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Comparative Analysis of Leasing versus Buying General Purpose Vehicles (Sedan) in the Korean Air Force

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COMPARATIVE ANALYSIS OF LEASING VERSUS BUYING GENERAL PURPOSE VEHICLES (SEDAN) IN THE KOREAN AIR FORCE

THESIS

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Abstract
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Abstract

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COMPARATIVE ANALYSIS OF LEASING VERSUS BUYING

GENERAL PURPOSE VEHICLES (SEDAN) IN THE KOREAN AIR FORCE

I. Introduction

Background

Since the South and North summit was held on June 2000, the Republic of Korea has set the mood for peace between North and South. As part of this current situation, the military has been requested by the National Assembly of Korea to cut down its budget and decrease military power gradually over time. Hence, in various branches of the military, they have been forced to manage military systems in effective and economic ways. However, relevant research for economical ways to manage military systems does not exist to a great extent in the current literature of the Korea Air Force. The main current of the Korean military to save money is to reduce the staff by urging individuals to resign, or allowing them to remain in their rank without being promoted. This way to decrease the indirect cost of military maintenance has been used for the last half a century.

The United States Air Force has conducted various research projects over the years concerning leasing and buying decisions. By doing that, they have achieved success in ways such as to cooperate with government and civilian organizations. But, Republic Of Korea Air Force (ROKAF) has never been referenced in published analyses regarding leasing versus buying vehicles. Current commercial technology has been

developed enough to meet military needs in diverse ways, especially in the automobile industry.

To improve military logistics management, this research will be conducted to provide guidelines for making decisions on leasing versus buying vehicles. The main objective of this research is to develop a model to analyze buying versus leasing decisions.

Problem Statement

In an era of decreasing defense budgets, the Military must try to look for ways to operate and manage the current military system in the most effective and efficient ways as possible. The Korean Air Force has been pursuing outsourcing from the commercial sector in various ways to save money within the shrunken military budget only in the office supplies not vehicles. Until now, nobody was concerned whether to lease or buy vehicles in the ROKAF.

Since 1997, the Korean Air Force Transportation Department has suffered from an insufficient vehicles procurement budget. In 1997, the budget for procuring vehicles was 22.2 billion won, however the budget dramatically dropped down to 0.78 billion won, almost a 68% decrease, in 1998. Thus, the Transportation Department in the ROKAF asked the National Assembly of Adjustment to increase their budget to recover the deficit. However the National Assembly of Korea did not accept this. To date, the budget for procuring vehicles in the Korean Air Force has been on a decreasing trend. The effect of the recession in 1997 and a decreased vehicles procurement budget has begun to be felt in all units of the Transportation Department, and resulted in aging vehicles, increasing

possibility of accidents, and lack of a number of vehicles assigned, as well as decreasing military morale.

For all the reasons mentioned above, the Korean Air Force Transportation Department has needed a breakthrough in this bad situation to overcome an extremely shrunken vehicles procurement budget and to retain the transportation ability to support the field of operation. However, in the Transportation Department, the method for procuring general-purpose vehicles is just buying, without taking into consideration economics. Thus, whether buying vehicles or leasing is more economical is not likely known to ROKAF. To date, they have not tried to lease vehicles.

The purpose of this research is not to emphasize the leasing method but to provide better ideas to make better decisions to procure Air Force general-purpose vehicles economically, and effectively. Another consideration in this research is to develop a method for evaluating the cost-benefit of leasing versus buying general-purpose vehicles, which has been used in buying versus leasing decisions. Historical researchers have just compared the cost of leasing vehicles to the cost of buying ones without considering the overhead cost if vehicles are leased and nontangible benefits, which would heavily influence the decision of new options for procuring Air Force vehicles. For example, if a company leases vehicles from the commercial sector, it might lead to saving money by reducing some vehicles management activities that consume certain resources. However, previous research, which will be introduced in the literature review in Chapter 2, has mainly focused on direct cost, because indirect cost is very difficult to trace down according to activities, which consume resources.

Research Objectives

The objective of this research is to give the Korean Air Force principles that guide them as to what are the strong points and weak points between leasing and buying vehicles, and how these two methods are compared and analyzed in terms of costs and benefits. In this way, this research could enlighten the Korean Air Force to be able to look at the matter from another angle in terms of procuring military equipment. Furthermore, this research could be potentially devoted to other Korean government services.

Investigative Questions

- What are the non-financial benefits of leasing and buying vehicles options?
- What are the cost elements included in leasing and buying vehicles cost pools?
- Is it beneficial to lease general purpose vehicles?
- Is it cost effective to lease general purpose vehicles?
- Can the procuring option be finally determined?

Data Collection Method

The data required to analyze cost-benefit leasing versus buying vehicles will be collected from the 17th Air Combat Wing in ROKAF, Korean Air Force Headquarters, Korean Air Force Logistics Command, and the largest commercial leasing company, KumHo, in Korea.

Interviews will be conducted with Korean Air Force Headquarter, Air Force Logistics Command, the commercial leasing company, and the Public Procurement

Service, which is the only government department leasing vehicles from commercial sector, using a survey instrument developed by the author.

The survey will be performed at the 10 different Air Force bases, Korean Air Force Headquarters, and Air Force Logistics Command.

Scope and Limitations

It is very hard to get data from ROKAF and would take a long time to get all of the data for general-purpose vehicles in ROKAF. Therefore, this research is limited to general purpose vehicles (sedans) at only one base in ROKAF, which is the one of the largest and most important Air Force bases strategically. Furthermore, if the researcher collected data from all bases in the Korean Air Force and integrated it into one big database, it would be classified.

Therefore, the researcher will collect and analyze data relative to leasing versus buying vehicles at the 17th Air Combat Wing. The reason the researcher focuses only on sedans for leasing vs. buying vehicles is that it is prohibited by law to lease trucks from commercial enterprises (Seo, 2001). Table 1 below shows the vehicles selected for this study.

Table 1. Vehicles Included in the Study

Vehicle Type (Sedan)	Cubit Centimeter Displacement	Dimension
Small Size	1500cc	Less than Length: 15.4' Width: 5.6' Height: 6.6'
Medium Size	1800cc	More than Length: 15.4' Width: 5.6' Height: 6.6'
	2000cc	

This research does not recommend a course of action, but provides information for Korean officers and planners in ROKAF to make better decisions in terms of the leasing versus buying decision.

In the method of data collection, the researcher might make a mistake in selecting a sample frame from the Korean Air Force and the amount of time to conduct a longitudinal survey might be insufficient because of insufficient time to finish this research. But, once this research develops the hypothesis and sets up the methodical process to evaluate the current vehicle procurement system in ROKAF, it may lead to a beginning to develop further research.

Assumptions

1. The leasing company could provide the same quality of service and frequency of maintenance with leased as with owned vehicles based on contractual agreements.
2. Transition costs of moving from ownership to leasing will not be occurred.
3. Every cost incurred under ownership vehicles will start year 2001.
4. The salvage value of ownership vehicles will be zero, because Korean Air Force can't sell the worn out vehicles to the commercial sector.
5. The life expectancy of ownerships of vehicles will be 7 years, even though it is regulated to vary from 6 to 7 years by the Ministry of National Defense Instruction (Equipment Catalog Handbook 1999).

Definitions

To provide a common frame of reference, the following terms are defined as they are used in this thesis.

- ROKAF: Republic Of Korea Air Force.

- Vehicles: All wheel mounted equipment, self-propelled and not self-propelled, such as trailers which are used in conjunction with self-propelled equipment.

- General purpose Vehicle: A vehicle designed for moving personnel or material; a vehicle which will satisfy general automotive transport needs.

- Lessor: The leasing company to which the car dealership assigns the rights to the contract.

- Lessee: Consumer of using vehicles from the leasing company, lessor.

- Net Present Value: The value of a dollar today versus the value of that same dollar in the future after taking inflation into account.

- Residual Value: The value of a leased vehicle that the lessor depreciated the vehicle down to during the term of the lease, typically based on an estimated future value.

- Lease charge: The portion of the payment covering interest which is charged by the leasing company.

- Open-Ended Lease: Lessee guarantees the value of the car at lease end.

- Close-ended lease: Lessee does not guarantee the residual amount.

- Depreciation: The decline in value over the term of the lease. The difference between adjusted capitalized cost and the residual value which makes up the major part of the lese payment.

- Discount rate: The interest rate used in calculating the present value of expected yearly benefits and costs.

- Benefit-Cost Ratio (BCR): The Total Discounted Benefits of a project divided by the Total Discounted Costs of the project. If the value of the BCR is less than one, the project should not be continued.

- Cost-Benefit Analysis (CBA): An evaluation of the costs and benefits of alternative approaches to a proposed activity to determine the best alternative.

- Inflation: The proportionate rate of change in the general price level, as opposed to the proportionate increase in a specific price. Inflation is usually measured by a broad-based price index, such as the implicit deflator for Gross Domestic Product or the Consumer Price Index.

- Life Cycle Cost: The overall estimated cost for a particular program alternative over the time period corresponding to the life of the program including direct and indirect initial costs plus any periodic or continuing costs of operation and maintenance.

- Central Limit Theorem: If sampling size "n" is sufficiently large, where n is greater than 30, the mean of n has approximately a normal distribution. The larger the value of n, the better the approximation. Then, the Central Limit Theorem can be used.

Chapter Overview

Chapter II is literature review containing pertinent background of leasing versus buying vehicles in United States Air Force, giving support to the importance of this research and provides strengths and weaknesses of leasing and buying. Chapter III explains the methodology used to analyze the costs of leasing versus buying vehicles. Chapter IV examines the data presented in determining the cost-benefit of leasing and buying vehicles of the Korean Air force, as discussed in Chapter III. Finally, Chapter V provides a conclusion of the data analysis, the limitations of the research, and recommendations for follow-on research of the leasing versus buying decision.

II. Literature Review

Introduction

This chapter addresses the literature pertinent to analyzing the general concept of leasing versus buying decisions, especially dealing with vehicles (sedan). Actually, no previous research was found regarding leasing versus buying vehicles in the Korean Air Force, thus the literature was reviewed from the United States Air Force to provide a framework for establishing the importance of this research, as well as a benchmark for comparing the results of this study with other findings.

The goal of this chapter has four main objectives. First, it provides the reason why the management decision to lease or buy consideration is worthwhile. Second, it provides benefits of leasing and buying decision based on relevant literature reviews. Third, it illustrates what kinds of methods were used to analyze leasing versus buying decisions found in literature reviews. Fourth, it provides the intangible factors that impact a buy versus lease decision.

Historical Background

The issue of leasing versus buying of the United States Air Force's general purpose vehicles has been widely studied. The Department of Defense has been struggling with this issue in one form or another form since the late 1940s. After the Second World War, the Department of Defense needed large quantities of vehicles, which resulted in concerns from the U.S. Congress. As a result, President Eisenhower established the General Service Administration (GSA) to oversee the replenishment of the required vehicles. Since implementation of the GSA, it has played a very important

role in supporting vehicles for the U.S. Government with leased vehicles and motivation for the U.S. Air Force to conduct leasing versus buying studies. (Neal, Undated). A majority of these studies identified vehicle procurement as the most cost effective option between commercial leasing, GSA leasing, and ownership. The GSA leasing option exists only in the United States for considering the ways to procure Air Force vehicles, but currently no statutory authority such a GSA exists in the Korean Air Force, which would allow the ownership of all general purpose vehicles to be transferred to the commercial sector.

Since the mid 1980's, the United States Air Force has suffered from a declining budget for procuring vehicles. As a result of that, the United States Air Force has needed more efficient and economic methodology for acquiring new vehicles. There are numerous studies of leasing versus buying vehicles in United States Air Force. Some researchers' studies did advocate the leasing of vehicles because they thought this would lead to a rationalization of fleet size and a concomitant reduction in the level of support resources needed to meet the requirement of a large and aging fleet. (Synergy Inc, 2000) Other researcher's studies argued for the ownership of military vehicles because they thought this was a more flexible and suitable option for meeting military mission objectives and would prevent the performance uncertainty and morale reduction that might have resulted from the leasing option, where the resources such as labor, equipment, and facilities were eliminated (Synergy Inc, 2000).

Yet to date, the United States Air Force still seems to lack a clear, empirical basis for determining general purpose vehicle leasing and buying decisions.

Why Leasing

Currently, the ROKAF government purchases the majority of heavy equipment motor vehicles and general purpose vehicles from the contractor who maintains the assets. Although this practice has been around for a long time, given today's dynamic business environment, purchase of capital equipment may not be the best alternative for the Government. Recognizing the changing business climate and complying with the Government agency's request, the contractor approached the ROKAF to conduct a study that would explore the advantages and disadvantages of leasing over purchasing the equipment. (Mollaghasemi, 1995)

Many businesses outside the military operate in environments that are highly dynamic and ever changing. Entire industries, such as aerospace and defense, have undergone significant and long-term changes, often resulting in permanent downsizing and complete redefinition of existing jobs. As the marketplace continues to become more and more global, many organizations are affected by political and economic events around the world. (Mollaghasemi, 1995)

It is sometimes believed that the lease vs. buy decision is an investment or capital budgeting decision, analogous to the make vs. buy decision in manufacturing. In fact, lease vs. buy is not an investment but a financing decision. (Reilly, 1980)

Popularity of Leasing

In the last two decades, leasing has become a popular method of financing. Today, many companies lease a significant portion of their assets and this is particularly true for equipment leasing. Nevitt and Fabozzi, who are the authors of "Equipment

Leasing", estimate that 80% of US corporations lease assets each year, totaling close to $100 billion. (Mollaghasemi, 1995)

A growing number of businesses are signing up for the extra services that leasing companies provide. People seem to enjoy the lucrative service options given by a leasing company. According to the Journal of Accountancy "Buy or Lease: The Eternal Question," one of every three new cars on the road today is leased, and consumers are confronted frequently with the decision of whether to buy or lease their vehicles. (Mollaghasemi, 1995)

Benefits of Leasing Vehicles

Raymond L. Smith, president of U.S. Fleet Leasing in San Mateo, California, says leasing is " a better use of cash flow versus putting out the full purchase price. Lessees can use that money to invest in their business without investing valuable capital in an asset that's depreciating and is not going to make any money for them."(Mollaghasemi, 1995) A key advantage of leasing is the uniform pricing as mentioned above. On the other hand, ownership of vehicles requires careful and accurate capturing and tracing of all life cycle costs from acquisition through disposal, because there are so many indirect costs. Another positive characteristic of leasing vehicles is to make the flexibility of financing possible, which is divided by two options: 1) closed-end leasing, in which the lessor is responsible for depreciation. 2) open-end lease, in which the lessee is responsible for the market value of the vehicles when it is sold at the end of the lease. First, for the closed-end leasing option, the lessor charges the customer based on estimates for depreciation, maintenance, insurance, and registration, plus a management

fee. The customer is liable only for lease payments. It is considered the easiest for budgeting and controlling costs. Second, for the open-end leasing option, as like mentioned above the lessee is responsible for the market value at the end of the leasing contract's period, Open-end deals are the most popular among firms that lease fleets because they ultimately have the lowest cost. (Mollaghasemi, 1995)

Service facilities are one of the advantages of leasing vehicles from leasing companies. The fleet leasing company can provide many services. "It is no longer just moving goods from point A to point B," says John Haddock, vice president of marketing for Ryder Transportation Services, a division of Ryder System. "Companies are winning by the quality of their supply chain as well as the quality of their product." Sometimes, the leasing company provides the vehicles' lessees an effective way of managing cars and trucks efficiently and economically. (Candler, 1997)

Also, leasing vehicles saves the time for all kinds of paperwork, which occurs in buying vehicles. The need for maintaining operating records and reports is eliminated. If there's an accident when somebody owns his or her vehicles, it could require a significant amount of time to handle it. However, lessees have contracts for covering all kinds of vehicle accidents with the leasing company, everything is taken care of with one phone call. (Mollaghasemi, 1995)

Other reasons why leasing is an attractive option include lower capital investment, the ability to terminate a contract, reducing the risk of obsolescence, and lower financing costs. (Bunjer, 1973)

Other benefits of leasing vehicles are represented as follows:

- Commercial leasing can provide benefits from market competition.

- Commercial leasing may result in a lower average age fleet than ownership and it leads to better fuel economy for the Air Force. (Neal, Undated).
- The Air Force will have more flexibility to choose the vehicles it desires in its vehicle fleet.
- Elimination of environmental concerns in the areas of general purpose vehicles repair. (Neal, Undated).

There are many advantages of leasing vehicles from the commercial sector. The most important item relevant to this thesis is saving money from leasing vehicles. The leasing company is required to maintain the vehicles thereby eliminating the user's need for maintenance facilities, personnel, and record keeping. All of these benefits aforementioned could save money from eliminating overhead, administrative, and personnel costs.

Benefits of Buying Vehicles

Although lease contracts have become more flexible and can be tailored to meet consumer needs, many consumers still prefer to buy rather than lease. Sometimes, owning their vehicles gives users more flexibility in choosing among them. It also allows the civilian business to deduct depreciation and interest from their tax bill. However, depreciation is not relevant to a government, since they are exempt from taxation.

The other reason for preferring to own vehicles is that vehicle owners may have the pride of ownership, and this results in better vehicle care. The Korean Air Force has competed to have the best maintenance for vehicles every year, and this adds to maintenance workers' moral and quality of vehicles at the same time.

The most important aspects of buying vehicles in the military are that Air Force vehicles can be deployed throughout Korea with minimum notice, and be stocked in

warehouses for WRM (War Reserved Materials) fleet to prepare for unexpected wars. If all vehicles are leased from the commercial sectors, it will be very difficult for the Korean Air Force Transportation Department to have the vehicles moved wherever they want, in fact it may not even be an option based on leasing contracts with the leasing company. Also, leasing vehicles could result in the lack of skill of repairing and maintaining vehicles during wartime, thus buying vehicles retains maintenance skills and may increase the Transportation Department's moral.

Leasing and Buying Trends

According to a United States Air Force Headquarters final technical report, trends were discovered through interviews conducted with all military services, other government organizations, and private sector companies. (Synergy Inc, 2000) These trends are briefly summarized below:

- Across the three categories of benchmarked organizations (military services, other government organizations, and private sector companies), the decision to lease and buy is a financial decision, not a fleet management decision. At the most basic level, fleet managers view vehicles as physical assets without regard to whether they have been purchased or leased.

- Corporate assumptions regarding cost of capital, depreciation rates, length of vehicle life, operations and maintenance costs, and other financial factors will determine the financial lease and buy decision.

- The United States Air Force's traditional approach of combining peacetime and wartime base operating support functions has masked the need for direct mission-support, general-purpose vehicles.

- Government organizations and the commercial sector have used leasing as a way to reduce near term outlays, avoid replacement vehicle cost spikes, and improve fleet age and performance, and breakthrough appropriated fund problems for replacement vehicles.

- Corporate strategy and the relative role of vehicle management to that corporate strategy influence the nature of the lease and buy decision.

- The new fleet management models put in play by private sector organizations are concerned with high-level outputs of fleet performance, not with inputs or processes. As a result, fleet staff sizes are relatively small in number when compared to traditional fleet staffs.

- Vehicle services may be bundled or unbundled. Individual services may be purchased separately and directly from primary vendors, or purchased on a bundled basis from third party providers.

Methodology

The most widely used methodology for analyzing the leasing versus buying vehicles decision found in current literature is cost-benefit analysis, which is to compare the cost of buying to alternative ways of acquiring vehicles through the life cycle, from acquiring to disposing of the vehicles. Based on a literature review from the United States Air Force, most studies consider three options, which are the GSA lease, commercial lease and ownership.

Nontangible Factors

As mentioned in Chapter 1, one of purposes of this thesis is to let the Korean Air Force officers, who make the decisions for vehicle procurement, know of the concept of leasing versus buying. In addition, various methodologies for analyzing the decision are outlined. This section introduces one of the methods for analyzing the buying versus leasing decision for government contracts based on the article "A Multiple Criteria Buy Versus Lease Analysis for Government Contracts." (Mollaghasemi, 1997) Many of the previous buy versus lease research efforts have failed to take into account the importance and influence of various nontangible factors. In most cases, leasing versus buying

studies did not consider the nontangible factors such as political considerations, and the reaction of the people who might be affected by a new policy of procuring vehicles.

Mollaghasemi described people's experiences with a real world case study that involved a buy versus lease decision for a government agency. (Mollaghasemi, 1997) The study was divided into two major multicriteria decision making models that explored the impact of both the tangible and nontangible factors in a buy versus lease decision. The selected multicriteria decision making approach was the analytic hierarchy process (AHP).

Mollaghasemi said in his study that in any problem where conflicting objectives and intangible factors play an important role, a formal multicriteria analysis is desirable. After careful consideration of several available multicriteria techniques, the AHP was chosen. The AHP was originally introduced by Thomas Saaty in the mid 1970's. Since its development, AHP is one of the most popular multicriteria decision making methodologies available today. AHP is a multicriteria decision-making technique that takes into account both objective and subjective factors in order to arrive at an important ranking of the alternatives. The first step in any multicriteria method is to identify the nontangible factors to be used in the evaluation of the decision. Then, the next step is to determine the relative importance of each element. (Mollaghasemi, 1995)

The nontangible factors played a critical role in many case studies of leasing versus buying decisions. Sometimes, these nontangible factors helped the decision makers to look beyond just numbers, and instead assess the long-term goals and implication of leasing. Based exclusively on financial considerations, the lease option is sometimes considered inferior to the buy option. (Mollaghasemi, 1995) Mollaghasemi

argued in his study that the decision maker must have a vision of long-term implications for the organization, and must take into account both qualitative and quantitative factors. Only then can an organization make sound and effective decisions (Mollaghasemi, 1995)

Summary

This chapter reviewed the current existing literature relevant to leasing versus buying vehicles methods. It dealt with the background of the leasing versus buying decision found in the commercial sector as well as in the United Stated Air Force, and showed how leasing is compared to another procuring methods. It also outlined the benefits of leasing and buying respectively. Finally, it discussed nontangible factors, which may critically affect the leasing versus buying decision. Overall benefit and nontangible factors found in the literature review will give the researcher more insight to identify the benefits of leasing and buying, which is discussed in the next chapter.

III. Methodology

Introduction

The purpose of this chapter is to explain the methods used to answer the research questions introduced in Chapter 1. The goal of the research questions is to ascertain the logistical benefits and costs of the two options: leasing versus buying. Once identified, the benefits and costs are used to perform a cost-benefit analysis that will answer the overall research question of this study. A cost benefit analysis traditionally considers at least three viable alternatives. (Lagas, 2001) However, the analysis performed in this research considers only two alternatives, since the Korean government has no authority to lease vehicles from an organization similar to GSA. Although this research has two alternative ways to procure vehicles, the basic concept and methodology will follow the rule of traditional cost benefit analysis.

Data Collection and Scope

As mentioned in Chapter 1, it is not possible to lease trucks from the commercial sector because it is prohibited by law. Thus, there is no place to acquire the cost of leasing trucks from civilian leasing companies in Korea, because they don't have the trucks to be leased. Therefore, this research focused on sedan cost data, which are available from the military and commercial leasing companies. Although the scope of this research is extremely narrowed down, the purpose of this research is to show another way to procure Air Force vehicles in an efficient and economic way.

The data of number of vehicles will be presented in peacetime total authorizations, not wartime authorizations, which come from 17th Air Force Combat Wing.

Leasing costs of vehicles will be taken from the commercial leasing company KumHo, which has provided sedans to the Public Procurement Service. KumHo is also widely known in Korea as setting up a sisterhood relationship with Hertz Rental Company.

Nontangible factors might affect the leasing versus buying vehicle decision. Therefore, field experts will be interviewed and surveyed to ascertain the relevant nontangible factors.

To make this research doable, certain assumptions about the economic life of the vehicles, and salvage value are made. The economic life of the vehicles will be determined by the Ministry of National Defense Instruction entitled Equipment Catalog Handbook 1999, and salvage value will be meaningless in this research, because the Korean Air Force cannot sell the worn out vehicles to commercial sector. This research will not consider fuel costs in the buying and leasing comparisons, since commercial leasing does not include the fuel costs in its contract and the cost of fuel will be the same on any alternative.

Research Design

This research will utilize a case study to analyze the leasing versus buying vehicles options. In a case study, a particular individual, program, or event is studied in depth for a defined period of time. A case study is utilized due to the limitation of accessing the databases of all vehicles in the Korean Air Force. For these reasons, it is necessary to select one of the Korean Air Force bases from which vehicle maintenance and operations data could be collected more precisely.

Contrary to a comprehensive research program, this case study could provide unique or exceptional qualities that can promote understanding and information for decision on vehicle procurement options. As a result, this study could have value to the entire vehicle procurement process throughout the ROKAF Transportation Department.

Methodology

The methodology utilized is a cost benefit analysis. The cost benefit analysis is a systematic, quantitative method of assessing the life cycle costs and benefits of competing alterative approaches, including determining which one of the alternatives is best. A cost benefit analysis will attempt to quantify every benefit and cost for inclusion in the financial analysis, even nontangible factors as mentioned Chapter 2.

A cost benefit analysis can be conducted from two approaches; one is to achieve the maximum benefit given limited budget, the other is to achieve a minimum expense given organizational goals. This research will be conducted based on the former, because as mentioned prior, the Korean Air Force Transportation Department has suffered from the shrunken budget. Thus, this research is focusing on the cheapest alternative between leasing and buying, while meeting Korean National Defense goals.

First, the benefit calculations will be done. Benefit analysis of lease versus buying vehicles will include the nontangible factors, which might influence the decision through scoring and weighting the relative importance or priority of each of the elements, and will be discussed in depth in the benefit of leasing and buying section in this chapter.

Next part of cost benefit analysis, the cost calculation will follow, which is much more complicated and complex than the benefit analysis. Cost analysis will analyze the

costs of the lease versus buying through discounted cash flow analysis. Each year's net cash will be discounted to take into account the time value of money. This discounting gives the present value of each of the amounts. Although the leasing payment is paid monthly to leasing company, calculation will be applied to yearly totals.

The present value of an amount of money is the sum the lessee would have to invest today at a stated rate of interest to have that amount of money at a specified future date.

The present value of a future amount of income is:

$$\text{Present Value} = (\text{Future Value})/(1+\text{Discount price})^{a}$$

Where the exponent ^{a} is the number of years in the future that the future value will be received. The discount rate is the same as the interest rate. (Lagas, 2001)

To determine the inflation rate, this analysis uses the consumer price index over the last 14 years. Yearly inflation rates will be summed and divided by 14 to derive the average inflation rate for last 14 years. This study assumes the result of the average forecasted discount rate will remain the same for the next 7 years.

The discount rate utilized in this net present value is found in " The Relation between Inflation and Productivity Growth in the Korea" from the Bank of Korea. (The Bank of Korea, 2001) Table 2 presents the history of inflation for last 14 years.

Table 2. The History of Inflation Rate (From Year 1986 To Year 2000)

Unit: %

Year	1986~87	1988~91	1992~97	1998	1999	2000	1986~2000
Inflation Rate	2.9	7.7	5.2	7.5	0.8	2.3	5.2

The inflation shown above is measured by the Consumer Price Index. The period for deriving average inflation rate was 1986 to 2000. The average inflation of 5.2 % will be employed in this research.

This analysis compares the costs of each alternative by considering the timing of the payments, the lease rate, and the cost uncertainty.

Finally, this study will analyze the results of the combined benefits and costs of each alternative by employing the cost benefit analysis, and sensitivity analysis will test the sensitivity of input parameters.

Benefit of Leasing and Buying

Determining Benefit

The Korean Air Force has not specifically defined vehicles management goals, objectives, and performance measures for general purpose vehicles management policy. Therefore, interviews with field experts will be conducted to identify the goals of vehicles management. The interviewees will be given the general fleet management objectives to help them to decide the benefits of leasing and buying options to Korean Air Force. The idea of the general fleet management objectives is taken from the National Association of Fleet Administrators. It has published a benchmarking study entitled: "Benchmarking for Quality in Public Service Fleet." This study identified the key goals of fleet management as follows:

- Availability
- Reliability
- Safety

- Economy
- Environmental Responsibility

These five goals of fleet management taken from the National Association of Fleet Administrators will give some guideline for interviewee to identify the benefits of vehicles management.

The field experts consist of three persons; one who works for the vehicles management at the Headquarter in the Korean Air Force, another who works for strategy vehicle maintenance at the Korean Logistics Command, and the third person who works for vehicle mobilization at the Headquarter in the Korean Air Force. All persons are very knowledgeable in the transportation field.

The next step is to estimate the value of the benefits. A survey will be used to collect information on the benefits. This survey will be distributed to experts throughout the Korean Air Force transportation fields. Thirty five surveys will be distributed to military personnel to make certain this survey is unbiased and reliable. Once the benefit is identified and surveyed for their effect of procuring vehicles, the following step is to quantify the intangible benefits.

Quantifying Benefit

After the benefits are identified, establish performance measures for each benefit. If a benefit cannot reasonably be assigned a monetary value, it should be valued using a more subjective, qualitative rating system, which assigns relative numerical values for the competing alternatives. A typical qualitative rating system might evaluate potential benefits against the following five criteria, which is taken from the Cost-Benefit Analysis Guide for NIH IT Projects (Lagas, 2001)

1. Provides Maximum Benefits (2 points)
2. Provides Some Benefits (1 point)
3. Provides No Benefits (0 point)
4. Provides Some Negative Benefits (-1 point)
5. Provides Maximum Negative Benefits (-2 points)

Those five criteria shown above will be evaluated for each of the alternatives by a survey contained in Appendix A. Once the benefits are assigned numerical values, and then they will be summed and averaged to obtain a score for each benefit. Table 3 shows the scores for hypothetical benefits A to E from four reviewers using a scale of -2 to 2.

Table 3. An Example of Quantifying Benefit of Leasing and Buying

Alternative	Benefit	Participant 1 Score	Participant 2 Score	Participant 3 Score	Participant 4 Score	Average Score
L E A S E	A	2	1	0	-1	0.5
	B	0	2	-2	1	0.25
	C	2	2	2	1	1.75
	D	1	1	0	-2	0
	E	-2	-1	0	1	-0.5
B U Y	A	1	1	1	-1	0.5
	B	1	-1	-2	1	-0.25
	C	2	2	2	0	1.5
	D	1	2	1	-1	0.75
	E	1	-1	1	1	0.5

Weighting Benefit

Once each benefit is evaluated by its score, then the importance among the benefits will be estimated by weighting. The more important the benefit, the higher the weight. The advantage of weighting is that the more important benefits have a greater

influence on the outcome of the benefit analysis. Thus, it makes this comparative analysis more valuable and reliable.

A percentage system was used to determine each benefit category's relative importance. Each survey participant allocated 100 points among the five benefit categories as shown below in Table 4. The averages of each category's submitted weights were used as the average weight. The result of average weights will be applied to both the leasing and buying option, since the importance of vehicle management is non-specific.

Table 4. An Example of the Weighting Benefit of Vehicle Management

Benefit	Participant 1 Weight	Participant 2 Weight	Participant 3 Weight	Participant 4 Weight	Average Weight
A	10%	5%	20%	15%	0.125
B	30%	30%	10%	25%	0.238
C	20%	10%	10%	20%	0.150
D	15%	25%	40%	10%	0.225
E	25%	30%	20%	30%	0.263
Total	100%	100%	100%	100%	1

Calculating Overall Weighted Score

Once the benefit is quantified and weighted, the next step is to calculate the overall weighted score. Each benefit's average score is multiplied by its average weight as table 5.

Table 5. An Example of Weighted Scores

Alternative	Benefit	Average Socre	Average Weight	Score*Weight
L	A	0.50	0.125	0.063
e	B	0.25	0.238	0.059
a	C	1.75	0.150	0.263
s	D	0.00	0.225	0.000
e	E	-0.50	0.263	-0.131
	A	0.50	0.125	0.063
B	B	-0.25	0.238	-0.059
u	C	1.50	0.150	0.225
y	D	0.75	0.225	0.169
	E	0.50	0.263	0.131

The next step is to sum all the benefits' weighted score of leasing and buying options respectively. This example is shown in Table 6.

Table 6. An Example of Overall Weighted Scores

	Benefit A W/S	Benefit B W/S	Benefit C W/S	Benefit D W/S	Benefit E W/S	Overall W/S
Lease	0.063	0.059	0.263	0.000	-0.131	0.254
Buy	0.063	-0.059	0.225	0.169	0.131	0.529

Cost of Leasing and Buying

Methodological Approach of Cost Comparison

To compare the buying with leasing options in terms of financial approach, the options must be evaluated on the same basis. The other factor relevant to this research is the cost uncertainty, especially dealing with the ownership. Individuals who lease generally face a relatively certain payment stream over time based on a contract year with a leasing company. Therefore, lessees can avoid the uncertain operation and management costs, at least within their contract. In contrast, individuals who buy vehicles incur a cost stream that is relatively certain in the early years, but it is subject to considerably more uncertainty in the out years. Therefore, this research must consider the cost uncertainty over time, especially in the aging vehicles where direct costs would increase dramatically at that time. This uncertainty of direct costs of ownership will be discussed in depth later based on a historical database.

Another important thing to be considered in this analysis is the indirect costs that are not traceable directly to a specific vehicle, such as higher headquarters' overhead, office supplies, and facilities. Within the general ledger of the Korean Air Force it seems to be almost impossible to look at specific indirect costs. Therefore, this study assumes that indirect costs will be allocated by the percentage of sedan out of total vehicles in 17th Air Combat Wing, which is 17 percent (number of sedan divided by the total number of vehicles in 17th Air Combat Wing).

The last consideration to be applied to this study is the variable inflation rate, which could be attributed to influence the overall costs of ownership and leasing vehicles.

Sensitivity analysis will be conducted to ascertain the effect of changes in these key variables.

Cost of Ownership

Cost of ownership is always more than just the purchase price, sometimes many times more. The total seven years of the cost of ownership for computing equipment, facility, labor, and all kinds of indirect and direct cost factors could be several times the original buying price (Synergy Inc, 2000). Vehicle costs to the Korean taxpayers begin the day the governmental procurement begins the process of acquiring new vehicles, and finish the end of the vehicles' life cycle. It is not easy to trace all relevant vehicles' maintenance and operating costs. They may be masked by indirect costs such as facilities and equipment. However, the researcher will identify the costs, which contribute to the hidden costs of the vehicles' life cycle costs. And the researcher will insure before tracking and comparing the vehicles life cycle costs that this comparison between the leasing versus buying option will be conducted from the same year bases. The period to compare the vehicle costs will be 2001 to 2007 for 7 years, which will equate the life cycle time of sedans regulated by the Ministry of National Defense Instruction (Equipment Catalog Handbook 1999). Thus, during that time of comparison there are no replacement vehicles until all new vehicles are worn out, and at the end of the life cycle (7 years), all vehicles will be disposed without any salvage value.

The life cycle costs are roughly presented in Figure 1.

From year 2001 to year 2007						
1	2	3	4	5	6	7
Procurement						
#Estimate Purchase Price						
Operations and Maintenance						
# Direct Material Costs chargeable to operations and maintenance						
# Direct Labor Costs chargeable to Vehicle operation and maintenance						
# Indirect Labor and Material costs that cannot be identified with specific vehicles which are expended indirect support of the motor pool						
						Scraping
						# No salvage

Figure 1. Life Cycle Cost of Configuration for 7 years

The cost models of ownership and leasing categorize sedans as 1500cc, 1800cc, and 2000cc as mentioned in Chapter 1, and presented in detail each type as well as the other kinds of vehicles in Table 7.

Table 7. The Number of Vehicles in the 17th Air Wing Combat

	Sedan				Bus	Truck	Special-Purpose	The Others	Total
	1500cc	1800cc	2000cc	Subtotal					
Total Authorization	50	5	2	57	32	48	176	19	332
Life Expectancy	7	7	7		8~10	8~12	5~12	5~20	

The ownership cost tracing starts with a fundamentals comparison, focusing on direct costs first. To calculate total costs of ownership, the first step is to establish the purchased costs of vehicles. The costs of procurement are based on the standard vehicles' cost provided in the 2002 vehicles procurement report to Korean Air Force Headquarters (Sept.11.2001), which reflect the 2001-purchasing price of each type of sedan.

Table 8. The Purchasing Costs of Sedans

Unit:1,000 won

	Sedan			
	1500cc	1800cc	2000cc	Total
Total Authorization	50	5	2	57
Purchaing Cost	7,115	10,881	14,668	
Total Purchasing costs	355,750	54,405	29,336	439,491

The second type of cost is direct costs, such as direct labor, direct material costs and automobile insurance. This direct cost is one of the biggest costs associated with ownership. Some of the costs that comprise the direct costs are reported by the "Annual Report of the Vehicles Maintenance Performance." However, these data did not capture all relevant direct costs such as labor costs; it just shows the costs of the repair for vehicles in a year. The direct labor cost can be estimated by the number of hours vehicle maintenance personnel work. To figure out the number of hours, the number of vehicle maintenance persons at the vehicle maintenance unit in the 17th Air Wing Combat transportation squadron is needed. The number of workers in the repair shop is presented as follows.

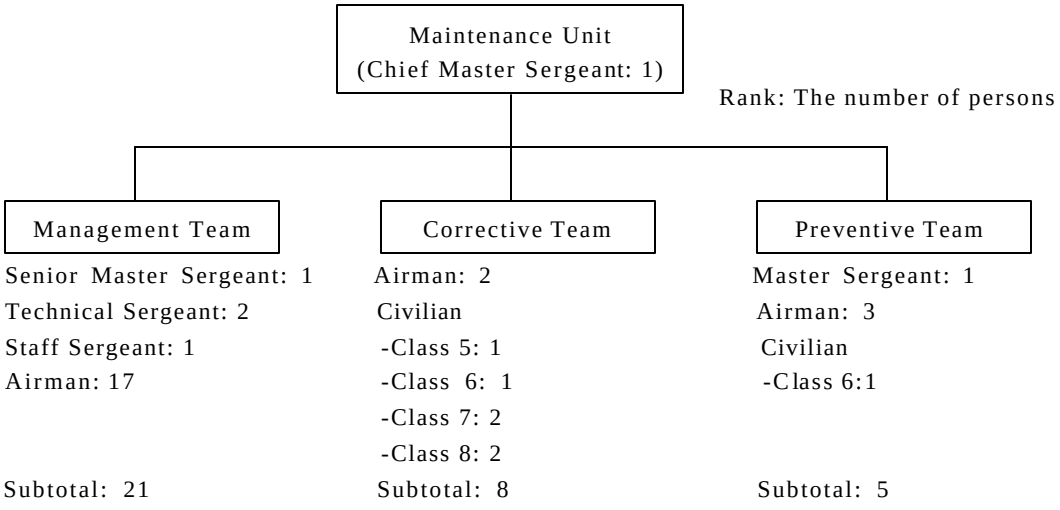

Figure 2. Organization of Vehicles Maintenance Unit in 17th Air Combat Wing

The following step is to calculate how much they get paid for their work and where they spend all their time. The paycheck information for each ranked person who works in the maintenance unit was found in the Accounting Department in the Korean Air Force and is represented in Table 9.

Table 9. Year 2001 Calculation of the Labor cost per Rank

Unit: 1000won

Rank	Yearly Cost	Monthly Cost	Daily Cost
Chief Master Sergeant	44,768	3,730	19.567
Senior Master Sergeant	45,555.6	3,796	19.911
Master Sergeant	36,254	3,021	15.845
Technical Sergeant	25,094	2,091	10.968
Staff Sergeant	15,576	1,298	6.808
Airman	1,869	155.8	0.826
Civilian Class 5	45,654	3,804	19.854
Civilian Class 6	38,817	3,234	16.966
Civilian Class 7	31,426	2,618	13.735
Civilian Class 8	24,094	2,007	10.531

This paycheck information is known to be very accurate to the extent that it includes fringe benefits, wages, salaries, and all personnel leave.

The mission of every vehicle maintenance unit in transportation squadrons in the Korean Air Force is to maintain and repair all vehicles that belong to their Air Combat Wing. Thus, the number of all vehicles belonging to their Air Combat must be identified to calculate the time spent on repairing and maintaining sedans. Then, the percentage of repairing and maintaining hours for sedans will be calculated by the number of sedans

divided by the total number of vehicles in the 17th Air Combat Wing. Then, this percentage will represent the percentage of workload for repairing and maintaining sedans. Although this percentage is an estimation, it will be reasonable. Every vehicle has its regular inspection and maintenance cycle based on the Korean Air Force Instruction 6-174 "Vehicle Maintenance Standard Time Schedule". However, the percentage of workload for sedans out of the total vehicles in the 17th Air Combat Wing could not capture the exact real time for sedans. Thus, the variance of the sedan workload will be reexamined by sensitivity analysis.

Once the costs of the labor force for the repair shop in the year 2001 is defined, it will be increased by the average rate of salary increase, which is 6 % based on the Compilation of Defense Budget Guidebook 2002.

Another direct cost factor is direct maintenance cost, which is found in the annual report of the Korean Air Force Headquarters Optimum Price Level of Vehicle Maintenance Costs Year 2001 and represented as follows.

Table 10. Optimum Price Level of Vehicle maintenance Costs Year 2001

Unit: 1,000 won

Type	Maintenance Cost (Maximum)	1st Year 25% of Maximum	2nd~7th Year 100% of Maximum
1500cc	816	204	816
1800cc	1,125	281	1,125
2000cc	1,498	375	1,498

As seen above, this table fails to represent the cost uncertainty of aging vehicles from the 2nd year to the 7th year. It shows the initial yearly maintenance costs and

assumed the rest of maintenance years are allocated the same amount of each type of sedan maximum yearly maintenance cost.

Mathematically, the uncertainty of this component can be thought of as the variance of the annual operating costs. At a minimum, it can be estimated from repair histories of a sample of vehicles. (Synergy Inc, 2000)

This will vary as to specific use and is therefore difficult to capture objectively in a high-level analysis. For example, the operating failure during an emergency mission-critical situation will have a much higher cost than the operating failure in some routine use not directly connected to a key Air Force mission. However, high-level analysis can explicitly show key trade-offs by capturing mean and variance of life-cycle costs under certain options as explained in this section. (Synergy Inc, 2000)

To calculate the cost uncertainty under various circumstances, the direct maintenance yearly costs will be captured by repair histories of a sample of vehicles. The sampling of vehicles will be selected from 10 different Air Force bases in Korea, and each location will provide 4 vehicles respectively, 1500cc, 1800cc, and 2000cc, which were purchased in 1994 and calculated for their life cycle, which is for 7 years from year to purchase.

Table 11. Direct Maintenance Costs of Sedans from year 1994 to year 2000

Unit: 1,000 won

Purchasing Price	1500cc		1800cc		2000cc	
	5,850		**9,347**		**13,542**	
Year	Yearly Cost	%	Cost	%	Cost	%
94~95	238	4%	259	3%	460	3%
95~96	365	6%	452	5%	712	5%
96~97	811	14%	985	11%	1,230	9%
97~98	955	16%	1,405	15%	1,809	13%
98~99	859	15%	1,650	18%	2,265	17%
99~00	652	11%	1,450	16%	1,698	13%
00~01	560	10%	1,056	11%	1,985	15%
Total	**4,440**	76%	**7,257**	78%	**10,159**	75%

Table 11 represents the yearly mean cost of sampled Air Force bases' vehicles and each percentage of year interval showed the percentage of initial purchasing vehicle's price. The percentage of total maintenance costs is 76% of the purchasing cost for 1500cc sedan, 78% of the purchasing cost for 1800cc sedans, and 75% of the purchasing cost for 2000cc sedans. These yearly costs summed and divided by 7 years will derive the annual average maintenance cost. Once the annual average maintenance cost is computed, it will be divided by the purchase cost of sedan type to derive the percentage of annual maintenance costs compared to purchase costs. The results of formula aforementioned are 11 percent of all vehicle types. This percentage will be applied to year 2001.

The other direct cost factor is the vehicle insurance costs, which must be bought from a civil insurance company according to Air Force Regulation. Thus, this research will not cover the accident cost, because there are no direct charges for car accidents from the insurance company. It would not be a significant amount in evaluating the alternative options between leasing and buying. Although the accident costs will not be a significant factor affecting the alternative decision, the effect of accident has to be considered, which would result in the obstacle of the mission accomplishment. The effect of accident, which is a non-financial factor, will be handled in benefit analysis in this research.

The insurance cost is found in the Automobile Insurance Policy Terms of SsangYong insurance company, which contracts to the Korean Air Force. The military is eligible for a 50 percent discount on the vehicle insurance bill. This insurance, which fully covers any kind of accident, is shown in Table 12.

Table 12. Vehicle Insurance Costs

Unit: 1,000 Won

	Sedan			
	1500cc	1800cc	2000cc	Subtotal
Authorization	50	5	2	57
Insurance Cost	311	290	304	
Yearly Cost	15,550	1,450	608	17,608

Total annual insurance costs are found by multiplying the annual insurance cost per vehicle by the number of authorizations, which for each sedan type is; 15,500,000 won for 1500cc, 1,450,000 won for 1800cc, 608,000 won for 2000cc.

These direct costs such as direct labor, maintenance, and automobile insurance, are relatively easily traced, discussed and represented so far. Indirect costs will be discussed next, which are not traceable directly to a specific vehicle, and include higher headquarters' overhead, office supplies, maintenance equipment, utility costs, and facilities.

Indirect costs of the vehicles, often referred to as overhead costs, are incurred in support of those vehicles for their life cycle. Typical overhead costs are indirect labor, indirect material, and fixed costs such as vehicle maintenance equipment, utilities, and facilities. Overhead will be broken into down two subcategories; operations overhead and general and managerial overhead. Operations overhead is defined as those costs that are not 100 percent attributable to the vehicles maintenance activity, but that are generally associated with the frequent management or support of that activity. General and managerial overhead includes salaries of indirect labor, equipment, facilities, and other activities relating to headquarters' management, accounting, personnel, legal

support, data processing management and similar general services performed outside the activity.

As mentioned above, the indirect costs are very difficult to trace from the Korean Air Force general ledger. The Korean Air Force has not calculated the indirect costs of vehicle management. Thus, this research assumes everything relevant to vehicle management activities starts at zero base in the year 2001. Overhead costs such as vehicles management, equipment, and repair facilities will be assumed to be new in the year 2001, and everything will be kept without replacement until the year 2007. This is because equipment and facilities are defined to retain their quality for more than 10 years respectively based on the Korean Air Force Regulation "Facility Plan Standard 2001".

The indirect costs are broken into down into four categories. First are the repair shop equipment costs needed to repair and maintain all vehicles in the 17th Air Force Combat Wing. This cost found at the Compilation of the Defense Budget Guidebook 2001 is shown in Table 13.

Table 13. Vehicles Maintenance Equipment Purchasing Costs

Unit: 1,000 won

Equipment	Total Costs
76 items	207,573

The vehicles maintenance equipment purchasing costs shown above will be divided by the percentage of sedans out of total vehicles in the 17th Air Combat Wing.

The second type of indirect costs, which is the facility cost, is found in the Compilation of the Defense Budget Guidebook 2001, is shown in Table 14.

Table 14. Facilities Costs

Unit: 1,000won

	Repairing Shop	Inspection Garage	Total Cost
Unit (m^2)	918	194	
Price / m^2	776	776	
Cost	712,368	150,544	862,912

The indirect vehicles equipment cost will be determined by dividing by the percentage of sedans accounting for all vehicles.

Third cost factor of the indirect costs is electric and water charges consumed by vehicle facilities. These data come from the "Utility and Water Record of the 17th Air Combat Wing" provided by the Civil Engineering Squadron in the 17th Air Combat Wing.

Table 15. Utilities Charges

Repairing and Inspection Shops		
Year	Electric (Kw)	Water (Ton)
1994	18,504	1,620
1995	20,113	1,450
1996	22,050	1,740
1997	23,051	1,560
1998	21,050	1,660
1999	19,550	1,320
2000	21,682	1,260
Total	146,000	10,610
Average Consumption	20,857	1,516
Unit Cost (won/unit)	75	1,192
Average Cost	1,564,286	1,806,731

Utilities' charges are shown in Table 15, and were taken from 1994 to 2000. This historical consumption data was summed and divided by 7 years to derive the annual average. The water was measured in yearly ton usage and electric in watts. Unit cost of electric and water is 75won/KiloWatt and 1,192won/ton respectively. The average costs are found by multiplying the average consumptions by the unit costs, for each utility is; 1,564,286 won for electric and 1,806,731 won for water.

The last cost factor is indirect labor cost consumed in all course of actions relating to vehicle life cycle activities. Although, this expense will be incurred from the beginning of acquiring the new vehicles to the elimination of the scrapped vehicles, it will not be counted in the indirect cost pool in this research, since each person related to one of those activities considers it a part of one's normal work flow. Thus, the labor associated with those activities can be committed to other jobs if the leasing option is selected as the vehicle procuring method.

To identify the total ownership vehicle costs, the researcher traced and integrated each type's of sedan's purchasing cost, direct labor cost, direct maintenance cost, automobile insurance cost, and the number of indirect maintenance costs as discussed above. To determine the overall costs of owning vehicles for 2001 and the next six years, the net present value of each vehicle type is summed.

Cost of leasing

The Korean Air Force has never adopted the leasing vehicles method, thus, there is nothing to compare with buying costs in the existing system in the Korean Air Force. However, the cost of leasing data will be traced from the Public Procurement Service, which is the only government service to lease vehicles from the commercial sector. The cost of leasing vehicles can be found in the contract from the commercial leasing company, KumHo, which is providing vehicles to government services under the contract. Under this contract, KumHo provide government services with a full service lease including vehicles maintenance, insurance, and all kinds of activities.

The lease charge used is a closed-end lease, in which the lessor is responsible for depreciation. The lessor charges the customer based on estimates for depreciation, maintenance, insurance, and registration, plus a management fee. The customer is liable only for the lease payments. This is considered the easiest for budgeting and controlling costs. Thus, this research assumes that the leasing contract type applied here will be the closed-end lease, and every cost datum will be taken from the existing contract.

A three-year leasing contract was signed between the Public Procurement Service and KumHo. Based on the interview with the person who administers this contract in the Public Procurement Service, it is beneficial for the government to lease vehicles for three years, but this has not been verified. The leasing company, KumHo, is of the same opinion concerning the three-year contract.

To compare the leasing options with ownership, the researcher needs a seven-year contract. Under Article 6 of the Public Procurement Service Contract Announcement 2000-306, the lessees can renew their contract up to a maximum of 2 years. Therefore,

the first three-year contract will be in effect for five years. The first year's renewal is discounted at 15 percent and the second year's renewal is discounted at 20 percent by Article 5 of the contract. The first contract will expire in 5 years, and then the second new contract will be contracted for 2 years, which is available under the different contract option in the leasing company, KumHo. However, the cost of the second contract after the first contract ends, which will be the year 2006, is not known, thus, it is forecasted by applying an inflation rate. The inflation rate previously discussed is 5.2 percent. This inflation rate is applied to the year 2006 to derive the yearly cost for leasing vehicles at that time. The formulation employed is an inverse operation of the net present value. For example, the yearly cost of leasing 1500cc vehicles can be calculated using the present value multiplied by the principle and discount rate and power to 5 years, which results in 9,385,000 won. The yearly leasing cost for 1800cc is 10,803,000 won, and 11,806,000 won for 2000cc. The annual costs of leasing vehicles for the first five years were adopted from the current contract documents, "The Public Procurement Service Contract Announcement 2000-306", and so were the yearly leasing costs for the second two-year contract. As a result of the two separate contracts, this research can make the comparative seven years.

Once all cost data relevant to each contract year is derived, and then total yearly leasing payments from 2001 to 2006 are computed by multiplying the number of each type's authority and each one of the yearly costs. It is shown in Table 16.

Table 16. Yearly Leasing Payment

Unit: 1,000 won

Year	Contract Type		Yearly Leasing Payment		
			1500cc	1800cc	2000cc
2001~03	First Three-year Contract Annual Rate		6,846	8,067	8,847
2004	One year Extended Rate	15% ↓	5,819	6,857	7,520
2005	Another One year Extended Rate	20% ↓	5,477	6,454	7,078
2006~07	New Two-year Contract Annual Rate	5.2% Inf.	9,385	10,803	11,806
Total Authorization			50	5	2
2001~03	Total Yearly Leasing Payment		342,300	40,335	17,694
2004	Total Yearly Leasing Payment		290,955	34,285	15,040
2005	Total Yearly Leasing Payment		273,840	32,268	14,155
2006~07	Total Yearly Leasing Payment		469,250	54,015	23,612

To compute the total cost of commercial leasing for the seven years studied in this analysis, all the vehicles' net present values will be summed.

Cost Benefit and Sensitivity Analysis

Once the benefits are quantified in numerical value and the costs are calculated, the costs and benefits need to be combined to evaluate the overall cost benefit between alternatives. The way to combine the different characteristic attributes is the benefit to cost ratio, that is the benefit divided by the cost, and will be used to differentiate between alternatives.

Sensitivity analysis tests the sensitivity and the reliability of the results obtained from the cost-benefit analysis. Since the general ledger in the Korean Air Force has not precisely defined every kind of cost relevant ownership vehicles, the data parameter values have to be reexamined as to the impact of differing values on the outcome. Thus, the sensitivity analysis will identify those input parameters that have the greatest

influence on the outcome, repeat the analysis with different input parameter values, and evaluate the result to determine which, if any, input parameters are sensitive. If a relatively small change in the value of an input parameter changes the alternative selected, then the analysis is considered to be sensitive to that parameter. If the value of a parameter has to be substantially increased before changing the selected alternative, the analysis is not considered to be sensitive to that parameter.

Sensitivity analysis will be applied to the cost analysis, since the benefit analysis is calculated through survey participants who are authorities in transportation and the data is assumed to be reliable. Thus, sensitivity analysis will not be undertaken on these data.

The considerations for variation of parameters for the sensitivity analysis in this research are as follows. First, the percentage of sedan workload weight, which is 17 percent simply calculated by the number of sedans divided by total vehicles in the 17th Air Combat Wing, may vary up to 35 percent due to maintenance requirements of different types of vehicles.

Second, indirect costs charged to ownership will vary. The current ownership cost models assume and calculate all indirect costs. However, indirect costs are not guaranteed to be eliminated in the military, such as facilities and equipment, if leasing alternatives are adopted for procuring vehicles. Thus, indirect costs may vary 30, and 60 percent, which impact on the cost pool of the leasing option, because of the indirect costs would not be eliminated under the leasing policy, the total leasing costs must bear the ongoing indirect costs.

Third, the direct maintenance cost charged to ownership will vary. The operating uncertainty and the potential for maintenance and repair could increase in the aging

vehicle. Even though this research developed the way to predict the uncertainty of maintenance by repair histories of a sample of vehicles, the uncertainty will be reexamined to examine into sensitivity. Eleven percent of indirect maintenance costs out of purchasing costs was employed in this research. Percentages for sensitivity analysis will be 11 and 20 percent.

Fourth, the inflation rate is one value that certainly changes over time. The cost models reflect the inflation rate as the interest rate in computing the present value of the annual costs. This analysis will vary with the inflation rate to determine how the costs of each model will react to different inflation rates. The inflation rate used to compute in this analysis is 5.2 percent and will vary 10 percent.

The step for processing sensitivity analysis for each input parameter, defined above, is presented as follows.

First, choose one of the parameters selected for sensitivity analysis

Second, determine the minimum and maximum values for that parameter

Third, repeat the cost-benefit analysis with the new parameter value

Fourth, document the results

Fifth, repeat the steps until all four parameters have been tested.

After repeating the above process for different parameters, this study will have a set of outcomes that will correspond to a given set of inputs, which will make a decision about the way to procure vehicles between leasing and buying.

Summary

This chapter covers the methodical approach employed for this cost-benefit analysis. This chapter describes all of the numerous variables used to represent the costs in the two different cost models and the different methods used to calculate the values for all of the variables.

IV. Results and Analysis

Introduction

This chapter discusses the results and analysis using the methodology discussed in chapter 3 to answer the investigative and overall research questions. To reiterate, the investigative questions are taken from Chapter 1 as follows:

- What are the non-financial benefits of leasing and buying vehicles options?
- What are the cost elements included in leasing and buying vehicles cost pools?
- Is it beneficial to lease general purpose vehicles?
- Is it cost effective to lease general purpose vehicles?

The first and third questions will be answered in the first section of this chapter, the Benefit of Leasing and Buying, and the second and fourth questions will be answered in the second section of this chapter, the Cost of Leasing and Buying.

Benefit of Leasing and Buying

Determining Benefit

As mentioned in previous chapter, the Korean Air Force has not yet defined what the benefits criteria are for procurement methods. This section reports the benefit factors based on the interview with field experts. The following bullets list the benefits of leasing and buying that came out of the interviews.

- Availability: This relates to the military operation and maintenance ability during periods of conflict or emergency. Whenever vehicles break during an operation, they should be repaired as soon as possible.

- Reliability: During a vehicle operation, a critical attribute is to meet the strategic goals so as not to fail a mission because of a defective vehicle.

- Safety: Leased fleets would generally be newer than purchased fleets, thus, it would be reasonable to assume that newer vehicles will be safer than older vehicles.

- Flexibility: Flexibility is a very important benefit for military operations of the Korean Air Force, since general purpose vehicles used to be moved to other base's according to bases gain and lose authorizations. By owning its vehicles, the Korean Air Force can easily move vehicles to other bases. By leasing vehicles, the Korean Air Force may not be able to accomplish vehicle reassignments as easily.

- Economy: Economy in this study means effective and efficient utilization of resources when it comes to buying and leasing as well as the avoidance of cost spikes due to the replacement of vehicles. These resources represent the personnel, facility, equipment, and fuel efficiency results from the well managing vehicles or newer ones.

- Organization: This criterion is very critical to the Korean Air Force. The scale and structure of ROKAF transportation personnel will be affected by the procurement type, whether leasing or buying. If the leasing option is selected for vehicles procurement, the number of vehicles management personnel could be decreased.

- Service quality: This criterion includes promptness of dealing with the aftermath of an accident, improved fleet age, outstanding performance, and replacement of disabled vehicles.

Quantifying Benefits

The seven criteria above that represent the intangible benefits will be quantified using a rating system already mentioned in Chapter 3. A survey was distributed throughout the ROKAF transportation units, and resulted in 30 completed survey returned. The results are shown in Appendix B and summarized in Table 17.

Table 17. Average Survey Score of Each Benefit

	Availability	Reliability	Safety	Flexibility	Economy	Organization	Service
Buy	1.367	0.733	0.233	1.300	0.267	1.167	0.033
Lease	0.067	0.767	1.133	-0.733	0.333	-0.567	0.633

The numerical values represent the preference of the attributes. The higher the score, the more the attribute is preferred. The result of survey indicates that availability, flexibility, and organization are better in buying, and safety and service are better in leasing. Reliability and economy are approximately the same in either option.

Weighting Benefits

After an average score of each benefit was calculated, the next step is to identify the rank of the importance by weighting. The survey participants ranked each benefit according to its relative importance. The result of weighting each benefit is summarized in Table 18. The results of the individual survey are found in Appendix C.

Table 18. The Result of Weighting Benefit of Vehicles Management

Availability	Reliability	Safety	Flexibility	Economy	Organization	Service	Total
22.8%	19.8%	16.4%	9.6%	9.5%	10.7%	11.2%	100.0%

As seen in Table 18, availability, reliability, and safety are turned out to be extremely important to vehicle management, while flexibility, economy, organization, and service are secondary in importance.

Calculating Overall Benefit Score

The score of each benefit and the relative importance of it has been quantified and identified. The next step is to calculate the overall weighted score of each benefit. This calculation consists of two steps.

First, each average score of a benefit is multiplied by its average weight. The result of a weighted score of each benefit of the leasing and buying option is shown in Table 19. Second, the sum of the weighted scores used to calculate the overall weighted score of benefit is shown in Table 20.

Table 19. The Weighted Scores

Alternative	Benefit	Average Score	Average Weight	Score*Weight
Buy	Availability	1.367	0.228	0.312
	Reliability	0.733	0.198	0.145
	Safety	0.233	0.164	0.038
	Flexibility	0.130	0.096	0.012
	Economy	0.267	0.095	0.025
	Organization	1.167	0.107	0.125
	Service	0.033	0.112	0.004
Lease	Availability	0.067	0.228	0.015
	Reliability	0.767	0.198	0.152
	Safety	1.133	0.164	0.186
	Flexibility	-0.733	0.096	-0.070
	Economy	0.333	0.095	0.032
	Organization	-0.567	0.107	-0.061
	Service	0.633	0.112	0.071

Table 20 presents the overall weighted score of the benefit of buying versus leasing. This table shows buying is more beneficial than leasing. The result of calculating the overall benefit score of buying is 0.661 and leasing is 0.325.

Table 20. The Overall Weighted Scores

	Availability	Reliability	Safety	Flexibility	Economy	Organization	Service	Overall Weighted Score
Buy	0.312	0.145	0.038	0.012	0.025	0.125	0.004	0.661
Lease	0.015	0.152	0.186	-0.07	0.032	-0.061	0.071	0.325

Cost of Leasing and Buying

Cost of Ownership

Before calculating the total costs of owning sedans, except purchasing and insurance costs, the percentage of sedans out of total vehicles in the 17th Air Combat Wing was computed. Seventeen percent of total vehicles in the 17th Air Combat Wing were sedans. Purchasing, equipment, facility are assumed constant. Labor is projected to be escalated by the defense budget guidebook. The variable costs of material, insurance, and utility were converted from future value into the value of won today by using net present value. All relevant costs of ownership are shown at Figure 3, and a discussion of each follows.

Unit: 1,000 won

Year	*Start up*	*Operation and Management*						
	Direct Costs				**Indirect Costs**			
	Purchasing	Labor	Material	Insurance	Equipment	Facility	Utilities Charges	
							Electric	Water
2001	439,491	79,524	48,344	17,608	35,287	146,695	266	307
2002	↓	84,295	NPV	NPV	↓	↓	NPV	NPV
2003		89,353						
2004		94,714						
2005		100,397						
2006		106,421						
2007		112,806						
Sub Total	439,491	667,511	277,720	101,152	35,287	146,695	1,528	1,764
	439,491	1,046,383			185,274			
Total Ownership Cost								
1,671,148								

Figure 3. Costs of Ownership

Purchasing. The purchasing cost was computed by the number of authorizations of each vehicle type multiplied by the year 2001 purchasing costs. This will be remain the same year 2007, because there is no replacement vehicles. The total purchasing cost is 439,491,000 won.

Labor. Labor cost was derived by the number of vehicle maintenance personnel multiplied by the salary of each, and then multiplied by the percentage of the workload, which is 17 percent. Annual cost of 2001 was 79,524,000 won, as shown the Table 21. It will be increased six percent annually according to "The Compilation of Defense

Budget Guidebook 2002". For year 2002 to year 2007, labor costs are found in Figure 3. The total labor cost is 667,512,000 won.

Table 21. The Annual Cost of the Labor

Unit: 1,000 won

Rank	# of people	Yearly Cost	17% of Labor
Chief Master Sergeant	1	44,768	7,611
Senior Master Sergeant	1	45,556	7,744
Master Sergeant	1	36,254	6,163
Technical Sergeant	2	25,094	8,532
Staff Sergeant	1	15,576	2,648
Airman	22	1,869	6,990
Civilian Class 5	1	45,654	7,761
Civilian Class 6	2	38,817	13,198
Civilian Class 7	2	31,426	10,685
Civilian Class 8	2	24,094	8,192
Total	35	467,788	79,524

Material (Maintenance Cost). Eleven percent, which was the percentage of the annual average maintenance cost out of the purchase cost of sedans as shown on page 37, was applied to the purchasing cost of each vehicle type to compute the annual maintenance cost. Then, this was multiplied by the number of each vehicle type.

Table 22. The Annual Cost of the Maintenance

Unit:1,000 won

	Sedan			
	1500cc	1800cc	2000cc	Total
Total Authorization	50	5	2	57
Purchasing Cost	7,115	10,881	14,668	
The Maintenance Cost is 11 % of the Purchasing Cost				
Maintenance Cost	783	1,197	1,613	3,593
Total Annual Cost	39,133	5,985	3,227	48,344

To find the net cost of maintenance for each vehicle type for the seven years, the net present value of the payments for the next seven years was calculated, using the average Consumer Price Index for the past 14 years, according to the Bank of Korea. Using the Excel program, the net present value for maintenance cost was calculated. The net present value of the maintenance cost for seven years is 277,720,000 won, as shown in Figure 3 on page 51.

Insurance. The annual insurance cost is found in Table 12. This cost is 17,608,000 won. As the same manner of the maintenance cost, the net present value is employed to convert the seven years into present Korean won value. The result is 101,152,000 won, as shown in Figure 3.

Equipment. A total of 76 items of equipment in the repair shop was purchased in the year 2001 to maintain and operate all kinds of vehicles in the 17th Air Combat Wing. To prorate the cost of equipment of sedan, the 17 percent figure was used to derive the annual cost of equipment cost for sedans. This amount is 35,287,000 won as shown in Table 23. This cost will be remain the same year 2007, because there is no replacement equipment.

Table 23. The Cost of Equipment For Sedan

Unit: 1,000 won

Equipment	Total Costs
76 items	207,573
Allocating to Sedans (17 % of Total Costs)	
207,573*0.17	35,287

Facility. The total cost of maintenance and facility costs is 862,912,000 won, based on the year 2001 price. The total facility cost is allocated to the sedan by the ratio of the number of sedan to the number of rest of vehicles, resulting in 146,695,000 won, as shown in Table 24. This cost will be constant over time.

Table 24. The Cost of Facility For Sedan

Unit: 1,000won

	Reparing Shop	Inspection Garage	Total Cost
Unit (m^2)	918	194	
Price / m^2	776	776	
Cost	712,368	150,544	862,912
Weight 17 % on Total Cost to derive the Facilities Costs for Sedan			
17%	121,103	25,592	146,695

Utilities (Electric and Water). The average yearly utility costs were shown in Table 15 and will be applied to year 2001. The average utility costs are allocated to the sedan according to the percentage of sedans out of the total vehicles in the 17th Air Combat Wing, which is 17 percent. The result is shown in Table 25.

Similar to insurance, the net present value is employed to convert the seven years into present value by applying the discount rate, 5.2 percent. The consequence of this computation is shown in Figure 3.

Table 25. The Annual Cost of the Utility

Unit: won

Unit Cost	75 won / kw	1,192 won / ton
Average Comsumption	20,857	1,516
Annual Cost	1,564,286	1,806,731
Allocate 17 percent of Annual Cost to Sedan		
17% of Annual cost	265,929	307,144

Cost of leasing

The yearly leasing cost from the year 2001 to the year 2007 was found in Table 16 of Chapter 3 of this study. The next thing to be done for the benefit cost analysis is to compute the net present value. By using the Microsoft Excel program, the net present value of each yearly future cost is derived. The result is shown in Table 26.

Table 26. The Total Leasing Cost

Unit: 1,000won

Year	Yearly Leasing Payment		
	1500cc	1800cc	2000cc
2001~03	342,300	40,335	17,694
2004	290,955	34,285	15,040
2005	273,840	32,268	14,155
2006~07	469,250	54,015	23,612
Converting Net Present Value of Each Year (Discount Rate: 5.2%)			
2001	342,300	40,335	17,694
2002	325,380	38,341	16,819
2003	309,297	36,446	15,988
2004	249,907	29,448	12,918
2005	223,581	26,346	11,557
2006	364,188	41,921	18,325
2007	346,186	39,849	17,420
Total	2,160,839	252,686	110,722
Total Leasing Cost			
2,524,247			

The net present value for the total of the 1500cc vehicle type comes to 2,160,839,000 won, 249,929,000 won for 1800cc, and 109,512,000 won for 2000cc as shown above.

Finally, the total leasing cost amounts to 2,524,247,000 won (Table 26), which is a cost increase of 853,099,000 won over the total ownership cost (Figure 3). This shows an increase of 51 percent over the total ownership cost.

The Result of Cost Benefit Analysis

As has been illustrated, the ownership has been shown to possess more benefits whiles being less costly. Hence, it would follow that the ownership would outperform the leasing option in a cost benefit analysis.

Table 28 presents the result of benefit to cost ratio of each options between buying and leasing. The benefit to cost ratio was computed by converting into common values to allow the calculation. As shown below, each cumulative discounted cost was divided by 10,000,000, and each benefit rating was multiplied by 1,000 respectively to bring raw data into a more manageable order of magnitude. The result of benefit to cost ratio of each option is 3.92 for the buying and 1.29 for the leasing. According to the result, the ownership of vehicles is almost three times more beneficial and cost efficient than the leasing option.

Table 27. The Result of Benefit to Cost Ratio

Options	Cummulative Discounted Cost (Won)	Converted D/C (1/10,000,000)	Benefit Rating	Converted B/R (1000)	Benefit To Cost Ratio
Buying	1,671,148,000	**167**	0.661	**661**	**3.96**
Leasing	2,524,247,000	**252**	0.325	**325**	**1.29**

The next consideration of this research is to make sure how the input parameters could affect the vehicle procurement decision. The input parameters were identified in the Chapter 3. It is re-examined how these input parameters are sensitive to decision making in the next section.

Sensitivity Analysis

The goal of this section is to determine if the results of this analysis change with different value for various input parameters used in the cost models.

To reiterate, the step of processing sensitivity analysis for each input parameter taken from the Methodology Chapter as follows.

- First, choose one of the parameters selected for sensitivity analysis
- Second, determine the minimum and maximum values for that parameter
- Third, repeat the cost-benefit analysis with the new parameter value
- Fourth, document the results
- Fifth, repeat the steps until all-four parameters have been tested.

Changes in The Percentage of Sedan Workload Weight

Owing to lack of exclusive cost of sedan such as labor, equipment, facility, and utility, these costs were allocated by the number of sedans out of total vehicles in 17th Air Combat Wing. The percentage of the workload was calculated to be 17 percent. To determine how sensitive the outcome is to this parameter, the value of the parameter is doubled to 35 percent. If the outcome is not significantly changed, the analysis is not considered to be sensitive to this parameter.

The result is shown in Table 28. In this result, the buying option increased by 2,381,411,000 won. However, the buying option is still more cost efficient than the leasing option. Thus, the change in the workload to the sedans is not sensitive to the outcome. The maximum value for this parameter is 35 percent, which doubled the initial value. If the maximum value were 40 percent, the cost of buying would be more expensive option than the leasing. However it cannot account for up to 40 percent, according to interviews with the field experts who are working at the Vehicle Maintenance Unit in the 17th Air Combat Wing.

Table 28. The Result of Benefit to Cost Ratio for the Changes in Workload

Options	Cummulative Discounted Cost (Won)	Converted D/C (1/10,000,000)	Benefit Rating	Converted B/R (1,000)	Benefit To Cost Ratio
Buying	2,381,411,000	**238**	0.661	**661**	**2.78**
Leasing	2,524,247,000	**252**	0.325	**325**	**1.29**

Changes in Indirect Cost

Indirect costs are one of the most difficult costs to account for when performing an analysis. The difficult part is in determining how much of the indirect cost should be included in the analysis. This analysis assumed that all indirect costs would be eliminated if military vehicles were all leased from the commercial sector. However, the question still remains as to what if the indirect costs were not eliminated from leasing. Therefore, the researcher assumed that 30 and 60 percent of the indirect costs would be ongoing, although the leasing option was adopted as a vehicle procurement method. Indirect cost varied 30 and 60 percent and was imposed on the leasing cost model.

The total indirect cost was shown in Figure 3 on page 52. This cost, comprised of equipment, facility, and utility charges, summed to 185,274,000 won. With the 30 percent ongoing indirect cost imposed, the overall cost of leasing shows an increase of 55,582,000 won over 2,524,247,000 won. With the 60 percent ongoing indirect cost imposed, the overall cost of leasing demonstrates an increase of 111,164,000 won over 2,524,247,000 won. These results are shown in Table 29, and 30.

Table 29. The Result of Benefit to Cost Ratio for the Indirect Cost (30%)

Options	Cummulative Discounted Cost (Won)	Converted D/C (1/10,000,000)	Benefit Rating	Converted B/R (1,000)	Benefit To Cost Ratio
Buying	1,671,148,000	**167**	0.661	**661**	**3.96**
Leasing	2,579,829,000	**258**	0.325	**325**	**1.26**

Table 30. The Result of Benefit to Cost Ratio for the Indirect Cost (60%)

Options	Cummulative Discounted Cost (Won)	Converted D/C (1/10,000,000)	Benefit Rating	Converted B/R (1,000)	Benefit To Cost Ratio
Buying	1,671,148,000	**167**	0.661	**661**	**3.96**
Leasing	2,635,411,000	**263**	0.325	**325**	**1.24**

As shown above, both 30 and 60 percent changes in indirect cost do not affect the decision. Therefore, the indirect cost input parameter is not sensitive to the research.

Changes in Direct Maintenance Cost

The maintenance cost is a typically uncertain cost of the vehicle life cycle cost pool. The uncertainty is caused by for aging vehicles, unexpected accidents, and defects in the vehicle system. All cost uncertainties were not considered in this research, however the uncertainty of the maintenance cost is illustrated by tracing the historical record found at

17th Air Combat Wing. The historical records of yearly maintenance costs were averaged for last 7 years and came to 11 percent of the purchasing cost. This percentage was varied by 20 percent, which is almost double the original. Table 31 presents the result of the cost benefit analysis with a 20 percent figure. Although the buying cost increases to 1,898,374,000 won, it is still less than the leasing cost, 2,524,247,000 won as shown in Table 31. Therefore, the direct cost is not sensitive to the outcome.

Table 31. The Result of Benefit to Cost Ratio for The Changes in Direct Cost

Options	Cummulative Discounted Cost (Won)	Converted D/C (1/10,000,000)	Benefit Rating	Converted B/R (1,000)	Benefit To Cost Ratio
Buying	1,898,374,000	**190**	0.661	**661**	**3.48**
Leasing	2,524,247,000	**252**	0.325	**325**	**1.29**

Changes in Inflation

To determine inflation's effect on the results, the rate used to compute the present value of the seven years worth of payments is 5.2 percent. With this inflation rate, the overall cost of ownership for sedans sums to 1,671,148,000 won. The leasing cost, using the same rate, totals 2,520,279,000 won. The difference between two options is that the cost of ownership is 849,131,000 won lower than the cost of leasing vehicles.

The next step is to determine what the costs of each option would be if the inflation rate increased to 10 percent. With a 10 percent inflation rate, the present value of the total cost of ownership for the seven years is 1,612,856,000 won and 2,211,530,000 won for the total cost of leasing option. The difference between two options is that the cost of ownership is still 598,674,000 won lower than the cost of

leasing option. As shown in Table 32, the change of the inflation rate does not affect the outcome within 10 percent of inflation change.

Table 32. The Result of Benefit to Cost Ratio for The Changes in Inflation Rate

Options	Cummulative Discounted Cost (Won)	Converted D/C (1/10,000,000)	Benefit Rating	Converted B/R (1,000)	Benefit To Cost Ratio
Buying	1,612,856,000	**161**	0.661	**661**	**4.10**
Leasing	2,217,781,000	**222**	0.325	**325**	**1.47**

Summary

This chapter provided a review of the research objective and the five investigative questions. It provided the results of the research conducted to answer each of these research questions introduced in Chapter 1. Specifically, the results of benefit analysis showed that the buying option provides more benefits than the leasing option while being less costly. Finally, a sensitivity analysis was done to confirm how the input parameters affect the current decision.

Table 33. The Summary of the Result of Cost Benefit Analysis

The Original Analysis					
Options	Cummulative Discounted Cost (Won)	Converted D/C (1/10,000,000)	Benefit Rating	Converted B/R (1000)	Benefit To Cost Ratio
Buying	1,671,148,000	**167**	0.661	**661**	**3.96**
Leasing	2,524,247,000	**252**	0.325	**325**	**1.29**
The Workload for Sedan (35%)					
Buying	2,381,411,000	**238**	0.661	**661**	**2.78**
Leasing	2,524,247,000	**252**	0.325	**325**	**1.29**
The Indirect Cost (30%)					
Buying	1,671,148,000	**167**	0.661	**661**	**3.96**
Leasing	2,579,829,000	**258**	0.325	**325**	**1.26**
The Indirect Cost (60%)					
Buying	1,671,148,000	**167**	0.661	**661**	**3.96**
Leasing	2,635,411,000	**263**	0.325	**325**	**1.24**
The Direct Cost (20%)					
Buying	1,898,374,000	**190**	0.661	**661**	**3.48**
Leasing	2,524,247,000	**252**	0.325	**325**	**1.29**
The Infation (10%)					
Buying	1,612,856,000	**161**	0.661	**661**	**4.10**
Leasing	2,217,781,000	**222**	0.325	**325**	**1.47**

V. Conclusion

Introduction

This research began with recognition of the problem the Korean Air Force has had in the shrunken budgets and in the limited vehicle procurement method, which is the ownership they have for the status quo. Also recognized was the lack of vehicles management goals in the Korean Air Force.

The authors of this research felt that more conclusive results might be obtained if the scope of the analysis were strictly limited. Consequently, the population of interest selected was sedan at 17th Air Combat Wing. The base was found to have a requirement for 57 of these vehicles. Two methods for meeting this requirement were selected for comparative analysis. These sources were the current Korean Air Force ownership method, and lease from the commercial sector.

The United States Air Force has researched numerous studies of the economies associated with leasing in lieu of buying and maintaining their vehicles. The literature review chapter presented the researches of the United States Air Force as well as the civilian sector relevant to the leasing versus buying studies to apply a proper methodology and analyze the current situation of vehicle procurement method in the Korean Air Force.

Reviewing the current literature, the researcher has found the appropriate methodology, which is cost benefit analysis to derive the most cost beneficial option of vehicle procurement in the Korean Air Force. In the methodology chapter, the researcher presented the data, explicated the variables, and described the methodology. To verify the sensitivity of input parameters, which affected the outcome of this research, the

researcher tests sensitivity and reliability of the results obtained from the cost-benefit analysis.

Finally, the researcher found in the chapter 4 that without a doubt, the ownership is a more beneficial alternative than lease from commercial sector while being less costly.

Conclusion

The most beneficial vehicle procurement alternative proved to be the ownership. As shown in Table 21, significant benefits seem to be available in the areas of Availabilities, Flexibility, and Organization for the ownership. On the contrary these benefits turned out to be weakness in the leasing alternative, but in the areas of Reliability, Safety, Economy, and Service, the lease is more beneficial than the ownership. Finally, overall benefits were measured at 0.661 for the ownership and 0.325 for the lease.

The present value of the total cost to the 17th Air Combat Wing by owning its vehicles (sedans) equals 1,671,148,000 won over seven years, and by leasing vehicles equals 2,524,247,000 won. When combining the cost and the benefit, the results of cost-benefit analysis are 3.96 for the ownership, and 1.29 for the lease. This represents that the ownership is almost three times more cost-beneficial than the lease. To verify the sensitivities of input parameters determine the decision of vehicles procurement options, this research employed the sensitivity analysis. The input parameters were four factors tested; 1) workload of sedans, 2) indirect cost, 3) direct maintenance cost, 4) inflation. The result of the benefit to cost ratio did not change a lot compared with the initial analysis, except the changes in the percentage of workload of sedans. Only under the

change of percentage of workload of sedans, the present value of buying was increased as much as the lease, but not exceeded.

After a thorough consideration of all the facts presented in this research, the researcher conclude that there is no economic and beneficial basis for replacing the current 17th Air Combat Wing vehicles management system based on ownership with one based on leasing.

It seems clear that the ownership is more beneficial and less costly than the leasing option as the primary vehicles procurement method, and will not be converted into the leasing option in a couple of years unless commercial leasing companies drop down the leasing price.

Limitations

Although the operation and maintenance patterns of vehicle type (sedan) selected in this research would apply across all Korean Air Force Bases, the scope of this study is not sufficient to evaluate and apply throughout all transportation units.

The interviews and survey might have mistakes and biases because of the limited time and space. To find the benefit of leasing and buying, the researcher implemented the Korean Air Force vehicles management for the first time in the Korean Air Force through the interview and survey. However, field experts in the transportation community have an unfamiliarity of measuring benefits of vehicle procurement methods by interview and survey, thus the resultant of the survey could change.

Recommendations

In order for any cost factor to transpire accurately, the Korean Air Force budget system more has to be classified by activities, which consume the resources. Current budget system seems almost impossible to look at the costs of specific vehicles.

According to survey taken by field experts in the transportation community, the ownership proved significant logistical advantages while being less costly. However, these significant benefits found in this research seem to be compulsory on the way to implement. Vehicle management goals have not existed in the Korean Air Force Transportation Department before this research began. Thus, Korean Air Force must have the fleet management goals to clarify their vehicle mission.

Leasing in the civilian area has become an accepted practice in fleet management generally, because operating uncertainty and its attendant maintenance costs are avoided. Although the resultant of this research argued that leasing is least desirable vehicle procurement method, it is worthwhile to lease some portion of vehicles to practice more advanced civilian fleet management. In advance to this action, the compromise leasing agreement, which is reasonable leasing price for Air Force, have to be arrived at first.

Future Research

Throughout this research, various issues arose that would be interesting areas for future research. First area for follow on research is to trace down more accurate and empirical cost pool for vehicles life span. A most difficult part when doing this research was to analyze a specific cost of each activity relevant vehicle management. Thus, follow on research may need to classify the activity according to characteristics of

vehicles management and operation, and then assign the costs to activities, which consume the resources.

Another area for future research is to consider the transition costs. Although this research did not mention the transition costs, it will be worthwhile to think and study the effect of changing status quo on overall costs. The transition costs represent the costs of implementing the change. Change does not come easy to most organizations and many change efforts fail because the change is often not well planned and managed. Transition costs sometimes do not always provide a clear picture of the tradeoffs between leasing and buying alternatives. By not providing this separation, this analysis could be potentially biased in either direction. Thus, follow-on researcher needs to consider this transition costs very carefully.

For the first time in the Korean Air Force, this research implemented the vehicle management goals to identify benefits of vehicles procurement options and the each benefits of options measured by numerical value. However, the researcher did not verify the validity of the results. Identifying these benefits will usually require an understanding of the work processes of the organization and its users. Thus, understanding and verifying the benefits of the fleet management in Korean Air Force is recommended to follow on researcher.

Contributions of Research

Prior to this research, there is no documented case of analyzing leasing versus buying vehicles in the Korean Air Force. There have been no comparisons leading to a leasing versus buying decision. Therefore, this research could enlighten the Korean Air

Force to be able to look at this matter from another angle in terms of acquiring military equipment. Furthermore, this research provides the Korean Air Force with a tool for quantifying benefits and comparing benefits and costs for future vehicles conversion decisions.

Appendix A. Survey

Survey for Quantifying Benefit of leasing and buying vehicles.

This survey questionnaire is intended to obtain information from transportation field experts about their own perception of benefit of vehicles procuring method between leasing and buying with respect to their current vehicles management and working situation.

Please, take a minute to complete this survey. The results will be used as one of comprehensive process designed to help us make a desirable decision on procuring the Korean Air Force vehicles next couples of years.

SCALE

1. Provides Maximum Benefits (2 points)
2. Provides Some Benefits (1 point)
3. Provides No Benefits (0 point)
4. Provides Some Negative Benefits (-1 point)
5. Provides Maximum Negative Benefits (-2 points)

Choose the most appropriate number after each statement

Part 1: Score the each benefit of leasing and buying method for procuring vehicles

Buying ***Leasing***

1. Vehicle Availability

Definition: This relates to the military operation and maintenance ability during periods of conflict or emergency. Whenever vehicles break during an operation, they should be repaired as soon as possible.

Question: How much do you think leasing and buying option can improve the availability respectively?

1	2	3	4	5	1	2	3	4	5

2. Reliability

Definition: During vehicle operation, a critical attribute is to meet the strategic goals and not to fail the mission because of a defective vehicle.

Question: How much do you think leasing and buying option can improve the reliability respectively?

1	2	3	4	5	1	2	3	4	5

3. Safety

Definition: Leased fleets would generally be newer than purchased fleets, thus, it would be reasonable to assume that newer vehicles will be safer than older vehicles.

Question: How much do you think leasing and buying option can achieve safety respectively?

1	2	3	4	5	1	2	3	4	5

4. Flexibility

Definition: Flexibility is a very important benefit for military operations of the Korean Air Force, since general purpose vehicles used to be moved to other bases according to bases gain and lose authorizations. By owning its vehicles, the Korean Air Force can easily move vehicles to other bases. By leasing vehicles, the Korean Air Force may not be able to accomplish vehicle reassignments as easily.

Question: How much do you think leasing and buying option can achieve the flexibility respectively?

1	2	3	4	5	1	2	3	4	5

5. Economy

Definition: Economy in this study means effective and efficient utilization of resources when it comes to buying and leasing as well as the avoidance of cost spikes due to the replacement of vehicles. These resources represent the personnel, facility, equipment, and fuel efficiency results from the well managing vehicles or newer ones.

Question: How much do you think leasing and buying option can achieve the economy respectively?

1	2	3	4	5	1	2	3	4	5

6. Organization

Definition: This criterion is very critical to the Korean Air Force. The scale and structure of ROKAF transportation personnel will be affected by the procurement type, whether leasing or buying. Because, if leasing option selected as a vehicles procurement, the number of vehicles management personnel could be decreased.

Question: How much do you think leasing and buying option can affect the transportation organizational structure?

1	2	3	4	5	1	2	3	4	5

7. Service Quality

Definition: This criterion includes promptness of dealing with the aftermath of an accident, improved fleet age, outstanding performance, and replacement of disabled vehicles.

Question: How much do yo3u think leasing and buying option can achieve the desirable serve level of military vehicles management?

1	2	3	4	5	1	2	3	4	5

Part 2: Weight the each benefit (Goal) of vehicles management

Allocate 100% to 7 benefits showed below based on your job experience and holistic picture of ROKAF vehicles management.

Example:	Availability	14.5%	
	Reliability	14.5%	
	Safety	14.0%	
	Flexibility	14.0%	
	Economy	14.0%	
	Organization	14.0%	
	Service Quality	14.0%	Total: 100%

Fill up the blank with the percentage allocated 100% to benefits

Availability	☐	%
Reliability	☐	%
Safety	☐	%
Flexibility	☐	%
Economy	☐	%
Organization	☐	%
Service Quality	☐	%
Total	100	%

Make sure sum of all benefits percentages have to be 100%

Appendix B. Survey Results

- **Benefit Scales**

1. Provides Maximum Benefits (2 points)
2. Provides Some Benefits (1 point)
3. Provides No Benefits (0 point)
4. Provides Some Negative Benefits (-1 point)
5. Provides Maximum Negative Benefits (-2 points)

Buying							
Number	Availability	Reliability	Safety	Flexibility	Economy	Organization	Service
1	2	1	1	2	1	2	-2
2	1	0	2	1	0	0	0
3	2	1	1	2	1	2	1
4	2	1	1	0	0	0	-1
5	1	2	1	1	-2	1	-1
6	2	1	1	2	0	1	1
7	1	1	0	0	1	-1	0
8	2	0	-1	2	-1	0	0
9	1	0	1	2	-1	2	2
10	1	1	-1	2	-1	1	0
11	1	1	1	1	0	2	1
12	2	2	0	1	1	1	1
13	1	0	-1	0	0	0	1
14	2	1	1	1	1	1	-1
15	0	0	-1	2	1	2	-1
16	1	2	0	1	1	2	-2
17	2	1	1	1	0	1	-1
18	1	2	0	1	0	0	0
19	2	1	1	0	0	2	-1
20	1	0	0	2	0	1	2
21	2	1	0	2	1	2	0
22	1	1	0	1	1	1	0
23	2	0	-1	2	1	2	0
24	1	-1	-1	1	-1	2	1
25	0	1	1	2	-1	2	1
26	2	0	0	2	0	2	-1
27	1	1	1	2	2	1	1
28	1	1	-1	0	-1	0	1
29	2	1	1	1	2	2	1
30	1	-1	-1	2	2	1	-2
Average	1.367	0.733	0.233	1.300	0.267	1.167	0.033

Leasing							
Number	Availability	Reliability	Safety	Flexibility	Economy	Organization	Service
1	0	1	1	-2	1	-2	1
2	0	0	2	-2	0	-1	-1
3	-1	1	1	-1	0	0	-1
4	0	1	0	0	1	-1	0
5	-1	1	1	1	1	-2	1
6	2	2	1	-1	1	0	2
7	1	2	1	0	0	1	2
8	-1	1	2	-1	1	-1	1
9	1	0	2	-1	0	-2	1
10	2	0	1	-1	1	-2	0
11	1	1	1	-2	0	-2	0
12	0	0	0	0	0	-1	0
13	0	0	0	0	0	-1	0
14	1	1	1	1	-1	0	1
15	-1	-1	2	0	1	-1	-1
16	0	1	1	-1	-1	-1	-1
17	0	1	2	0	0	0	2
18	1	2	2	0	0	0	2
19	0	1	2	-1	1	0	1
20	0	1	1	-1	2	0	1
21	-1	0	1	-2	1	-1	1
22	0	1	1	-2	1	0	1
23	0	1	1	-1	0	-1	0
24	1	2	1	-2	0	-1	1
25	0	0	0	0	-1	0	1
26	-1	1	1	-1	0	0	1
27	0	2	1	0	1	0	1
28	-2	-1	1	-1	0	1	1
29	0	0	1	-1	0	1	0
30	0	1	2	0	0	0	1
Average	0.067	0.767	1.133	-0.733	0.333	-0.567	0.633

Appendix C. Survey Weight Results

Weighting Scores								
Number	Availability	Reliability	Safety	Flexibility	Economy	Organization	Service	Total
1	30%	20%	10%	15%	10%	10%	5%	100%
2	40%	30%	10%	10%	2%	3%	5%	100%
3	20%	20%	20%	10%	15%	10%	5%	100%
4	25%	25%	15%	10%	5%	10%	10%	100%
5	15%	15%	15%	15%	10%	15%	15%	100%
6	15%	30%	15%	10%	15%	10%	5%	100%
7	27%	24%	9%	12%	15%	3%	10%	100%
8	30%	25%	10%	10%	5%	10%	10%	100%
9	25%	25%	15%	10%	5%	10%	10%	100%
10	15%	15%	25%	10%	10%	15%	10%	100%
11	15%	15%	15%	15%	15%	15%	10%	100%
12	30%	20%	20%	20%	3%	4%	3%	100%
13	30%	25%	25%	5%	5%	5%	5%	100%
14	15%	10%	15%	15%	25%	10%	10%	100%
15	20%	20%	10%	5%	15%	15%	15%	100%
16	20%	15%	10%	10%	10%	25%	10%	100%
17	22%	25%	24%	10%	5%	5%	9%	100%
18	25%	25%	10%	10%	10%	10%	10%	100%
19	30%	25%	15%	5%	10%	5%	10%	100%
20	25%	15%	15%	15%	5%	10%	15%	100%
21	10%	10%	20%	5%	30%	10%	15%	100%
22	20%	20%	10%	5%	5%	30%	10%	100%
23	25%	10%	15%	15%	10%	10%	15%	100%
24	25%	20%	10%	5%	5%	5%	30%	100%
25	20%	20%	15%	5%	10%	10%	20%	100%
26	10%	10%	30%	5%	10%	10%	25%	100%
27	30%	30%	20%	5%	5%	5%	5%	100%
28	20%	15%	20%	5%	5%	25%	10%	100%
29	15%	15%	30%	5%	5%	10%	20%	100%
30	35%	20%	20%	10%	5%	5%	5%	100%
Average	0.228	0.198	0.164	0.096	0.095	0.107	0.112	1.000

Appendix D. The Result of Sensitivity Analysis for The Percentage of Workload

Unit: 1,000 won

Year	*Start up*	*Operation and Management*						
	Direct Costs				**Indirect Costs**			
	Purchasing	Labor	Material	Insurance	Equipment	Facility	Utilities Charges	
							Electric	Water
2001	439,491	163,726	48,344	17,608	72,651	302,019	547	632
2002	↓	173,549	NPV	NPV	↓	↓	NPV	NPV
2003		183,962						
2004		195,000						
2005		206,700						
2006		219,102						
2007		232,248						
Sub Total	439,491	1,374,288	277,720	101,152	35,287	146,695	3,145	3,633
	439,491	1,753,160			188,760			
Total Ownership Cost								
2,381,411								

Unit: 1,000won

Converting Net Present Value of Each Year (Discount Rate: 5.2%)			
Year / Vehicle Type	1500cc	1800cc	2000cc
2001	342,300	40,335	17,694
2002	325,380	38,341	16,819
2003	309,297	36,446	15,988
2004	249,907	29,448	12,918
2005	223,581	26,346	11,557
2006	364,188	41,921	18,325
2007	346,186	39,849	17,420
Subtotal	2,160,839	252,686	110,722
Total Leasing Cost	2,524,247		

Options	Cummulative Discounted Cost (Won)	Converted D/C (1/10,000,000)	Benefit Rating	Converted B/R (1,000)	Benefit To Cost Ratio
Buying	2,381,411,000	**238**	0.661	**661**	**2.78**
Leasing	2,524,247,000	**252**	0.325	**325**	**1.29**

Appendix E. The Result of Sensitivity Analysis for the Indirect Cost

Indirect Cost Varies 30 Percent

Unit: 1,000 won

Year	*Start up*	*Operation and Management*						
	Direct Costs				**Indirect Costs**			
	Purchasing	Labor	Material	Insurance	Equipment	Facility	Utilities Charges	
							Electric	Water
2001	439,491	79,524	48,344	17,608	35,287	146,695	266	307
2002		84,295						
2003		89,353						
2004		94,714	NPV	NPV			NPV	NPV
2005		100,397						
2006		106,421						
2007		112,806						
Sub Total	439,491	667,511	277,720	101,152	35,287	146,695	1,528	1,764
	439,491	1,046,383			185,274			
Total Ownership Cost								
1,671,148								

Unit: 1,000won

Converting Net Present Value of Each Year (Discount Rate: 5.2%)				Indirect Cost (30%)
Year / Vehicle Type	1500cc	1800cc	2000cc	
2001	342,300	40,335	17,694	
2002	325,380	38,341	16,819	
2003	309,297	36,446	15,988	
2004	249,907	29,448	12,918	
2005	223,581	26,346	11,557	
2006	364,188	41,921	18,325	
2007	346,186	39,849	17,420	
Subtotal	2,160,839	252,686	110,722	55,582
Total Leasing Cost	2,579,829			

Options	Cummulative Discounted Cost (Won)	Converted D/C (1/10,000,000)	Benefit Rating	Converted B/R (1,000)	Benefit To Cost Ratio
Buying	1,671,148,000	**167**	0.661	**661**	**3.96**
Leasing	2,579,829,000	**258**	0.325	**325**	**1.26**

Indirect Cost Varies 60 Percent

Unit: 1,000 won

Year	*Start up*	*Operation and Management*						
	Direct Costs				**Indirect Costs**			
	Purchasing	Labor	Material	Insurance	Equipment	Facility	Utilities Charges	
							Electric	Water
2001	439,491	79,524	48,344	17,608	35,287	146,695	266	307
2002	↓	84,295	NPV	NPV	↓	↓	NPV	NPV
2003		89,353						
2004		94,714						
2005		100,397						
2006		106,421						
2007		112,806						
Sub Total	439,491	667,511	277,720	101,152	35,287	146,695	1,528	1,764
	439,491	1,046,383			185,274			
Total Ownership Cost								
1,671,148								

Unit: 1,000won

Converting Net Present Value of Each Year (Discount Rate: 5.2%)				Indirect Cost (60%)
Year / Vehicle Type	1500cc	1800cc	2000cc	↓
2001	342,300	40,335	17,694	
2002	325,380	38,341	16,819	
2003	309,297	36,446	15,988	
2004	249,907	29,448	12,918	
2005	223,581	26,346	11,557	
2006	364,188	41,921	18,325	
2007	346,186	39,849	17,420	
Subtotal	2,160,839	252,686	110,722	111,164
Total Leasing Cost	2,635,411			

Options	Cummulative Discounted Cost (Won)	Converted D/C (1/10,000,000)	Benefit Rating	Converted B/R (1,000)	Benefit To Cost Ratio
Buying	1,671,148,000	**167**	0.661	**661**	**3.96**
Leasing	2,635,411,000	**263**	0.325	**325**	**1.24**

Appendix F. The Result of Sensitivity Analysis for The Direct Maintenance Cost

Unit: 1,000 won

Year	*Start up*	*Operation and Management*						
	Direct Costs				**Indirect Costs**			
	Purchasing	Labor	Material	Insurance	Equipment	Facility	Utilities Charges	
							Electric	Water
2001	439,491	79,524	87,898	17,608	35,287	146,695	266	307
2002	↓	84,295	NPV	NPV	↓	↓	NPV	NPV
2003		89,353						
2004		94,714						
2005		100,397						
2006		106,421						
2007		112,806						
Sub Total	439,491	667,512	504,946	101,152	35,287	146,695	1,528	1,764
	439,491	1,273,609			185,274			
Total Ownership Cost								
1,898,374								

Unit: 1,000won

Converting Net Present Value of Each Year (Discount Rate: 5.2%)			
Year / Vehicle Type	1500cc	1800cc	2000cc
2001	342,300	40,335	17,694
2002	325,380	38,341	16,819
2003	309,297	36,446	15,988
2004	249,907	29,448	12,918
2005	223,581	26,346	11,557
2006	364,188	41,921	18,325
2007	346,186	39,849	17,420
Subtotal	2,160,839	252,686	110,722
Total Leasing Cost	2,524,247		

Options	Cummulative Discounted Cost (Won)	Converted D/C (1/10,000,000)	Benefit Rating	Converted B/R (1,000)	Benefit To Cost Ratio
Buying	1,898,374,000	**190**	0.661	**661**	**3.48**
Leasing	2,524,247,000	**252**	0.325	**325**	**1.29**

Appendix G. The Result of Sensitivity Analysis for The Inflation

Unit: 1,000 won

Year	*Start up*	*Operation and Management*						
	Direct Costs				**Indirect Costs**			
	Purchasing	Labor	Material	Insurance	Equipment	Facility	Utilities Charges	
							Electric	Water
2001	439,491	79,524	48,344	17,608	35,287	146,695	266	307
2002		84,295						
2003		89,353						
2004		94,714	NPV	NPV			NPV	NPV
2005		100,397						
2006		106,421						
2007		112,806						
Sub Total	439,491	667,512	235,359	85,723	35,287	146,695	1,295	1,495
	439,491	988,594			184,772			
Total Ownership Cost								
1,612,856								

Unit: 1,000won

Converting Net Present Value of Each Year (Discount Rate: 10%)			
Year / Vehicle Type	1500cc	1800cc	2000cc
2001	342,300	40,335	17,694
2002	311,182	36,668	16,085
2003	282,893	33,335	14,623
2004	218,599	25,759	11,300
2005	187,036	22,039	9,668
2006	291,367	33,539	14,661
2007	264,879	30,490	13,328
Subtotal	1,898,256	222,165	97,360
Total Leasing Cost	2,217,781		

Options	Cummulative Discounted Cost (Won)	Converted D/C (1/10,000,000)	Benefit Rating	Converted B/R (1,000)	Benefit To Cost Ratio
Buying	1,612,856,000	**161**	0.661	**661**	**4.10**
Leasing	2,217,781,000	**222**	0.325	**325**	**1.47**

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Vita

Captain Jungjin Kim graduated from Shin Heung High School in Cheong-Ju, Korea in March 1991 and entered the Korean Air Force Academy in Cheong-Ju. After he graduated with a Bachelor of Arts degree in English Literature in 1995, he was commissioned as a transportation officer and assigned to the Transportation Squadron in 17th Air Combat Wing in Cheong-Ju as a chief of transportation management. In July 1997, he was assigned to the 60 Transportation Group, ROKAF Logistics Command in Taegu where he served as a Foreign Military Material Transportation Commander.

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14. ABSTRACT

In an era of decreasing defense budgets in Korea, the Korean Air Force Transportation Department has suffered from an insufficient vehicles procurement budget, resulting in fewer vehicles of increasing age, as well as decreasing military morale. For these reasons, the Korean Air Force Transportation Department needs a breakthrough to retain the transportation ability to support the field of operation in an effective and economic way. However, the Korea Air Force Transportation Department has only one method for procuring general-purpose vehicles, which is purchasing. Thus, the comparative analysis of leasing versus buying vehicle study started from the recognition of this situation in which ROKAF needs an efficient and effective vehicle procurement method.

The purpose of this research is not to emphasize the leasing method, but to provide better ideas to make decisions to procure Air Force general-purpose vehicles economically, and effectively. Another consideration in this research is to develop a method for evaluating the cost-benefit of leasing versus buying vehicles, which has been used in buying versus leasing decision.

This research analyzed two variables, logistics benefits and costs, and compared these variables for leasing and buying options to discover which one provides the most logistical benefits for the life cycle cost. The results of the analysis concluded that buying offers more benefits at significant cost savings.

15. SUBJECT TERMS
Leasing versus Buying Decision, Vehicles, Net Present Value, Inflation, Indirect Cost, Direct Cost, Cost-Benefit Analysis

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