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A STUDY ON LOCAL MANUFACTURE OR IMPORT DECISIONS IN DEFENSE SYSTEM PROCUREMENTS IN TURKEY USING ANALYTIC HIEARCHY PROCESS

A. Aykut Öncü¹, M. Atilla Öner² and Nuri Başoğlu³

ABSTRACT

This research discusses different choices for defense technology sourcing of countries after reviewing strategic “make or buy” approaches in private firms. It also reviews prior work on the impact of defense expenditures on a country’s economy. It proposes a decision model for “local manufacture or import” decisions of the officials in the Turkish Armed Forces (TAF) and reports the results of its pilot application. The model components are derived from prior work on “make or buy” decisions of private firms and on development and defense concerns of countries.

The proposed model can be seen as a contribution to the current “cost/effectiveness”-based acquisition approach in Turkey by adding long term strategic factors that evaluate capabilities and competencies present in the national industrial base. The paper reports a multi-criteria decision model and its application in Turkey (Turkish Armed Forces) using Analytic Hierarchic Process (AHP). This paper contributes to the defense management literature with an example of decision model of members of TAF, and to the multi-criteria decision making literature with an example of AHP application in Turkey. Our analysis shows that when the weights of factors in the model change, the decision results change. This is a main difficulty of decision making in defense system procurement due to frequent changes in officer locations and ranks. This problem may be remedied by frequent update of the model weights after each and every major rank/location change of the officers actively involved in the defense system acquisition.

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1. INTRODUCTION

With new technology advances being made in just a few years, countries continue to insert new technologies and improvements into existing defense systems. The questions of:

1. whether a country buys a new system or modernizes the existing one, and
2. whether a country imports new systems or finances local development and manufacture the needed systems,

are of strategic nature for all countries. There are many factors affecting these decisions. Authorities decide according to capabilities of the national industries. (Oner, Basoglu, Ozmen, 2001) These are critical decisions and the presence of multiple criteria to be taken into account makes them more complex. The options of the decision "local manufacture" or "import" of defense systems of a country can be compared with the "make or buy" decision of for-profit firms..

In the present study, the decision criteria of the "make or buy" used in the private sector are adapted to "local manufacture or import" decision on defense technology acquisition decisions for countries. To assist the Turkish government officials in developing a defense systems renewal policy, we have examined the economics and business management literature to find theories and evidences, because the literature on defense or governmental buying exists in fewer numbers than the analysis for private firms.

Our literature survey did not reveal any results on "local manufacture or import" decisions on defense systems for countries, although Israeli et al. (1998) report the use of AHP in justifying the purchase of global

positioning systems for Israeli Defense Force, and Cheng, Yang, Hwang, (1999) report an AHP model for technical evaluation of attack helicopters.

"Make or buy" decision was argued most frequently by the economists. (Hartley, 1969, 1987; Hartley and Corcoran, 1978; Hartley and Watt, 1981; Dunne, 1991a,b; Brauer and Marlin, 1992; Brito, 1995; Murshed and Sen, 1995) The economists have considered the "make or buy" problem especially with the perspective of costs. But the "make or buy" decisions on defense systems cannot only focus on costs. There are many points that must be considered before taking a decision because of nature of the defense systems; specificity, security, high technology and need for great performance capability. Zekey (1999) reports conflicting results with regard to the impact of military expenditures on national economies. One might argue that a military expenditure creating direct demand for in-country national industries would have different impact on the economy than a military expenditure creating demand for imports.

The concept of "strategic sourcing" is related with the importance and longer-term considerations of acquiring. By examining various dimensions, the pitfalls of the classic "make or buy" exercise can be avoided where cost alone is used as deciding factor. Many companies decide to "buy" rather than "make" for short-term reasons of cost reduction and lack of capability. One may expect countries (i.e., governments) to have a longer-term perspective for their national interests. Although Venkatesan (1992) suggests that "*today manufacturing focus means learning how not to make things*",

countries determine what to “make” (i.e., what to manufacture locally) in their national defense industries by taking a longer perspective.

“Make or buy” decisions are expected to be influenced by technological innovations that can be made through a variety of methods benefit companies (and countries) in many ways, from the design process to management techniques to marketing the final product. Industrial modernization encompasses the idea of analyzing new technologies as they relate to particular industries and aiding in the decisions of a firm in a particular industry to adopt or reject a new technology. The decision of adoption of the new technology would bring with it the firm’s hopes of success. This success could manifest itself in realization of increased productivity, increased quality, growth in market share, raised product/process performance, increased workforce skills, etc. The emphasis of the industrial modernization concept tends to be within the area of manufacturing. According to Shapira (1999) industrial modernization is linked to:

1. National industrial competitiveness strategies, by promoting high performance in industry,
2. Technology policy and transfer, by diffusing innovation,
3. Economic and regional development, by jobs-especially higher-wage jobs,
4. Social capital and community development, by building learning and knowledge infrastructures,
5. Management of technology, by developing firm capabilities,
6. Reinvented government, by new performance-based strategies.

The goal of this paper is to develop a multi-criteria decision model for military systems acquisitions using Analytic Hierarchic Process and to report initial results as obtained by the choices of individuals who are either active or will be active in the Turkish defense system acquisition process. The next section will discuss make or buy decision in private companies. Section 3 will discuss the needs for and nature of defense systems. Section 4 will introduce “people – system – organization – knowledge” approach in project management. Section 5 gives the methodology, field study, the model developed in this study and discusses the results. Section 6 concludes the paper.

2. “MAKE OR BUY” DECISIONS OF COMPANIES

When industrial requirements arise, they are satisfied by purchase of the needed product or material from some outside source and also as a second alternative possibility of satisfying the requirement by assuming the production of a needed part or product within the buyer’s own organization. The addition of a new product or substantial modifications of an existing one require “make or buy” analysis and many firm’s use this analysis in all new product development decisions.

We can say that there are essentially two categories of motivation for technological change: the first is from within a business; the second is a response to pressures from its environment. (Betz, 1994) Technological progress relates to the increased capability of a new or existing technology to satisfy human wants for goods and services and thus to enhance their customer value by one of the following criteria (Lowe, 1995):

1. Lower costs for a given specification,
2. Improved technological parameter values giving better functional performance,
3. Greater reliability,
4. Increase in scale
5. Miniaturization

An understanding of the firm's organizational resources and environment is crucial to the development of an effective business strategy. This understanding requires an analysis of the firm's technological resources and environment, in order to determine what technological resources can be used to create a strategic advantage for the firm and what resources are required to support the firm's chosen strategy (Saunders et al., 1995).

A "make or buy" problem arises from variety of ways. Sometimes problems arises as a result of : (Welch and Nayak, 1992)

1. unsatisfactory vendor performance,
2. poor quality,
3. delivery problems,
4. unreasonable vendor price increases,
5. addition of a new product or substantial modifications of an existing one
6. changes in sales volume and related variations in plant capacity,
7. reduced sales,
8. idle plant, equipment and manpower.

Decision makers need a full understanding of product/delivery attributes and key buying criteria in the new marketplace as well as the competitors' existing or potential sources of competitive advantage (Javidan, 1998). Managers need an in-depth analysis of the industry they wish to enter in terms of its competitive dynamics, major trends, customer needs and key success factors.

Many firms have made "make or buy"

decisions based disproportionately on unit cost, with insufficient regard for strategic or technological issues (Venkatesan, 1992). This only-cost-focused approach has caused a lot of problems for firms and industries. In all cases, a fundamental understanding of the technology available to the business required, and this usually makes use of competitive and life cycle concepts of technology (Probert, Canez, Phaal, 1999). The life cycle view and the particularly the emerging category of technologies, require a good understanding of future trends.

Understanding the technology life cycle is critical for strategic technology management and sourcing decisions (Canez, Probert, 1999), because understanding the life cycle of technologies and constantly monitoring the technology growth is essential to remain competitive. Timing in the switching of technologies is critical. Hanging on to obsolete technologies may lead to loss of market share and may even threaten the future of the company (Abetti, 1989) .

The importance of the technology should be determined in relation to future technological trends. It is difficult to foresee how technologies are going to change overtime. The technology-sourcing matrix of Welch and Nayak (1992) illustrates different technology sourcing options, depending on the position of the technology in the matrix. Their Strategic Sourcing Model (SSM) is developed to help managers in assessing strategic and technological factors by examining various dimensions of the process technologies involved in the sourcing decision avoiding the pitfalls of the classical "make or buy" decisions where only cost is used as a decision variable:

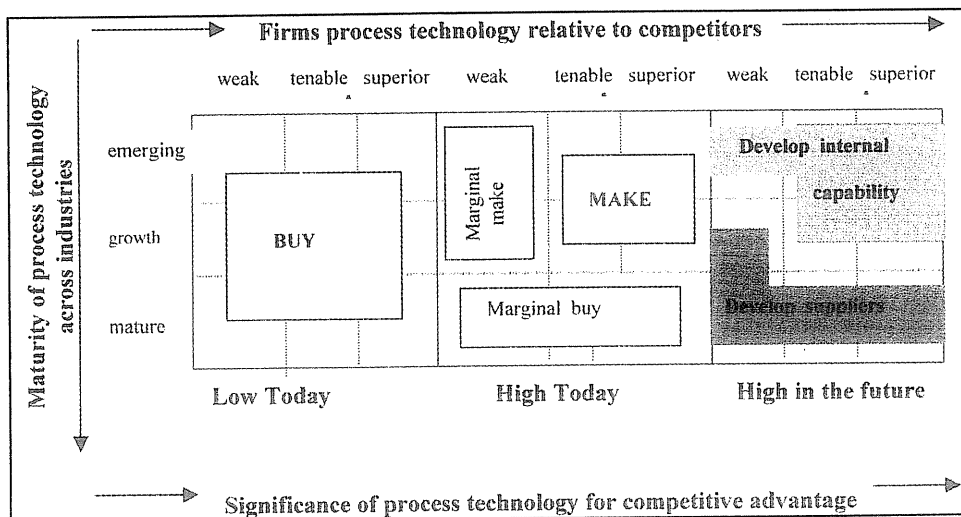
1. Process technology's role in providing competitive advantage,
2. Maturity of the process technologies under consideration,
3. Competitors process technology positions.

According to Welch and Nayak (1992) technologies, which are of low importance to the business, should not be kept in-house. They suggest that companies should focus their efforts, resources on technologies that are important to them. For medium-important technologies with weak or neutral competitiveness, forming alliances is suitable, if the competitiveness of the company is strong, it is better to consolidate the technology in-house and keep pace with its changes. Technologies that contribute to sustaining competitive advantage for the business should be kept in-house. According to Abetti (1989), *"Companies should only bring mature technologies in-house when the remainder of the life cycle allows the business to depreciate them fully over their useful life"*. Technologies that have a strong competitive position in an important technology should be invested and maintained. But when the competitiveness for important technologies is weak or neutral and

competitiveness for important technologies, acquiring, forming alliances and licensing-in technologies are suitable options.

The "make or buy" is a strategic decision and has implications for the overall corporate strategy of the organization by analyzing a number of strategic factors. In case of short term cost reduction purpose, longer-term strategic considerations, which have greater importance, should be considered. While cost is undoubtedly a very important factor, there may be long term strategic issues which need to be considered if future competitiveness is to be secured (Probert, Canez, Phaal, (1999)). Pressured by short decision cycles, many manufacturers lost sight of the long-term risk associated with buying key inputs. So, the sourcing decision should also consider the technology positions of competitors and potential competitors (Welch, Nayak, (1992)). When sourcing decisions are examined, managers must be very careful because buying (outsourcing) R&D, design, engineering, manufacturing, or assembly, in the short term and in the long term may be detrimental to firm's competitive position.

FIGURE 1: STRATEGIC SOURCING MODEL (WELCH AND NAYAK, 1992)



Strategic sourcing is the process of taking a longer-term and bigger-picture view of sourcing (Saunders et al., 1995). Strategic sourcing is not one tool or process but a business philosophy that requires a willingness to approach business from a multi faceted and holistic/organic point of view. The objective is to provide an environment for business that allows for optimized resource allocation facilitating a comprehensive and balanced engagement of all business channels (HRH Strategic Consulting, 1999). It provides an organization the opportunity through comprehensive analytical research and analysis in all aspects of individual business functions and across multiple disciplines the ability to generate strategic long-term corporate business goals and plans.

Venkatesan (1992) proposes a critical input for “make or buy” decisions, “hierarchy of strategic importance” indicating that it is crucial to make this categorization in order to match the purchasing strategy with the relevant purchased item in a hierarchy. Venkatesan relates sourcing decisions with a strategy of survival in highly engineered products and defines the components as *core components*, that critical to the product and that the company distinctively good at making, and *commodities*, that might be produced in any number of other places. His approach is based on three principles:

1. Focusing on components that are critical to the product and that the company is distinctively good at making (core components),
2. Outsourcing components where suppliers have a distinct comparative advantage,

3. Using outsourcing as a means of generating employee commitment to improving manufacturing performance.

McIvor, Humphreys, McAleer (1997)] state that “*without this categorization, when companies are making sourcing decisions they may find themselves over-investing in non-critical components and disregarding the core activities of their business.*”

Undertaking “make or buy” decisions requires an analysis of in-house and external manufacturing technologies and capabilities (Canez and Probert, 1999). The level of technology and its appropriateness is affected by the technological capability of the company. This comprises the capability of necessary adaptation, sustained and effective operation, as well as the competence to maintain process and equipment at a corresponding level (Lowe, 1995). In-house competence and capability must match outside sources of knowledge and specific technology. Firm’s not having some required capabilities urges firm to acquire it externally.

Core competencies should be limited to the two or three activities most critical to the organization’s future success, activities in which it must maintain absolute preeminence (Pint and Baldwin, 1998). By focusing resources in a small number of activities, the organization’s preeminence in selected fields becomes increasingly difficult for competitors to overtake. Quinn and Hilmer (1994) note several characteristics of core competencies as:

1. Sets of skills or knowledge that cut across traditional functions and allow the organization to consistently perform an activity better than its competitors,

2. Flexible, long-term platforms rather than specific products that are capable of adaptation or evaluation to meet customers' needs over time,
3. Unique sources of value that are difficult to duplicate and in which investments in intellectual resources will have the highest payoff,
4. Activities in which the organization is a market leader and can focus its managerial and financial resources to maintain leadership,
5. Elements that relate directly to understanding and serving customers, which the organization can provide at lower cost or more effectively, and
6. Activities that are embedded in the organization's values, structures and management systems not dependent on a few talented individuals.

Prahalad and Hamel (1990) proposed that at least three tests can be applied to identify core competencies in a company:

1. A core competence provides potential access to a wide variety of markets,
2. A core competence should make a significant contribution to the perceived customer benefits of the end product,
3. A core competence should be difficult for competitors to imitate.

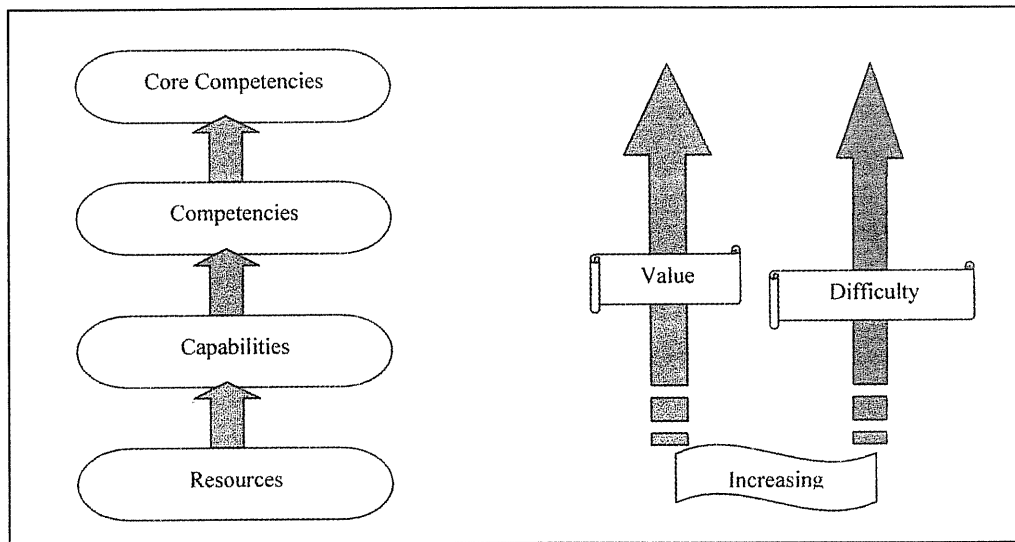
They also stated that *"It will be difficult if it is a complex harmonization of individual technologies and production skills. A rival might acquire some of the technologies that comprise the core competence, but it will be more difficult to duplicate the more or less comprehensive pattern of internal coordination and learning"*.

The most important step in successfully identifying and exploiting capabilities and competencies is to understand the concepts of the capability, competence and organizational resources. Javidan (1998) defined them in a hierarchy (see Figure 2). In identifying company's competencies, participation in determination process should be limited to senior management. The optimal solution lies in a situation where managers representing the key functions all business units, important cross functional or cross SBU teams and important projects are into the process, as a part of the company's regular strategic planning exercise.

Competency is a cross-functional integration and coordination of capabilities. In a multi-business corporation, competencies are a set of skills and know-how housed in an SBU and they result from interfaces and integration among the SBU's functional capabilities (Javidan, 1998).

Core Competence is a collection of competencies that are widespread in the corporation. Prahalad and Hamel (1990) developed the concept of *"core competence"*. They described *core competencies* as *"the collective learning in the organization, especially how to coordinate diverse production skills and integrate multiple streams of technologies"*. Another definition proposed by Coyne, Hall and Clifford (1997) is; *"A core competence is a combination of complementary skills and knowledge bases embedded in a group or team that results in the ability to execute one or more critical processes to a world-class standard"*. According to Coyne, Hall,

FIGURE 2: THE COMPETENCIES HIERARCHY (JAVIDAN, 1998)



Clifford (1997), such a definition excludes many skills or properties often cited by organizations as core competencies, patents, brands, products and technologies do not qualify; neither do broad management capabilities such as strategic planning, flexibility, and teamwork; nor do high-level corporate themes like quality, productivity and customer satisfaction. They grouped core competencies into two categories:

Insight/foresight competencies enable a company to discover facts that create first-mover advantages. This kind of competence derives from the insight. Such insights might derive from:

1. Technical or scientific knowledge that produces a string of inventions,
2. Proprietary data, such as the behavioral and credit-scoring knowledge,
3. Information derived from having the largest share of leading-edge transactions in the deal flow,
4. Pure creative flair in inventing successful products,
5. Superior analysis and inference.

Frontline execution competencies arise in

cases where the quality of an end product or service can vary appreciably to the activities of frontline personnel. They can be defined as “a unique ability to deliver products and services that are consistently nearly equal in quality to what the best craftsman would have produced under ideal circumstances.

Dunphy, Turner and Crawford (1997) also grouped core competencies into two groups; technical competencies which provide the key to the organization’s market position and management competencies which are vital to its performance as an integrated organization that reside in key individuals, in the collective membership and are embedded in the organization’s fabric.

Because managers may not be able to devote as much attention to non-core activities, internal service and support activities often act as monopolies, with little incentive to improve their productivity or achieve world-class performance standards. This creates a presumption in favor of outsourcing for activities that are not core competencies, particularly if the organization can gain access to world-class performance

from an outside specialist provider (Pint and Baldwin, 1998).

After having discussed factors affecting firm-level “make or buy” decisions, in the next section we will review the need for and nature of defense systems as a prelude to our model development efforts.

3. NEED FOR AND NATURE OF DEFENSE SYSTEMS

According to a study done by Defense News in 1995, Turkey and Greece received 35 percent of all arms delivered in 1994, importing about 1600 and 1150 pieces, respectively, of arms and associated military equipment largely from the United States and Germany. The world’s top three importers in 1994 were Turkey, Greece and Saudi Arabia (SIPRI, 1994; MIIS, 1994). A separate study published in February 1994 by the U.S. Arms Control and Disarmament Agency (ACDA) records arms imports and exports by dollar value and shows Turkey ranking fifth among world arms importers with \$ 975 million worth (Opall, 1995).

With the longtime adversaries and escalating volatility in Middle East, need for new and effective weapon systems may pose an inescapable reality for Turkey. According to above-given data, Turkey is a great market for defense system manufacturers in the world. Arms import of Turkey is very high with respect to her export of arms. This unbalanced situation poses a great economical problem for Turkey with its negative impact on the balance of payments. Turkish Ministry of National Defense sources have expressed their desire in reaching a balance between “local manufacture” and “importation” (MSB,

1999). For this, Turkey may evaluate her industrial base (Öner, Başoğlu, Özmen, 2001) in a detailed way to learn about existing capabilities and possibilities for in-country production of defense systems to gain advantages from her needs, which are great in amount.

Although the defense industry has much in common with other industries, it also shows some differences. In particular, advanced technology and high quality are important requirements. Cost, repair, maintenance and delivery time are most important factors in defense systems and the increasing complexity of systems has led to unacceptable long development times. Reducing life-cycle costs is the single most important opportunity for improving value for money in defense procurement.

Although the market for TAF requirements is large, Turkey’s National Defense Industry’s market share is today too small to fund major weapon system programs requiring heavy R&D investment, the costs of which could not be borne by the industry itself. Turkey wants to improve her national industries market share in procurement of defense systems for TAF. (MSB, 1999) Increases in the cost of developing and producing modern defense equipment, coupled with reductions in the defense budget, make wider collaboration with other nations vital to meet Turkey’s future defense needs.

In the Gulf War, even USA’s, world’s most powerful country, inventories of Maverick, TOW, Sparrow and Sidewinder missiles were exhausted, replacements would not be easy because reliable domestic sources of all parts were not available

(Christiansen, 1991). If Turkey became dependent on one company or one country for the equipment she bought, then would be doing herself damage in the longer term. Relying on an established company in own country for support to a project is very effective and practical approach. Turkey faced this problem in 1974 during the Cyprus Peace Operation, the sources of her weapon systems were foreign countries and they put an embargo on weapons and ammunitions supplied to Turkey.

Scientific and high technology infrastructure of countries and their capabilities to convert this infrastructure to high technology products are evaluated as the critical national resource of countries. These national resources affect the strategic power, economical competition capability and the social wealth of countries. Countries' security and their position in the world are to be based not only on the strength of their Armed Forces but also on the capability of their technological base and industry to develop and produce key high technology systems in a fully independent way.

By the nature of his/her work a commercial entrepreneur can limit his/her thoughts to a rather limited range of effects, but a planner on behalf of the country takes a wider view. The manager of a company as an entrepreneur tries to get more profit, the other benefits related with national ones does not interest him so much.

Governments are committed to the welfare and improvement of the living standards and the growth of the economies of their countries. And one determinant of the strength of an economy is its industries, both manufacturing and service. A government

concerned with economic growth cannot ignore the economic aspects of technology. Major purpose of a national technology policy is the harnessing of technology to meet economic and social goals, unlike the private companies in which only economic one is aimed. This technology policy needs to encourage the deployment of national resources with a high and rising level of productivity, leading to the upgrading of the economy and industrial capability (Lowe, 1995).

The factors affecting "make or buy" decisions in private firms may also be used for the decisions that decide for "local manufacture or import". Because of the characteristics of the national projects some factors are more effective than the others are. United Nations Industrial Development Organization defined six main objectives for National projects that affect national economic profitability as follows (Dasgupta, Sen, Marglin, 1972):

1. *Aggregate Consumption*: the raising of the standard of living is a fundamental goal of national projects and one important measure of the standard of living is the level of aggregate consumption per head.
2. *Income Distribution*: the considerations of distribution are important for estimating national profits and cannot be separated from aggregate consumption. The measure of the redistribution benefit is the amount of consumption that is generated in the poorest region or enjoyed by the poorest class.
3. *Growth Rates of National Income*: the raising of the rate of growth of national income is an important national policy

objective. It is an indicator of future consumption possibilities.

4. *Employment Level Expansion*: expansion of the employment or reduction of unemployment is desirable for its impact on aggregate income and consumption or on income distribution. Unemployment makes it difficult for some people to have an income, so contributes to the “ill-distribution” of income and consumption.
5. *Self Reliance*: Because of chronic shortages of savings or of foreign exchange, developing countries are severely dependent on the richer countries for their economic development efforts. So, to reduce dependence on foreign countries and develop self-reliance is a national goal. One project may help to have self-reliance while another increasing the dependence on other countries; this is not easy to measure. Deficit in balance of payments and deficit in trade, i.e. the gap between imports and exports are indicators of dependence.
6. *Merit Wants Employment*: and self-reliance are examples of goals whose national importance is not determined by individuals as consumers and these goals are called “merit wants”. Education is an example of meritorious wants and has an importance in public policy. People may be reluctant to spend money on education but the public policy aims to foster it.

These six objectives move evaluators to think broadly and strategically on the behalf of their country. In the sourcing decisions, all countries aim these objectives, but industrial impossibilities of national industries result in dependence on foreign countries. Countries also should examine their industries

capabilities and choose capabilities that are core to them and then, they should focus on those capabilities. These core capabilities or competencies must be held in harmony with the requirements of the country.

The other important factor in national decision making process is the international relations. This factor is not so important in the private firms decision process, but at the national level, relations between countries and the characteristics of these relations are fundamental issues in the decision making process, because, continuity or reliability depends on the international political relations between the buyer and supplier country.

The local production of requirements, which are suitable for a country's industrial base capabilities and country's future competitive advantage across the world, will cause great positive effects on welfare of the country. When one local-manufacture project is chosen rather than an import project, the choices have consequences for employment, output, consumption, savings, and reduction in the need for foreign currency for imports, income distribution and other related things to national objectives. Each local manufacture project will affect employment and wage payments.

Secrecy and reliability are the most important factors that affect decisions in procurement of defense systems because of national security. Deger and Berthelemy (1998) emphasize the link between (national) security and development which is vital for developing countries and suggest that its output should be available for national development

Six main objectives of national economic

profitability combined with the security, secrecy and reliability requirements of national defense issues make some changes in factors that affect private firms' decisions. The dominance of some factors is definitely expected to change when applied to national defense decisions.

4. PEOPLE-SYSTEM - ORGANIZATION - KNOWLEDGE APPROACH

National projects have to be based on different fundamental concepts because of their structure discussed above. All national projects are aimed to serve people of the country. Their organizations are affected by the results of each and every project that contain new systems or knowledge. The concept of "PSO" in project management is based on the experiences that successful implementation of new systems requires more than a concern with the technical development of the new system. "PSO" concept helps us to prevent the system from having negative effects on people and organization and to achieve the required benefits of system development by "balancing" three elements.

Andersen, Grude and Haug (1995) suggested that although projects often involve the building or installation of a physical product, the training and motivation of the people who will use this product or capability must not be forgotten. Organization must also be taken into account because of the fact that innovations facilitate completely new forms of organization.

We have added one other important component to these three factors, *knowledge*. In the projects, knowledge is important as much as people, system and organization.

Knowledge acts as a complementary unit to the concept of PSO. Several authors regard knowledge as a human capability rather than a property of an inanimate object such as a book or computer record (Nonaka and Takeuchi, 1995; Sveiby, 1996). Gundry and Metes (1996) define knowledge as a personal capability like a skill, experience, or intelligence: a capability to do or to judge something, now or in the future. This capability can be acquired by an individual as a result of reading, seeing, listening to, or feeling (physically or emotionally) something.

It is difficult to decide for defense products for a country because of the above interests added to factors involved in the "make or buy" decisions in private companies. People in the decision process decide according to some varying criteria. Some of these criteria may have higher priorities than the other ones.

5. METHODOLOGY

This paper aims to determine

1. the factors which are important for TAF in making locally or importing a weapon system, and
2. the relative importance assigned to them by people involved in defense systems procurement process in Turkey.

We investigated factors that affect "local manufacture or import" decisions in TAF's with a two-part questionnaire. First part of the questionnaire tried to understand present factors that affect procurement decisions and second part tried to explore the factors that are ideal to experts in Ministry of National Defense and Turkish

Land Force Headquarters of Turkey using Analytic Hierarchy Process of Saaty and Vargas (1982). AHP is used to assist decision-makers by decomposing information into a hierarchy of criteria and alternatives. Then it is synthesized to determine relative rankings of alternatives. (Israeli et al., 1998; Cheng, Yang, Hwang, 1999) The questionnaire shows the numerical pair-wise comparison between factors; equality between two factors corresponds to 1, if one criteria is moderately more important than the second criteria, then the answer is 3, if strongly more important then 5, if very strongly more important then 7, and if extremely more important then 9. The results of the assessments are given as weights of factors in the model adding to 1,00 or 100 %.

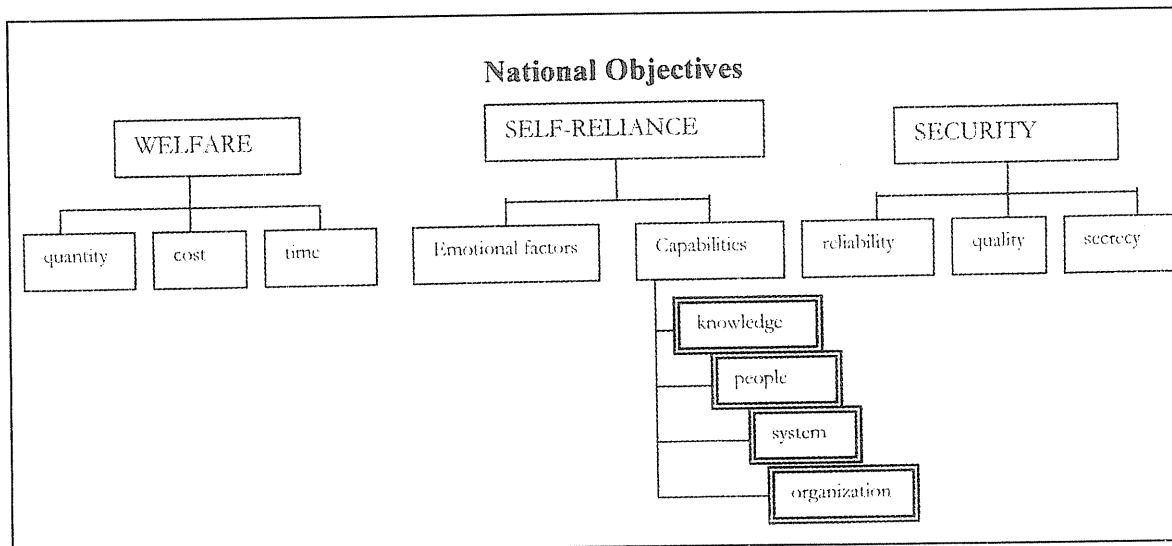
In this research, expert panel is used because of the limited number of specific type of people who will be able to provide the desired information about procurement process of TAF. The population surveyed in this study consisted of people that work at

various stages of procurement cycle. 33 individuals participated in the survey.

Individuals made two-sided judgements with pairwise comparisons of factors with respect to goal (Saunders et al., 1995). Using pairwise comparisons, the relative importance of one criterion over another can be expressed. This resulted in 34 pairwise comparisons of 8 effecting factors which are; cost, quality, reliability, quantity, secrecy, capability and emotional factors that derived from the investigation of “make or buy” decisions in private firms. These eight factors are adapted from the firms’ “make or buy” decision factors.

Expert Choice using AHP combines the results one by one by using geometric mean to determine relative rankings of the determined criteria. These eight factors are grouped in three objectives of national projects; *welfare*, *self-reliance* and *security* which are based on the *Fundamentals of Turkish Defense Industry Policy and Strategy* published in the Official Gazette (June 20, 1998- 98/11173) by the order of

FIGURE 3: THE PROPOSED MODEL FOR NATIONAL OBJECTIVES RELATED WITH THE DECISION FACTORS



Council of Ministers (MSB, 1999). In the questionnaire the *capabilities* are divided into four main groups, which are *knowledge, people, system and organization* to explore the importance of them as in Figure 3.

5.1. Important Factors Affecting Decisions

It was not surprising that the results of both ideal and present situations have the dominance of *reliability* and *secrecy* because of the nature of the defense products. People involved in the procurement process of defense products highly think that *cost* and *time* are the influencing factors in the present decision process. They think that *cost* might not take so much importance (see Figure 4)

They also think that TAF should not import just because the item is cheap and also should not give up if the product is expensive, some other important factors must be considered in the decision making. The other important point that must be considered is the increase in the weight given to *capability*. Whatever the *cost*, local capacity building is one of the important

issues that must be given great emphasis according to participants. There is a great desire for local manufacture and local capacity development without neglecting the *secrecy, reliability* and *quality*. Even if importing is chosen, the experts think that some resources must be allocated for the local *capacity building*. The reliable local defense industries that make quality products are the wish of people that work in the procurement process.

This wish is not an abnormal feeling for a developing country like Turkey. Even in a developed country like USA, with the law of "Buy American Act" local industry is protected. This legal protection forces foreign industry to offer a 20-30 % cheaper proposal than a local manufacturer and is one of the most important laws and regulations that mandate preferences for U.S. domestic products (or products of certain U.S. trading partners) or that exclude foreign products in federal procurements. Similar tendency is present for *European Community* countries; in November 1996, Britain, France,

FIGURE 4: IMPORTANCE GIVEN BY THE EXPERTS TO THE DECISION FACTORS

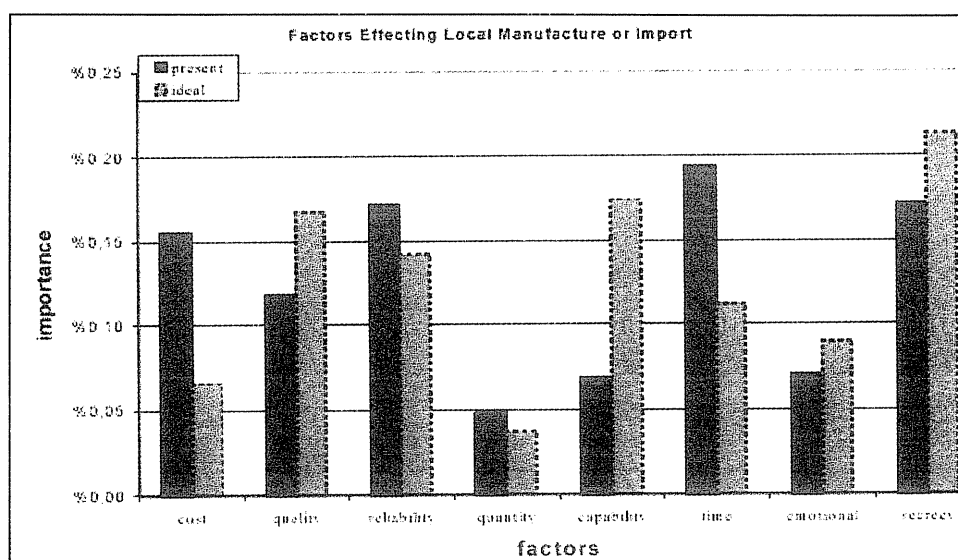
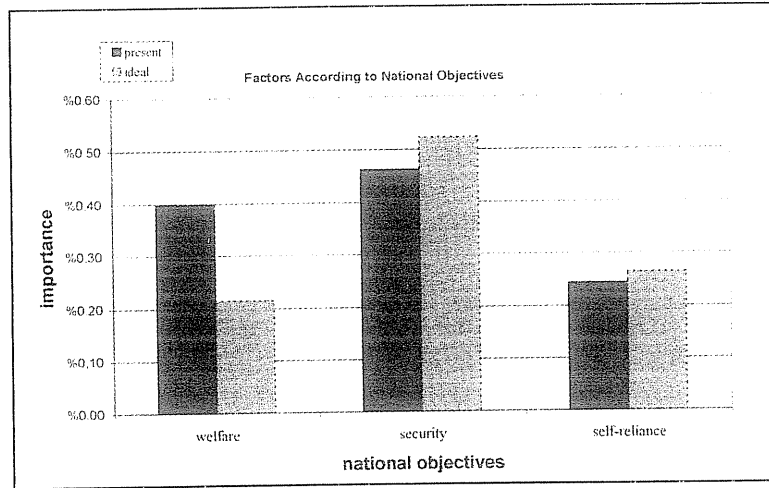


FIGURE 5: IMPORTANCE ACCORDING TO THE NATIONAL OBJECTIVES



Germany and Italy signed a document that commits four countries to preferring when meeting the requirements of their armed forces, products in whose development they have participated. This *emotional* factor depends largely on desire for *economic welfare* of the countries.

According to national objectives (see Figure 5) the desire for producing and local capability development appear as a wish for *self-reliance*. The result does not show that *welfare* is not important. It shows that one has to think with a long-term view because *local capacity development* will influence *economic welfare* with a delay.

The great emphasis given to *time* in the present procurement process shows us that if you have no preparation for future, you can face with the situations in which you have to decide quickly. The detailed future plans that are for minimum ten years will prevent people to decide quickly at the time of procurement. Longer term planning will be helpful for local manufacturer to make preparation for the defense products, because to make adjustments in the production units and to make R&D will take time.

5.2. Sensitivity of the Factors

To see difference of the results according to present and ideal situations, we made a study in Infantry Branch School using an expert panel. 12 officers were asked to give weights to local manufacture or import alternatives for each of the eight factors for three weapons, one infantry rifle and two anti-tank missiles. At the time of the research, the Infantry School was investigating these weapons for their usability in the Turkish Land Forces. The officers give weights to each factor for the preference of local production and import. The preference of the officers according to local manufacture or import for each factor is applied for the present and ideal acquisition processes with the weights given in the questionnaire. The overall results for three weapons have preference of import.

When we applied results to the present procurement weights of the questionnaire local manufacture and import take the preference of 2.42 and 3.03 respectively. Also in ideal procurement process according to the questionnaire we applied the results of the study for three weapons they take the

preference of 2.60 and 2.94 respectively. The preference of import in present procurement process is much higher than ideal process.

To see the sensitivity of the results we increased weights of three factors: *secrecy*, *emotional factors* and *time* (while other factors weights were decreased) that can be increased in the period of crisis, by 5 % for each time. When we increased the weight of three factors by 45 % local manufacture preference is greater the preference of import (see Table 1).

procurement. This study can be applied for the different cases in which importance of some factors increases. For example in war or in conflict escalation periods, importance of *quantity* increases more than the other factors.

5.3. Importance of the Capabilities

The concept of “KPSO” (Knowledge, People, System and Organization), emphasizing the importance of not losing sight of the composite goal, helped us to

TABLE 1: THE INCREASE OF WEIGHTS IN PRESENT VALUES

Make	2.42	2.46	2.49	2.53	2.56	2.59	2.62	2.66	2.69	2.72	2.75
Import	3.03	3.02	2.98	2.94	2.90	2.86	2.82	2.78	2.75	2.71	2.67
Increase	original	% 5	% 10	% 15	% 20	% 25	% 30	% 35	% 40	% 45	% 50

But in ideal procurement process according to people who participate in procurement process of TAF, when we increased weights of three factors 25 % decision about the procurement changes to import (Table 2). These results indicate that present procurement process of TAF has tendency to import.

identify people’s understanding of the capabilities. The importance that the people think about *capability* in the first part of the questionnaire is considerably high. We aimed to learn which types of capabilities have importance in TAF’s present procurement process and which capabilities should have superiority on the others

TABLE 2: THE INCREASE OF WEIGHTS IN IDEAL VALUES

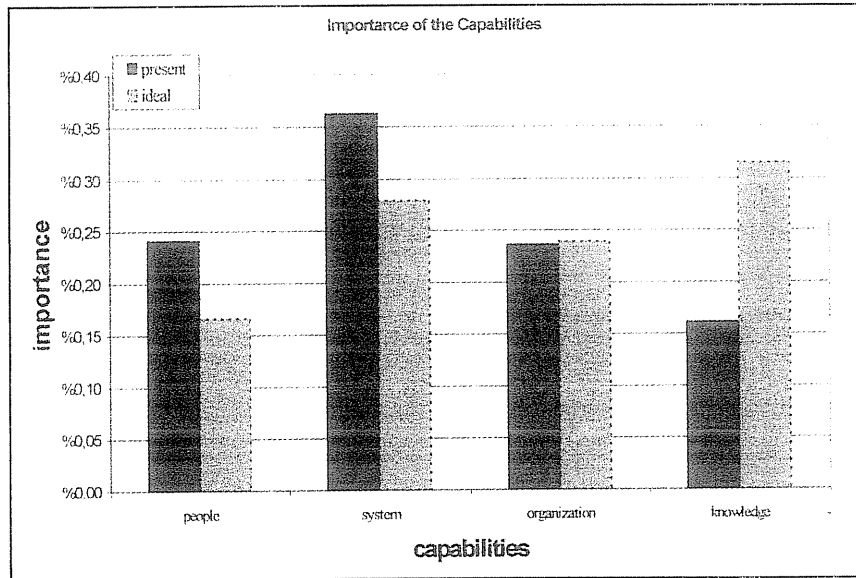
Make	2.60	2.63	2.66	2.70	2.73	2.76	2.80	2.83	2.86	2.90	2.93
Import	2.94	2.90	2.86	2.83	2.79	2.75	2.71	2.67	2.63	2.59	2.55
Increase	original	% 5	% 10	% 15	% 20	% 25	% 30	% 35	% 40	% 45	% 50

This case shows us that when the weights have flexible structure, the results can change and this is a main difficulty of decision making in defense system procurement due to frequent changes in officer locations and ranks. In case of an international crisis, local manufacture will be most preferable alternative for the

according to people involved in the process.

Again the Expert Choice software compared the importance of the capabilities with pairwise comparison in six questions. The results of the questionnaire indicate that according to experts TAF’s present procurement system gives much importance

FIGURE 6: THE IMPORTANCE OF THE CAPABILITIES



to the *system* capabilities (see Figure 6). It means that there is too strongly focus on the technical content and this is a most common failure in the projects (Andersen, Grude, Haug, 1995). Solely concerning with the systems without developing people, organization and related knowledge will influence the effectiveness of the system. Buying new system without considering the other factors will add no value. According to Andersen, Grude, Haug (1995) projects should be considered composite, and goals should be achieved in all “KPSO” dimensions.

Another important result from the questionnaire is that there is a great confidence in human resources in TAF, but people think that this human resource should be used in a well-designed organizational structure to benefit from the capabilities of these people. By forming new organizations, a dynamic structure can be gained for effective use of the systems.

The small *knowledge* value in the present process points out that the people with the

experience and knowledge can not transfer them to the organization. Because of the lack of tools or mechanisms this knowledge can not be spread around the organization or an organizational memory can not be captured. The need for systems that support organizational memory in the organizations by relating the projects to each other and storing the knowledge in a network is apparent. There exist many tools that would help in realizing this objective, like MORN (Özkan, Başoğlu, Öner, 2002).

6. CONCLUSION

Technology sourcing decisions are complex because of numerous factors that need to be considered. Sourcing dilemma “to buy or to make” is another important aspect of the technology sourcing. Basing this decision only on cost is a common way for consideration. While the cost is always undoubtedly important in any decision, decision-makers need also consider strategic and technological issues in connection with the decision. Buying provides a shortcut to a

product, but it contributes little to future skills of the organization.

To align with the technological advances and rapid obsolescence rate, technology sourcing is an obligation for the national defense systems. While deciding on the procurement of technologies for defense systems, a similar process to “make or buy” decisions in private companies occurs. Since short-term gains will add no value to the national interests, all the sourcing decisions is suggested to be investigated from strategic perspectives. Technology infrastructure and technological capabilities are critical because of their effect on strategic power, economical competition and the wealth of a country. Countries can decide according to strategic, long term factors like private firms for the benefit of their welfare.

This study points out the remarkable difference of the factors affecting “local manufacture or import” decisions in the present and the ideal procurement process according to the military officers that participate in any phase of the decision process. The difference stems from the lack of strategic approach for the procurement. The short-term factors like *cost* and *time* have great effects on TAF’s existing procurement. Decisions made with the

consideration of *cost* and *time* will lead TAF to import the product. The idea of the people for an ideal process give us hope, because they are aware of the drawbacks of the short-term objectives and have great desire to produce locally with the development of capability.

Another result of this study shows that survey participants think that *system capabilities* have too much importance than the other *knowledge*, *people* and *organizational capabilities*. Rapid advances in technology cause tremendous effects on the systems, but procurement of a defense requirement is not only buying the system. While procuring a new system TAF need to consider *people* and *organizational structure*, too (Andersen, Grude, and Haug, 1995) TAF may try to accumulate knowledge or form organizational memory, because human resources carry their knowledge and experiences with them while leaving the organization which happens frequently in TAF due to periodic relocation of officers.

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