1980's grants became another method of procuring needed military research. Grants are usually limited to universities and other non profit organizations for research on weapons and other military needs, or for projects of potential interest to the Department of Defense. Unlike contracts, grants are administrated under the Department of Defense Grant and Agreement Regulations (DoDGARs) and do not allow for active government participation in the research.

2.7.1.4. Technology Transfer Act of 1986

According to Brody (1996) the first legislation allowing the military to enter into public private partnerships was the Federal Technology Transfer Act of 1986 (FTTA). The FTTA

allowed federal laboratories to enter into Cooperative Research and Development Agreement (CRADAs) with private industry, universities and other interested parties.

CRADAs allow federal and private sector scientists and technologists to work closely together in developing a technology for government mission and commercial uses.

2.7.1.5. Cooperative Agreements

In 1989, Congress gave DARPA the authority to use Cooperative Agreements (CAs) under –Title 10, United States Code, Section 2358, R&D Projects- and extended their use to all of DoD in 1991. In accordance with section 2358, CAs can be used for basic research, advanced research, applied research, and development projects that relate to military weapon systems and other needs of potential interest to the DoD.

CAs allow cost sharing between parties. In addition CAs unlike grants, allow for the military to participate in the performance of the research.

2.7.1.6. Other Transactions

In 1989, a law (Title 10, United States Code, Section 2371, "Advanced Research Projects: Transactions other than contracts and grants") gave DARPA the authority to use a form of transaction other than a contract, cooperative agreement or grant.

2.7.1.7. Other Transactions for Prototyping

In 1993, Congress amended Title 10, Section 2371 by adding Section 845 to the existing law. Section 845 allowed DARPA to use OTs for prototype projects.

2.7.1.8. Test and evaluation

In 1993, U.S. Congress under title 10, section 2681(Use of Test Evaluation Installations by Commercial Entities) gave the military additional leeway in forming public private partnerships with outside agencies by extending its authority to enter into contracts with commercial entities that want to conduct commercial test and evaluation activities. Under this legislation, the military can rent test and evaluation facilities to commercial entities to conduct non-military testing.

2.7.1.9. National Technology Transfer and Advancement Act of 1995 (NTTAA)

In 1995, the Stewenson-Wydler Technology Innovation act of 1980 and The Federal Technology Transfer Act of 1986 were amended through the National Technology Transfer and Advancement Act (Public law 104-113), in an effort to speed

commercialization of inventions developed through collaborative agreements between the government and industry.

The law provides that under a CRADA, industry partners and government may have exclusive license rights of new technologies in areas agreed upon during negotiations. The amended law also enhanced incentives for federal employees who develop new inventions or technologies and allows federal laboratories greater flexibility in using royalties that result from commercialization. The changes sought to promote an increase in the use of partnership ventures between the private sector and the government, while attracting more nontraditional government contractors to enhance the flow of technology to government usage.

2.7.1.10. Proposed Technology Transfer Commercialization Act of 1997 (TTCA)

On September 30, 1997 TTCA was introduced with the intent of encouraging technology transfers to the private sector by simplifying licensing procedures for federally owned inventions.

2.7.1.11. Leases on Non-Excess Property

Title 10, Section 2667 is the primary vehicle for leveraging fixed assets. Chang et al. (1999) report that this legislation authorizes the military to lease non-excess property to civilian entities when it is considered advantageous to the government and will promote the national defense or be in the public interest.

Rental money received for the lease of non-excess property can be deposited in the Treasury for use by the Army, with no less than 50% returned to the installation to directly support the lease, as in facility maintenance and repair or environmental restoration. The money may also be reapportioned by Congress before it is returned to the Army, thus delaying its use for a year.

2.7.1.12. Results

By the late 1980s, a new paradigm of technology policy had developed. In contrast to the enhanced spin-off programs -enhancements that made it easier for the private sector to commercialize the results of mission R&D- the government developed new public-private partnerships to develop and deploy advanced technologies.

These new programs incorporate features that reflect increased influence from the private

sector over project selection, management, and intellectual property ownership. The new paradigm has several advantages for both government and the private sector. By treating the private sector as a partner in federal programs, government agencies can better incorporate feedback and focus programs.

The private-sector-as-partner approach allows the U.S. government to measure whether the programs are ultimately meeting their goals; increasing research efficiencies and effectiveness and developing and deploying new technologies. Finally, rather than relying on "technology-push" by the federal government, these programs use "market-pull" to promote innovation, increasing the probability that the targeted technologies will be successfully commercialized.

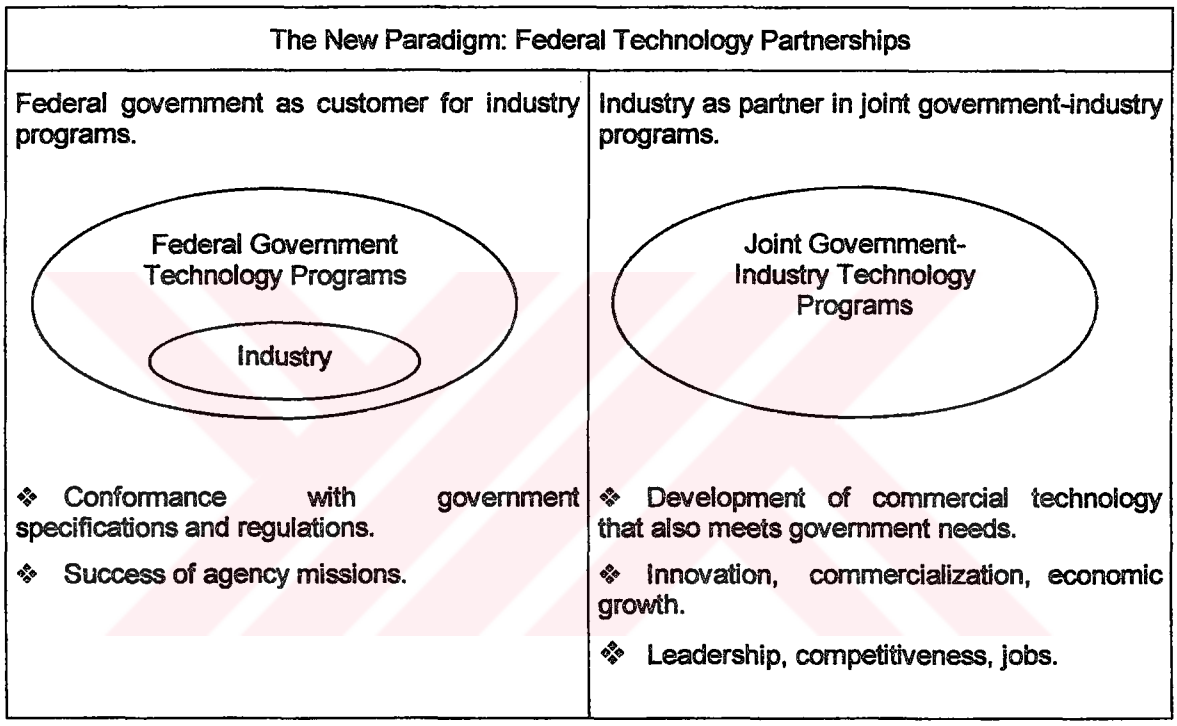

Figure 2.4: The New Paradigm (Brody, 1996)

According to Brody (1996) key elements of the new paradigm (Figure 2.4.) include;

1. Maximizing the return on federal and private sector R&D investment.
2. Making government a better partner with the private sector.
3. Increasing the private sector role in project definition, selection, and management.
4. Conducting programs on a cost-shared basis.
5. Limiting the length of participation. Limit project life to a short term. (1-3 years)

2.7.2. Legal Basis for Public-Private Partnership in Turkey

Today the accepted means of procuring military equipment and services is almost a standard contract. There are two different source of procurement in Turkey. One of them, procurements doing by Ministry of Defense (MoD), the other one includes procurements doing by Undersecretariat for Defense Industries (SSM). (Ziylan et al., 1998)

2.7.2.1. MoD

According to number 1325th law, TAF's requirements are procured by Undersecretariat of MoD. There are two kinds of procurement method in this law. These are internal and external procurement. Internal procurement is available for number of 2886th law. (Government contract law). For external procurements there are five ways;

1. Direct buying from international weapons firms,
2. Buying with the Turkey's foreign representatives,
3. By Foreign Military Sales (FMS) from USA,
4. By BWB (Budesant für Wehretechnik und Beschauffung-Germany defense procurement agency) from Germany,
5. NAMSA (NATO Maintenance and Supply Agency)

2.7.2.2. Undersecretariat for Defense Industries

For meeting TAF requirements by developing national defense industry, number of 3238th law is accepted. According to the law Defense Industry support fund is formed. It is formed for national defense industry firms. Number of 2886th law does not include Undersecretariat for Defense Industries. There is an executive committee formed by primer minister, chief executive officer and minister of defense. This committee decides with which firm, Undersecretariat for Defense Industries will make the agreement. The first goal of the Undersecretariat for Defense Industries is not direct buying. It's goal, is supporting establishment of national defense firms which will produce required defense systems. It does sometimes direct buying too. Since 1990s there are some studies in Undersecretariat for Defense Industries (SSM). These studies ***(Appendix-D)*** let SSM to collaborate with universities and industries.

2.8. Critical Success Factors For UnIAr Collaboration

There are many different point of view (Martin, 1976; Locke, 1984; Cleland and King, 1983; Sayles and Chandler, 1971; Baker, Murphy, and Fisher, 1983) to define critical

success factors in project implementation. Researcher's works about critical success factors in projects can be classified as given in Table 2.6.

There are many factors which influence project's success as given Table 2.6. Another important point is that it is advantageous to determine factors leading to project's failure, such as poor communications, human relations and coordination among parties, inadequate project manager (in point of view human skills, technical skills, influence and authority, lack of project team members in decision making and problem solving, inability to freeze design early, inappropriate project organization, lack of control in the project team, etc.

Generally there are 3 main activity stages in a collaboration. These activity stages are before collaboration activities, during collaboration activities, and after collaboration activities. These activities can be seen in Table 2.7.

It is possible to determine critical success factors in a collaboration stage by stage. If parties correctly behave during these stages collaboration also will be successfully resulted.

2.8.1. Before Collaboration Activities

This stage is enormously important in the collaboration. Because, there, parties make decisions about project's designing. If designing is successful, collaboration will succeed. This phase provides a framework for defining the needs of the organization, evaluating partnering as an option to fulfill these needs, and allocating responsibilities to be performed by the three primary organizations in the collaboration.

2.8.1.1. Conceptual Model of Collaboration

At the outset of the collaboration, there is one another critical success factor. This is constructing a conceptual model of collaboration. Conceptually defined model, provides a framework about organization's political success factors in a collaboration. If this model is effectively defined, and if subsequent activities happen under characteristics of this model, collaboration will succeed.

Table 2.6: Critical Success Factors in Project Implementation (Adapted from Pinto and Slevin, 1987)

Sayles and Chandler (1971)	Martin (1976)	Cleland and King (1983)	Baker, Murphy and Fisher (1983)	Locke (1984)	Weston and Gibson (1993)
Project manager's competence	Define goals	Project summary	Clear goals	Make project commitments known	Early start
Scheduling	Select project Organizational Philosophy	Operational concept	Goal commitment of project team	Project authority from the top	Commitment from top management on both (all) sides
Control systems and responsibilities	General management support	Financial support	On-site project manager	Appoint competent project manager	Appointment of a partnering representative on all sides
Communication	Organize and delegate authority	Logistic requirements	Adequate project team capability	Setup communications and procedures	Selection of participants for the workshops
Monitoring and feedback	Select project team	Facility support	Accurate initial cost estimates	Set up control mechanisms (schedule etc.)	Scheduling the workshops
Continuing involvement in the project	Allocate sufficient resources	Market intelligence (who is the clients)	Minimum start-up difficulties	Progress meetings	Conducting the workshops
	Provide for control and information mechanisms	Project schedule	Planning and control techniques		Routine follow-up workshops
	Require planning and review	Execute development and training of personnel	Task (vs.social) orientation.		
		Manpower and organization	Absence of bureaucracy		
		Information and Communication channels			
		Project review			

As Crowley and Karim (1995) reported, partnering can be defined in one of two ways; by

its intended attributes such as trust, mutual goals, long-term commitment; or by the process where partnering is seen as verb, as in developing a mission statement, agreeing on goals etc.

Table 2.7: Collaboration stages activities

Before Collaboration Activities	Constructing a conceptual model of collaboration
	Defining a collaboration process model
	Organization's internal alignment
	Partner selection
	Defining goals, measures and reward system
	Providing financial/manpower support and scheduling
During Collaboration Activities	Adequate communications among parties
	Problem definition
	Adequate dispute resolution
	Providing effective project control
After Collaboration Activities	Feed-back for next possible collaborations

In the business area, generally collaboration has three different parties, owner, designer, and contractor. In a UnIAr collaboration owner is TLF, designer is university (by help of Contractor and owner), and Contractor is industrial firms. A schema of this relationship is given in Figure 2.5.

Theoretically, collaboration is a process of resolving interpersonal and inter-organizational conflicts. At the outset of the relationship, collaboration team must determine clearly each party's role and collaboration's goals. As owner, TLF must define it's requirements. Thereafter, TLF, University, and Firm build the specifications. University designs them according to requirements and specifications. As Contractor, firm must produce them properly. Cost effectiveness, high quality, and schedule are critical factors for firm's success.

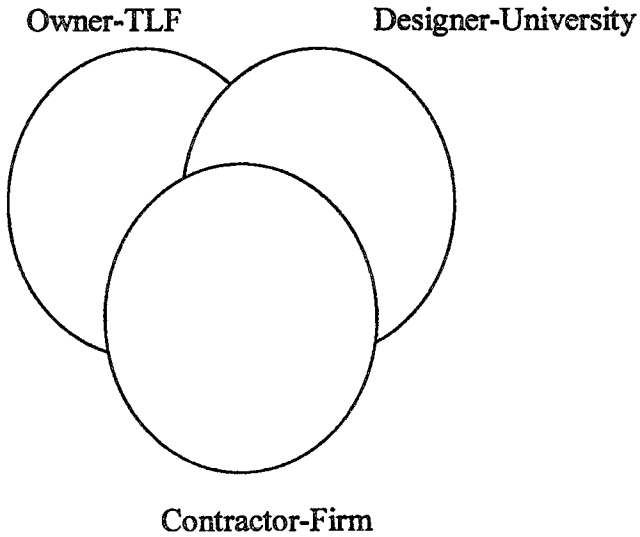

Figure 2.5: Parties and roles in a collaboration

Crowley and Karim (1995), suggest that partnering conceptual model is developed in four section. These are background, partnering organization, model validation and applications.

1. Background

It consists of partnering, matrix organizations, decentralization, organizational boundaries, organizational interfaces, conflict resolution, personality conflicts, problem definition, and communication.

In partnering; the key elements are described as trust, long term commitment, and shared vision. Trust develops confidence, encourages open communication, exchange of ideas, and sharing of ideas. Partnering provides win-win-win attitudes, conflict resolution through problem solving, freedom of speech and openness, innovation, equity, and shared risk.

Through the allocation and sharing of resources, a matrix organization facilitates problem solving by improving the capacity of the organization to implement innovative ideas. This organization can achieve rapid responses to day-to-day problems. It defines clear organizational boundaries and lines of authority. The matrix structure forces decision making to be a constant process of exchange between the many functional interest group represented.

Decentralization provides the scope to solve day-to-day problems, resolve conflicts, expedite decision making, and increase organizational competence in achieving project

goals.

Organizational boundaries within government agencies are rigid and impermeable. In these organizations, employees and their departments have well-defined jurisdictions, responsibilities, and a hierarchy of authority. This traditional bureaucratic system of organizing must be overcome to allow public agencies to partner effectively. In contrast, private sector organizations have more flexible and permeable boundaries. This corporate climate is ideal for the inter-organizational cooperation necessary in partnering. Their boundary permeability along with a minimum of internal regulations allow for the open communication and exchange of ideas with external organizations.

A partnering alliance is defined to a large extent by its organizational interface. Organizational interface is cooperative interdependence, which compels interaction among hostile organization where parties tend to gain from the interaction. A productive interface typically exhibits moderately open boundaries and maintains only enough internal regulation to prevent escalation of the problem or withdrawal from it, while not suppressing critical differences. In a tightly organized interface, external boundaries are comparatively closed and the regulation of internal activity is tight. This limits the discretion and flexibility of the representatives are free to interact at their own discretion.

Effective conflict resolution plays a key role in partnering. Conflict affects all kinds of organizations, especially those where managers work in direct contact with each other, as in partnering. If managed properly, conflict contributes to success in these organizations. It leads to creative solutions, which enhance the ability to work together in the future. Conflict resolution within partnering frequently leads to innovative techniques in achieving project goals.

Personality conflict is a situation of interpersonal strife or incompatibility among persons. Managers' open-door policy provide their subordinates to openly communicate problems and concerns. Accepting conflict at a personal level raises to potential to confront, manage, and solve problems at an organizational level, instead of avoiding them.

Problem definition begins with the identification of specific needs and desires of the parties and then defining them as jointly held concerns. Successful problem evaluation leaves the parties with positive feelings toward each other, a high commitment to meet the common objectives, and an understanding of the win-win outcomes.

Communication among the partners play a vital role in problem definition and conflict resolution. All projects begin with concepts, images and expectations. Communication is successful when the intended meaning is transferred from the message sender to the receiver.

2. Partnering Organization

Crowley and Karim (1995), proposed a model of the partnering organization as given in Figure 2.6. Along with the three project participant involve in partnering-the owner, designer, and contractor- are shown the boundaries which define and separate them.

3. Model Validation

The proposed partnering organizational model is validated by showing that the prerequisite attributes of partnering trust, long term commitment, and shared vision. Trust helps develop confidence in one another, encourages open communication, allows the exchanges of ideas, and the sharing of resources.

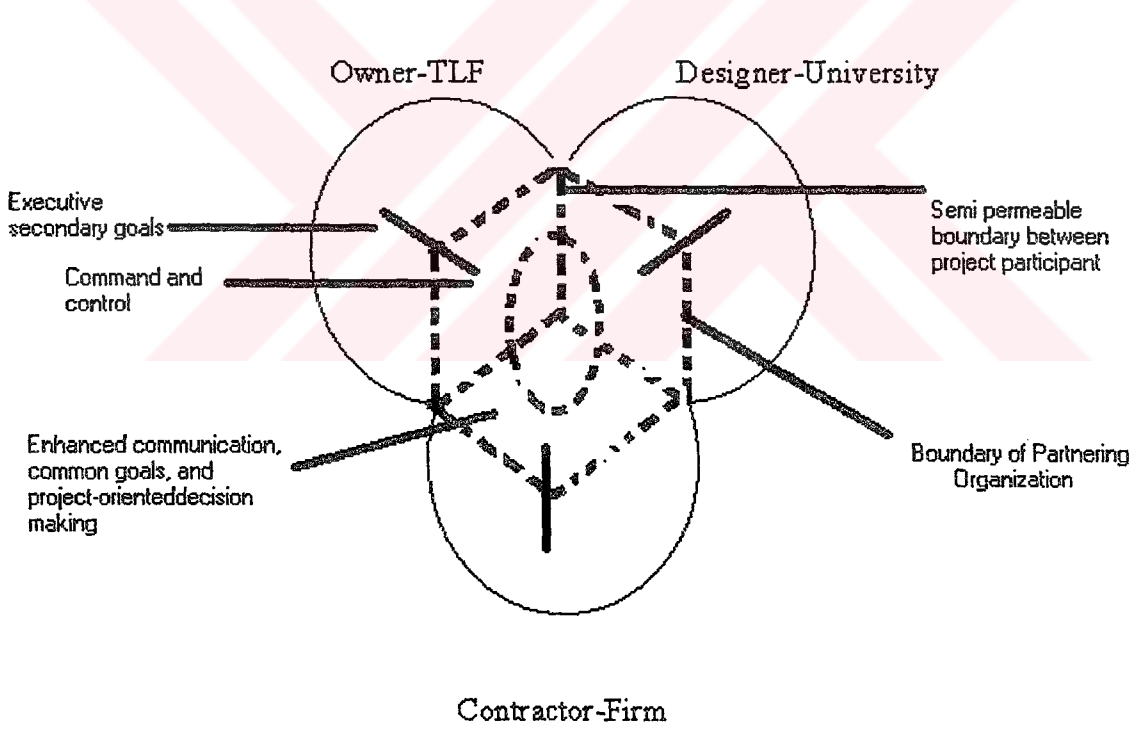

Figure 2.6: Conceptual Model of Partnering (Crowley and Karim, 1995)

4. Applications

The proposed organizational model enhances the overall efficiency of the partnering technique by defining the objectives, segregating the resources, and establishing a territory for the participants through the modification and addition of new boundaries. The prototype provides a guideline to organize partnering according to individual project requirements.

In its research, Chapman (1998) defines conceptual model of partnering with three levels. These are; structuring a partnership, social and cultural considerations, and external aspects.

Structuring partnership includes, clearly and simply stated goals, high level support, accountability at a high political level, limited number of these kind of partnership, anticipation of funding and technology needs, problems associated with the lack of central budget, dual-use multi-agency projects, and building on an existing core government R&D program.

Social and cultural considerations include, differing agendas, challenging competition, social encounters to improve working interactions, and sheltering technical people from political turbulence.

External aspects include, involving congress, importance of public affairs, and flexible and proper planning for meeting the unexpected. It is possible to see all these classifications as given in Table 2.8a, 2.8b., 2.8c.

2.8.1.2.Collaboration Process Models

After constructing a conceptual collaboration model, it is easy to build a collaboration process model. In this thesis there are 2 different types of partnering process model. One of them is Crane et al., (1997) model (Model-1), the other one is Wilson, Songer, and Diekmann (1995) model (Model-2).

Crane et al., (1997) describe partnering process model in 5 basic phases. Owner's internal alignment, partner selection, alliance alignment, project alignment, and work process alignment. It is possible to see thee phases and their objectives in Table 2.9.

Table 2.8a: Structuring a Partnership (Chapman, 1998)

STRUCTURING A PARTNERSHIP	Clear and simply stated goals	Are most effective for motivating technical staff and winning public support. Such simply expressed goals also help motivate even the most technically sophisticated scientists.
	High level support	Is vital, within both government and industry. As with any advanced technology project, the interest and support of top management are important for encouraging support within the organization. (Congress, media, public)
	Accountability at a high "politico" level	Accountability at a high politico level in each participating agency is a must.
	Limited number of these kind of government – industry partnerships	Number should be limited.
	Anticipation of Funding and technology needs	The government must anticipation of funding and technology needs at the outset. This is particularly difficult for any government activity but necessary.
	Problems associated with the lack of central budget	
	Dual-use multi-agency projects	Is defense terminology for an item with both military and civilian applications?
	Building on an existing core government R&D program	Creating a new partnership without tapping into an existing program involves developing a program plan, determining funding needs, inserting the funding request into the nearest budget request, and then responding to congressional action.

Table 2.8b: Social and Cultural Considerations (Chapman, 1998)

SOCIAL AND CULTURAL CONSIDERATIONS	Differing Agendas	Although government and industry may agree to pursue the same goals, the agendas should be expected to vary. It is important to recognize this phenomenon. Otherwise, much energy may expend in appealing to higher interests when all that is needed is finding constructive ways of satisfying less-exalted motives.
	Challenging Competition	Competition in industry is a stronger force than cooperation and should be channeled rather than discouraged.
	Social encounters to improve working interactions	Social encounters improve working-level technical interactions.
	Sheltering technical people from political turbulence	

Table 2.8c: External Aspects (Chapman, 1998)

EXTERNAL ASPECTS	Involving Congress	Program managers must take sufficient time to involve congress without inviting micro-management.
	Importance of Public Affairs	Public affairs should be given priority as an extremely important component of a government-industry partnership.
	Flexible and Proper planning for meeting the unexpected	Flexibility and proper planning will help when faced with the inevitable unexpected circumstances. Partnerships with fairly long time spans will need to allow for flexibility.

Table 2.9 :Partnering Process Model-1 (Crane et al., 1997)

PHASES	OBJECTIVES
1. Owner's Internal Alignment	Identify business drivers
	Evaluate partnering
	Prepare and align
2. Partner Selection	Select optimum partner
3. Alliance Alignment	Align objectives
	Develop measures
	Develop reward system
4. Project Alignment	Develop "win/win" objectives
	Reward accomplishment of objectives
5. Work Process Alignment	Establish intraproject goals
	Establish processes to support measures

According to Wilson, Songer, and Diekmann, (1995), there are 8 stages in a partnering process model. (Figure 2.7.) Identifying and selecting the leaders, and obtaining their unequivocal commitment to partnering, is critical to a successful partnering effort.

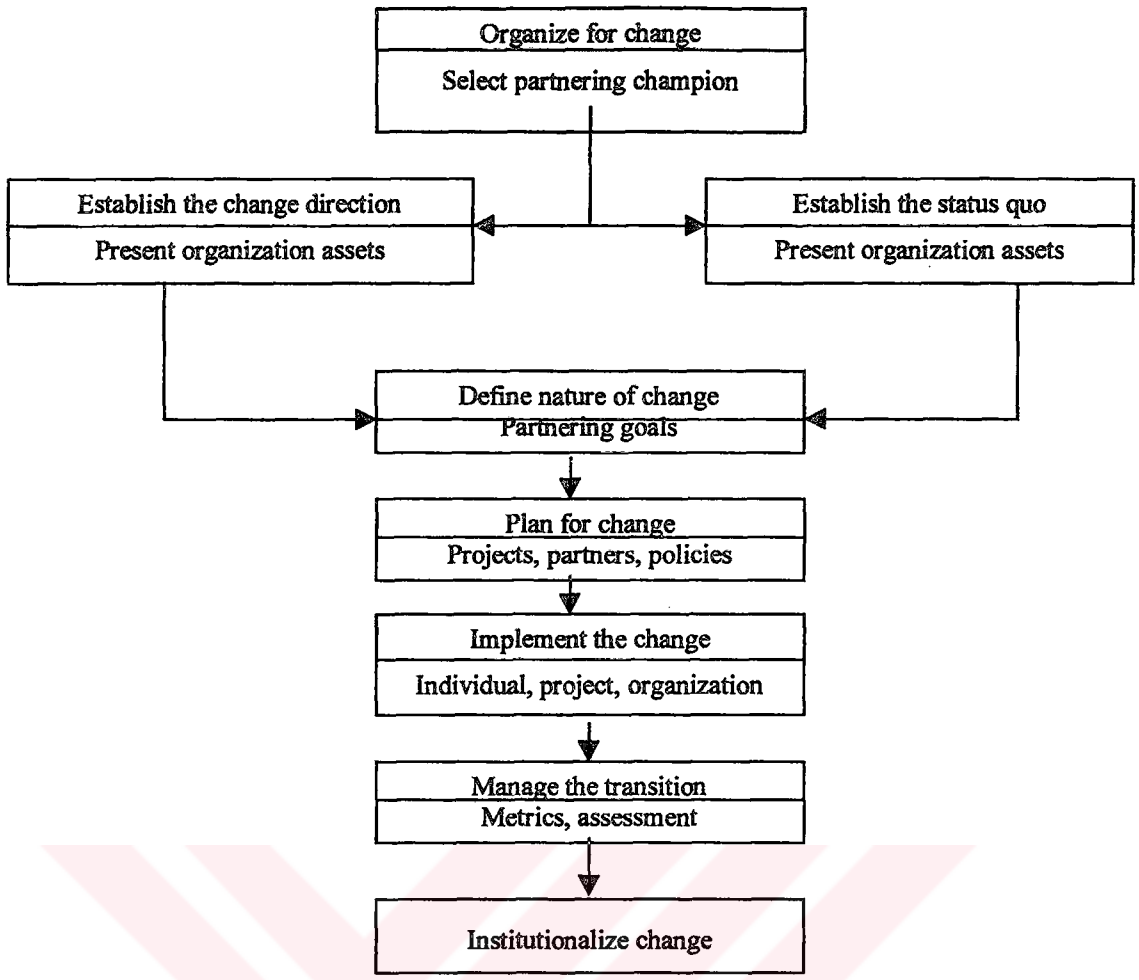

Figure 2.7: Partnering Process Model-2 (Wilson, Songer, and Diekmann, 1995)

The definition of an organization's future state is highly dependent on primarily four components; vision, mission, values, and goals. Vision expresses the long-term perspective of the organization. It provides strategic direction for all components of the organization. Mission is a specific statement, which provides operational answers to the questions who, what, when, where and why. A mission statement indicates the "raison d'être" for the organization. Values are fundamental notions of correct behavior. Values form the foundation of an organization's character. Examples of partnering values include;

1. Commitment,
2. Trust and confidence,
3. Clear expectations,
4. Responsibility,
5. Courage,

6. Understanding and respect and
7. Excellence.

Goals are mutual understandings, which establish the operational parameters driving mission fulfillment. Examples of partnering goals; include on-time delivery, within budget, no claims and litigation, quality product, no rework, increased communication, better working environment, and customer (end-user) satisfaction.

Once direction has been determined, the organization must assess its present state in order to develop a plan of action. Organization should identify their problem areas such as poor communication, lack of cooperation, etc. During this phase, organizations reexamining their old vision, mission, goals, values, culture, systems and structure. As doing these, they use some tools. Some appropriate assessment tools are; consultants, employee questionnaire, group surveys, individual surveys, interviews, and competition analyses.

Once differences between the future-present state are noted, organizations can develop specific goals for partnering endeavors in defining nature of change/assessing the present in terms of the future stage.

After defining organization's goals; organizations develop and implement a strategy to attain the goals. The partnering transformation requires cultural adaptation, which may meet forceful resistance.

Implementing changes occurs at three levels. Individual, project and organizational intervention. Individual is critical to any change, and some organizations are changing their environmental attitudes through partnering and are experiencing rewards such as work satisfaction and cooperation. Individual training programs (introductory workshops, formal training, long-term training) are imperative for successful corporate change. If there is one area where the industry excels in developing partnering relationships, it is at the group or project intervention level. The last level of intervention required to internalize change is at the organizational level. The goal is to create an open and learning organization, able to react to internal and external forces. Organizational intervention begins with a commitment from the top to focus on the process, and to change the process based on feedback and assessment. The organization must seek feedback both internally and externally and restructure its programs, policies, and procedures to meet its partnering vision, mission and goal.

In the institutionalizing change stage, the organization must support and recognize accepted behavior and it must incorporate observations and recommendations from the management phase into every applicable phase of the model. Both of these tasks represent reinforcement for the new vision. This reinforcement may require the organization to review its necessary support systems to ensure that the reward system is aligned with the new vision, recruiting procedures and selection criteria are aligned with the new vision, job descriptions reflect the new vision, people view the process as a new way of life. Leadership and management personnel play equally critical roles in the stabilization of the change effort.

2.8.1.3. Organization's Internal Alignment

According to Crane et al., (1997), internal alignment activities include 3 level. Identifying business drivers, evaluation of partnering, and preparing and aligning.

1. Identifying organization's business drivers

This level will help the organization determine which benefits it hopes to gain through collaboration.

2. Evaluation of partnering

It is an option to achieve identified goals. In this stage organization must determine the cost and benefits of collaboration. It may be very difficult to determine cost and benefits.

3. Preparing and aligning for collaboration

Organization must identify all types of barriers to collaborating within the organization, and work to reduce them. Organization's internal alignment, predict potential problems in advance; therefore the collaboration will start right and subsequent steps will guard that the relationship stays right.

2.8.1.4. Partner Selection

After internal alignment, organization must select a partner to collaborate. Organization must have a empowered selection team which should consist of representatives from all department. This team must develop a list of potential partner and team must develop a list of selection criteria. For example in their works, Crane et al., (1997), determined a list of selection criteria as given in Table 2.10.

All organizations may develop such a criteria list. The important thing, is the evaluating all potential partners with the same list.

2.8.1.5. Defining Goals, Measures and Rewards System

1. Defining goals

In a collaboration it is important to build trust among parties. Shared knowledge helps each partners to build trust and to better understand the other's needs, resources and objectives. In a collaboration if employees feel that they are a part of the project, they are more committed to success. This process aids to development of trust. Open communication also decreases duplication of efforts and help to increase performance of developing collaboration goals.

Table 2.10: List of Criteria Used by an owner to select partner (Crane et al., 1997)

Selection Criteria	Points	Selection Criteria	Points
1. Project experience	150	6. Safety program/performance	70
2. Project performance	150	7. Organization/mobilization	80
3. Management team	150	8. Pricing	70
4. Partnering	80	9. Commercial	50
5. Total quality program	70	10. Subcontracting	30
		Total	1000

Goals of the project must be determined clearly. Clearly defined goals includes general project philosophy or general mission of the project. Goals must be specific and carefully monitored. To be successful, parties must work together with the commencement of the collaboration to integrate partnering into all organization's strategic plans.

2. Developing partnering measures

The partners develop measures to monitor the progress of the relationship. The partnership has already defined what it hopes to achieve; now it needs a means of verifying that the stated objectives are indeed being met.

Measures can be quantitative such as schedule or cost of project, or qualitative such as worker morale, communication and leadership.

As Crane et al., (1999) pointed out, there are three level of measures in a collaboration as it is given in Figure 2.8.

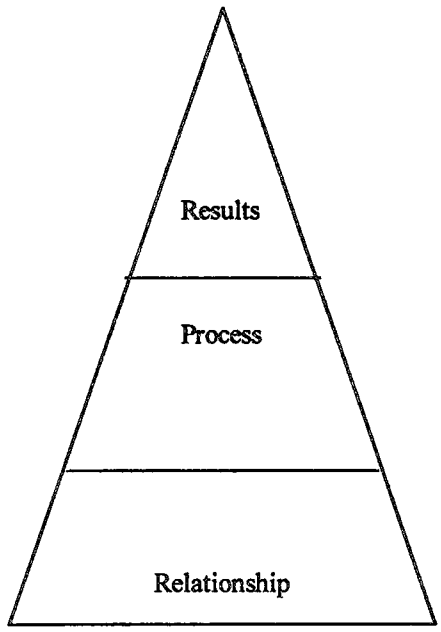

Figure 2.8: Measures (Crane et al., 1999)

a. Result and process measures

Result measures are "hard" measures based on performance. (Cost, schedule, quality, and safety are result measures)

Results and process measures includes 5 different types of measures. These are cost, schedule, safety, quality, and litigation. Cost measures include cost performance index, project within cash flow plan, billable ratio (engineering), engineering work-hour /unit of product, third party work sampling to determine contractor effectiveness, Value engineering savings, engineering as a percentage of total installed cost, duplication of effort, cost growth, and overhead as a percentage of total installed cost

Schedule measures include Schedule performance index, milestones met, immediate notification of delays, pre-assembly of equipment (percentage of total), timely issue of engineering documents and equipment, availability of spare parts/change parts, cycle time (product to market), and time to process change orders, purchase orders, request for information.

Safety measures include, lost time and non-lost time incidents, occupational safety and health administration recordable incidents, drug testing results, safety training performed

on time, and same-day correction of safety problems.

Quality measures include, conformance to specifications, achievement of operating objectives, percent of rework, plant output, participation in design by construction / manufacturing personnel, start-up performance, number of engineering changes, customer feed back, audit deviation, errors and omissions, and first pass yield.

Litigation measures include outstanding claims, and number of conflicts elevated to each level.

According to Crane et al (1999) "*Process measures are used to effectively track in progress activities, and thus provide and early-warning system for identifying necessary midcourse corrections. The primary advantage of identifying potential problems early is to provide the decision maker with the greatest number of options for problem solution. Corrections made early tend to result in reduced project expenses and improved partner relations.*"

b. Relationship Measures

Internal communication, external communication, meeting effectiveness, worker morale, internal trust/candor, external trust/candor, internal leadership, external leadership, accomplishment of objectives, utilization of resources, problem solving, creativity and synergy, timely evaluation and appropriate response, definition and adherence to roles and responsibilities, continuous improvement, teamwork.

Cost and schedule variance can be used to measure how well the project adheres to the original estimate and schedule. Quality typically includes such measures as the amount of rework required. Safety can be measured by compiling safety statistics such as lost time incidents.

The establishment of measures is an important aspect of the collaboration. If they are created correctly, measures will provide useful information about the performance of a collaboration relationship. They can help managers determine the effectiveness of the relationship and of the various processes so that appropriate actions maybe taken to ensure the realization of established goals. To be most efficient and effective in the measurement process, factors must be prioritized and attention directed to only the most significant items.

3. Developing a reward system

Incentives should be developed based on the measures. They should be structured so that they reward progress toward the advancement of the general business drivers identified at the beginning of the relationship.

The development of incentives (based on measures) are critical to reinforce the success of a partnering relationship. They show organization's certain goals and encourage desired behavior and increased effort among employees.

2.8.1.6. Providing Financial/Manpower Support And Scheduling

The last critical activity before collaboration, is providing financial/manpower support to project team. Adequate schedule also is important to achieve organization's collaboration success.

2.8.2. During Collaboration Activities

2.8.2.1. Adequate Communications Among Parties

Crowley and Karim (1995) report that communication among parties play a crucial role in problem definition and conflict resolution. All projects begin with concepts, images, and expectations. Communication is successful when the intended meaning is transferred from the message sender to the receiver.

2.8.2.2. Problem Definition

Problem definition begins with the identification of specific needs and desires of the partners and then defining them as jointly held concerns. Successful problem evaluation leaves the parties with positive feelings toward each other, a high commitment to meet the common objectives, and an understanding of the win-win-win outcomes.

2.8.2.3. Adequate Dispute Resolution

Effective dispute resolution plays an important role in collaboration. Conflict affects all kinds of organizations, especially those where managers work in direct contact with each other, as in collaborating. If managed properly, conflict contributes to success in these organizations. Properly managed conflicts leads to creative solutions, which enhance the ability to partnering/work together in the future. Conflict resolution within collaboration generally leads to innovative methods in reaching mutual project goals.

Gardiner and Simmons report (1998) in their work which done in U.K., include construction projects between 2 Million $ - 8 Million $, most frequent causes of

Organizational conflict as given in Table 2.11.

Table 2.11: Most Frequent Causes of Organizational Conflict Identified in Projects Studied (Gardiner and Simmons, 1998)

Cause of Conflict	Summary
Task interdependency	Conflict resulting from dependency upon others (e.g. for information, feedback, or completion of a task)
Organizational differentiation	Conflict due to different groups of people perceiving the same thing differently
Values, Interests, and objectives	Conflict arising from misalignment of personal goals with the project goal
Tension	Conflict resulting from unresolved and mounting interpersonal tensions
Personality traits	Conflict escalation due to lack of understanding or inability to manage personalities encountered

According to Ellison, Miller (1995), one critical key to successful project is establishing relationships among the parties driven to resolve issues before they become disputes. They define 4 levels for partnering.

Level 1, includes 4 basic question; who is responsible for what, what happens when things go wrong, how will fault be determined, and who should pay for problems.

Level 2 has two basic requirements; a trust relationship between the supplier of services and the client, and communications designed to facilitate solutions, rather than to establish positions or find fault. At the outset of the working relationship, the parties must have a fundamental belief that they are embarking on a project of mutual benefit, with common goals. Although the contractual terms and conditions will still be negotiated (and may not look dissimilar to those in level1), the parties must sign a memorandum of understanding to demonstrate the following values they want their working relationship to embody;

The nature of the project and the mutual benefits each party will reap from a successful project and how effective communication can be achieved. The parties may establish an open channel of communication between executives of the client, instead of leaving

communications solely to the project manager or at the working level.

Level 3 includes 5 phases which develops a partnering relationship:

1. Need analysis includes; describing the current status of the project; defining the roles of key participants; defining potential opportunities and liabilities; and developing a framework including guidelines or criteria for the work.
2. Partnership structure and scope includes; identifying the core structure; naming principal contracts; and establishing a charter with mission, goals, and measurements; roles, responsibilities, and formal authority; and incentives to meet and exceed goals
3. Relationship with other stakeholders includes; defining the role of major subcontractors, outside agencies, community organizations, decision makers; and identifying the means to minimize disputes and to build compromise.
4. Shared risk/reward includes; identifying contractual issues and defining the relationship among the various stakeholders; establishing the tools for both measurement and sharing of liabilities; defining the incentives for measurement and sharing of gains/liabilities;
5. Continuous improvement includes; Joint assessment of progress; evaluation of changing needs and expectations; analysis and application of lessons learned; and prescribing actions to respond changes, correct course, and size opportunities,

Level 4 (Synergistic Partnership), requires a commitment by the parties well beyond success on a particular project. The parties anticipate a longer term strategic alliance, a relationship that requires complete trust, even to the extent of sharing confidential or proprietary information.

2.8.2.4. Providing Effective Project Control

The logistics of defining, researching, developing, testing, purchasing, maintaining and phasing out the weapon systems is actually a massive project management effort.

According to Woodrich (1993), "*project controls are the techniques, methods, tools and style of implementation used to control the time, cost, and quality of a project. Effective project control is the ability to manage a project according to an established plan (time, budget, resources), producing agreed upon results (time, budget, expected deliverables)*

These tools include, but are not limited to; work breakdown structure, task matrix, statement of work, specifications, task authorization, project budget, cost accounts,

schedules, networks, critical path determination, tracking, reporting, support and leadership. All these tools boil down to three distinct pillars (people, metrics and measurements)"

People, are the most valuable asset of an organization, and it follows that the control of a project starts with the team development. It is the team involved in a project that can ultimately produce success or failure. Team development affects the control of a project by a number of factors including motivation, commitment, and leadership.

People come together to work out a detailed plan, reach an agreement between the team, obtain commitment from the individuals and management, define measurable milestones, detect problems early, communicate the true project status, and meet milestones- including delivery of final product. Motivation and commitment of people on a project are the critical to the successful control of that project.

The metrics; (which refers to measurable quantities, management style, and effectiveness) of a project are the deliverables and the plans to achieve them as compared to the result finally obtained. Metrics are the "how" of project completion – how a project is intended to be completed and how it is actually accomplished. Project metrics are flexible and tracked with benchmarks and milestones.

The measurement of a project, is accomplished with tracking and budgeting tools. Such tools include program evaluation review technique (PERT), percentage complete, and performance value indexing.

2.8.3. After Collaboration Activities

The main activity is doing feed-back in parent organization and later gaining knowledge from each party. This will help the success of the next collaborations. It will be useful to obtain critical success and fail factors in a collaboration with feed-back analysis.

3. UnIAr COLLABORATION MODEL FOR TURKEY

Collaboration is working with someone else to a specific purpose and a principal method to overcome today's academic, public and business environment problems. Collaboration is built on teamwork, conflict management, conflict resolution management, trust, mutual goals, and objective development among parties.

As it is clear, in a UnIAr collaboration, there are three parties. These are University-Industry-Government (Turkish Land Forces). There will be many barriers during the collaboration. To overcome barriers, all parties must behave like a unit. Team spirit is most important thing, on which, parties must come to an agreement. In a collaboration, parties should share their financial, research, human and infrastructure resources. Parties walk on a bridge during collaboration. UnIAr "Bridge to Partnership" characteristics can be demonstrated as given Table 3.1.

Table 3.1: UnIAr Collaboration Bridge

Separate University-Industry-Army	UnIAr Collaboration
Us versus Them	We're in this together
Win / Lose / Lose	Win / win / win
Surprises	Effective communication
Their problem	Our problem
Individual Government & Industry & University response	Team response.
Separate goals & objectives	Common goals & objectives

As it's can be seen in Table 3.1, in the separate work there is only a team's vision, goals and benefits but in the collaborative work there is shared vision, goals and objectives. In the separate work there is only one winner, in the collaborative work all parties are the winners, because in a partnership parties aren't rivals. There aren't surprises in the collaborative work by help of effective communication. Problems are "our problem", not "their problem". In order to be successful organizations need to collaborate.

In a collaboration government has roles as owner and ruler. Universities, generally as trainer and researcher, industry as producer and Contractor. However, their roles are not like black and white. Their roles are mixed. Generally parties play same role (Government as ruler-owner, university as researcher, industry as producer-Contractor) in the collaboration, but there is a need to consult to others and working together, during the collaboration project. In a successful collaboration parties must behave like a unit if they want to be successful.

Countries may have different ideas and implementation for a UnIAr collaboration according their development level. As a developed country, USA, must have different implementations than a developing country like Turkey. Turkey has different conditions, capabilities, law infrastructure, financial structure, and different system requirements (for the defense of the country) than USA and other countries. However, this reality, do not change collaboration need of the any of these countries.

3.1. Basic Data About Proposed Model

In this chapter, an UnIAr collaboration model is proposed for Turkey. As preparing this proposal, Turkey's defense industry law infrastructure and rules, and actual collaboration works are analyzed. It is possible to find GDPM implementation of a party of this proposed model in Chapter 4.

3.1.1. Goals

Goals of this study are proposing a collaboration model which provides maximum benefits with optimum cost and risk, modeling a R&D collaboration among partners, and preventing duplicative works. It is hoped that this proposal will have positive influences for next UnIAr researches.

3.1.2. Participants

First of all, it is useful to determine participants of such a potential collaboration. As it is known, as main participants, UnIAr collaboration include; University, Industry, and Army (TLF).

Other actors can be given in three group:

1. Participants from Government side; MoD, MoD R&D department, Undersecretariat of Ministry of Defense, Undersecretariat for Defense Industries (SSM), Turkish Patent

Institute (TPI), Chief of Staff R&D Department, TLF's technique project management department, Small and Medium Industry Development Organization (KOSGEB), Ministry of Industry and Trade, State Institute of Statistics (SIS), The Scientific and Technical Research Council of Turkey (TÜBİTAK), State Planning Organization (DPT).

2. Participants from University side: Turkish Council of Higher Education (YÖK).
3. Participants from Industry side: SADAK / SADER (Defense Industry Members), The Turkish Industrialists' and Businessmen's association (TÜSİAD), and The Union of Chambers of Commerce, Industry Maritime Trade and Commodity exchange of Turkey (TOBB).

3.1.3. Roles

MoD, as a manager of the proposed model, will finance project and coordination among partners. Another mission of MoD, is selecting "UnIAr collaboration project members".

Undersecretariat of Ministry of Defense, will support project team about development of communication with universities. Undersecretariat for Defense Industries will support project team about Turkish firms and industrial area. MoD R&D department, will support project team to pursue TLF's R&D works and TLF's R&D capability.

Chief of Staff R&D department will pursue collaboration works and will diffuse successful collaboration applications to all TAF's units.

TLF's technique project management department, will aid project team, and MoD R&D department about TLF's R&D applications and capabilities.

Small and Medium Industry Development Organization (KOSGEB), will determine Turkey's Small and Medium size Organization's capability, and will propose new useful products / production techniques for defense industry.

Ministry of Industry and Trade (MoIT), will aid project team about determining Turkish firms' capability. As a department of MoIT TPI, will follow new patents and useful models/ideas. Then, TPI will provide knowledge to project team about these patents.

State Institute of Statistics (SIS), will support project team with statistical data and works.

The Scientific and Technical Research Council of Turkey (TÜBİTAK), will be consultant of the project and project team.

State Planning Organization (DPT), will help about projects' compatibility to actual five years developing plan. In addition, DPT will propose new collaborations, and will take parties' proposals into consideration for next five years developing plan.

Turkish Council of Higher Education (YÖK) and universities will have trainer and basic researcher roles in such a collaboration. YÖK will determine universities' basic and R&D researches capabilities. Then, YÖK will plan universities' participation to collaboration.

SADAK / SADER (Defense Industry Members) as key defense producer, will actively participate all phase of the collaboration.

The Turkish Industrialists' and Businessmen's association (TÜSİAD), will follow it's members' defense/weapons system production capabilities and will give obtained data to project team.

The Union of Chambers of Commerce, Industry Maritime Trade and Commodity exchange of Turkey (TOBB) will have a same role like TÜSİAD.

3.2. Model

Before of the collaboration activities, participants of collaboration must be in accordance about collaboration. To provide an accordance among participants, there is a need to apply some prerequisite activities. Proposed model is a "product" of these prerequisite activities. Prerequisite activities of the collaboration are analyzed in GDPM section of Chapter 4. If MoD, as a manager of the project, applies GDPM methodology, it will arrive to this "product" (model). This model forms "Organization" dimension of the GDPM methodology. In this chapter, a designing process is formed and proposed. (Figure 3.1)

Proposed model is accomplished in 17 steps. First step is selecting project participants. This activity is management's responsibility. As a manager, MoD must select project members. This step is analyzed in Chapter 4 as a *"Management Responsibility"* of the collaboration.

Second step, is forming "rule infrastructure" of the collaboration. In this phase, it is hoped to prepare required rules for effective UnIAr collaboration. This step forms *"System"* dimension of the GDPM methodology. (Chapter 4)

Third step is training activity of selected team members. In this phase, it is aimed to enhance project member's level of knowledge transfer and collaborative work capability. This step is analyzed in Chapter 4 in *"Knowledge"* dimension of the GDPM.

Forth step includes developing GDPM as a common methodology among partners. This step is analyzed in Chapter 4, in *"People"* dimension of the GDPM.

Other collaboration steps are given below;

1. Selecting business drivers, "must be national", "critical", and "other" technologies

This step, is the first activity after providing prerequisite activities among partners. All participants from all sides (university, industry, government) must participate to selecting business drivers step. All participants have critic and important role but especially, industry's members play an important role at this stage. They are always in such an activity. Government side participants have a key role in determining "must be national", "critical" ,and "other" technologies. Since these technologies are very important for following defense industrial activities, government side must consult to University's and Industry's participants as making decisions. At this stage, there is a must to determine universities', firm's and cities' capabilities for defense industrial area. These data will help to select business drivers, "must be national", "critical", and "other" technologies.

2. Building strategic goal planning (SGP)

Government side, builds strategic goal planning. Responsible of this activity is MoD. As building SGP, universities may have a role in determining technological and R&D goal plans. Industry's members must be informed as building it. Industry must prepare it's infrastructure for next applications. (Defense R&D and Technology Plan (SAGTEP) is a part of SGP and it is revised every two years.)

3. Preparing 10 years procurement plan (OYTEP)

Undersecretariat of MoD is principally responsible of this activity. As preparing OYTEP Undersecretariat of MoD must being in near accordance with Chief of Staff. In this stage, responsible office takes country's financial resources for defense into account. After the forming activity, plan is diffused to industry side. Industry, with OYTEP gain a advantage to know Army's requirements beforehand. This ability provides easiness to make decisions early. OYTEP must revise every two years.

4. Forming of Technology Panels

Technology panels are formed, after the selection of "must be national", "critical", and "other" technologies. Technology panels are formed to provide collaboration among owner, industry, universities and research centers. The main goal is meeting TAF's requirements from national firms. As forming technology panels, MoD takes SAGTEP into consideration.

5. Selecting optimum partner for collaboration

Till now, all activities were normal procedures of the Turkish Procurement system. As from this point, all activities are proposed for a successful UnIAr collaboration. Project team, selects "must be national" and "critical" technologies to research and develop within the country. Then, firms' universities' and cities' capabilities are determined and MoD forms technology panel. Following stage is to select partners to collaborate with. As selecting the partner, the main factor is take it's capabilities into consideration. Most important selection must be made for university, and firm with TLF's participant will collaborate. As selecting partner it will useful to use a list of criteria. Some critical selection criteria may be partner's capability found in first activity of this process (Selecting "business drivers"), previous experiences, price, achieved same type project beforehand, R&D level, and ability of management team.

6. Evaluating objectives of the collaboration

Objectives of the collaboration are as important as selecting right partner. It is useful to defined reachable objectives according to present time, financial and manpower resources. Other possible type of UnIAr collaboration goals are; on-time delivery, quality product, end-user satisfaction, and no duplication. Another important factor is clearly defined objectives. All partners must be clear at the outset of the collaboration. As evaluating objectives, however owner of the project (Government) is key actor, project team must consult also to university's and industry's partners.

7. Defining measures of the collaboration

Measures of the collaboration are important to measure of the collaboration success. After the evaluation of the objectives, measures provide data in all stages of the collaboration. Partners must develop three type of measures; result, process and relationship. It is important to evaluate qualitative measures as much as quantitative measures. As it is

known, qualitative factors such as team morale, internal communication/trust, problem solving, creativity, synergy and teamwork. Measures defined by owner as participants from university provides academic/conceptual support and industry members provide assistance from their past experiences.

8. Evaluating reward system

This stage is most open to problems in a UnIAr collaboration. University's members has different expectations from TLF's members and industry's members. Industry's expectation is generally financial yield. TLF's expectation is having cheaper, high quality weapons systems. University's expectations are increases of brain power, knowledge level and basic researches. It is important also to evaluate reward system for members as well as for organizations. Project members have great influences to success of the collaboration. As a unique responsible, owner must take reward system into consideration at the beginning of the project. Incentives should be developed based on the measures structured at the beginning.

9. Cost/risk analysis

Risk analysis is in a complex structure. As a responsible MoD must plan, identify, analyze, handle, and monitor risk of the collaboration. Cost analyzes is a part of risk analysis. As analyzing risk of the collaboration, cost analysis also is determined. If there is a need, project team analyzes cost separately.

10. Planning schedule/Resource allocation

In this phase, project team members plan schedule of the collaboration. As scheduling, they allocate also resources which will be required during the project.

11. Implementation

Collaboration done in this phase. Project members may face all possible problems in this phase. This stage is a field study of the collaboration. The most important factors for this phase are creating adequate communications among partners, effective problem definition, adequate dispute resolution, providing effective control and providing better working environment for project team.

12. Feed-back

Feed-Back is a key success factors of actual and potential collaborations. In this phase

parties gain knowledge from implementation of the project. Effective feed-back analysis provides parties to obtain data about critical success and fail factors in a collaboration

13. Quality activities throughout the project

Quality activities must be done throughout the project. University and Industry play a key role in quality activities stage. MoD may use their experiences.

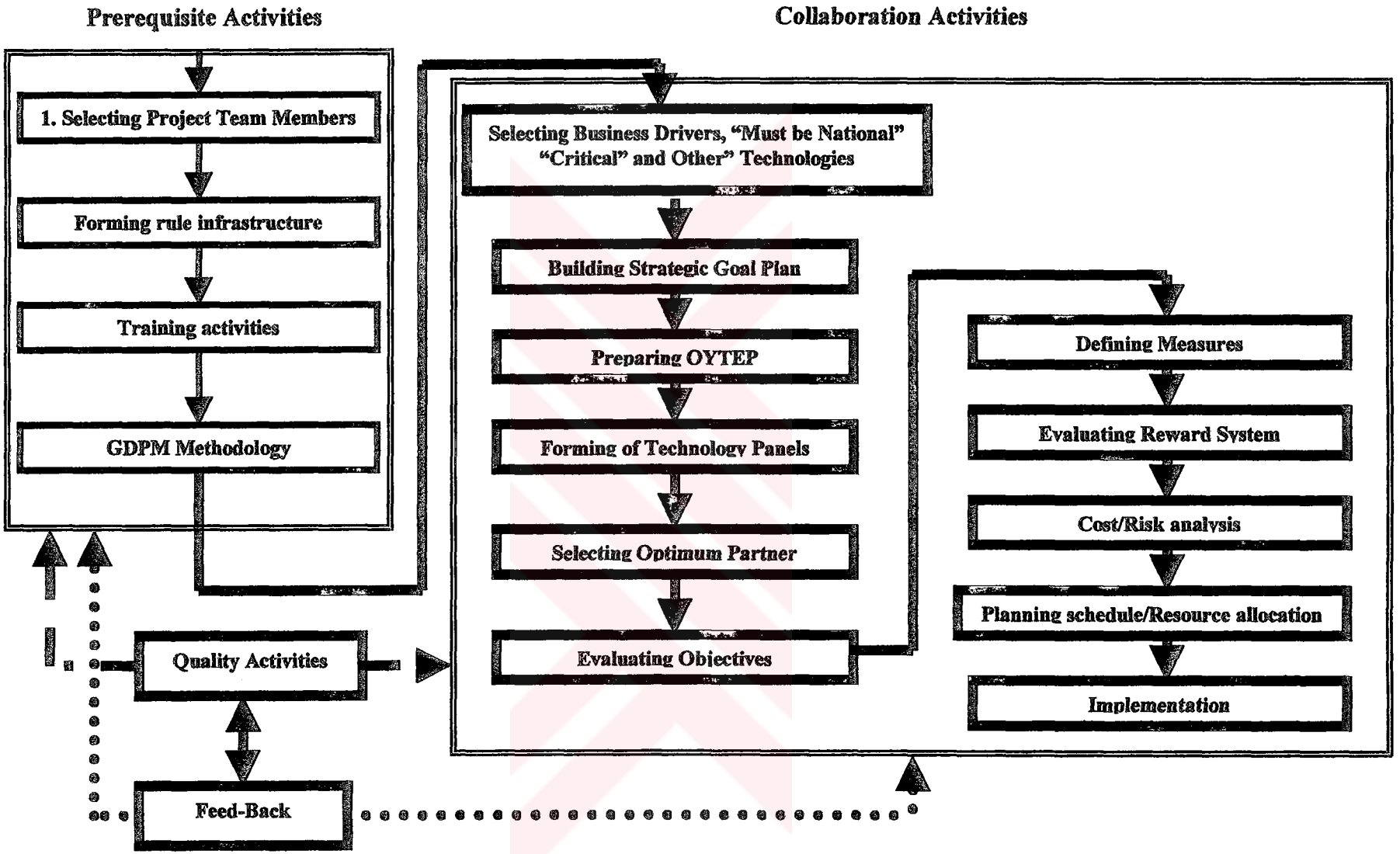

Figure 3.1: Proposed UnIAr Model

4. METHODOLOGY IMPLEMENTATION

There are four different methodology implementations in this thesis. GDPM methodology implementation is given in Chapter 4 section 1. GMS methodology implementation is given in Chapter 4 section 2. Field study is given in Chapter 5 and Harvard Business School case writing methodology implementation is given in Appendix-A.

4.1. UnIAr Collaboration Using GDPM Tools

In this thesis, there is a model for successful UnIAr collaboration given in Chapter 3. As structuring the model, it is used a logical sequence. There are 2 phase in the model. First phase includes prerequisite activities. One used GDPM methodology to explain these activities. Second phase includes designing collaboration process activities. Designing collaboration activities is explained in the model in Chapter 3. As unique owner and main responsible of the project, if, MoD apply GDPM methodology, as describing prerequisite activities, it is possible that MoD arrives to the same "product" (proposed model) explained in Chapter 3. In this section, GDPM methodology is used to modeling prerequisite activities. GDPM methodology includes some tools as constructing model. These are;

- Project mandate,
- Work breakdown structure (WBS),
- Result paths,
- Milestone planning,
- Responsibility chart,
- Activity planning.

These tolls are prepared as drafts. Actual project teams must prepare their real implementations according their projects' structures.

4.1.1. Project Mandate

It is possible to see the draft project mandate in Table 4.1. Generally project mandates involve project's name, background information about project and project's subject, customer of the project, goal and objectives of the project, limitation and financial resources of the project.

Project's name is "*Proposing a University-Industry-Turkish Land Forces Collaboration model*". Since financial resources of the project is meeting by defense industry supporting fund, and this fund is using by Ministry of Defense, *"customer" is Ministry of Defense.* Another reason is that there are multiple partner in the project. These are University, Industry, and Turkish Land Forces. Ministry of Defense is in the best position to successfully execute this collaboration project.

Project's goal is "*to propose a collaboration model which gives us maximum benefits with optimum cost and risk, providing a R&D collaboration among partners, and to prevent duplicative works.*" Project's objectives are implement some steps to support developing of Turkish Defense Management system, and to offer a successful collaboration model among University-Industry-TLF.

Table 4.1: Draft Project Mandate

Project's name	Proposing a University-Industry-Turkish Land Forces Collaboration Model
Customer	Ministry of Defense
Goals	1. Proposing a model for developing University-Industry-TLF Collaboration
	2. R&D coordination among partners
	3. Propose a model to provide maximum benefits with optimum cost and risk.
	4. To prevent duplications.
Objectives	1. Implementation some steps to support developing of Turkish Defense management system.
	2. To offer a successful model for University-Industry-TLF Collaboration
Limitations	2. Project includes only Turkish Land Forces.
	3. There is loopholes in Turkish Defense law infrastructure. There is also coordination problem among UnIAr collaboration partners. Government must fill the gap. There will many problems in multiple partner's projects as building a model without solving these problems.
Budget	Defense Industry Supporting Fund

4.1.2. Objective Breakdown Structure

Project's main goal is to propose a successful model for developing University-Industry-TLF Collaboration. It is hoped that this implementation will have positive influences for next UnIAr researches.

In GDPM methodology work breakdown structure is arranged after preparing project mandate. (Table 4.2) There are 3 different sections in WBS;

One of them includes management's mission in the project. In the project management side's (Ministry of Defense) missions are financing project and providing coordination among partners and selecting collaboration project team members.

The other one includes supporting units' missions in the project. Supporting units are organization's internal units. Ministry of Defense's units are R&D department, Undersecretariat of Ministry of Defense, Undersecretariat for Defense Industries (SSM). R&D department, will support project team to pursue TLF's R&D works and TLF's R&D capability. As it is known TLF is a partner in this collaboration project. Undersecretariat of Ministry of Defense, will support project team about development of communication with universities and Turkish Council of Higher Education (YÖK). Universities are second partner of the project. Especially, universities' actual and potential R&D capabilities are important for the project. Undersecretariat for Defense Industries will support project team about Turkish firms and industrial area. Because industry is the last partner of the project and Undersecretariat for Defense Industries knows Turkish industry well. Firms' actual and potential producing techniques are important in the project. As a result, supporting units will add to project team in partners' coordination with each other.

The last one includes project team's missions in the project. As it is known, in GDPM projects people, system and organization (PSO) are developing simultaneously. And knowledge added to this three common goals (Öner, Başoğlu, 1999). In this project, project teams develop knowledge, people, system and organization (KPSO) dimensions simultaneously. It is called core goals. Each dimension reflect different core goal. A dimension may have a or many core goals. In project, each dimension has a core goal. Core goals may have many sub-goals.

The first one, is about knowledge dimension. The goal is to enhance partners' collaborative works and knowledge transfer capabilities. Second core goal is about people. It includes

developing GDPM as a common methodology among partners. Third core goal is about system. It includes developing law infrastructure for UnIAr collaboration. Fourth and last core goal is about organization dimension. Organization dimension includes designing a University-Industry-TLF collaboration process. Organization dimension of the GDPM implementation is explained in Chapter 3.

Each core goal has sub-goals. One must meet these sub-goals to achieve core goal. Objective breakdown structure is useful to understand project's aim and it facilitates arrive to object.

Table 4.2: Draft Objective Breakdown Structure

MISSION/GOAL: Proposing a successful University-Industry-TLF Collaboration Model					
Financing project and coordination among partners and Selecting collaboration project team members **MANAGEMENT**	Enhancing people's level of knowledge transfer and collaborative work capability **CORE GOAL – 1 (Knowledge)**	Developing GDPM as a common methodology among partners **CORE GOAL – 2 (People)**	Forming regulation infrastructure of collaboration **CORE GOAL – 3 (System)**	Designing process of University-Industry-Turkish Land Forces Collaboration **CORE GOAL - 4 (Organization)**	MoD R&D Department will support about TLF's R&D works, Undersecretariat of MoD about collaboration and communication with Turkish Council of Higher Education and Universities, Undersecretariat for defense industries will support about collaboration and communications with firms **SUPPORT**
Ensure working within agreed budgets	Focus on collaboration projects' key success and failure factors	Developing required project members skills and expertise	Enhancing project members' knowledge about University, Industry and TLF	Selecting "business drivers" and "critical", "must be national" and "other" technologies of defense technology area	Provide all physical feasibility which promote teamwork
Secure good access for project team members	Developing required project members skills	Coordination with project management consultant firms	Ensure all written rules of all parties	Building strategic goal planning	Provide logistic support to enhance parties' communication
	Developing a culture of shared prosperity through shared knowledge	Developing an effective resource allocation system	Recording all verbal rules of all parties	Forming OYTEP	Develop a database which provide communication among partners
	Developing a reward system for effective communication	Developing projectivity within collaboration team	Defining common and different rules of parties	Forming of Technology Panels	Provide a new physical environment
	Developing a shared vision			Selecting Optimum partner for collaboration	
				Selecting objectives-measures and reward system of the collaboration	This section is explained in Chapter 3. This is the "product" of the GDPM implementation of collaboration
				Cost analysis and planning schedule	
				Implementation of collaboration	

4.1.3. Principle Responsibility Chart

Principal responsibility chart includes, project's general responsibilities of the project participants, groups, institutes and organizations. MoD is owner the project. MoD Secretary, MoD R&D Department and Undersecretariat for Defense Industries are organizations which will support project. The Scientific and Technical Research Council of Turkey (TÜBİTAK) is the consultant of MoD. YÖK and universities form a great and important part of the UnIAr collaboration. Industry side of collaboration is represented by SASAD/SADER (Defense Industry Members), The Turkish Industrialists' and Businessmen's association (TÜSİAD), The Union of Chambers of Commerce, Industry Maritime Trade and Commodity exchange of Turkey (TOBB), and Small and Medium Industry Development Organization (KOSGEB). All these key actors are interested with UnIAr collaboration.

Table 4.3: Draft Principal Responsibility Chart

X: executes the work D: takes decisions solely d: takes decisions jointly P: manages progress T: provides tuition on the job C: must be consulted I: must be informed A: available to advice	MoD	MoD Secretary	MoD R&D Dept. Man.	YÖK-Universities	Project Members	Project Manager	TLF's Units' represents	Projects Mgmt. Dept.	Chief of Staff R&D Dept.	SADAK-SADER	Turkish Patent Institute	TÜSİAD	KOSGEB	Ministry of Trade	TOBB	SIS (DİE)	TÜBİTAK	SPO (DPT)
Principle responsibility chart	D	C	C	C		X/P	I	C	C	C	I	A	I	I	I	A	A	C
Milestone planning, project responsibility chart	I	D	d	I	X	X/P	X	I	C	I	I	I	I	I	I	I	I	I
General Source allocation	D	d	d	d	C	P	I	d	d	I								C
Milestone planning reports		D	d	d	C	X/P	I	d	d	d	I	I	I	I	I	I	I	I
Activity planning, Due date		C	A	A	C	X/P	A	A										
-selecting implementers		D	d	d	C	X/P	d	d	d	A							A	
-determining activity period						X/P	X											
-determining starting date and sequence						D												
-allocation of section sources				d	d													
-Deciding use of section sources					X													
-realizing activity					X	P	C											
Activity responsibilities					C	X/P												
Activity reports					X	P												
Activities related with working environment		D	d	C		P	C	C	C									

4.1.4. Result Paths

There are four different dimensions in this project. Knowledge, people, system, and organization. There is a sequence in realization of these dimensions.

A result path is series of milestones which are especially closely connected to each other. A result path is formed by milestones which all contribute to the creation of a certain result. The links between the result paths show that work on the different types of results is interdependent. Figure 4.1. shows the result path of the UnIAr collaboration.

The realization step of the milestones are given above:

Firstly project team defines potential problem areas of UnIAr collaboration. (CW-1). Thereafter, selected project team join to seminars for effectively communicate with each other. (CW-2) Establishing of the standards, times and sources of the GDPM activities (GDPM-1) follow CW-2. Then project team select organization which will train and personnel who will train.(GDPM-2) Examining actual regulation infrastructure activities follows GDPM-2 activities. Core goal of *"Developing GDPM as a common methodology among partners"* is finishes with the achieving GDPM training activities. (GDPM-3). Next activity is preparing new rules for UnIAr collaboration. According to these rules, project team establishes information sharing system on OYTEP (10 years procurement plan). Final activity is signing readiness report (readiness to pass to designing collaboration process activities.

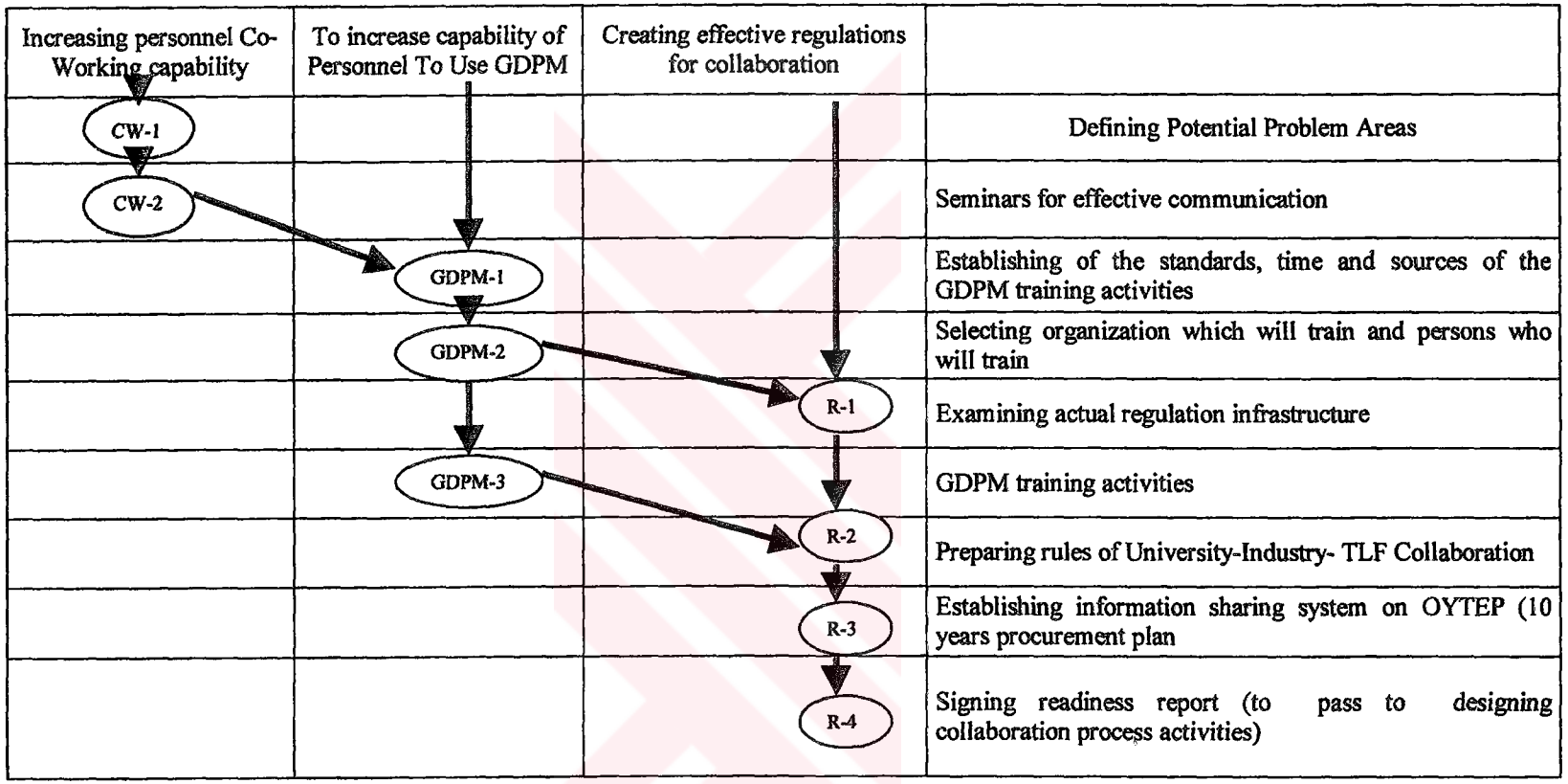

Figure 4.1: Draft Result Paths

4.1.5 Milestone Plan

According to GDPM methodology, now it is possible to prepare milestone plan of the model. First step is defining potential problem areas of potential UnIAr collaboration. Final step is signing readiness report. In the milestone planning there are also planned dates of the milestones. Figure 4.2. shows the model's milestone plan.

4.1.6 Project Responsibility Chart

Project responsibility chart includes milestones, starting and completion dates of the milestones, work content as day, estimated project's time, project's participants and their role as reaching the milestones.

The role of the project participants can be seen in Figure 4.3. There some letters related with the roles. X means this person will progress the work, D takes decision solely, d takes decision jointly, P manages progress, T provide tuition on the job, C must be consulted, I must be informed, and A available to advice.

First milestone is defining potential problem areas of UnIAr collaboration. Main responsible is SSM (Undersecretariat for Defense Industries, it is stated with capital D, in figure 4.3 and means take decision solely.) MoD Secretary, MoD R&D and Chief of Staff R&D departments share responsibility with Undersecretariat for Defense Industries. (Miniscule "d", means take decision jointly) To meet first milestone, project team must consult to TLF Logistics and Project Technique Management Departments, and TÜBİTAK; and must inform KOSGEB, TOBB and Ministry of Trade and Industry. (It is demonstrated with capital C). SASAD/SADER (Defense Industry Members; SADER is National Defense Members Association , SASAD is Multinational Defense Members Association.), The Council of Turkish Higher education (YOK) ,universities, and TÜSIAD are available to advice (Capital A) for the first milestone. Work content day is 14 for the first milestone. Starting date is 01.10.1999 and completion date of the first milestone is 15.01.1999. After first milestone, project members start to work on other milestones .

Planned Date	Milestone Plan			University-Industry- TLF Collaboration Model	Project Manager	
					Date	Report
	Co-Work	GDPM	Regulations			
15.10.99	CW-1			Defining potential problem areas (Co-work)		18.10.99
05.11.99 19.11.99	CW-2	GDPM-1		Seminars for effective communication (Co-Work), Establishing of the standards, times and sources of the GDPM training activities(GDPM)		08.11.99 22.11.99
26.11.99 17.12.99		GDPM-2	R-1	Selecting organization which will train and Persons who will train (GDPM), Examining actual regulation infrastructure(Regulations)		29.11.99 20.12.99
08.01.00 20.01.00		GDPM-3	R-2	GDPM training activities (GDPM), Preparing rules of University-Industry- TLF Collaboration (Regulations)		11.01.00 23.01.00
05.03.00			R-3	Establishing information sharing system on OYTEP (10 years procurement plan)		08.03.00
08.03.00			R-4	**Finishing prerequisite activities and signing readiness report to pass to designing collaboration process activities**		11.03.00

Figure 4.2 : Draft Milestone Planning

X: executes the work
D: takes decisions solely
d: takes decisions jointly
P: manages progress
T: provides tuition on the job
C: must be consulted
I: must be informed
A: available to advice

Approved by/ Date: Minister of Defense / 15.03.2000 — Version: 1.0

Work content Days	Starting Date	Period lengths (Week) WEEK 2 4 6 8 10 12 14 16 18 20 22	Completion Date	No	Milestones	MoD	Undersecretariat for defense Industries (SSM)	MoD R& D. Dept.	SADER-SASAD	Project manager	Project Members	YOK-Universities	TLF. Logistics .Dept.	Chief of Staff R&D. Dept.	TLF. Project Tech. Mgmt. Dept.	TLF Units' Represents	MoD Secretary	Turkish Patent Institute	TUSIAD	KOSGEB	Ministry of Trade	TOBB	SIS (DIE)	TUBITAK	SPO (DPT)		
						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
14	01.10.1999		15.10.1999	1	CW-1		D	d	A	X/P	X	A	C	d	C		d		A	I	I	I		C			
21	15.10.1999		05.11.1999	2	CW-2		C	C	A	X/P	X	T	A	I	I	I	C		I	I		I		A			
14	05.11.1999		19.11.1999	3	GDPM-1		D	d		X/P	X	A	d				d										
7	19.11.1999		26.11.1999	4	GDPM-2		D	d		X/P	X	C												C			
21	26.11.1999		17.12.1999	5	R-1		D	A		X/P	X		I	I	I		C										
21	17.12.1999		08.01.2000	6	GDPM-3					X/P	X	T															
42	08.01.2000		20.02.2000	7	R-2		D	d	C	X/P	X	C	A	A	A	I	d	I	I	I	I	I	I	I	I		
14	20.02.2000		05.03.2000	8	R-3		D	C	I	X/P	X	C	d	d	d	I	d		A	A				C			
3	05.03.2000		08.03.2000	9	R-4	D				X/P	X																
WORK DAY					Estimated time (157 days)																						

Figure 4.3: Draft Project Responsibility Chart

4.1.7. Activity Responsibility Chart

Draft activity responsibility chart (Figure 4.4) includes the first milestone's activities, role of the persons who joined to project for the first milestone, and period lengths for the reaching of the each activity.

To meet first milestone's goal, there is a need to make some activities. For example for the first milestone, (Defining potential problem areas of UnIAr collaboration) firstly one must to define potential problems in general partnership activities. Then project members define potential problem area in UnIAr collaboration, then they define risks in a UnIAr collaboration and evaluate resolution of beforehand defined problems. Feed-back is done throughout the project. Drawing-up the report is a activity which is done at the end of the project. Each milestone has such an activity plan. The role of the project participants can be seen in the figure with letters (X ; D ; d ; P ; T ; C ; I ; A) as it is explained in 4.1.6.

4.1.8. Result

GDPM, is a central tool of a collaboration model. In a UnIAr collaboration, GDPM provides a different scope than other methodologies. Central tools of the GDPM methodology are milestone plan and responsibility chart. As it is known, project participant must have different responsibilities than each other. Project responsibility chart provides a good focus for whole project. Milestone planning also, gives us the right sequence of the works.

One proposed a for University-Industry-TLF collaboration. This model is built according to Turkish Defense Management requirements. There is a need to determine new tools for such a collaboration type. This work may have many different partners. The important thing is using right methodologies, and using methodologies rightly. GDPM is a good methodology for the defense management projects. Partners must use this methodology rightly.

CW2

Report Date : 18.10.1999
Prepared by : Mikail URAY
(Project Member-1)

Milestone Plan: CW-1 Defining potential problem areas.

X: executes the work
D: takes decisions solely
d: takes decisions jointly
P: manages progress
T: provides tuition on the job
C: must be consulted
I: must be informed
A: available to advice

A	B	C	D	E	F	G	H	Period Length	Starting Date	1 2 3 4 5 6 7 8 9 10 11 12 13 14	Comp. Date	No	ACTIVITIES	Minister of Defense 1	Project manager 2	SSMM Member 3	MoD R&D. Dept. 4	SADER-SASAD 5	Project Members 6	YOK-Universities 7	TLF. Logistics Dept. 8	Chief of Staff R&D. 9	TLF. Project Tech. 10	TLF Units' Represets 11	MoD Secretor 12	Turkish Patent Ins. 13	TUSIAD Member 14	KOSGEB Member 15	SPO (DPT) Member 16	TUBITAK Member 17
Work content days	Works which will make Days	Finishes on time (Y/N)	Quality level is approved (Y/N)	Acted to responsibility chart																											
2	1 2	Y	Y	Y	N	N	-	2	01.10.99	→	03.10.99	1	Defining potential problems in general partnership activities	D	X/P	d	d	C	X	d	C	C	C	I	d	A	A	I	C	A
1	1 1	Y	Y	Y	N	N	-	1	03.10.99	→	04.10.99	2	Defining critical success factors in a collaboration	D	X/P	d	d	C	X	d	C	C	C	I	d	A	A	I	C	C
2	9	Y	Y	Y	N	N	-	2	04.10.99	→	06.10.99	3	Defining potential problem area in UnIAr collaboration	D	X/P	d	d	C	X	d	C	C	C	I	d	A	A	I	C	C
1	8	Y	Y	Y	N	N	-	1	06.10.99	→	07.10.99	4	Defining risks in a UnIAr collaboration	D	X/P	d	d	C	X	d	C	C	C	I	d	A	A	I	C	C
6	2	Y	Y	Y	N	N	-	6	07.10.99	→	13.10.99	5	Evaluating resolution of defined problems	D	X/P	d	d	C	X	d	C	C	C	I	d	A	A	I	C	C
1	1	Y	Y	Y	N	N	-	1	13.10.99	→	14.10.99	6	Feed-Back		X/P				X							A	A	I	C	C
1	0	Y	Y	Y	N	N	-	1	14.10.99	→	15.10.99	7	Draw-up the report	I	X/P		d		X											

Additional comments

1. Required more resources than estimated
2. Planned persons did not participate to project work
3. Work content days are not enough
4. ....tarihine kadar ertelendi

Figure 4.4 : Draft Activity Chart

4.2. UnIAr Collaboration Using GMS Methodology (Case of DFINT-3T)

Graphical modeling system (GMS) is developed by Kostoff and Zurcher (1999). GMS is a packaged program. Users can enter some data and relations and get some output time network view, network display. It requires easy and understandable database for complicated and multi-impact projects. (Kostoff, and Zurcher, 1999) Yılmaz Yıldırım analyzed in its M.S. thesis (1999) technology roadmap for Tactical Rocket by help of GMS methodology. He determined a roadmap for tactical rocket. In fact, GMS is using to construct a roadmap Since GMS provides simultaneously, a general focus on a selected project, one searched a way to use GMS for UnIAr collaboration. (Case of DFINT-3T) With the help of the GMS, project members are aware about works done in project team. Since there are three different parties in a UnIAr collaboration model, GMS supports parties to work collectively in the project.

4.2.1. Phases In GMS

There are three phases, in GMS. Preliminary activities, development of the technology roadmap, and follow-up activities. In this section, one will focus on development of the technology roadmap. However, one will not construct a roadmap, will analyze DFINT-3T project with construction of roadmap method.

4.2.1.1. Preliminary Activities

This phase includes three activities.

1. Satisfying essential conditions. (Why TLF requires DFINT-3T ?)
2. Providing leadership/sponsorship. (It is realized with the implementation of GDPM methodology)
3. Defining the scope and boundaries for the technology roadmap.

These activities are necessary to construct a roadmap. DFINT-3T case also includes some preparation activities.

4.2.1.2. Development Of The Technology Roadmap

This phase includes, seven activities.

1. Identify the product that will be focus of the roadmap. As it is known, the product is DFINT-3T system.

2. Identify the critical system requirements and their targets. At this point, system engineering is needed for the conversion of the military requirements into system requirements. Universities and firms may help to TLF as describing them. For DFINT-3T, system requirements can be;

a. Parameters (weight between 20-40 kg, operating temperature between –20 and 50 C, frequency range between 20-1200 MHz, Scan speed better than 1000 MHz/second, power 24 VCD and/or 110/220 VAC, transportable with 3-4 people),
b. Transportable,
c. Software must be in Turkish,
d. No sensitive to atmospheric conditions,
e. Operation, training, and maintenance must be easy for the users,
f. Fast location fixing capability,
g. Quick set-up and tear down,
h. Acquired direction finding.

3. Specify the major technology areas. They must be clarified to define existing capabilities and the key technologies to fit the system requirements. To make this technology area work,

a. System requirements must be well defined. (They are defined above)

b. Components of the system must be laid out. Components of the DFINT-3T are; Receiver/processor Unit, DF antenna unit, and software. These are required in implementation phase.

c. Technologies which are involved in those components must be turned into technological breakdown. Technological breakdown for DFINT-3T must be determined by ASELSAN, METU, and TLF.

4. Specify the technology driver and their targets. At this point critical system requirements are transformed into technology drivers for the specific technology area.
5. Identify technology alternatives and their time lines. Once the technology drivers and their targets are specified, the technology alternatives that can satisfy those targets must be identified in this stage.
6. Recommend the technology alternatives that should be pursued. This step selects the subset of technology alternatives to be pursued. These technology alternatives vary in terms of cost, schedule and/or performance.

7. Create the technology roadmap report. It includes technology and market forecast, product lifecycle estimates, product development maps, new product project plans, product development maps, divisional marketing/business plans etc.

4.2.1.3. Follow-up Activities

This phase includes three activities.

1. Critique and validate the technology roadmap.
2. Develop an implementation plan. (Making better technology selection and investment decisions)
3. Review and update. Routine reviews and updates semiannually.

4.2.2. Implementation

There are three different type of perspective as developing a roadmap. These are mission area perspective, technology program perspective, and research program perspective. There are 4 dimensions and an initiation phase in GMS methodology. Dimensions are requirements, capabilities, developments, and researches.

1. Initiation phase: Why DFINT-3T is needed ? How it is occurred requirement of DFINT-3T? What were the conditions for production of DFINT-3T? TLF wanted to have a transportable direction finding system to be used against to terrorism. Initiation conditions is given in **Appendix-A.** TLF is responsible to define initiation phase of the selected product or weapon system. University and Industry members must participate this activity.
2. Requirements: How these initiation conditions, became as requirements? University-Industry- TLF must work together to define requirements. In defining requirements phase partners select the right products and their requirements.
3. Capabilities: What are the expectations from DFINT-3T? Designing phase is most important phase of the UnIAr collaboration. UnIAr collaboration project team, must decide collectively, capabilities of the selected product.
4. Developments: What are the expectations from researches, how a change may be called as development? Industry members is responsible of this phase. They must examine universities' researches and they must adopt these researches into developments.
5. Researches: Which researches are related with the project? University is responsible of the researches activities. This not means that other partners will not join to researches

activities. All partners must participate to all activities, but there are responsible of the phase. Responsible of the phase, is the most close to the activity.

4.2.2.1. Mission Area Perspective

Mission area perspective, is useful for managers of TLF. Mission area perspective provides knowledge to TLF's managers about product specifications. It provides a global focus on project. It is possible to see works, expectations, specifications and developments of the project on it. At the outset of the project, it will useful to prepare it for managers. (Figure 4.5)

4.2.2.2. Technology Program Perspective

Technology program perspective is useful for engineers. Technology program perspectives is useful for the firms' engineers. In technology program perspective, there are expectations as numerical values.

4.2.2.3. Research Program Perspective

Research program perspective is useful for whole of the project team. It is possible to see whole project from all point of view by help of research program perspective. Universities' members must be main responsible for preparation of research program perspective. (Figure 4.6)

4.2.3. Result

GMS portrays the technology development process of selected weapon system or any other high-tech product. By breaking down the technology, it is possible to see its future developments.

In this thesis, one used GMS, to indicate UnIAr collaboration. There are responsibilities for each phase. University is responsible in researches activities, Industry in development activities, TLF in initiation phase, all partners are common responsible in defining capabilities. In fact these three key actors, are common responsible of whole project.

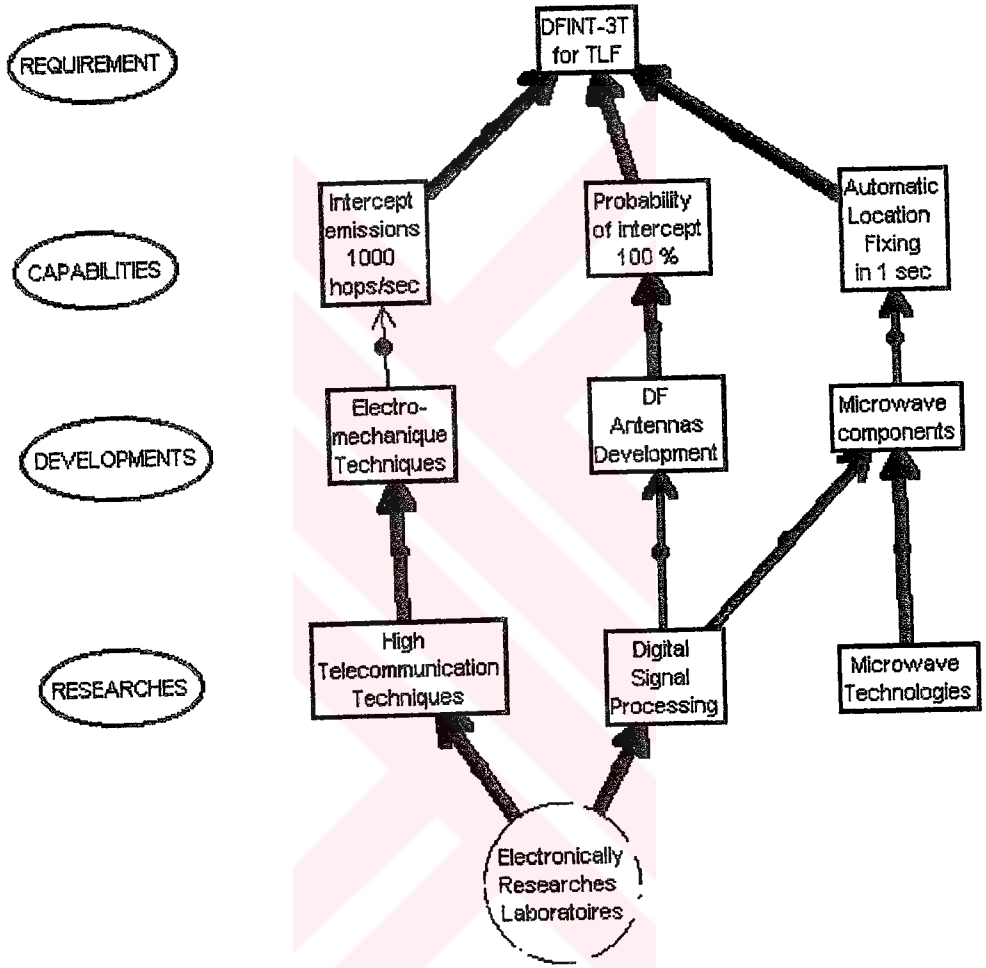

Figure 4.5 : DFINT-3T Mission Area Perspective (For TLF's Managers)

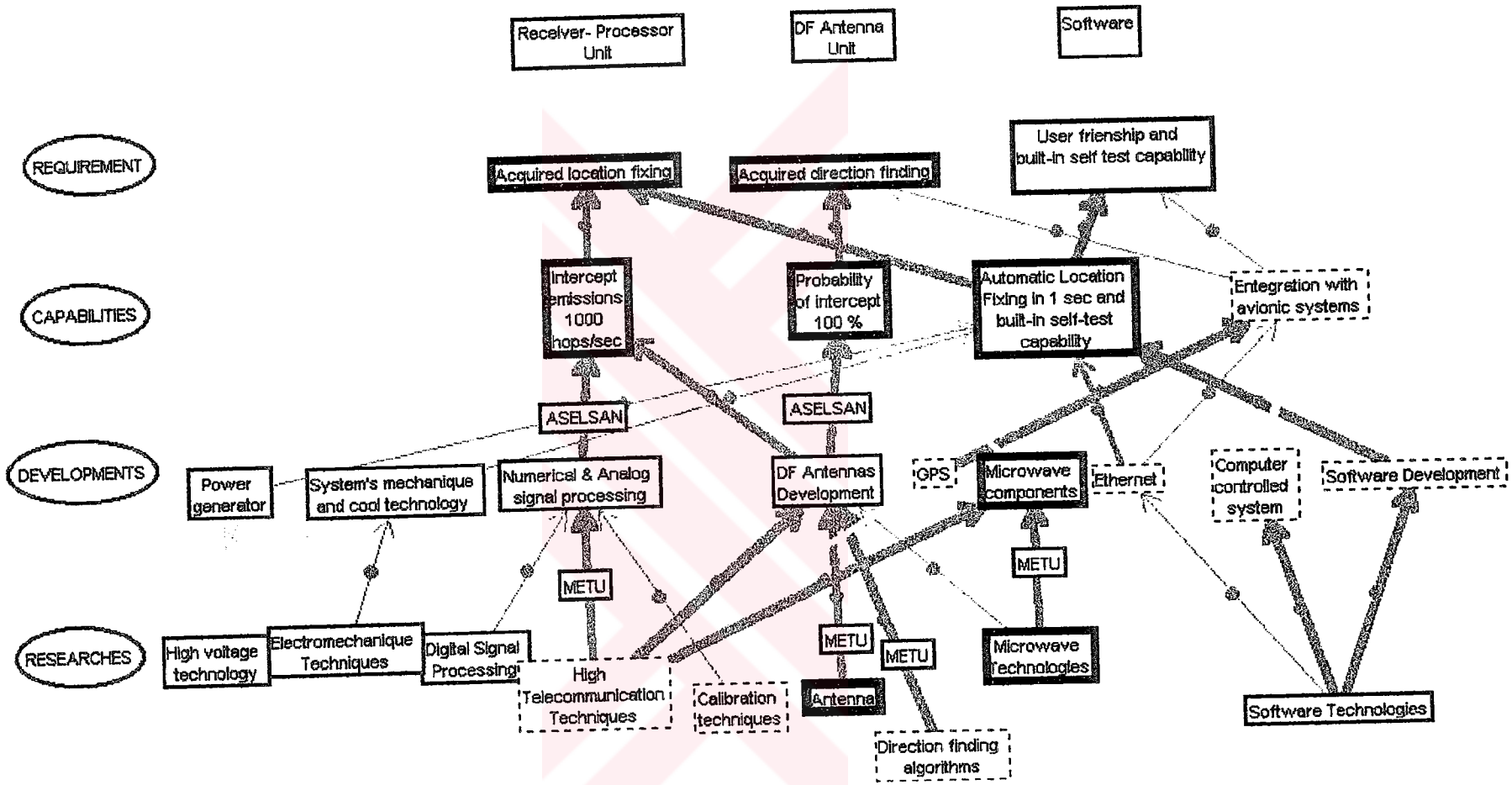

Figure 4.6: DFINT-3T Research Program Perspective (For Project Team)

5. RESULTS OF THE FIELD STUDY

5.1. Sample Size

Since the questionnaire is applied to all persons who worked DFINT-3T project, the sample size is also the population. All participants are specialists. This questionnaire was applied to 27 specialists; 12 from ASELSAN, 8 from TLF, and 7 from METU (Table 5.1).

Table 5.1: Sample size

	Number of Sample	Male	Female
METU	7	7	-
ASELSAN	12	11	1
TLF	8	8	-
TOTAL	27	26	1

5.2. Procedures

Data collection was carried out by the researcher himself in two weeks time. Questionnaire was applied in Turkish, because the mother language of all participants is Turkish. Questionnaire contains 21 questions in four different groups. These groups are <meeting design goals>, <benefits to end user>, <benefits to the developing organization>, <potential benefit to the defense and national infrastructure> and a core concept question. Likert type (interval) scale has been used.

5.3. Questionnaire

The questionnaire *(Appendix-E)* was developed by Tishler et al. (!996). This questionnaire identifies critical success factors of defense projects. They collected 400 managerial variables, and derived 20 measures of success for each project. This questionnaire is selected for the study, because present model of collaboration includes 3 different parties, University (METU), Industry (ASELSAN), Government (TLF). In the questionnaire there are 4 different sections; <Meeting design goals>, <benefits to end user>, <benefits to the developing organization>, <potential benefits to the defense and national infrastructure>.

These 4 sections reflect parties' ideas about DFINT-3T case. Researcher added a core concept question, to analyze multiple regression of the questionnaire.

<Meeting design goals>' four questions are related with the all parties of the project. In designing phase all parties must work together. <Benefits to end user>'s seven questions are related with the TLF generally. It is important to know the feelings of METU and ASELSAN about benefits to end user. It will be useful to discuss differences of the scope of these three different parties. <Benefits to the developing organization's> five questions are related with the ASELSAN. <Potential benefits to the defense and national infrastructure's> five questions are related with the all parties. (One question is the same with one question of benefits to the end user questions)

5.4. Core concept

DFINT-3T project 's being a good University-Industry- Turkish Land Forces Collaboration case.

5.5. Statistical Methods Used To Analyze Data

Since this study tries to understand/explain differences among parties, firstly descriptive statistics such as mean, mode, range, standard deviation, etc. are used. Secondly, factor analysis is used to ensure validity. Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Barlett Test of Sphericity are used for validity. Thirdly, to ensure reliability, reliability is assessed by Cronbach's Alfa. Fourthly, and lastly, multiple regression analysis is done. In the multiple regression analysis, linearity, multi-collinearity, auto-correlation (Durbin-Watson), Multiple significance (F test), and Coefficient Beta (t test) tests are used. The Excel, and SPSS 5.0 packaged program are used to analyze the data of the study.

5.6. Findings

5.6.1. Descriptive Statistics

Since this study's goal is to determine differences among parties' opinions, it is useful to look at averages, ranges and modes of the answers of the questionnaire to understand it. Core concept question is not used in the descriptive, factor, and reliability analysis.

5.6.1.1.Arithmetic Means

As given in Table 5.2., questionnaire's arithmetic mean is 4,92. It means, according to parties' participants in DFINT-3T project, it is satisfactory. There are some differences among parties' averages. METU's average is 5,55, ASELSAN's average is 4,79 and TLF's is 4,56. As a consultant of the project, METU may have been in a optimism.

Between ASELSAN and TLF, there are no significant differences. As the end user of the product, TLF, may think in a pessimist way, because TLF HQ's gather many feed-back from end users of the DFINT-3T product. TLF may think in different way, there became many personnel losses in sixteen years. TLF, need a lot of complex weapons and electronically systems. TLF's expectations from these systems are sometimes unrealizable. ASELSAN is the producer of the product and it generally role plays as a bridge among parties. It can be said that participant's opinions from ASELSAN described general tendency of the questionnaire.

Table 5.2: Descriptive Statistics-1

	Average	METU's avg.	ASELSAN's average	TLF's avg.	St. Dev.	Mode	Median	Range
Total	4,92	5,55	4,79	4,56	0,93	5	5	1,17
Total minimum	3,96	5	2,92	4	0,55	4	-	0,39
Total maximum	5,33	6	5,42	5,13	1,36	6	-	2,23

5.6.1.2. Modes, Medians, And Response Distributions

Questionnaire's median is 5. As known, Median = (n+1) / 2. There are 540 responses in the questionnaire. 271st value is the median. It is 5. Average standard deviation is 0,93. And questionnaire's mode is 5. Average range among parties is 1,17. Distributions of the responses are given in Table 5.3 and in Figure 5.1.

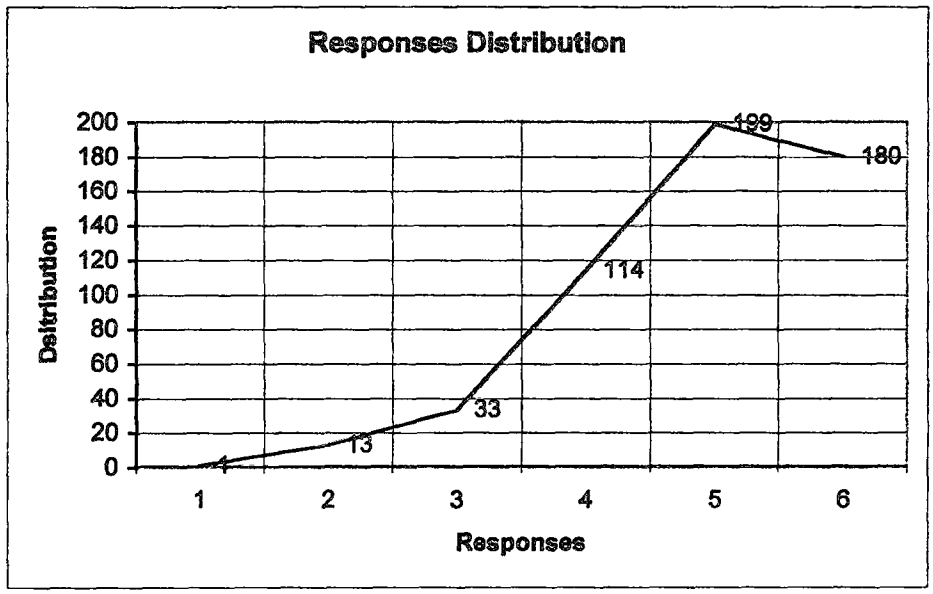

Figure 5.1: Descriptive Statistics-2

As it can be seen in Figure 5.1, graphic is left skewed. There are 47 responses for first three questions. Second group (4, 5, 6) includes 493 of the total 540 responses.

Mode of the questionnaire does not represent 50 % of the questionnaire's response. It represents 37 % of the responses. It is useful to use median as an arithmetic mean of the questionnaire.

5.6.1.3. Ranges Among Partner's Responses

Table 5.4 describes range among parties. Minimum ranges are in 11th and 19th questions, *"user is satisfied with product"* and *"project decreases dependence on outside sources" questions.* Maximum range is in third question, *"meeting schedule goals"*. Partners think different about schedule goals. Differences are coming from ASELSAN's and METU's different expectations. ASELSAN may have been under pressure of the TLF about meeting design goals. There may be also focus differences among ASELSAN's project members. ASELSAN's members may have been in disputes among themselves about schedule goals.

Table 5.3: Descriptive Statistics-3

	Distribution					
Questions	1	2	3	4	5	6
1. Functional specification	0	1	0	9	10	7
2.Technical specifications	0	0	0	5	19	3
3. Schedule goals	1	3	6	5	9	3
4. Budget goals	0	4	4	6	10	3
5. Meeting acquisition goals	0	0	2	4	14	7
6. Meeting the operational need	0	0	1	5	13	8
7. Product entered service	0	0	1	5	10	11
8. Reached the end-user on time	0	3	3	5	13	3
9. Product had a substantial time for use	0	0	2	10	11	4
10. Product yields substantial improvement in user's operational level	0	0	1	3	10	13
11. User is satisfied with product	0	1	2	9	10	5
12. Project yielded relatively high profit	0	1	3	10	9	4
13. Project opened new markets	0	0	1	6	5	15
14. Project created a new product line	0	0	1	6	5	15
15. Project developed a new technological capability	0	0	2	2	10	13
16. Project improved reputation	0	0	1	6	7	13
17. Project contributed to critical subjects	0	0	0	5	9	13
18. Project maintains a flow of updated generations	0	0	1	4	6	16
19. Project decreases dependence on outside sources	0	0	2	6	7	12
20. Contribution to other projects	0	0	0	3	12	12
Total	1	13	33	114	199	180

Table 5.4: Descriptive Statistics-4

Questions	ASELSAN	TLF	METU	Range
1. Functional specification	1,01	0,96	0,95	*0,06*
2.Technical specifications	1,03	1,04	0,93	*0,11*
3. Schedule goals	0,61	1,01	0,93	*0,40*
4. Budget goals	0,70	1,01	0,90	*0,31*
5. Meeting acquisition goals	1,03	0,96	1,03	*0,07*
6. Meeting the operational need	1,04	0,96	1,06	*0,10*
7. Product entered service	1,08	0,99	1,06	*0,09*
8. Reached the end-user on time	0,82	0,90	0,98	*0,16*
9. Product had a substantial time for use	0,92	0,93	0,98	*0,06*
10. Product yields substantial improvement in user's operational level	1,13	1,04	1,03	*0,10*
11. User is satisfied with product	0,94	0,90	0,95	*0,05*
12. Project yielded relatively high profit	0,85	0,96	0,93	*0,11*
13. Project opened new markets	1,11	1,07	1,00	*0,11*
14. Project created a new product line	1,15	0,99	1,03	*0,16*
15. Project developed a new technological capability	1,11	1,01	1,06	*0,10*
16. Project improved reputation	1,13	0,96	1,03	*0,17*
17. Project contributed to critical subjects	1,13	1,04	1,03	*0,10*
18. Project maintains a flow of updated generations	1,08	1,15	1,06	*0,09*
19. Project decreases dependence on outside sources	1,03	1,01	1,06	*0,05*
20. Contribution to other projects	1,11	1,10	1,03	*0,08*
Average				*0,12*

For seven questions, all parties' answers are above the average. For three questions, they are below the average, *"reached the end-user on time"*, *"product had a substantial time for use"*, and *"user is satisfied with product"* questions are below the average. *"Product yields substantial improvement in user's operational level"*, *"project opened new markets"*, *"project developed a new technological capability"*, *"project contributed to critical subjects, project maintains a flow of updated generations, project decreases dependence on outside sources"*, and *"contribution to other projects"* questions, are above the average for all parties. There is an interesting result, it is that all of the potential <benefits to the defense and national infrastructure's> four questions' values are above the average. This means that, all parties are thinking in the same way; DFINT-3T project has potential benefits to the defense and national infrastructure.

5.6.1.4.Meeting Design Goals Questions' Descriptive Analysis

It will be useful to look at descriptive analysis differently for each group of questions. In Table 5.5, there is <meeting design goals'> questions' descriptive statistics.

Averages of these four questions is 4,5. It means that, it is below of the general mean. *"Meeting schedule goals"* question caused this consequence. ASELSAN's average is 2,92 for this question, it is the lowest average of the questionnaire. Because, according to researcher's interview in ASELSAN, and TLF, it is determined that there is a problem in schedule of the project. Project' s duration is limited , TLF wants to have product early because of its crucial urgent needs. ASELSAN must produce required products (DFINT-3T) within schedule. This problem caused some disputes in ASELSAN during DFINT-3T project. These disputes may affect the response of the third question. Ranges among parties, and standard deviation of the question also are bigger among other questions. It is possible to think that TLF, as an owner of the project, did not have a lot responsibilities for the schedule, because TLF has such a mission to control ASELSAN if it meets design goals or not. METU also has no problem about schedule, because basic researches of the project, done before of the project. METU made only some improvements and developments during DFINT-3T project.

"Budget goal" also has same problem. TLF and METU have not budget problem. TLF, as an owner, pay only if product is produced within schedule and budget goals. ASELSAN, may have some problem. During construction phase there will be a lot of problems. There is a new product, new way of thinking, new market, and two different partners with

whom disputes will resolve. Production phase contains a lot of problems such as prototype production, technical specs.

Table 5.5: Descriptive Statistics-5

	Questions	Avrg	METU avg.	ASELSAN avg.	TLF avg.	St. Dv.	Mode	Range
Meeting Design Goals	1. Functional specifications	4,96	5,71	4,83	4,5	0,96	5	0,91
	2. Technical specifications	4,96	5,14	4,92	4,88	0,55	5	0,39
	3. Schedule goals	3,96	5,14	2,92	4,5	1,36	5	2,23
	4. Budget goals	4,11	5	3,33	4,5	1,26	5	1,67
Average		4,5	5,25	4	4,6	1,03	5	1,30
Minimum		3,96	5	2,92	4,5	0,55	5	0,39
Maximum		4,96	5,71	4,92	4,88	1,36	5	2,23

5.6.1.5.Benefits To End User Questions' Descriptive Analysis

Second group of the questionnaire includes seven questions about <benefits to the end-user> (Table 5.6). TLF is end-user of the product. TLF's opinion is more important than others. It will be useful to look at METU's and ASELSAN's opinions to understand success level of the collaboration. Average of the second group questions is 4,87. Minimum average is 4,29. This value is going from TLF's responses to product's reached the use on time question. Maximum average is 5,29 from *"product yields substantial improvement in user's operational level"* question. METU and ASELSAN believe that, end-user met acquisition goals in this project. TLF, as an and-user of the product do not believe that. It is valid for *"meeting operational needs"* question too. TLF may have excessive expectations from product. Since DFINT-3T is the first national direction finding system, end user may see problems easier than academicians and producers. Product may work in laboratory conditions well, but in the field, there may occur different problems such as maintenance, transportation, different field conditions (mountainous, steep and broken ground) etc.

Table 5.6: Descriptive Statistics-6

	Questions	Avg.	METU avg.	ASELSAN avg.	TLF avg.	St. Dev.	Mode	Range
Benefits to the End User	5. Meeting acquisition goals	5,04	5,71	4,92	4,63	0,85	5	1,34
	6. Meeting the operational need	5,04	5,86	5	4,38	0,81	5	1,48
	7. Product entered service	5,26	6	5,17	4,75	0,86	6	1,36
	8. Reached the end-user on time	4,29	5,29	3,92	4	1,18	5	1,51
	9. Product had a substantial time for use	4,59	5,29	4,42	4,25	0,84	5	1,18
	10. Product yields substantial improvement in user's operational level	5,29	5,71	5,42	4,75	0,82	6	0,96
	11. User is satisfied with product	4,55	5,14	4,5	4,13	1,01	5	1,16
Average		4,87	5,57	4,76	4,41	0,91	5	1,28
Minimum		4,29	5,29	3,92	4,13	0,81	5	0,96
Maximum		5,29	6	5,42	4,75	1,18	6	1,48

ASELSAN and TLF approximately think in the same way about *"reached the end user on time"* question. For the near future, these two organizations must make their contracts in more realistic sort. The most important yield in the user's point of view is the product provided substantial improvement in user's operational level. It means that, the product may have some problem, but it is useful to train TLF's user's of DFINT-3T system. METU and ASELSAN think that user is satisfied with product. TLF's average is below of these two organizations.

Average range is 1,28. Minimum range is 0,96 and it is coming from product's supporting user's operational level. Maximum range is 1,48 and it is related with the DFINT-3T's meeting operational need. Average standard deviation is 0,91 and mode of the group is 5.

5.6.1.6.Project Benefits To The Developing Organization Questions' Descriptive Analysis

Third group questions include parties' opinions about project benefits to the developing ASELSAN (Table 5.7). Third group includes five questions. Average of these questions is 5,08. As average this group is at the second range of the questionnaire's four groups. TLF has least average. It does not believe that DFINT-3T project will have great influences to ASELSAN as much as METU and ASELSAN do. There is an interesting result in third group. METU's average is higher than ASELSAN. This means that ASELSAN members, because of they are above the trees, they may not see the forest. ASELSAN's members must be aware ASELSAN's mission and vision to become successful.

Table 5.7: Descriptive Statistics-7

	Questions	Average	METU's avg.	ASELSAN's avg.	TLF's avg.	St. Dev.	Mode	Range
Benefits to the Developing Organization	12. Project yielded relatively high profit	4,44	5,29	4,08	4,25	1,01	4	1,06
	13. Project opened new markets	5,29	5,86	5,33	4,75	0,94	6	0,70
	14. Project created a new product line	5,26	5,86	5,5	4,38	0,94	6	1,21
	15. Project developed a new technological capability	5,22	5,57	5,33	4,75	0,90	6	1,23
	16. Project improved reputation	5,18	5,57	5,42	4,5	0,92	6	1,34
Average		5,08	5,63	5,13	4,52	0,94	6	1,11
Minimum		4,44	5,29	4,08	4,25	0,9	4	0,7
Maximum		5,29	5,86	5,5	4,75	1,01	6	1,34

Minimum average is coming from ASELSAN members, about project's yield. They do not believe DFINT-3T project relatively yielded than other projects. Since ASELSAN done a lot of changes in production phase during the project, cost of project is realized more than forecasted amount. They might be influenced from this situation. Another reason, they

may not be aware about product's place, and market share, in World defense products area. As it is known, all participants from ASELSAN are engineer. ASELSAN, firstly must train it's personnel about ASELSAN and other World defense systems producers.

The maximum average of this group is about *"product's opening new markets."* All participants, mostly believe that DFINT-3T opened new markets. If it is compared with above results, there is a problem. ASELSAN members do not believe that DFINT-3T project yielded relatively high profit, but they believe that it opened new markets. As it is given above, this result may come from the forecasted and realized cost of the project.

Generally parties, believe that the project *"created a new product line"* and it *"developed a new technological capability"*. Another interesting result is; METU's belief about project' improving ASELSAN's reputation is greater than ASELSAN's participants' believe. TLF do not believe that DFINT-3T project improved ASELSAN's reputation. This result may come from TLF's participants' missing knowledge.

Average standard deviation of the group is 0,94. Mode of the group is 6. Average range is 1,11. Minimum range is coming from project opening new markets, and its value is 0,7 as maximum range is 1,34 and it is coming from project improving reputation question.

5.6.1.7.Potential Benefits To The Defense And National Infrastructure Questions' Descriptive Analysis

The last group is <potential benefits to the defense and national infrastructure.> (Table 5.8). All participants' opinions are important equally. Because, this group is showing us, at the same time, parties beliefs about DFINT-3T project's potential benefits to Turkey's defense and national infrastructure. Since this thesis' case is DFINT-3T project, these results are most important.

This group has greatest average of the questionnaire. This means that all participants believe that DFINT-3T project has and potentially will have benefits to the defense and national infrastructure. Participants average is respectively 5,72 for METU, 5,21 for ASELSAN, and 4,85 for TLF. TLF's average is smaller than other's. TLF is far to project than other organizations. Because ASELSAN, and METU's members are in a cooperation. Some ASELSAN members are Ph.D. and graduate students in METU electrical and electronically division. Some METU's academicians are consultant of the ASELSAN, METU's students has many advantageous to work in ASELSAN as temporary technical

personnel. TLF's personnel have not yet the possibility to work with these organizations. They work together, but not in the same place and every time. In the near term, Turkish Defense Management must find new methodologies, to support collaboration among these three key partners. This will be realized firstly with the new arrangements in legal area.

For this group the most meaningful results are *"project's maintaining a flow of updated generations"* and *"project's contribution to other projects"*. This not mean that other questions have not meaning. They are meaningful too. Minimum average is *"project's decreasing dependence on outside sources"*, is 5,07. It means that participants' belief about this question is above the general average (4,92). This group's average standard deviation is 0,84 and lowest among other groups and mode is 6 biggest of the other groups. Average range of the group is 0,9 and it is the lowest among others.

Table 5.8: Descriptive Statistics-8

	Questions	Average	METU's avg.	ASELSAN's avg.	TLF's avg.	St. Dev.	Mode	Range
Potential Benefits to the Defense and National Infrastructure	17. Project contributed to critical subjects	5,18	5,29	5,42	4,75	0,78	6	0,96
	18. Project maintains a flow of updated generations	5,33	5,86	5,17	5,13	0,88	6	0,69
	19. Project decreases dependence on outside sources	5,07	5,86	4,92	4,63	1,00	6	1,23
	20. Contribution to other projects	5,33	5,86	5,33	4,88	0,68	5	0,71
Average		5,23	5,72	5,21	4,85	0,84	6	0,9
Minimum		5,07	5,29	4,92	4,63	0,68	5	0,69
Maximum		5,33	5,86	5,42	5,13	1	6	1,23

It is possible to look at the comparative average of the questionnaire. ***(Appendix-F)*** METU's average is above in all groups. TLF's average is below of the general average except the first group of the questionnaire. (Meeting design goals). ASELSAN's averages are in the middle of the other except first group of the questionnaire. ASELSAN was a bridge between TLF and METU. Both organizations, METU and TLF cooperatively worked during the project with ASELSAN. TLF's authorities believe that they are working well with ASELSAN members, METU's academicians also think in the same way. As it is

find in the questionnaire too, ASELSAN plays an important role among these two key actors of the Defense management area.

5.6.2. Factor Analysis

In this section of the analysis, SPSS packaged program was used. In the questionnaire there are 20 different factors. In the factor analysis section, the goal is to find Kaiser-Meyer-Olkin measure of Sampling Adequacy, Barlett Test of Sphericity and its significance, factors who has Eigenvalue over 1 and grouped factors. Results of the analysis are given below;

Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0,51 > 0,50. It means that the sample size is meaningful. Significance of the Barlett test is 0,0000 >0,05. It can be said that factor questions is well grouped and homogenous. SPSS, found 4 factors which have Eigenvalue over 1. (Table 5.9)

Table 5.9: Factor Analysis

Factor	Eigenvalue	Percentage of Variance	Cumulative Percentage
1- Relatively high profit	9,82070	49,1	49,1
2- Opened new markets	2,40007	12,0	61,1
3- Improved reputation	2,00896	10,0	71,1
4- New technological capability	1,01094	5,1	76,2

Cumulative percentage is 76,2 for these four group. This means that, these four groups explain 76,2 % of the questionnaire.

In the rotated factor matrix, in first factor group, generally includes benefits to the developing organization's and potential benefits to the defense and national infrastructure's questions are grouped. In the second and third group there are generally meeting design goals questions. Last group includes only benefits to the end-user questions. Rotated factor matrix is given in Table 5.10.

Table 5.10: Rotated Factor Matrix

	Factors	Factor 1	Factor 2	Factor 3	Factor 4
GROUP 1	New product line	.82413	.16268	.19700	.30780
	Contributed to critical subjects	.82156	.20230	-.11253	.21058
	Maintains a flow of updated generations	.81580	-.00790	.37690	-.22218
	Decreases dependence on outside sources	.79590	.00403	.38528	-.10916
	Developed a new technological capability	79080	. .32444	-.09397	.29074
	Contribution to other projects	.72167	.28960	.35740	.28015
	Improved reputation	.66240	.23486	-.11255	.62762
	User is satisfied	.57635	.50291	.19938	.17152
	Product has a substantial time for use	.53462	.52490	.31954	.18965
	Opened new markets	.45494	.29770	.41781	21668
GROUP 2	Functional specifications	.05447	.83925	.22787	.13957
	Technical specifications	.16490	.74099	.00106	.09638
	Substantial improvement in user's operational level	.58941	.66626	.01565	.00905
	Meeting the operational need	.22542	.66294	.26424	.48893
GROUP 3	Schedule goals	.02903	.10109	.85326	.15767
	Budget goals	.10585	.18380	.83570	-.05331
	Relatively high profit	.16487	-.00174	.64730	.60227
	Reached the end-user on time	.40910	.21099	.62359	.29986
GROUP 4	Meeting the acquisition goals	.08184	.54771	.24835	.67788
	Entered service	.22154	.47861	.42070	.56897

5.6.3. Reliability Analysis

Reliability analysis gives us internal adequacy of the factor, grouped factor, core concept, and sub-concept questions. In the performed questionnaire there are not core concept and sub-concept questions. In the analysis there will be only questionnaire's, and factor groups' reliability analysis.

In the reliability analysis of the questionnaire, Cronbach's Alpha is found 0,9369 for total factor questions. Since Alpha is bigger than 0,7 factor questions are reliable. There are 4 different group in the questionnaire related with the factor analysis. All found alphas are bigger than 0,7. The questionnaire is reliable. The result of the reliability analysis of the groups is given in Table 5.11.

Table 5.11: Reliability Analysis

Groups	Cronbach's Alpha
Group 1	0,9332
Group 2	0,8213
Group 3	0,8482
Group 4	0,8321
Total	0,9369

5.6.4. Multiple Regression Analysis

Descriptive statistics of the multiple regression analysis is given in Table 5.12. CC question is *"Does participants believe that DFINT-3T is a good case for University - Industry - Turkish Land Forces Collaboration?"* CC question is the dependent variable for the multiple regression. Four groups which were found in the factor analysis are independent variables. SPSS packaged program is used for multiple regression analysis.

5.6.5. Steps In Multiple-Regression Analysis

First step of the regression analysis is analyzing linearity. Linearity can be find as analyzing results of the regression. (Table 5.13)

First line gives us linearity. There is a linear relation among dependent and independent variables, if the first line's value is bigger than 0,7 and if it's significance is small than 0,5. Group1 gives us a linearity according to results.

Table 5.12: Descriptive statistics of the multiple regression

	Mean	Std Dev	Cases
CC	5.185	.921	27
Group 1	51.037	7.314	27
Group 2	20.259	2.379	27
Group 3	16.815	3.981	27
Group 4	10.296	1.409	27

Table 5.13: Regression Results-1 (Pearson Correlation Matrix)

	CC	Group1	Group2	Group3	Group4
CC	1.000	.781	.556	.282	.608
	.	.000	.001	.077	.000
	27	27	27	27	27
Group1	.781	1.000	.667	.503	.559
	.000	.	.000	.004	.001
	27	27	27	27	27
Group2	.556	.667	1.000	.411	.756
	.001	.000	.	.017	.000
	27	27	27	27	27
Group3	.282	.503	.411	1.000	.600
	.077	.004	.017	.	.000
	27	27	27	27	27
Group4	.608	.559	.756	.600	1.000
	.000	.001	.000	.000	.
	27	27	27	27	27

Second step is finding multi-collinearity. In a linear regression, results are good if there is no correlation among independent variables. To understand this relation, one must look at relation among independent variables. If there is a relation bigger than 0,7 among independent variables, it can be said that there is a linear relation between these two

independent variables. In this case, one must shoot one independent variable which has small linearity. In this case, between group2 and group4 there is such a relation. One must shoot group2 from analysis. Group2's linearity is small than group4's have. There is not another correlation among independent variables.

Third step of the regression is test of auto-correlation. (Durbin-Watson test.) This gives us also, the danger of the independent variables' having relation with each other. Durbin-Watson Test result is 1.75936. From the Durbin Watson test table, (at the 5% significance, for number of independent variables=4 and for number of participants=27) one found that dL is equal to 1,084 and dU is equal to 1,753. Durbin-Watson test result is bigger than 1,753. It can be say easily there is no auto-correlation among independent variables.

Fourth step is multiple significance (F) test. This gives us significance of the multiple regression. From the regression results it is found that F =15.60302 and Signif F =.0000<0,05. It means that multiple regression is significant.

Fifth and last step is coefficient Beta (t test) test. It gives us significance of linear equation. The Beta test results is given in Table 5.14. From the table, Group1, Group3, and Group4 are found significant. Because, their SigT<0,05.

Table 5.14: Variables in the Equation

Variable	B	SE B	Beta	T	Sig T
Group4	.378371	.124563	.578663	3.038	.0060
Group1	.104908	.019586	.832768	5.356	.0000
Group3	-.084794	.033411	-.366362	-2.538	.0187
Group2	-.110788	.074071	-.286078	-1.496	.1489
(Constant)	-.394534	.885393		-.446	.6602

From the regression analysis, Group1, Group3, and Group4 are found as significant independent variables. As a result, it is found that,

Multiple R = 0.85987 (Correlation of the four independent variables with the dependent variable after all the intercorrelations among the four independent variables are taken into account.)

R Square = 0.73937 (Square of the Multiple R.)

Adjusted R Square = 0.69199

As a result, 73,9 % percent of the variance (R Square) in DFINT-3T project's being a good University-Industry- TLF Collaboration case, has been significantly explained by the four independent variables.

5.7. Recommendations

University-Industry-TLF collaboration is a necessity in the new defense systems management area. All these key parties must find a way to enhance their interrelations. As an example, one analyzed ASELSAN's case of DFINT-3T transportable direction finding system. This system, was very useful, to enhance level of national and defense infrastructure as it is given in the Case. ***(APPENDIX-A)***

The questionnaire is designed to analyze adequacy of the DFINT-3T as a case of University-Industry- TLF collaboration. It is used descriptive statistics, factor analysis, reliability analysis, and multiple regression analysis. From all of these analyses, it is found that,

1. DFINT-3T project, has potential benefits to the defense and national infrastructure. This is most meaningful result of the analysis.
2. METU's academicians have general optimism, because they are far from ASELSAN and end-user.
3. Since ASELSAN members are into production phase, they may not look at the problems globally.
4. Project's designing phase is not useful to become a model of collaboration. Parties must work together more in the designing phase. If there is a problem which come from the beginning, all phase will be influenced from it.
5. ASELSAN played a role as bridge among TLF and METU. TLF's authorities and METU's academicians who were far from each other. They must find solutions of this problem.
6. Although they have worked together, parties have different opinions about the project. It can be say that there is a communication problem among parties. Maybe, they do not said about it during the meetings, but partners must find effective dispute resolution methods.

7. Questionnaire is prepared well , according to results of the factor, reliability, and multiple regression analyses. Except the four questions (Group2- *"functional specifications", "technical specifications", "substantial improvement in user's operational level", "meeting the operational need"*), all groups (and questions) are significant to explain core concept of the questionnaire.

6. DISCUSSION, CONCLUSIONS, LIMITATIONS

6.1. Discussion

Defense industry has many specifications which are different according to other type industries. It requires sensitive manufacturing techniques, specific quality standards, manpower with high capability, high R&D activities (because of focus on the state-of-the-art technology), and high quantity of investments. It has also specific conditions such as security and reliability. Due to these conditions, defense industry become more risky. Defense management area's actors must find ways of decreasing this risk to a minimum level.

Collaboration is a new method to decrease defense management area's risk, R&D costs, and duplicative works. Collaboration is working together, to achieve specific purposes. The most appropriate collaboration type is University-Industry-Government Collaboration. This type of collaboration contain all "key actors" of the defense industry.

In this study, it is designed a model for University-Industry-Government (Turkish Land Forces) Collaboration. In many developed countries there are a lot of collaboration types and models, but in Turkey there is not yet such works.

Turkish Armed Forces is the second largest armed forces within the North Atlantic Treaty Organization consisting some 640.000 soldiers. Due to her geo-political situation Turkey has to give a special attention to defense matters. Current defense spending is over 8 Billion $. As a result, defense spending and defense procurement is at the first priority in the country. For next 30 years, TAF will spend 150 Billion $, for modernization of equipment.

Turkey wants to modernize its equipments by help of national firms. Turkish defense industry firms and universities have a chance to gain some money from this modernization. In Turkey, there are three category in procurement; "Must be National", "Critical", and "Others" types. Turkish defense firms must to work collectively with universities and TAF, to overcome obstacles, enhance their images and reputations, access to the newest technologies and gain much more.

TAF and TLF must work together with Turkish defense industry and universities, because this type of procurement will more cheaper than others. In addition, TAF's and TLF's members can also participate designing phase of the required weapon systems. They will

have chances to interfere problems at the right time. Totally collaboration helps Army to compete with other countries' armies.

Universities also must participate in collaborations. Defense management area, is a whole. Universities have important roles in this whole. Their key role is doing their researches in defense management area. This will expose students and faculty members to practical problems.

One proposed a University-Industry Turkish Land Forces Collaboration model, used GDPM, and GMS methodologies to examine this model, and used Case Writing Methodology, and done a field study about DFINT-3T system . As a consequence of these studies, it is possible to say that DFINT-3T system is a good case for a University-Industry-TLF collaboration as a first collaboration of Turkey.

6.2. Conclusions

One proposed a University-Industry- TLF collaboration model for Turkey. According to the model, there are two phases. Prerequisite activities and collaboration activities. In the prerequisite activities, firstly project team members are selected. Then, these project members determine rule infrastructure of the collaboration. In order to be successful, project members, must have technology transfer and collaborative work capabilities. By help of training activities, people capabilities are enhancing. Another important critical success factor, is developing GDPM, as a common methodology among partners. These activities form "prerequisite" of the model. On used GDPM methodology to analyze prerequisite activities part of the model. Project mandate, work breakdown structure, result paths, milestone plan, responsibility chart, and activity plan are prepared as draft. Actual project teams must prepare their "real implementation" plans and charts according to GDPM methodology.

Second phase is collaboration activities. Collaboration activities, contain 11 sub-phases. Selecting business drivers, "must be national", "critical", and "other" technologies, building strategic goal planning, preparing OYTEP, and forming technology panels, selecting optimum partner, evaluating objectives, defining measures, evaluating reward system, Cost/Risk analysis, planning schedule/resource allocation and implementation activities.

Quality and feed-back activities are executed simultaneously with prerequisite and collaboration activities.

Graphical Modeling System methodology is used to analyze ASELSAN's DFINT-3T project. Requirements, Capabilities, Developments, and Researches are determined for the project. There are three point of view in GMS. These are, mission area perspective, technology program perspective, and research program perspective. Mission area perspective can be used for TLF HQ's managers decisions. Technology program perspective for the engineers of ASELSAN. Final perspective is research program perspective, and it can be used in University-Industry-TLF collaboration project team.

One prepared two network displays; mission area, and research program network displays. Project team members, can see all phases of the project by help of GMS.

Field study is applied to understand focus differences of the University, Industry, and TLF. A questionnaire is applied to whole project members of DFINT-3T. Average of the questionnaire is found 4,92 / 6. Mode and Median are found 5.

As group, group-4 is the most appropriate. It is formed with four questions and called "product's potential benefits to the defense and national infrastructure" Average of this group is biggest and 5,23.

All partners, think in the same way, about 10 questions of the questionnaire. They do not believe that "product reached the end-user on time", "product had a substantial time for use", and "user is satisfied with product." Their responses' means are below the average for these three questions.

They believe that "product yields substantial improvement in user's operational level", "project opened new markets", "project developed a new technological capability", "project contributed to critical subjects", "project maintains a flow of updated generations", "project decreases dependence on outside sources", and "project contributed to other projects". Their responses' means are above the average for these seven questions.

Factor analysis is done with SPSS packaged program. Kaiser-Meyer-Olkin Measure of Sampling Adequacy is found 0,51. SPSS found 4 factors which have Eigenvealue over 1. (Relatively high profit, opened new markets, improved reputation, developing new technological capability) In reliability analysis phase, SPSS formed 4 new different question groups with the rotated factor matrix. Their reliability analysis showed that all

group are reliable. Cronbach's Alphas are found 0,9369 for total questionnaire, 0,9332 for first group, 0,8213 for second group, 0,8482 for third group, and 0,8321 for fourth group.

In regression analysis, it is found that group 1 had a linearity with the core concept. One found two group questions which have correlation with each other. (Group2 and group4 rotated factor matrix) Linearity of group2 is less than group4's has. Group 2 is extracted from analysis. According to Durbin-Watson test, there is no autocorrelation among independent variables. In the multiple significance (F) test, multiple regression is found significant. Lastly, R Square is found 0,74, and adjusted R Square 0,69.

As a result, DFINT-3T project is found a good University-Industry-TLF collaboration case. It has potential benefits to the defense and national infrastructure. This is most meaningful result of the analysis.

Project's designing phase found not useful to become a model of collaboration. Parties must work together more in the designing phase. If there is a problem which come from the beginning, all phase will be influenced from it.

ASELSAN played a role as bridge among TLF and METU. TLF's authorities and METU's academicians who were far from each other. They must find solutions of this problem.

Questionnaire is prepared well , according to results of the factor, reliability, and multiple regression analyses.

6.3. Limitations

The main limitation was that there has not been any previous research report on this subject. Since, University-Industry-TLF collaboration model is a new way for Turkey, there are not yet such works. This deficiency prevented to make more efficient study.

There was not a questionnaire in Turkey for University-Industry-TLF collaboration. This was a problem for the researcher.

TLF's DFINT-3T project members were appointed to other services. They are forced to remember some details of the project.

Since there was three parties in this study, and time was limited, interviews are done shortly. For next researches, it will useful to take this problem into consideration.

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ASELSAN'S CASE OF TRANSPORTABLE DIRECTION FINDING SYSTEM (DFINT-3T)

1. Benefits Of Case Study

Today, many researchers use case study to express successful business implementations. Case studies' benefits are given below;

1. Case studies cut across a range of companies, industries, and situations, providing an exposure far greater than what students are likely to experience otherwise. They can increase their knowledge of many management subjects by dealing extensively with problems in each field.
2. Cases help us sharpen our analytical skills.
3. Case and case discussions provide a focal point for an exchange among students of the lessons of individual experiences.
4. Cases are useful for developing sets of principles and concepts that can be applied in practice.
5. There is one final benefit that we seek to achieve by using business case studies; to renew the sense of fun and excitement that comes with being a manager. (Intellectually, politically, and socially)

2. Problems Of Case Studies

Although there are many benefits of case study, it imports also some problems. To become more successful in the study writers must take these problems and limitations into consideration.

1. The information come to the case writers in neatly but managers in business and government, accumulate facts and opinions through meetings, memos, conversations, reports and the public press.
2. A case is designed to fit a particular unit of class time and focus on a certain category of problems, for instance, marketing, production, or finance. It may then omit elements of the real situation-people, or organizational issues.
3. A case is a snapshot taken at a point in time. In reality, business problems are often seen as a continuum calling for some action today, further consideration and action tomorrow.

3. Writing Case

Firstly, there is a preparation and interview session before writing a case. In preparation session it must make a plan, develop case themes and determine type of case. Interview session includes a series of interviews. After these two session, it is possible to write case. Lastly, closure session is important to sign off writing.

3.1. Preparation

Preparation session is planning session of the study. First of all, case writer must build a plan. During planning, case writer must take a critical point into consideration; case must be specific and actionable not theoretical. The case topic may be historical or in-process.

Case writer must have a clear decision and focus about case. He/she must determine learning objectives (from case) and who will be audience be. Their familiarity and expertise about case.

Thereafter, case writer must determine what type of case he/she will write. There are many types of case. These are; decision-focus, compare/contrast, demonstration, implementation, case series, quantitative, summary or exam case, and mini-case for specific application.

The other thing that case writer must decide is what type of ancillary materials will he/she develop? (Exhibits-tables-graphs, videotapes, computer exhibits)

After these preparations case writer must do:

1. Review the annual reports of the firm for the past three to five years.
2. Library search about the firm. It is enormously helpful to have a theoretical framework that relates to the issues he/she will be discussing.
3. The case must have a structure but not a shifting structure.
4. The case must have a actor or actors.
5. Compile a view of the industry from public sources. It is the foundation for one section of the case document. It also prepares the case writers for informed discussions with executives.
6. Develop case theme or themes. Three theme are adequate for this session.
7. Identify the central theme of the case.

3.2. Interviews

During interviews session case writer firstly develops an interview guide. This can be very rough and extremely detailed. He/she must decide whom to see and what to talk about.

With the theme (determined in planning session) in mind, work with the contact person to compose a list of interviews. The important thing here is be careful about interviews time planning. Interviews must be 1 hour and at least 15 minutes between them, not including travel time. Case writer may do six interviews a day, this is intensive but feasible. More than six interviews may be harmful. The other important key points during interview session are given below;

1. Interview the most senior people in the case at the very beginning, and again at the end of the roster. Senior people generally have a clear focuses on firm, or organization. This can give case writer a clear idea about organization. At the end of the session, senior people, may aid case writer to make clear his/her ideas about case/organization.
2. Interviews are best conducted two-on-one. Two case writers interview one respondent. One case writer is the chief questioner and the other is responsible for taking copious notes.
3. During interview great notes make the job of writing much easier.
4. Tape recorded interviews are an alternative to written notes. But transcription may be expensive and takes time.
5. Case writer must tell the people with whom he/she done interview some words about what will he/she do after he/she have left them.
6. It is important to bring lots of paper and pens and one tablet for every two interviews.

3.3. Writing (Draft)

The key point about writing the case is the driving the case writing session. Case writer can get feedback from others, but he/she must drive the process.

When the interviews are completed and materials collected; it is very important to draft the case as quickly as possible. If case writer delay, the real story fades and everyone loses interests. Timing is everything in keeping the momentum alive.

The first step in producing the draft is reading all of the materials and interview notes in one sitting.

Generally case writer firstly, writes the chronology, thereafter organizational structure, problem structure and lastly closing paragraph.

1. Chronology ----------Where we were?
   ----------Where we are now?
   ----------Where we need to go?
2. Organizational Structure: Describe the situation by moving through the key blocks in the organizational chart. This works best when the chart is reasonably clear and clean.
3. Problem Structure: Lay out the problem as the company sees it, then work through the alternatives or different position on what should be done.
4. Write closing paragraph. Recapitulate the central issues and focuses.

After writing case, case writers must reread the case to edit it for clarity, content, and length. Cases are often too long. They can; eliminate everything that is not related to the story or they can check the line inches of various sections of the case. The length of the section should be commensurate with its importance. They can use exhibits for this.

The other important key factors during writing the case are given below;

1. As writing a case they must use person's first name and title when they are first mentioned in the case. Afterwards, only last names are used.
2. Titles are not capitalized.
3. Cases are written in the past tense.
4. They must use no sexist language.
5. As writing the case style must be objective, concise, direct and unadorned.
6. They must to try to keep paragraphs and sections a reasonable length.
7. Too many headings fragment the case and its material. Too few headings make it difficult for the reader to relocate material later on. Headings should be straightforward, not evaluative.
8. They must number exhibits.
9. And case writer must uses the exhibits within the text at appropriate points. It is possible to use them to present complex (especially numerical data) clearly, to present visual/spatial relationships (organizational charts, flow charts, process representations etc..)
10. Case writer must create dramatic interest.
11. Case must include enough data but not very detailed or unrelated details.

12. Case must have a logical shape or structure. For example chronology; issue focus; foreground/background descriptions; cause/effect, inverted pyramid moving from broad generalization to specific actionable questions etc..

13. Case writer must be careful about writing style. Don't be familiar.(inside-joke)

3.4. Closure (Quote Approval And Sign Off)

1. Clearing the quotes

- Before a case draft can be sent to the company for review, each person quoted in the case is sent a personal letter that asks him or her to approve the exact wording of the quote.
- Keep the hard copy of the quotes in case questions arise later.

2. Circulating the draft

- When the draft is completed and the quotes are approved, send a copy to the contact persons.

3. The sign-off

- An officer of the company must formally sign off a case to be published.
- Send a finished copy of the document to company.

If one want to give brief knowledge about case writing, one can summarize it as given Table APP-A1.

TABLE APP-A1: Standard Components of a Case Study

OPENING PARAGRAPH	BACKGROUND/ CONTEXT (For firm, Case Actors and Industry)	CASE STORY	CONCLUSION
Position case in time	Tell only enough history to suggest the culture and values that will be important to your case discussion.	Being the boss	Clearing the quotes
Identify major actors	Avoid evaluative or leading adjectives / descriptions. The prose in these sections should be the barest and most matter -of-fact in your case.	Writing as quickly as possible after interviews sessions	Circulating the draft
Identify firm	Use exhibits to economize on text. (For example use them for summarizing company's history or for a manager's career chronology, or present industry market share data)	The rank is; chronology, organizational structure, problem structure, closing paragraph	The sign-off
Identify or suggest the issue or decision focus (microcosm of case problem)		Create dramatic interest	
Be brief		Use no sexist language	
Create dramatic interest		Use past tense	
Use descriptive details sparingly and selectively		Be objective	
Remember the significance of "first impression"		Be careful about writing style	

4. Giriş

ASELSAN'ın üretimini yaptığı DFINT-3T sistemi tezde örnek olay olarak alınmıştır. Örnek olay olarak bu sistemin alınmasının en temel sebebi bu sistemin Üniversite-Sanayi-Türk Kara Kuvvetleri işbirliği modelini ilk olarak kullanan ve başarılı olan bir örnek oluşturmasıdır. Ayrıca modelin ekonomik olarak başarılı olması, üretilen DFINT-3T sisteminin diğer sitemlere kaynak oluşturması, ve Türkiye Elektronik Sanayicileri İşadamları Derneği (TESİD) tarafından da 1999 yılında yenilik ve yaratıcılık ödülü almış olması bu vakanın seçilmesinin diğer alt nedenleridir.

1974 Kıbrıs Barış harekatını müteakip, Türkiye'ye uygulanan ambargo, Türk Savunma Sanayiini yeni teknoloji edinmede eskisinden farklı yeni metotlar geliştirmeye itti. Bu ambargoyla Türk Savunma Sanayii kritik bazı teknolojilerde kendi kendine yetebilir olması gerektiğini anladı. İşte bu şartlar içinde ASELSAN, 1975 yılı sonunda Kara Kuvvetlerini Güçlendirme Vakfı öncülüğünde vakıf kuruluşu bir anonim şirket olarak kuruldu. İlk yatırım çalışmalarını müteakip 1979 başlarında Ankara Macunköy tesislerinde üretim faaliyetlerine başladı.

ASELSAN'ın kuruluşundan hemen sonra göreve gelen Genel Müdür Hacim Kamoy 1997 yılında yapmış olduğu söyleşide:

"15 Ocak 1976'da Genel Müdür olarak işe başladığım zaman ilk düşüncem üniversitelerle işbirliği oldu...İşe ilk olarak güçlü bir teknik personel kadrosu kurmakla başladık. ODTÜ'de elektronik bölüm başkanı sınıf arkadaşım Halil Bengi idi. Eski PTT'li ve TRT'li arkadaşım Prof. Dr. Hakkı Oranç da aynı bölümde idi. Üçümüz oturduk, kendi amaçlarımı anlattım, birbirleri ile ahenkli olarak elbirliği, gönül birliği ile çalışacak, teknik yönden yetenekli 3 öğretim üyesi istedim." derken, aslında bugünkü başarılı işbirliğinin temelinin ASELSAN'ın kurulduğu günlere dayandığını belirtiyor.

O günlerde elektronik bölümünde genç bir öğretim üyesi olan ve bugün bu bölümün başında olan Prof. Dr. Fatih Canatan ise ASELSAN dergisinde yer alan makalesinde o günleri şöyle anlatıyor:

"Prof. Dr. Halil Bengi anlatılan görüşmeden sonra konuyla ilgili olabilecek öğretim üyeleriyle bir toplantı yaptı. Aramızdan genç, dinamik ve konuya en yakın üç arkadaşımız saptandı. Onları ASELSAN'ın kurulma çalışmalarını yapmak üzere uğurladık."

Uzun süren çalışmalar neticesinde ASELSAN, bugün iki ayrı büyük tesiste 1000'den fazla müşteriye 35 ayrı sahada hizmet vermeye devam eden bir kuruluş olarak Türk savunma sanayinin önder kuruluşları arasında yerini aldı.

4.1. ASELSAN'ın Misyonu

İleri teknolojiyi yakından izleyerek Türk Silahlı Kuvvetleri'nin elektronik cihaz sistem ve gereksinimlerini fiyat-zaman-kalite yönünden en uygun koşullarda ve dışa bağımlılığı en aza indirecek şekilde karşılamak, milli savunma sanayiinin gelişmesinde önder olmak, sahip olunan bilgi birikimini ülkemizin diğer elektronik sistem ihtiyaçlarının karşılanmasında ve ihracat olanaklarında kullanmak, bu şekilde her türlü şartlar altında devamlılığı ve gelişimi sağlamaktır.

4.2. ASELSAN'ın Vizyonu

Yurtiçi ve dışında ulaşılan başarılı konumu sürekli geliştirerek faaliyet alanlarında Türkiye'de en iyi olmak, dürüst ve güvenilir bir firma olarak müşteri memnuniyetini ve ülkemizin beyin gücünün verimli kullanımını sağlamaktır. Küresel rekabet ortamında başarımızı artırarak sürdürmek, yeni iş olanakları yaratmak, çalışanlarımızın hayat standardını yükseltmek, ürün ve hizmet kalitemizi sürekli iyileştirmek üzere müşteri memnuniyetinin sağlanması, proseslerimizin sürekli iyileştirilmesi, ekip çalışmalarının yaygınlaştırılması, insan kaynaklarımızın geliştirilmesi, çevre ve topluma katkı ana ilkelerimiz olarak benimsenmiştir.

4.3. ASELSAN'ın Ürünleri

ASELSAN'ın ürünlerini profesyonel ve askeri olarak ikiye ayırmak mümkündür. Profesyonel ürünler **(Ek 1.a)**; profesyonel telsiz haberleşme sistemlerini, merkezi bilgisayar kontrollü uyarı sistemlerini, ve elektronik sayaç, ses şifreleme cihazları, anons ve siren sistemleri gibi diğer profesyonel ürünleri kapsar.

Askeri Ürünler **(Ek 1.b)** ise askeri telsiz sistemlerini, elektronik harp ve radar sistemlerini, komuta kontrol ve topçu atış sistemlerini, elektro-optik ürünlerini, güdüm ve seyrüsefer sistemlerini, ve sahra telefonu, NATO ortak araştırma projeleri, kripto cihazları gibi diğer askeri ürünleri kapsar.

4.4. Kuruluşu

ASELSAN'ın faaliyetleri, çeşitli alanlarda yürütülen proje konularına bağlı olarak Macunköy ve Akyurt tesislerinde sürdürülmektedir. ASELSAN'ın genel müdürlük teşkilatı Ankara Macunköy'de bulunmaktadır. Macunköy'deki tesislerde geniş makine teçhizat parkının yanında elektronik üretim bölümleri, baskı devre üretim, mekanik üretim, ve kalıp üretim bölümleri bulunmaktadır.

Üretim hatlarında; çok katlı ve esnek baskı devreler, yüzey monte teknolojisi, bilgisayar destekli tasarım-üretim, teknolojileri kullanılmaktadır. Akyurt tesislerinde ise otomasyona dayalı modern üretim araçlarıyla donanmış olarak, 2000'li yılların kritik teknolojileri arasında yer alan mikroelektronik ve elektro-optik alanlarında üretim gerçekleştirilmektedir.

Bunun dışında kendi bölgelerinde pazarlama, tesis ve bakım onarım hizmetleri vermek üzere İstanbul ve İzmir'de bölge müdürlükleri kurulmuştur. Bunların dışındaki illerde satış bayilikleri bulunmaktadır.

İlk yurtdışı şirketi ASELSAN-BAKÜ adıyla 1998 yılı başında Azerbaycan'da kuruldu. İran, Azerbaycan ve Özbekistan'da ASELSAN büroları ve diğer bazı ülkelerde de satış temsilcilikleri vardır.

AR-GE harcaması olarak ASELSAN'ın diğer firmalara göre üstünlüğü vardır. ASELSAN'ın AR-GE harcamalarının toplam satış hasılatı içindeki payı 1995'de %3.6, 1996'da %2.8, ve 1997'de ise %3.2 olmuştur. AR-GE faaliyetleri ayrıca ASELSAN'ın işgücünün büyük bir bölümünü oluşturduğundan, firmanın işgücünün büyük kısmını mühendisler oluşturmaktadır. 1998 itibariyle ASELSAN'da 781 mühendis, 453 idari personel, ve 1431 teknik ve üretim elemanı olmak üzere 2665 kişi görev yapmaktadır. Ayrıca, ODTÜ Elektrik-Elektronik Bölüm Başkanı Prof. Dr. Fatih Canatan'ın da belirttiği gibi *"ASELSAN'da çalışan mühendislerin ¾'ünün ODTÜ mezunu"* olması önemli bir özellik olarak karşımıza çıkmaktadır. Bu da Üniversite-Sanayi-Türk Kara Kuvvetleri işbirliği modelinin üniversite-sanayi işbirliği aşamasına katkı yapmaktadır. ASELSAN'ın kuruluş şemasını **Ek 2** 'de görmek mümkündür.

MST Yazılım mühendisliği müdürlüğünde teknik lider olarak çalışan Elif Baktır'a göre *"ASELSAN personelini üniversite sonrası yüksek lisans ve doktora çalışmalarında sürekli destekledi. 1998 Kasım ayı verilerine göre ASELSAN çalışanlarından 250'ye yakınının*

yüksek lisans, 9'unun da doktora eğitimlerini tamamlamışlardır." Bu da firmanın işgücü kalitesini ve üniversite olan diyalogunun gelişmişliğinin bir göstergesidir.

4.5. Örnek Olay

4.5.1. Arka Plan

Radyo dalgaları ile telsiz haberleşmesi askeri ve sivil amaçlarla çok yoğun olarak kullanılmaktadır. Telsiz haberleşmesinin ilk kullanılmaya başladığı zamanlardan itibaren havadaki telsiz yayınlarının tespit edilmesi, dinlenmesi, yayın kaynaklarının nerede olduğunun belirlenmesi sürekli merak ve dolayısıyla araştırma konusu olmuştur.

Özellikle 2. Dünya Savaşı sırasında telsiz yayınlarını tespit edip, sinyallerin hangi yönden geldiğini bulan sistemler başarı ile kullanılmıştır. Geçen zaman içinde bir yandan telsiz haberleşme sistemleri çok hızlı bir gelişme izlerken, bir yandan da bu yayınların tespit edilmesi, dinlenmesi, hangi yönden geldiğinin ve hatta yayın kaynağının yerinin belirlenmesini sağlayan sistemler de hızla gelişti. Bu sistemler yön bulma/kestirme sistemleri olarak adlandırıldı.

Prof. Dr. Fatih Canatan'ın savunma elektroniği çabalarının başlaması olarak nitelendirdiği aşama 1980'li yıllarda başladı. Prof. Canatan o dönemi şöyle anlatıyor:

"ASELSAN'ın kurulmasından bir süre sonra 80'li yıllara gelindiğinde ASELSAN'ın isteği üzerine bir grup ODTÜ öğretim üyesi aralarında muntazam seminerler düzenleyerek savunma elektroniğinin yapı taşlarını sanki kendileri üretecekmişcesine ayrıntılı olarak öğrenmeye koyuldular. Elektrik ve Elektronik mühendisliğinin değişik dallarından ve çeşitli yaş gruplarından insanlar yaklaşık bir yıl kadar kendilerini ve birbirlerini eğittiler. TSK elinde bulunan oldukça eski bir sistemi modernize etmek istemekteydi. Bu sistemin parçaları üzerinde ODTÜ Elektrik Elektronik Mühendisliği Bölümü Mikrodalga ve Anten Laboratuarlarında geliştirmeler ve uzun süren deneyler yapıldı. Ana hatlarıyla bir kavramsal model geliştirildi ve bu, laboratuarda test edildi. Sistem TSK ilgili birimlerine gösterildi. Bu arada konuya ilgi duyan Devlet Başkanı Sayın Org. Kenan Evren bizzat laboratuarımıza gelerek gelişmeleri yakından izlemek istedi. Kendisi gerek Devlet Başkanlığı ve gerekse Cumhurbaşkanlığı dönemlerinde bu çalışmaların değişik aşamalarını teşvik etmiştir.

Çalışmalar başarılı olmakla birlikte artık bir sanayi kuruluşu bünyesinde yürütülmesi zarureti doğmuş oldu. ASELSAN henüz bu alanda çalışan bir alt birim oluşturmamıştı. Bu

nedenle, aynen ASELSAN'ın kuruluş yıllarındakine benzer bir kararla ODTÜ ekibi içinden bir arkadaşımız gönüllü olarak ASELSAN'a geçerek bu birimin oluşturulmasında görev aldı. Ancak bundan sonradır ki tüm cihazlar oraya nakledilebildi ve proje bölümümüz tarafından danışmanlık biçiminde desteklenmeye devam etti."

Bu gelişmelerin ışığı altında çalışmalar başladı. Üzerinde çalışılan sistemin değişik disiplinlerden kişiler gerektiriyordu. Sistemin bu kişilerce anlaşılması ve ortak bilgi düzeyini artırılması için önce seminer çalışmaları yapıldı. ASELSAN danışmanı ve ODTÜ Elektrik-Elektronik Bölümü öğretim üyelerinden Prof. Dr. Nevzat Yıldırım'a göre; "*Bu aşamada hem değişik akademik birikimi olan öğretim üyeleri arasındaki boşluklar, kopukluklar ortaya çıktı, hem de akademik bilgilerden gerçek üretime giden yoldaki boşluklar, eksiklikler belirlendi."*

Yapılan çalışmalarda ilk önce akademik eksiklikler giderildi. Daha sonra ise, yurtdışından üzerinde çalışılan konularla ilgili olarak parçalar ısmarlandı. Tabii tasarımlarda gereken parçaların fiyatlarının çok yüksek olması beraberinde hem fikirlerde, hem de tasarımlarda revizyonu getirdi. Yeni malzemelerle birlikte "yeni gerçekler" ortaya çıktı. Bu teori-pratik çatışmasının projede yaşanan ilk örneği oldu. Daha sonraları ise diğer çatışmalar meydana geldi. Çatışmalar birer birer çözüldü. Bunu yaparken projede çok çeşitli bilim dallarından öğretim üyeleri, asistanlar, mastır ve doktora öğrencileri ve Silahlı Kuvvetler mensupları görev aldılar. Öğretim üyelerinin yaşadığı sıkıntıları en iyi yaşayanlardan biri olan Prof. Dr. Yıldırım'a göre; "*Gerçek sınırlamaların bilinmediği koşullarda tasarımlar yapmaya alışmış iddialı uzmanlar, tasarımladıkları cihazların diğer devre veya cihazlarla bir araya geldiğinde çalışmadığını, laboratuarda iyi çalışan bir devrenin karta geçince çalışmadığını ve işlerin bilinmeyen yönlerinin olduğunu öğrendiler."* Bu tür problemlerin halledilmesi, beraberinde hemen başarıyı getirmedi. Başarı için atılması gereken daha çok adım vardı. Bu adımlar birer birer atıldı ve sistemin kusursuz çalışması sağlandı. Ancak bu yeterli değildi. Prof. Dr. Yıldırım'ın ifadesine göre; "*Sorunlar takım halinde çalışan akademisyen ve mühendislerin yardımıyla çözülür. Herkesin kendine güveni artar. Sistem çalışır, testlerden geçer. Tam bayram edilmeye hazırlanırken genel müdür yardımcısı neşenize limon sıkar."Ne bitirmesi, esas sorun şimdi başlıyor. Hadi bakalım, en yetenekli ve bilgililerinizi yeni Pazar bulmaya" der. Bu noktadan sonra kendinizi dünyanın dev firmalarıyla rekabet halinde bulursunuz. Bu da en acı gerçektir. Macera gerçekten bitmemiş, henüz başlamıştır. Bundan sonra hep dünyanın devleriyle yarış*

durumundasınızdır. Yani sürekli araştırma, geliştirme, modernizasyon. Bisiklete bindiniz, durursanız düşersiniz. Böylece akademik hayata, derslere, tezlere, laboratuarlara, araştırma konularına, öğrencilere bakış açısı değişir. Ayakları Türkiye topraklarına basan tezler verilemeye başlanır. En ileri düzeydeki teorik bilgi ile uygulamadaki sorunlar arasındaki köprüler tamamlanmaya çalışılır. Teorik çalışmalar yön ve nitelik değiştirir. Dersler birbirini bütünleyecek veya destekleyecek biçimde yeniden düzenlenir. Araştırma konuları ayıklanmaya ve her konuya aynı gözle bakılmamaya başlanır. Başarılı ve verimli konular kendiliğinden ortaya çıkmaya başlar. Ne yapılması gerektiği, endüstri ve pazardan alınan "geri besleme" ile kendiliğinden ortaya çıkar. Kısır bir tartışma konusu olan "temel araştırma mı yoksa uygulamalı araştırma mı?" soruları da ortadan kalkar. Çünkü geçirilen tecrübelerle, en ileri temel araştırmalarla uygulamanın birbirinden koparılamayacağı ortaya çıkmıştır." İşte DFINT-3T projesine temel teşkil eden çalışmalar böyle başladı ve devam etti.

ASELSAN kestirme sitemleri geliştirme çalışmalarına 1989 yılında başladı. Neticede bugün ASELSAN, haberleşme kestirme sistemleri konusunda dünyada rekabet edebilir seviyeye gelmiştir.

4.5.2. Fikrin Doğuşu

1974 Kıbrıs Barış Harekatı sırasında telsiz haberleşme ve kestirme sistemlerinin yetersizliği büyük ölçüde hissedildi. Harekatın ardından uygulanan ambargo da bu tür sistemlerin temininde yurt dışına bağımlılığın yaratacağı güçlükleri açıkça ortaya koydu. Bu gelişmelerin ışığı altında çalışmalar başladı.

Proje, yukarıda anlatıldığı şekilde ağır ve fakat bir o kadar da milli olması sebebiyle meşakkatli ve yorucu gelişmesini sürdürürken, Güneydoğu Anadolu bölgesinde yaşanmaya başlayan terör olayları da telsiz kestirme sistemine olan ihtiyacı artırdı. Sonuçta büyük platformlar üzerinde bulunan kestirme sistemleri arazi şartları nedeniyle bölgede kullanılamadı. KKK, 1989 yılında, daha hafif/taşınabilir kestirme sistemleri modellerinin geliştirilmesi halinde bölgede teröre karşı başarılı olunabileceği fikrini ortaya attı. İşte KKK. lığı ve GES K. lığının yönlendirmeleri doğrultusunda yürütülen ve tümüyle ASELSAN'da geliştirilen, tasarımı ve en önemlisi yazılımı ile ilk milli kestirme ve dinleme sistemi çalışmaları da böylece başlamış oldu.

4.5.3. Kestirme Sistem Çalışmaları

1989 yılında başlayan çalışmalar neticesinde, 1992 yılında Araç üzerinde ilk prototip üretildi. Temmuz 1995 ile Ağustos 1996 tarihleri arasında seri üretim ile sistemler tamamlandı ve kullanılmaya başlandı. Yine 1995 yılı içerisinde DFINT-3T'nin prototipi oluşturuldu. Bu, yaklaşık 90 kg. ağırlığında bir cihazdı.

1996 Aralık sonunda DFINT-3T için TSK ile ASELSAN arasında alım anlaşması imzalandı. 1998 Ocak ayından itibaren ise yeni modeller teslim edilmeye başlandı. 1999 yılında ek sözleşme imzalandı ve ek sözleşmeyle teslimatların 2000 ve 2001 yıllarında yapılacağı hükme bağlandı.

4.5.4. DFINT-3T Sisteminin Özellikleri

Bugün DFINT-3T sistemi teknik özellikleri ve kabiliyetleri göz önüne alındığında dünyanın en küçük ve en hafif kestirme sistemidir. DFINT-3T taşınabilir ve arazi koşullarında kullanılabilir bir sistem olmanın yanında sabit tesislerde, kara, deniz ve hava araçlarına monte edilmiş olarak da kullanılabilmektedir.

Tamamıyle milli olan sistem, sayısal işaret işleme teknolojisine dayalı modern bir mimariye sahiptir. Bu sayede frekans spektrumunu hızla tarayarak bir saniyeden kısa süreyle havada kalan telsiz yayınlarını dahi tespit etmekte, frekanslarını belirlemekte ve aynı zamanda yönlerini de bulabilmektedir. Koordineli çalışan başka sistemlerden otomatik olarak alınan yön bilgileri birleştirilerek yayın kaynaklarının yerleri de tespit edilebilmektedir. Bu sayede hedef koordinatları saniyeler ile ifade edilebilecek süreler içinde belirlenebilmektedir. DFINT-3T sistemini Ek 3 'de görmek mümkündür.

Teknolojik ilerlemelere paralel olarak dünyada yeni yeni kullanıma giren frekans atlamalı telsizler de DFINT-3T sistemi ile hızla tespit edilebilmekte, yön ve yerleri bulunabilmektedir.

Haberleşme sistemleri tespit edilmeyi zorlaştıracak haberleşme teknikleri kullanmaya yönelmektedir. Bunlardan biri de frekans atlamalı haberleşme tekniğidir. Frekans atlamalı telsizler yayın yaptıkları frekansı sürekli değiştirirler. Alıcı telsiz de göndermeçle eş zamanlı olarak frekansı değiştirir ve yayını alır. Dünyada kullanılan telsizler saniyede 300-400 frekans değiştirebilirken, DFINT-3T, 1000 kereden fazla frekans değiştiren yayınları bile yönleriyle tespit edebilmektedir.

DFINT-3T sisteminin tasarımında, yüksek yön doğruluğu, yüksek hassasiyet ve frekans atlamalı yayınlar da dahil yakalama yeteneği sağlayan hızlı tarama ile koordineli çalışmaya dayalı sağlıklı yer belirleme, en önemli özellikler olarak ön planda yer almıştır.

DFINT-3T taşınabilir kestirme sistemi, 20-1200 MHz bandındaki –frekans atlamalı ve burst yayınlar da dahil olmak üzere – haber yayınlarını tespit etme, kestirme (yön bulma) ve dinleme görevlerini yerine getirebilir. Sistem 2-3 kişi tarafından kurulup, işletilebilir, gerektiğinde hızla toplanıp yeri değiştirilebilir.

Sistem ile ayrıca emniyet ve istihbarat teşkilatları, telsiz yayınlarını düzenleyebilir/denetleyebilir, arama kurtarma çalışmaları, boğazlar ve su kanallarında trafik düzenlemesinde kullanılabilir. Proje yöneticisi Mehmet Böncü ayrıca kullanılan temel teknolojinin Milli monitör sistemi gibi diğer projelerde de kullanılabileceğini beyan etmiştir.

Sistemin temelinde 6 temel özellik yer aldı. Bunlar;

a. Sayısal İşaret İşleme teknolojisi ve ASELSAN ürünü DSP ve A/P Kartı

1997'de ASELSAN'da tasarımlandı. Bu kart ile, yurtdışından alınacak 2-3 kart ile gerçekleştirilebilecek görevleri, daha küçük bir hacimde, daha az bir güç ile maliyet açısından 1/5 oranında tasarruf sağlayarak yerine getirilebilir.

b. Uzaktan kullanım

Sistem kullanıcı ara yüz yazılımı PC uyumlu bir bilgisayar tarafından gerçekleştirilebilmektedir. Ana bilgisayarın kestirme alt birimleri ile bağlantısı "Ethernet" standardındaki arayüz üzerinden sağlanmaktadır. "Ethernet" bağlantısı bir konnektör ile sistemin arka panelinde de mevcuttur. Gerektiğinde bu bağlantı sayesinde dışarıdan bağlanan bir bilgisayar ile sistem işlevleri uzaktan kumanda edilebilir. Bu, kullanımda ve bakın-onarımda önemli faydalar sağladı.

c. Karbon Karışımlı Kompozit Anten Direği

Hafif olması taşınabilir için bir sistem için şarttır. Pratik kullanımlı ve hafif bir anten direği geliştirebilmek için omuzdan atılan Stinger füzelerinin namlularını üreten Barış Elektronik firması ile birlikte karbon karışımlı malzemeden bir anten direği geliştirildi. Bu, diğer direklerin %60'ı kadar ağırlıktadır. Ayrıca bu, maliyet açısından daha avantajlıdır ve bir başka malzemede daha yurtiçi kaynak yaratılmıştır.

d. Grafiksel Kullanıcı Arayüz yazılımı

Dış ortamda kullanılan kestirme sistemlerinin çoğunda ekranda küçük göstergeler kullanılmaktadır. Bu da kullanıcıya sunulan bilgileri sınırlandırır. DFINT-3T sistemi ise bilgi akışını hızlandırmak amacıyla grafik ve listelerle desteklenmiş ekran sunuşları sağlar. Bunlardan bazıları; gerçek zaman, yön-frekans, genlik frekans grafiklerinin birlikte sunulduğu BANT tarama; tek hedefin izlenebildiği veya listedeki hedeflerin hızla taranabildiği PANORAMİK spektrum ve polar yön gösterimli ADIM tarama ekranı, ve sayısal haritalı yer belirleme ekranıdır.

e. Sistem Mekanik Yapısı ve Soğutma Teknolojisi

Kestirme sistemleri içinde zor çevre koşullarında çalışabilen modeller büyük hacimli sistemlerdir ve sınırlı performans ve işlevlerle çalışırlar. DFINT-3T ise tamamen yalıtılmış bir kutu içine yerleştirilerek toz ve neme karşı gerekli önlemler alınmıştır. Soğutma için dünyada yeni gelişmekte olan ısı borusu (heat pipe) teknolojisi kullanılmıştır.

f. Kestirme Anteni

ASELSAN'ın kendi ürünüdür ve mekanik ve elektronik tüm tasarımı ASELSAN'da yapılmıştır. 20-1200 MHz bandını kapsar. Yön doğruluğu özelliklerinden hiç ödün vermeden ağırlık 1/3'üne indirilmiştir. Taşınabilir olması için antenin yekpare yapısı, katlanabilir/ayrılabilir hale getirilmiştir. 11.1 Kg. toplam ağırlığı ile benzer kestirme antenleri içinde dünyadaki en hafif antendir.

4.6. Proje Aktörleri

Proje tam anlamıyla bir Üniversite-Sanayi-Türk Kara Kuvvetleri işbirliği modelinin uygulanışıdır. Başarılı bir örnek olan DFINT-3T projesi aynı zamanda Türkiye'nin ilk Üniversite-Sanayi-Türk Kara Kuvvetleri modelidir.

Bu projede fikir, Güneydoğu Anadolu Bölgesinde yaşanan terör olaylarında görev alan ve birçok personelini teröre kurban veren Türk Kara Kuvvetlerinden çıktı. Fikrin çıkışından ürünün geliştirilmesi çalışmalarında son kullanıcı geri besleme faaliyetlerine kadar her alanda projede yer aldı. KKK aynı zamanda projenin tek alıcısı olarak görev aldı.

Ürün özelliklerinin tespiti, ASELSAN tarafından hem ihtiyaç makamı olan KKK, hem de proje ile ilgili temel araştırma görevini yapan ODTÜ ile yapılan ortak çalışmalarla ortaya kondu. Bir tarafta kullanıcının ihtiyaç ve istekleri, diğer tarafta temel araştırmalardaki

bilimsel kısıtlamalar çalışmalarda ASELSAN'ın rolünü daha önemli hale getirdi. ASELSAN bu projede milli bir kuruluş olarak köprü vazifesini yaptı. Projenin 3 temel aktörü şunlardır;

a. KKK (İstihbarat ve Muhabere Elektronik Bilgi Sistemler (MEBS) Daireleri)
b. ODTÜ Elektrik-Elektronik bölümü
c. ASELSAN ve DFINT grubu.

Projenin ana mimarı olan ASELSAN'daki proje grubunun üyeleri şunlardır;

Proje Yöneticisi :	Mehmet BÖNCÜ
Proje Yönetimi Sorumlusu:	Demet OZMAN
Sistem Mühendisliği Sorumlusu:	İsmail DÖNMÜŞ
Donanım Geliştirme Sorumlusu:	Serhat ERZİN
Yazılım Geliştirme Sorumlusu:	Baki DEMİREL
Mekanik Tasarım Sorumlusu:	Serdar YURT
Üretim Sorumlusu:	Mehmet ALPATA
Test Mühendisliği Sorumlusu:	Zafer GÜRIŞIK
Ürün Destek Sorumlusu:	Kadir BAYAR

DFINT-3T sisteminin yöne bulma algoritmaları ODTÜ Elektrik, Elektronik mühendisliği bölümünden Prof. Dr. Yalçın TANIK'ın danışmanlığında geliştirildi. Kestirme anten tasarımında ise aynı bölümden Prof. Dr. Altunkan Hızal'ın katkı ve yönlendiriciliği oldu. Ancak projenin yöneticisi olan Mehmet BÖNCÜ, DFINT-3T projesinin geliştirilebilmesinde, pazarlamasında, ve üretiminde projenin baş aktörü olmuştur.

4.7. DFINT-3T'nin Getirdikleri

4.7.1. İlk Üniversite-Sanayi-Türk Kara Kuvvetleri İşbirliği Modeli Olması

Bu, projeye çok daha büyük bir anlam kazandırmaktadır. Modelin başarısı, ileride benzer uygulamaların yaygınlığını etkileyecek ana faktördür.

Prof. Dr. Nevzat Yıldırım'a göre ASELSAN' ile yapılan proje ODTÜ Elektrik-Elektronik bölümünde mikrodalga anabilim dalında birçok değişikliğe yol açmıştır. Bu proje ile birlikte radar, mikrodalga filtreleri dersleri açılmış ve daha önce var olan çeşitli analitik ve sayısal elektromagnetik dersleri içerik değiştirmiştir. Daha önce birbirleriyle ilgisiz doğrultularda verilen mastır ve doktora tezleri bu proje ile birlikte belirli doğrultularda, birbirlerini tamamlayacak biçimlerde verilmeye başlanmıştır. Pratik tezlerde büyük nitelik

sıçraması olmuş, ASELSAN'da çalışıp mastır-doktora yapan öğrenciler, birçok gelişmiş ülke üniversitelerinde bile tümünü bir arada göremeyecekleri çeşit ve nitelikte modern cihazlarla donatılmış laboratuarlarda yüksek teknolojik bilgi seviyesine ulaşmışlardır. Hem teorik ve hem de teknolojik düzey olarak dünya ölçüsünde orijinalitesi olan tezler yapılabilmiş, bazı mastır-doktora öğrencileri de ASELSAN'da çalıştıkları konuyu teze dönüştürerek o konuya en yeni akademik gelişmeleri uyarlayabilmişlerdir.

Ayrıca MST Yazılım Mühendisliği müdürlüğünde başmühendis olan Levent Alkışlar'ın verdiği rakamlara göre "*1997 yılında ASELSAN'da iki yüzü aşkın stajyer ve 24 adet de geçici teknik eleman görev yaptı. Stajyerlik ve geçici teknik eleman uygulaması, Öğrenciler içindi ve öğrencileri, öğrencilik dönemlerinde sanayi uygulamaları açısından yetiştirmek ve mühendislik eğitimi açısından pozitif katkılar yapmak gayesiyle oluşturuldu.*" Geçici teknik eleman olarak öğrencilik dönemlerinde ASELSAN'da çalışmaya başlayan birçok ASELSAN çalışanı vardır. MST Yazılım mühendisliği bölümünde teknik lider olarak görev yapan Elif Baktır'ın da geçici teknik eleman olarak 1986 yılında bu aşamadan geçmiş olması bu modelin başarısına bir örnektir.

4.7.2. Yeni Yaratıcı Fikir, Teknoloji Ve Yöntemlere Yol Açması

Kapalı mekanlarda işletilmek için geliştirilmiş ve oldukça yetenekli kestirme sistem özelliklerinden ödün vermeden, taşınabilir, dış ortamda zor çevre koşullarında kullanılabilir, kolay kurulup toplanabilir, az güç harcayan bir sistemin geliştirilmesi doğal olarak pek çok yaratıcı fikir ve yeni teknoloji kullanımını zorunlu kıldı. Bunlar; Sayısal işaret işleme teknolojisi ve ASELSAN ürünü ASP ve A/D kartı., Grafiksel kullanıcı arayüz yazılımı, sistem mekanik yapısı ve soğutma teknolojisi, kestirme anteni, uzaktan kullanım, ve karbon karışımlı kompozit anten direğidir.

4.7.3. Yeni Fikir ve Teknolojilerin Yeni Pazar Oluşturmadaki Etkinliği

DFINT-3T, küçük boyut ve ağılığı olmasına karşın kestirme yeteneğinden ödün vermemesi, pazarlama açısından en önemli gücü oluşturmaktadır. Potansiyel kullanıcılar doğal olarak yetenekli buldukları en küçük sistemi tercih etmektedirler.

Sistemin zor çevre şartlarına uygun, şok ve vibrasyona karşı dayanıklı olması taşınabilir ve araca monteli uygulamalarda Pazar şansını artırmaktadır. Sistem mekanik yapısının sızdırmaz şekilde tasarlanması da toz ve nemin problem olduğu özellikle tropik iklime sahip ülkelerde pazar şansını artırmaktadır.

Kestirmenin dışında hedef koordinatlarını saniyeler içinde tespit edebildiğinden istihbarat açısından kolaylık sağlamaktadır. Bu da Pazar şansını artıran diğer bir etkendir.

Yeni pazarlar için "bilgi üretimi" ve "bilgi yayılımı" kavramlarının uygulanıyor olması gerekmektedir. Prof. Dr. Nevzat Yıldırım'a göre; *"Bu projeye kadar bu kavramlar kafalarda "muğlak" kavramlardı. Araştırmalar sadece akademik dürtü ve amaçlarla yapılıyor ve "herhalde birileri bunları kullanır" diye düşünülüyordu. Yani "bilim için bilim" yaklaşımı ağır basıyordu. Bu projede bilgi üretimi ve yayılımının ne olduğu ve nasıl olduğu görüldü. ASELSAN'da çalışan birinin yaptığı tezin oradaki birçok çalışanın bilgi ve tecrübe düzeyini yükseltmiş, niteliklerini artırmıştı. Tek tek hiçbir iş üretemeyen akademisyen, araştırmacı ve öğrenci bu tür bir takım çalışmasıyla üretken olabileceği, akademik bilginin ülke yararına endüstriyel ürüne dönüşeceği görüldü."*

Tüm bu gelişmelerin, DFINT-3T sisteminin yeni pazarlarda başarılı olmasında, birçok olumlu etkisinin olacağı değerlendirilmektedir.

4.7.4. Bakım Ve Servis Kolaylığı

Sistem bilgisayar kontrollü bir sistem olması dolayısıyla kendi kendini test etme özelliğine sahiptir. Elektronik harp ve istihbarat sistemleri genellikle büyük ve ağır sistemlerdir. Bu sistemlerin bakım ve onarımı önemli problemler teşkil etmiştir. DFINT-3T 'nin boyutları bakım onarımda ve nakliyelerde doğal bir kolaylık sağlamaktadır.

Sistem su yalıtımlı bir mekanik yapıya sahiptir. Bu tür cihazlarda, genellikle bir kere açıldığında yenilenmesi gereken tipte yalıtımlardan kaçınıldı, contalı ve tekrar tekrar açıp kapamaya uygun mekanik yapılar tercih edildi.

Gerektiğinde dışarıdan bağlanan bir bilgisayar ile sistem kullanıcı arayüz yazılımı çalıştırılabilmektedir. Bu sayede, hem sistem bu bilgisayar üzerinden ve gerekirse kablo ile uzatılarak uzaktan kullanılabilmekte ve kendi kendini test işlemi dışarıdan yapılabilmektedir. Telefon hatları üzerinden sistemi kullanmak, test etmek ve yazılım yüklemek için gerekli altyapı hazırdır.

4.7.5. Benzer Sistemler İçin Altyapı Oluşturması

DFINT-3T sistemi yeni fikir ve teknolojilerin gelişimine katkıda bulunduğu gibi halen yürütülmekte olan birçok projeye de nüve teşkil etmektedir.

Ulaştırma Bakanlığı tarafından yürütülen Milli Monitör projesi ile sınır güvenliği için oluşturulacak projede DFINT-3T için geliştirilen teknolojiler temel olarak kullanılacaktır. Bu projeler onlarca Milyon $ seviyesindedir. Bu durum maddi olarak da ASELSAN ve Türkiye açısından sevindiricidir.

4.7.6. Tasarımın Özgünlüğü

DFINT-3T yazılımı ve donanımı ile tamamen ASELSAN ürünü bir sistemdir. İçinde yurtdışı kaynaklı bazı modül ve malzemeler olsa da gerektiğinde alternatifleri ile değiştirmek mümkündür.

Sistemin yazılımı ve kestirme anteni tamamen millidir. Ayrıca bu boyutlarda ve ağırlıkta olması sınıfı içinde sisteme ayrı bir özellik katmaktadır.

Taşınabilir olan, frekans atlamalı yayınları tespit edip yön ve yerlerini bulabilen dünyadaki ilk sistem olması, sistemin özgünlüğünü gösteren diğer özellikleridir.

4.7.7. Kullanıcıya Getirdikleri

En önemli kolaylık taşınabilir olmasıdır. Ancak taşınabilir olması için sistem özelliklerinden feragat edilmemiştir. Anten taşınabilirdir. Bu, taktik kullanım için önemlidir. Sistemin mekanik yapısı açık arazinin zor şartlarında kullanıma olanak vermektedir. Hedef yayın, havada 1 saniyeden daha az süre kalsa bile ve frekans atlamalı olsa dahi tespit edilebilmektedir.

Sistem ayrıca araca monte edilebilmekte ve helikopterle taşınabilmektedir. Kullanıcı arayüzü "kullanıcı dostu" prensibini göz önünde tutarak tasarlanmıştır. Kullanıcıdan gelen geri beslemelerle sistem devamlı yenilenmektedir.

4.7.8. Ticari Başarısı

Yurtiçinde V/UHF haberleşme kestirme sistemleri konusunda, son birkaç yıldır ASELSAN, Pazar payının hemen hemen tamamına yakınına sahip durumdadır. 1998 yılı içerisinde Ulaştırma Bakanlığı'na bağlı Telsiz genel Müdürlüğü' nün Milli Monitör sistemi ihalesini ASELSAN kazanmıştır. Milli Monitör sisteminde DFINT-3T sisteminin bir türevi kullanılacaktır.

Yurtdışındaki ihalelere ilk defa Mart 1999'da girilmiştir ve İsrail'den 2, Fransa, Almanya, ve ABD'nden birer, 5 firmanın 6 ürünü ile birlikte katıldığı ihalede en düşük ikinci fiyatı

ASELSAN vermiştir. Ancak ihalede en düşük fiyatı veren firmaya göre tropikal iklimde kullanabilme özelliği DFINT-3T'de daha iyidir.

4.7.9. DFINT-3T Projesinin Önerilen Model ile Karşılaştırılması

Tezde önerilen modelde işbirliği öncesi yapılması gereken faaliyetler vardır. Bu yapılması gereken faaliyetler, tezin 4. Bölümünde Hedef Yönlendirmeli Proje Yönetimi Metodolojisi (GDPM) ile ele alınmıştır. Bunlardan ilki projenin sahibi olan Milli Savunma Bakanlığı tarafından yapılması gereken bir faaliyet olarak bu projede çalışacak olan proje üyelerinin ve proje yöneticisinin seçilmesidir. Türk Silahlı Kuvvetleri'nde (TSK) ve Savunma Sanayi alanında proje yönetimi kavramı uygulanıyor olmasına rağmen, TSK'nin yapısından kaynaklanan, proje üyelerinin projenin hayatı boyunca devamını sağlayamama gibi problemlerden dolayı istenen verim elde edilememektedir. DFINT-3T projesinde de başlangıçta proje üyesi olan kişiler, daha sonra başka görev yerlerine atandıklarından dolayı, azami verim elde edilememiştir.

İşbirliği öncesi yapılması gereken ve proje takımının yapması gereken çeşitli faaliyetler vardır. Bu faaliyetler, birbirleriyle eş zamanlı olarak yürütülebilecekleri gibi aşağıda belirtilen sıra ile de yürütülebilir. Önemli olan, hedef yönlendirmeli proje yönetimi metodolojisinde belirtildiği gibi bilgi, insan, sistem, organizasyon konusundaki gelişmelerin proje boyunca birlikte geliştirilmesini sağlamaktır. Bu sağlamadığı taktirde projenin bir tarafı eksik olacak ve başarı sağlanamayacaktır.

İlk faaliyet "Üniversite-Sanayi-Türk Kara Kuvvetleri İşbirliği" modelinin yasal mevzuat altyapısını oluşturmaktır. Bu, aynı zamanda, Hedef yönlendirmeli proje yönetimi metodolojinin *"sistem"* boyutunda yapılması gereken faaliyetleri kapsar. Türkiye'de bugün böyle bir işbirliği modeli için uygulanabilecek bir yasal mevzuat hazır değildir. Farklı kanun, tüzük, yönetmelik ve talimnamelerde böyle bir işbirliğinin olması gerektiği devamlı yer almasına rağmen, bu konuda kesin çerçeveyi çizecek bir yasal mevzuat hazır değildir. DFINT-3T projesi de, böyle bir altyapıdan yoksun olarak başlamıştır ve devam etmektedir. Mevzuatın var ve uygulanıyor olması, tarafların projeye katılımlarını ve projenin başarısını artıracaktır.

Yasal mevzuatın oluşturulmasını müteakip, proje üyelerinin bilgi paylaşma ve bilgi transfer kabiliyetlerini artırma aşaması gelmektedir. Bu, Hedef yönlendirmeli proje yönetimi metodolojisine Öner ve Başoğlu'nun (1999) yaptıkları katkı olan *"bilgi"* boyutu

içinde edinilmesi gereken bir yetenektir. Bilgi boyutu, projenin amaçlarına ulaşabilmesi için gerekli olan faaliyetleri kapsar. Eğer proje üyeleri, bilgi paylaşımı ve transferi konusunda bir *"ortak vizyon"* a sahiplerse projenin başarılı olması çok daha kolay hale gelecektir. DFINT-3T projesinde proje üyelerinin bilgi paylaşımı ve transferi becerilerinin –proje başarılı olduğundan dolayı- yüksek olduğu düşünülmektedir. Ancak bu kabiliyetlerin her proje için bir arada olması mümkün gözükmemektedir. Önemli olan bu tür işbirliğinde benzer başarının gösterilmesidir. Benzer başarının gösterilmesi için de katılımcıların bu yeteneklerinin daha projenin başında geliştirilmesi gerekmektedir.

İşbirliği öncesi yapılması gereken en son faaliyet, hedef yönlendirmeli proje yönetimi metodolojisinin *"insan"* boyutunu oluşturan hedef yönlendirmeli proje yönetimi metodolojisinin proje üyeleri ve tarafları için ortak bir metodoloji olarak ele alınması ve geliştirmesidir. İnsan boyutu projenin insanda meydana getireceği katkıları ele alır. Eğer proje üyeleri bu metodolojiyi "ortak bir metodoloji" olarak benimserlerse, projenin başarısının artacağı düşünülmektedir. DFINT-3T projesinde proje yönetimi anlayışına uygun hareket edildiği tam olarak söylenemez. Taraflar, işbirliği mevzuatının da olmaması sebebiyle, ortak zeminlerde, tam katılımının sağlandığı bir ortak çalışma imkanı bulamamışlardır. Bu tür proje çalışmaları öncesinde, proje üyelerine bu metodolojinin kazandırılması başarıyı artıracaktır.

Geri besleme ve kalite çalışmaları, belirtilen tüm proje faaliyetleri boyunca yapılması gereken faaliyetlerdir.

İşbirliği sırasında yapılması gereken faaliyetler, aynı zamanda hedef yönlendirmeli proje yönetimi metodolojisinin *"organizasyon"* boyutunu temsil etmektedir. Bu faaliyetler tezin 3. Bölümünde *"Önerilen İşbirliği Modeli"* başlığı altında incelenmiştir. Buna göre, aşamalar şunlardır:

1. "Milli Olması Zorunlu", "Kritik" ve "Diğer" teknolojilerin belirlenmesi,
2. Stratejik Hedef Planının yapılması,
3. OYTEP'in hazırlanması,
4. Teknoloji panellerinin oluşturulması,
5. En uygun proje ortağının seçilmesi,
6. Amaçların belirlenmesi,
7. Ölçülerin belirlenmesi,
8. Ödül sisteminin belirlenmesi,

9. Maliyet ve risk analizinin yapılması,
10. Proje Takvim ve Kaynak dağıtım planlarının hazırlanması ve,
11. Projenin uygulamaya konması.

En uygun proje ortağının seçilmesine kadar olan aşama, tüm projeler için ortak faaliyetlerdir. Spesifik olarak her proje için ayrı olarak yapılmaz. Ancak, en uygun ortağın seçilmesi aşamasından itibaren aşamalar her proje için farklılık gösterir.

DFINT-3T projesi için ele alınacak olursa, *"En uygun ortak kimdir ?"* sorusunun cevabı, üç ortağı da ilgilendirir. Kara Kuvvetlerini, sahip olmak istediği sistem için birlikte çalışacağı ortakların seçilmesi konusu ilgilendirir. Buna göre, kestirme sistemi için üretici olarak en uygun ortak ASELSAN' dır. Hem milli bir firma olarak Türkiye'nin tercihlerine uygundur, hem de kestirme sistemleri konusunda sadece Türkiye'de değil dünyada da söz sahibi konuma gelmiştir. Üniversite olarak da 20 yılı aşkın bir süredir, ASELSAN ile işbirliği yaparak, kestirme sistemleri konusunda uzmanlaşan, hatta ders programlarını bile buna göre düzenleyen ODTÜ Elektrik-Elektronik Mühendisliği Bölümü en iyi ortak olarak görünmektedir. Yani, DFINT-3T projesi için ortakların seçilmesi konusunda problem yaşanmamıştır. Ancak, burada dikkati çeken en önemli husus, uygulanacak diğer projelerde, hangi "Savunma Sanayi Firması'nın", ve hangi "Üniversitenin" ne tür yeteneklere, AR-GE kapasitesine, beyin gücüne ve imkan ve kabiliyete sahip olduğu sorusuna verilecek cevaptır. Böyle bir cevabın verilebilmesi için bu yeteneklerin ortaya çıkarılması gerekmektedir. Bu faaliyet yapıldıktan sonra, ancak, "En uygun ortak kimdir?" sorusunun cevabı kolaylaşacaktır.

Projenin amaçlarını, ölçüleri, ödül sistemini, ve takvim/kaynak dağıtım planlarını hazırlayabilmek için tarafların aynı mekanda sık sık bir araya gelerek çalışma zorunlulukları vardır. Ancak, ASELSAN projede bir köprü vazifesi gördüğü için hem Kara Kuvvetleriyle ve hem de ODTÜ ile işbirliğini tek elden yürütmeye çalışmıştır. Bu da akademisyen bakış açısıyla, son kullanıcı bakış açısının aynı çatı altında tartışılmasını engellemiştir. Yukarıda bahsedilen dört aşama da ancak, ASELSAN tarafından taraflarla yapılan görüşmelerden çıkarılmıştır. Halbuki önerilen modelde uygulansa idi tarafların katılımı, projeyi sahiplenmeyi ve başarıyı daha da artıracaktı.

Sonuç olarak, DFINT-3T projesinde önerilen model çok iyi uygulanmamış olsa da, tarafların özverili çalışması neticesinde başarıya ulaşılmıştır. Ancak bu demek değildir ki,

her benzer projede aynı başarı sağlanacaktır. Benzer başarıların sağlanması, ancak işbirliği için önerilen sürecin uygulanmasıyla mümkün olacaktır.

4.8. DFINT-3T Projesindeki Aksaklıklar

Proje yöneticisi Mehmet Böncü'ye göre en büyük aksaklık olarak ilk ihale süresinin KKK tarafından 12 ay olarak belirlenmesiyle yaşanmıştır. Sürenin azlığı sebebiyle tasarım aşaması hızlı geçilmiş, ve hatta prototip üretilmeden üretime geçilmiştir. Bu, hem mali olarak üretici firmayı, hem de kalite olarak KKK. lığını etkilemiştir. Ancak daha sonra yapılan kapsamlı yenileştirmeler ile ilk aksaklıklar giderilmiştir. Tabii ki KKK. lığının ihaleyi 12 ay gibi kısa bir zaman olarak belirlenmesinin en büyük sebebi Güneydoğu Anadolu bölgesindeki yaşanan terör olaylarının o dönemde had safhada olmasıdır. Ancak bundan sonraki uygulamalarda bu husus dikkate alınmalı ve aynı hataya düşülmemelidir.

Ayrıca, ihale sahibi olarak KKK. lığı, üretici olarak ASELSAN, temel araştırma ve temel araştırma danışmanı olarak ODTÜ elektrik-elektronik bölümü ürünün daha tasarım aşamasında bir araya gelmeleri gerekirdi. Ancak bu, mümkün olmamış, ODTÜ-ASELSAN, ve ASELSAN-KKK ilişkileri ile proje yönlendirilmeye çalışılmıştır. Bundan sonraki uygulamalarda yine ürünün tasarım özellikleri ortaya konurken bu üç taraf da aynı masanın etrafında bir arada olmalıdırlar.

4.9. Sonuç

Halen DFINT-3T sistemi aynen veya türevleri ile ASELSAN'ın üstlendiği birçok istihbarat/elektronik harp/komuta kontrol projesinde önemli bir unsur olarak yer almaktadır. Yurtdışında da Pakistan, Sri Lanka, Malezya, Bosna-Hersek, Azerbaycan ve Mısır ile uluslar arası pazarlama yapan Alman, İsrail, İngiliz ve Amerikan şirketleri sistem ile ilgilenmektedirler.

Şu ana kadar sistemin satışları 10 Milyon$'a ulaşmıştır ve proje yöneticisi Mehmet Böncü'ye göre bu rakamın önümüzdeki 2 yıllık dönemde en az iki katı kadar artacağı öngörülmektedir.

Benzer uygulamalar ile Üniversite-Sanayi-Türk Kara Kuvvetleri işbirliği modelleri geliştirilmeli, hem fiyat, hem kalite ve hem de zaman olarak en iyiyi yakalayabilmek için ortak çalışma kanunları ve yönerge/yönetmelikleri çıkarılmalıdır. Böylece maliyetler paylaşıldığı gibi aynı zamanda daha kaliteli ürünü, daha kısa zamanda elde etme imkanı doğacaktır.

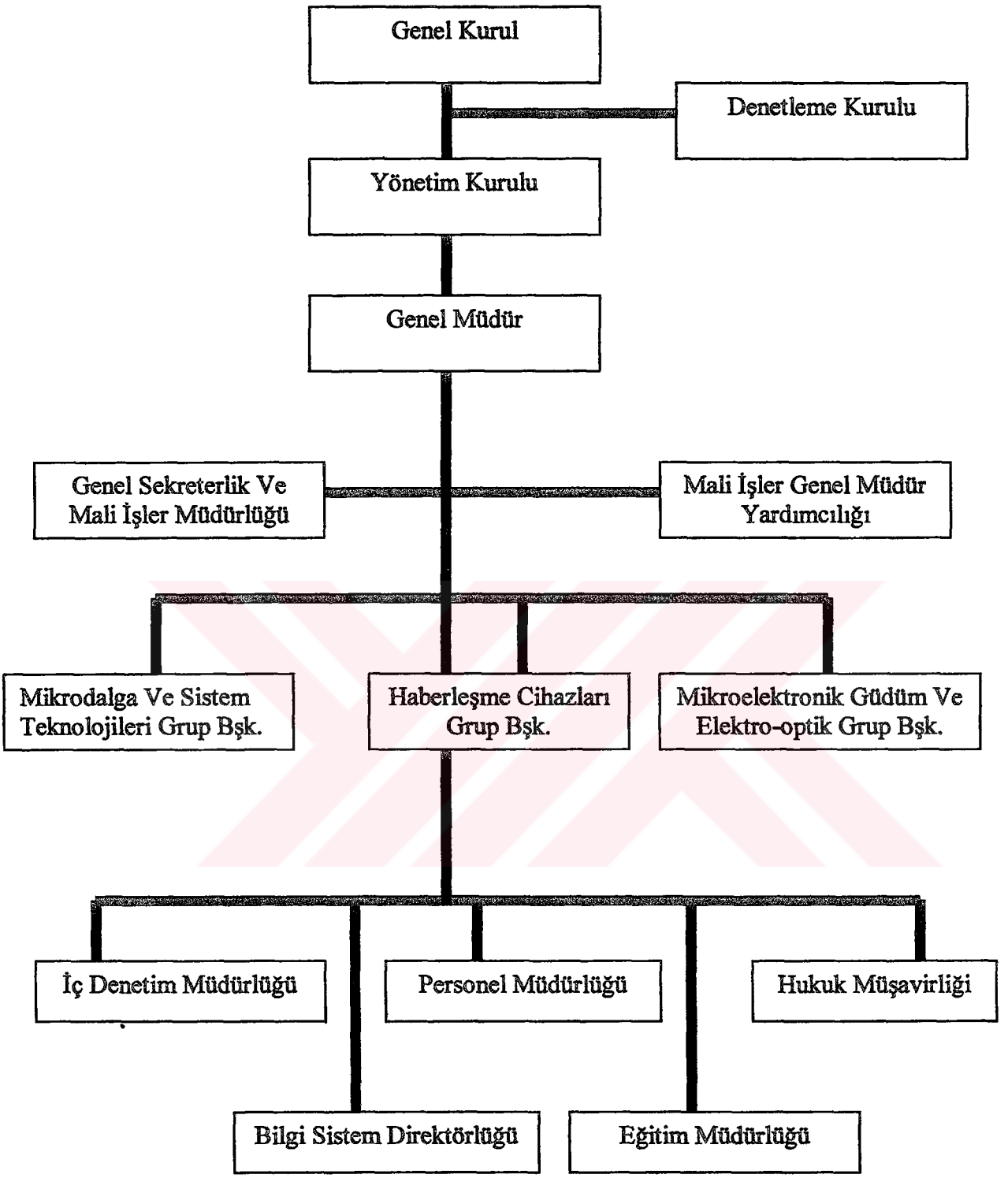
Ek 1.a. ASELSAN'ın Profesyonel Ürünleri

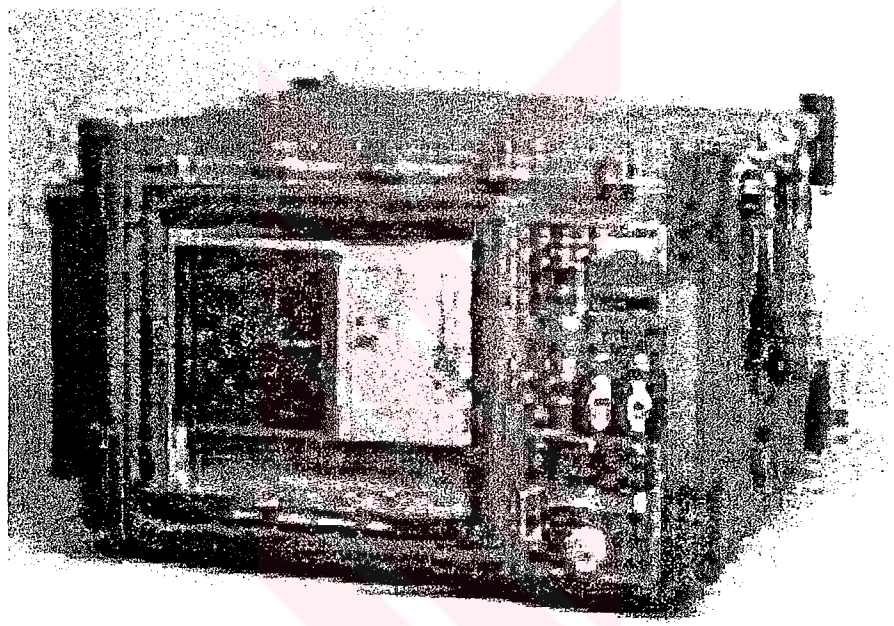
Profesyonel Telsiz Haberleşme Sistemleri	Sentezörlü telsiz aileleri
	Trunk telsiz aileleri
	Özel haberleşme sistemleri
	GSM cep telefonu
	TV-Radyo Aktarıcı/Verici cihazları
Merkezi Bilgisayar Kontrollü Uyarı Sistemleri	Otoyol acil yardım haberleşme sistemi
	Otoyol ücret toplama sistemleri
	Diğer merkezi uyarı ve alarm sistemleri
Diğer Profesyonel Ürünler	Elektronik sayaç
	Ses şifreleme cihazları
	Anons ve siren sistemleri

Ek 1.b. ASELSAN'ın Askeri Ürünleri

Askeri Telsiz Sistemleri	VHF/FM taktik telsiz ailesi
	VHF/FM frekans atlamalı telsiz ailesi
	VHF-UHF/FM hava yer telsizleri
Elektronik Harp ve Radar Sistemleri	Kestirme/dinleme/karıştırma sistemleri
	Kara gözetleme radarı
	Topçu meteoroloji sistemi
Komuta Kontrol ve Topçu Atış Sistemleri	Batarya atış idare kompüter sistemi
	Veri terminalleri
	Taktik ve stratejik haberleşme sistemleri
	Kısa menzilli mobil silah sistemleri
	Elektronik ihtiraklı tapalar
Elektro-optik Ürünler	Termal kamera sistemi
	Pasif gece görüş cihazı
	Gece-gündüz termal görüş sistemleri
	Lazer mesafe ölçme cihazları
	Gündüz görüş periskopları
Güdüm ve Seyrüsefer Sistemleri	STINGER füzesi güdüm elektroniği (mikroelektronik hibrid devreler)
	F-16 uçakları INS sistemleri
Diğer Askeri Ürünler	Sahra telefonu
	NATO ortak araştırma projeleri
	Kripto cihazları

Ek 2 ASELSAN'ın Organizasyon Şeması





Ek 3: DFINT-3T Sistemi

COLLABORATION TYPES

1. Infrastructure

Chang et al. (1999, pp.59-72) described six different types of collaboration as given below:

1. Leasing out facilities and assets: Leasing out facilities such as laboratory space and other assets such as R&D equipment is highly likely to be feasible with respect to legality, acceptance, and attractiveness. This idea would involve a private firm renting laboratory facilities or equipment that is not to be used by the Army during the lease period. The Army simply collects a fee and turns over the leased facility or equipment to the renter, and the renting firm conducts its business without interaction with the Army.
2. Fee for use of services and facilities: In this scheme the Army can perform the service and charge a fee for its services and use of equipment on a per-use basis and let the user operate the equipment.
3. Joint ownership of non-critical assets: Involves the Army and a private party both owning the infrastructure item. The Army may use the item exclusively and pay its partner a fee, or the private party may use it and pay the Army a fee.
4. Joint employees: An employee works part time for the Army and part time for a private firm. It is difficult to accept but it can reduce personnel costs. This kind of employee arrangement might also allow the Army to influence technology early if the joint employees facilitate communication between the Army and private-sector scientists.
5. Timesharing of facilities or equipment: Where the Army uses the asset during part of each day, week, month, or year and the private party use it during the other times.
6. Co-Use of Army laboratories / R&D assets: Army shares the use of its facilities with a private firm. The private firm pays the Army a fee, and the employees of both the Army and private firm work side by side, using the same equipment and facilities to perform their tasks.

2. Intellectual Property

Includes 8 types of collaboration.

1. Third party with established programs: Proactive efforts to identify Army research goals that intersect DARPA, SBIR, (small business innovation research; for Turkey KOSGEB) and other established programs may be an approach that will allow the army to gain partial funding of some of its research. This scheme could help reduce the Army's cost of research in multi use technologies. The Army may also benefit by influencing the technology early and be able to buy the quantities and versions it needs at lower prices. Lower prices may be possible because the production costs for the Army's buy could be reduced by the larger production volume of commercial versions of the products.
2. Design modularly for retrofit or cost: Designing modularly with retrofit in mind does not require a Public-Private Partnership, but the process is likely to be more efficient if the Army makes this requirement known early in the R&D process, and a partnering arrangement could facilitate communications about Army expectations and the developing partner's views. By using this practice the Army can not only reduce the cost of the version it needs, it may also be able to influence the technology early enough to allow for lower-cost upgrading in the future.
3. Design with lower-cost substitute, or design for cost: This idea is included as a partnership because for it to work and be acceptable to the Army, the Army must work very closely with a private-party developer to ensure that all Army requirements are met and that the resulting product is not inferior in performance or reliability. The Army would have to make its requirements known early in the R&D phase. This early involvement might lead to an additional price decrease due to production costs that are lowered by the higher production volume of commercial versions of a dual-use product.
4. Other transactions joint venture: An other transaction joint venture (OTJV) is an agreement between the Army and a private firm that takes full advantage of the cost sharing and return-on-investment provisions allowed in other transactions agreements. Such an OTJV entity might allow both parties to contribute funds and expertise while a separate management unit is created for the OTJV operation. Both parties would monitor the management unit, and Army participation in the research may be negotiated along with terms for Army sharing in future profits, revenues, or equity in any spin-off unit as a passive investor. The Army could also choose to receive a portion of its return in free or discounted products. For example, if an OTJV results in a dual-

use product, the Army can choose to receive one free unit for every hundredth unit sold commercially, up to the number that the Army needs.

5. Army equity fund: Under this concept, the Army invests a small portion of its R&D funds as a cornerstone limited partner in an equity fund chartered to develop Army and dual-use products and services. As a cornerstone limited partner, the Army helps attract other limited partners who provide the majority of the fund's capital.
6. Leasing technology with option to buy: Leasing technology can help decrease Army outlays for technology.
7. Research fund: This is an idea of collecting R&D contributions from private firms and combining the money in a large research fund. Then distribute the money to fund research in dual-use technologies. One potential benefit to the Army is likely to be the ability to influence the technologies early in their R&D phases.
8. Incubator arrangement: Is a venture in which the Army contributes a facility such as a research center and, perhaps, some infrastructure-support services such as secretarial assistance. Startup firms doing R&D in dual-use areas may use the facility and services, and in return the Army receives equity in the companies.

3. Financial Arrangement

Includes 10 types of collaboration as given below:

1. Negotiate discount: For some purchases, it may be possible and appropriate for the Army to negotiate discount.
2. Negotiate exchange privileges: Exchange privileges may be appropriate for some of the equipment that the Army purchases. This practice may allow for expedient replacement of detective or ineffective equipment at lower cost.
3. Nontraditional cost sharing: The Army has traditionally used money, personnel, and physical assets such as facilities as mean for in-kind cost sharing. In some cases, other items may be appropriate. Options might include equity, future discounting, and percentage of sales, free merchandise, complementary services, credit and shares in intellectual property ownership.
4. Auctions: There are many instances when the Army disposes of unneeded equipment by giving it away. An alternate means of disposing of unneeded equipment might be to auction it. This means is likely to be legal, acceptable, and attractive. It might also generate a small amount of revenue for the Army.

5. Army affinity credit card: Is a credit card that provides usage rewards for cardholders and card sponsors. The rewards can take the form of frequent flyer miles, discount on purchases, accumulation of bonus money, or funding for specific groups. The rewards can be split between the cardholder and the affinity group named on the card.
6. Purchasing rights: Is a provision placed into an agreement between the Army and a commercial firm from which the Army is planning to buy products. For example, the Army may wish to provide a priori purchasing agreements with a vendor as an incentive to build a product needed by the Army. Another use is for the Army to use purchasing rights to allow it to buy certain products at predetermined prices before the products are released for public sale.
7. Project finance: Is a very specialized debt arrangement. A loan is arranged to finance a specific project. The security for the loan is the project itself. This concept could allow the Army to undertake projects that will eventually bring a monetary return without investing any of its own funds.
8. Army information broker service: The Army owns the databases and patents, some of which may have commercial value. Under an Army information broker service, Army owned patents, test data, human test data, psychological profile data, and other such items are made available to commercial users for a fee.
9. Army loan program: The Army could create small-loans programs for its members. The main purpose of such a program would be to provide a loan option for Army members. One possible arrangement would be for the Army to enter into an agreement with a commercial lending institution. The institution would provide the funds for the loans and the Army would provide the customers.
10. Army real estate investment trust: Combines a number of notions and can be set up in a variety of ways. One possible implementation would be to view all the land and facilities that the Army leases out as a package, called a real estate trust. The trust can then be used to raise money from the financial markets. The commercial equivalent of this idea would be real estate investment trusts that are made up of shopping centers located in different areas but owned by a single owner. Such a trust is traded as a security on a stock exchange and could generate income to shareholders. (Chang et al., 1999, pp. 59-72)

TYPES OF COLLABORATION IN DIFFERENT LEVELS

Table-APP-C1: Financial Type of Collaboration

	University Industry Coll.	Army Industry Coll.	Army University Coll.	University Industry Army Coll.
Leasing out facilities and assets		*		
Joint employees		*		
Timesharing of facilities or equipment		*		
Third party with established programs		*		
Design modularly for retrofit or cost		*		
Design with lower-cost substitute, or design for cost		*		
Other transactions joint venture		*		
Army equity fund		*		
Leasing the technology with option to buy		*		
Research fund		*		
Incubator arrangement		*		
Negotiate discount		*		
Negotiate exchange privileges		*		
Nontraditional cost sharing		*		
Auctions		*		
Army affinity credit card		*		
Project finance		*		
Purchasing rights		*		
Army information broker service		*		
Army loan program		*		
Army real estate investment trust		*		

Table-APP-C2: Training type of Collaboration

	University Industry Coll.	Army Industry Coll.	Army University Coll.	University Industry Army Coll.
Graduate / Post graduate education	*		*	*
Training	*	*	*	*
Continuing education courses	*		*	*
Officer training		*	*	*
Technical Seminars	*	*	*	*
Conferences	*	*	*	*

Table-APP-C3: Co-research and Co-production type of Collaboration

	University Industry Coll.	Army Industry Coll.	Army University Coll.	University Industry Army Coll.
Collaborative research	*	*	*	*
Research Support	*	*	*	*
Alliances	*	*	*	*
Contract Research	*	*	*	*
Consortia				*
Teaming	*	*	*	*
Technology licensing	*	*	*	*

Table-APP-C4: Sharing Source Type of Collaboration

	University Industry Coll.	Army Industry Coll.	Army University Coll.	University Industry Army Coll.
Technology Transfer	*	*	*	*
Data and scientist/engineer exchange	*	*	*	*
Knowledge Transfer	*	*	*	*
Exchange of research materials	*	*	*	*

Table-APP-C5: Other Type of Collaboration

	University Industry Coll.	Army Industry Coll.	Army University Coll.	University Industry Army Coll.
Expert consultancy and Investigation	*		*	*
Subcontracting		*		
Research Report	*			*
Literature/Patent inquires	*		*	*
Short term collaboration	*	*	*	*

SSM BÜNYESİNDE YÜRÜTÜLEN AR&GE FAALİYETLERİ VE ÖNERİLER

(Kaya, 1995)

Table-APP-D1: Devlet-Üniversite İşbirliği

Proje Adı	Yürütücü kuruluş	Süresi	Finans desteği	Teknolojik alanlar
Bitmiş Projeler				
Bor karbür esaslı zırh malzemesi üretimi	İTÜ Metalürji Fakültesi	24 ay	765.000 $	Malzeme
Silisyum karbür esaslı seramik malzeme üretimi	ODTÜ Metalürji Mühendisliği Bölümü	24 ay	530.000 $	Malzeme
Sıvı yakıtlı ramjet motoru geliştirme projesi	ODTÜ Havacılık Mühendisliği Bölümü	24 ay	235.000 $	Havacılık
Ulusal savunma sistemleri için yazılım ve donanım desteği geliştirme projesi	Boğaziçi Üniversitesi Elektrik Elektronik Mühendisliği Bölümü	34 ay	738.287 $	Yazılım
Milimetrik dalga elektronik harp projesi	ODTÜ Elektrik Elektronik Mühendisliği Bölümü	42 ay	1.098.077 $	Elektronik
Alaşım yarı iletken teknolojileri araştırma merkezi	Bilkent Üniversitesi Fizik Mühendisliği Bölümü	36 ay	3.100.000 $	Elektronik
Uzun Ufuk Projesi (1. Etap)	TUBITAK / MAM	16 ay	550.333 $	Yazılım/ Simülasyon
Devam Eden Projeler				
Kısa ve orta menzilli füze teknolojisi oluşturma projesi	TUBITAK / SAGE	54 ay	2.598.000 $	Roket/Füze
Uzun ufuk projesi	ITU/SAM	24 ay	1.850.000 $	Yazılım / Simülasyon
TSK Otomatik komuta kontrol bilgi sistemi	ITU/SAM	15 ay	757.728 $	Komuta-kontrol ve ileri gözetleme

Table-AAP-D2: Devlet-Sanayi İşbirliği

Proje Adı	Yürütücü kuruluş	Süresi	Finans desteği	Teknolojik alanlar
Bitmiş Projeler				
PRC/VRC 9600 VHF/FM Frekans atlamalı telsiz ailesi geliştirme projesi	ASELSAN	60 ay	2.093.529 $	Elektronik
PCTE+(Taşınabilir ortak gereçler ortamı) projesi	STFA-SAVRONIK	40 ay	419.400 $	Yazılım
İnsansız hava aracı (UAV-X1) projesi	TAI	24 ay	828.500 $	Havacılık
Devam Eden Projeler				
GÜFTAG güdümlü füze tasarım altyapısı geliştirme projesi	ROKETSAN	36 ay	1.850.000 $	Roket/Füze

QUESTIONNAIRE

(A. Tishler, D.Dvir, A.Shenhar, S. Lipotevsky; Technological forecasting and social change, 51, 1996, pp. 151-171)

Table-APP-E1: Questions

Meeting Design Goals	• Functional specifications • Technical specifications • Schedule goals • Budget goals
Benefits to End-User	• Meeting acquisition goals • Meeting the operations needs • Product entered service • Reached the end user on time • Product had a substantial time for use • Product yields substantial improvement in user's operational level • User is satisfied with product
Benefits to developing organization	• Project yielded relatively high product • Project opened new markets • Project created a new product line • Project developed a new technological capability • Project improved reputation
Potential benefit to the defense and national infrastructure	• Project developed a new technological capability • Project contributed critical subjects • Project maintains a flow of updated generations • Project decreases dependence on outside sources • Contribution to other projects

LÜTFEN AŞAĞIDAKİ SORULARA SİZE UYGUN OLAN CEVAPLARI VERİNİZ VE SİZE GÖRE UYGUN OLAN RAKAMI İŞARETLEYİNİZ. (1 EN AZ UYGUNLUĞU, 6 EN ÇOK UYGUNLUĞU İFADE ETMEKTEDİR)

(PROJENİN TASARIM AŞAMASINDAKİ HEDEFLERİNE UYGUNLUĞU)

1. DFINT-3T Taşınabilir telsiz kestirme cihazı projesi fonksiyonel özellikleri bakımından tasarım aşamasındaki hedeflere uygundur.

(1) (2) (3) (4) (5) (6)

2. DFINT-3T sisteminin teknik özellikleri tasarım aşamasında belirlenen hedeflere uygundur.

(1) (2) (3) (4) (5) (6)

3. DFINT-3T sistemini üretirken proje takvimine riayet edilmiştir.

(1) (2) (3) (4) (5) (6)

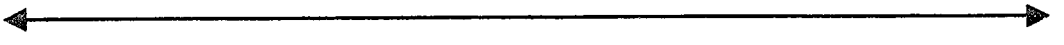
4. DFINT-3T sisteminin üretiminde tasarım aşamasındaki maliyetler aşılmamıştır.

(1) (2) (3) (4) (5) (6)

(PROJENİN SON KULLANICIYA FAYDALARI)

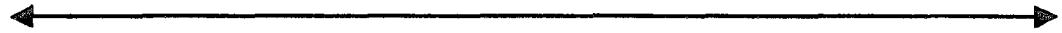
5. DFINT-3T sistemi son kullanıcının satın alma hedeflerine uygundur.

(1) (2) (3) (4) (5) (6)



6. DFINT-3T sistemi son kullanıcı açısından operasyonel ihtiyaca uygundur.

(1) (2) (3) (4) (5) (6)



7. DFINT-3T sistemi hizmete girdi.

(1) (2) (3) (4) (5) (6)

8. DFINT-3T sisteminin son kullanıcıya teslim zamanında problem yoktur.

(1) (2) (3) (4) (5) (6)

9. DFINT-3T sisteminin kullanım ömrü yüksek.

(1) (2) (3) (4) (5) (6)

10. DFINT-3T sistemi kullanıcının operasyonel seviyesinin gelişiminde önemli katkı yapmaktadır.

(1) (2) (3) (4) (5) (6)

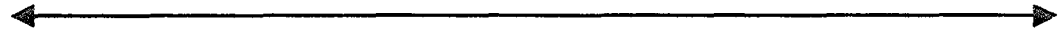
11. DFINT-3T sistemini kullananlar üründen memnundurlar.

(1) (2) (3) (4) (5) (6)

(PROJENİN ORGANİZASYONUN GELİŞİMİNE KATKILARI)

12. DFINT-3T projesi diğerlerine göre daha fazla kar getirdi/getirecek.

(1) (2) (3) (4) (5) (6)



13. DFINT-3T projesi yeni pazarlar yarattı.

(1) (2) (3) (4) (5) (6)

14. DFINT-3T projesi yeni bir ürün hattı yarattı.

(1) (2) (3) (4) (5) (6)

15. DFINT-3T projesi yeni teknolojik yeteneklerin geliştirilmesine katkıda bulundu.

(1) (2) (3) (4) (5) (6)

16. DFINT-3T projesi ASELSAN'ın şöhretini artırdı.

(1) (2) (3) (4) (5) (6)

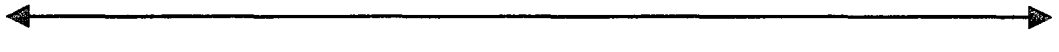
(PROJENİN ULUSAL VE SAVUNMA TEKNOLOJİ ALTYAPISINA KATKILARI)

17. DFINT-3T projesi kritik teknolojilerde / konularda katkıda bulundu.

(1) (2) (3) (4) (5) (6)

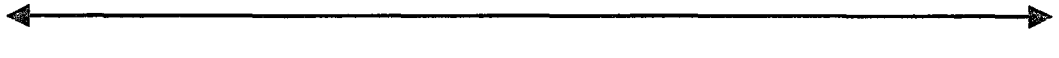
18. DFINT-3T Projesi iyileştirilmiş yeni nesil ürünleri çıkarma imkanı yarattı.

(1) (2) (3) (4) (5) (6)



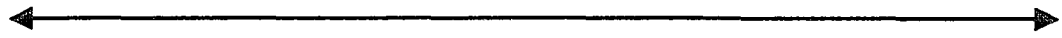
19. DFINT-3T projesi dış kaynaklara bağımlılığı azalttı.

(1) (2) (3) (4) (5) (6)



20. DFINT-3T projesinin diğer projelerin gelişmesine de katkısı oldu.

(1) (2) (3) (4) (5) (6)



(ANA KONSEPT SORUSU)

21. DFINT-3T projesinde başarılı bir Üniversite-Sanayi-Kara Kuvvetleri işbirliği modeli uygulandı.

(1) (2) (3) (4) (5) (6)

DECSRIPTIVE ANALYSIS

Table APP-F1: Comparative Averages of the Group Questions

	1. GROUP	2. GROUP	3. GROUP	4. GROUP	GENERAL
METU	5,25	5,57	5,63	5,72	5,55
ASELSAN	4	4,76	5,13	5,21	4,79
TLF	4,6	4,41	4,52	4,85	4,56
GENERAL	4,5	4,87	5,08	5,23	4,92

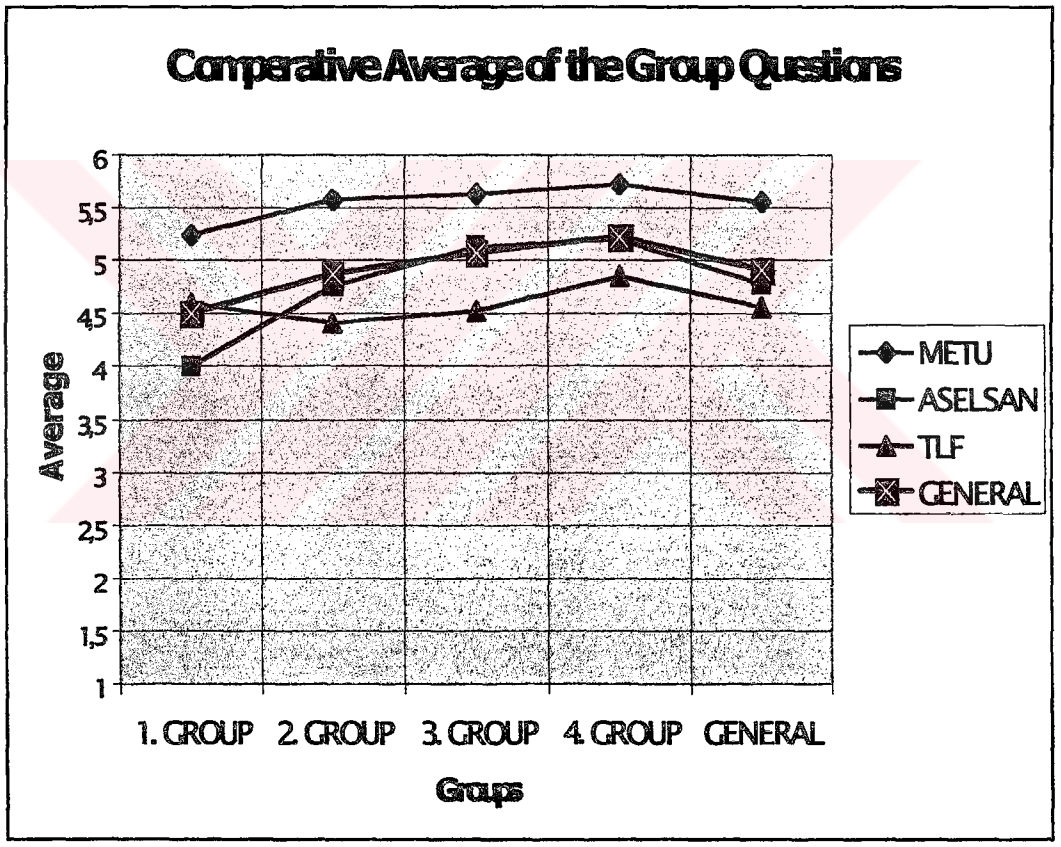


Figure APP-F1: Comparative Averages of the Group Questions

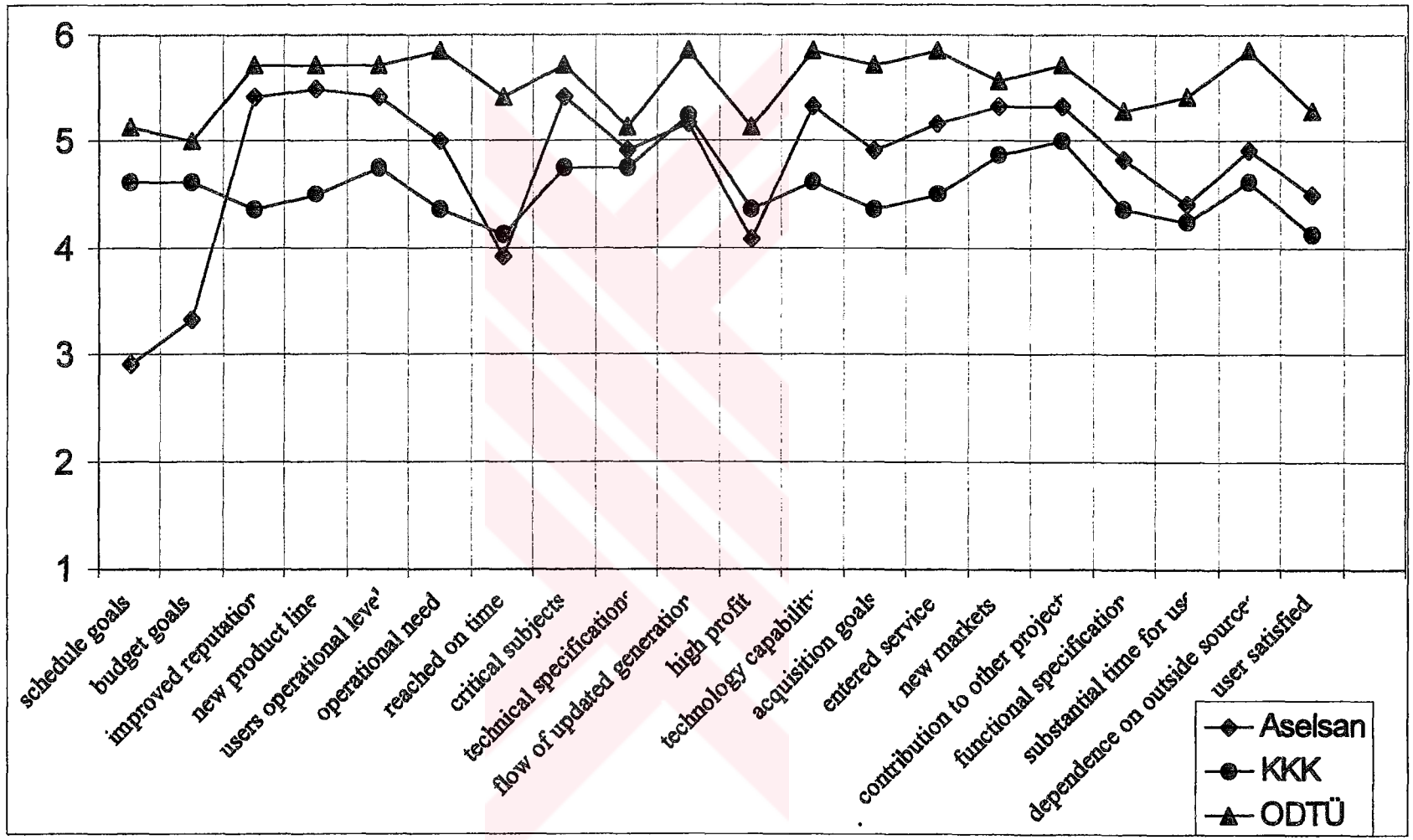


Figure APP- F2 : Comparative Averages of the Questions

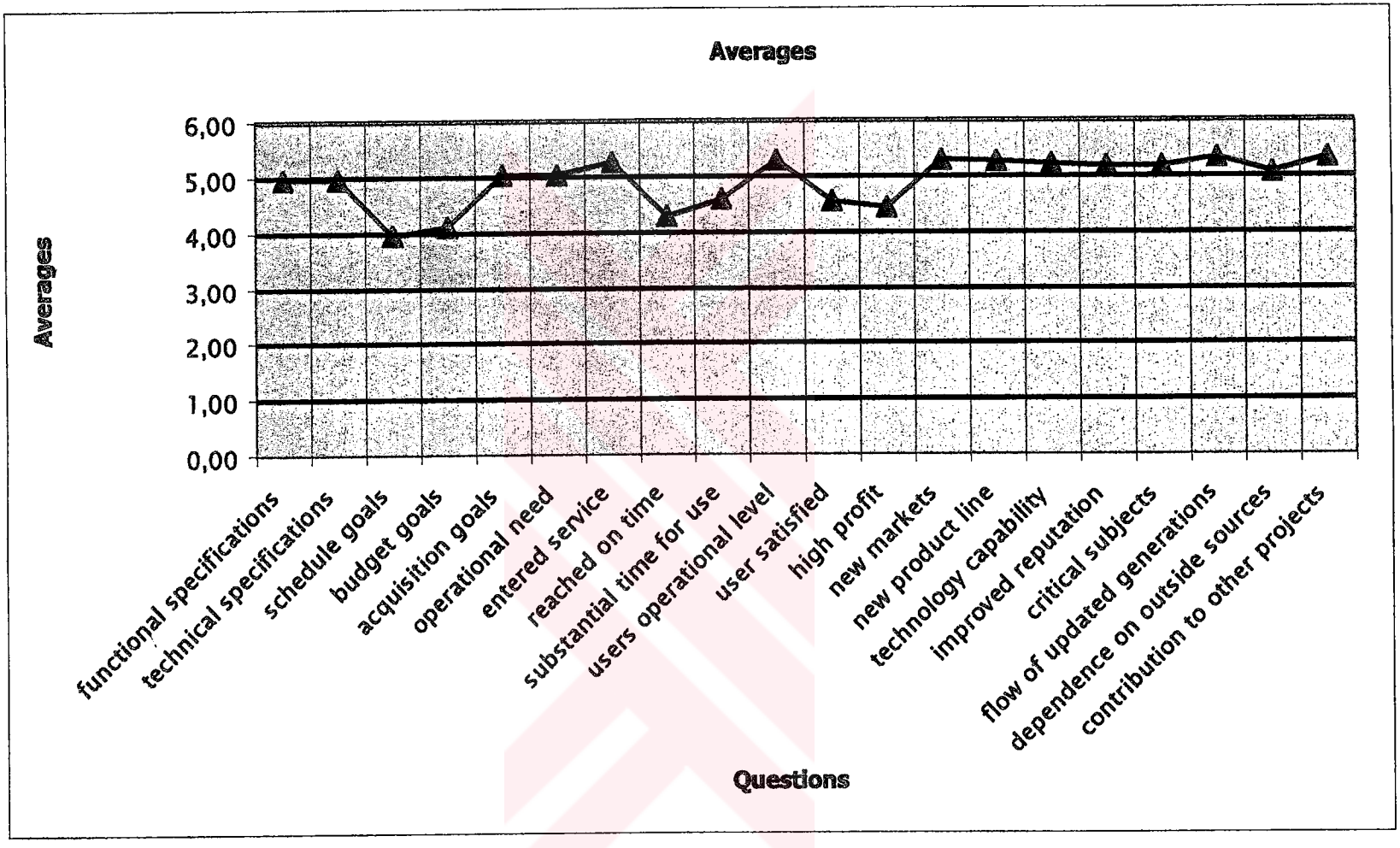


Figure APP-F3: General Averages of the Questions

CV

Birth of Date	: 23 JULY 1972
Birth of Place	: Ankara
High School	: 1983-1986 60. Yıl High School /Ankara 1986-1990 Işıklar Military High School /Bursa
Bachelor's Degree	: 1990-1994 Military Academy (System Engineering) /Ankara
Courses	: -
Institution	: Army