



**NAVAL  
POSTGRADUATE  
SCHOOL**

**MONTEREY, CALIFORNIA**

**MBA PROFESSIONAL REPORT**

---

**Valuing the DoD Process Output**

---

**By: Petros Bourazanis  
Gusnadi  
December 2005**

**Advisors: Thomas J. Housel  
Bill Gates**

*Approved for public release; distribution is unlimited.*

THIS PAGE INTENTIONALLY LEFT BLANK

<b>REPORT DOCUMENTATION PAGE</b>			<i>Form Approved OMB No. 0704-0188</i>
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.			
<b>1. AGENCY USE ONLY (Leave blank)</b>	<b>2. REPORT DATE</b> December 2005	<b>3. REPORT TYPE AND DATES COVERED</b> MBA Project	
<b>4. TITLE AND SUBTITLE:</b> Valuing the DoD Process Output			<b>5. FUNDING NUMBERS</b>
<b>6. AUTHOR(S)</b> Petros Bourazanis and Gusnadi			<b>8. PERFORMING ORGANIZATION REPORT NUMBER</b>
<b>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)</b> Naval Postgraduate School Monterey, CA 93943-5000			<b>10. SPONSORING/MONITORING AGENCY REPORT NUMBER</b>
<b>9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b> N/A			<b>11. SUPPLEMENTARY NOTES</b> The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.
<b>12a. DISTRIBUTION / AVAILABILITY STATEMENT</b> Approved for public release; distribution is unlimited			<b>12b. DISTRIBUTION CODE</b>
<b>13. ABSTRACT (maximum 200 words)</b> The Department of Defense (DoD) is facing the challenge to discover a tool to measure its performance as part of its responsibility to taxpayers. As a public institution that provides a public good to the people, the DoD has difficulties in using the prominent investment financial ratios used by the private sector as a metric of their performance. The problem is that DoD does not generate revenue and simultaneously, in many cases, a huge amount of money, as an investment, is spent in favor of its mission without further analysis about the efficiency of this investment. The DoD, by operating more efficiently could increase the value of the output its produces. They should try to enhance the knowledge of their human resources. To measure this knowledge, a methodology called Knowledge Value Added (KVA) is available that enables every organization to value their performance by creating common output in terms of Knowledge units. By creating common units for different organizations, including non-profit organizations, it is then possible to use market comparables to ascertain which organization is more efficient and additionally to value their process output.			
<b>14. SUBJECT TERMS</b> ROI, Return on Investment, Valuation Methods, Market Comparables, Public Goods, KVA, Knowledge Value Added, Public Sector Finance			<b>15. NUMBER OF PAGES</b> 59
			<b>16. PRICE CODE</b>
<b>17. SECURITY CLASSIFICATION OF REPORT</b> Unclassified	<b>18. SECURITY CLASSIFICATION OF THIS PAGE</b> Unclassified	<b>19. SECURITY CLASSIFICATION OF ABSTRACT</b> Unclassified	<b>20. LIMITATION OF ABSTRACT</b> UL

THIS PAGE INTENTIONALLY LEFT BLANK

**Approved for public release; distribution is unlimited**

**VALUING THE DOD PROCESS OUTPUT**

Petros Bourazanis, Lieutenant, Hellenic Navy  
Gusnadi, Captain, Indonesian Air Force

Submitted in partial fulfillment of the  
requirements for the degree of

**MASTER OF BUSINESS ADMINISTRATION**

from the

**NAVAL POSTGRADUATE SCHOOL  
December 2005**

Authors:

\_\_\_\_\_  
Petros Bourazanis,

\_\_\_\_\_  
Gusnadi

Approved by:

\_\_\_\_\_  
Thomas J. Housel, Lead Advisor

\_\_\_\_\_  
Bill Gates, Support Advisor

\_\_\_\_\_  
Robert N. Beck  
Dean, Graduate School of Business and Public Policy

THIS PAGE INTENTIONALLY LEFT BLANK

# **VALUING THE DOD PROCESS OUTPUT**

## **ABSTRACT**

The Department of Defense (DoD) is facing the challenge to discover a tool to measure its performance as part of its responsibility to taxpayers. As a public institution that provides a public good to the people, the DoD has difficulties in using the prominent investment financial ratios used by the private sector as a metric of their performance. The problem is that DoD does not generate revenue and simultaneously, in many cases, a huge amount of money, as an investment, is spent in favor of its mission without further analysis about the efficiency of this investment. The DoD, by operating more efficiently could increase the value of the output its produces. They should try to enhance the knowledge of their human resources. To measure this knowledge, a methodology called Knowledge Value Added (KVA) is available that enables every organization to value their performance by creating common output in terms of Knowledge units. By creating common units for different organizations, including non-profit organizations, it is then possible to use market comparables to ascertain which organization is more efficient and additionally to value their process output.

THIS PAGE INTENTIONALLY LEFT BLANK

# TABLE OF CONTENTS

<b>I.</b>	<b>INTRODUCTION.....</b>	<b>1</b>
<b>A.</b>	<b>PURPOSE/PROBLEM STATEMENT .....</b>	<b>1</b>
<b>B.</b>	<b>BACKGROUND .....</b>	<b>1</b>
<b>C.</b>	<b>RESEARCH OBJECTIVES .....</b>	<b>4</b>
<b>D.</b>	<b>METHODOLOGY .....</b>	<b>5</b>
<b>II.</b>	<b>RETURN ON INVESTMENT/VALUATION METHODS.....</b>	<b>7</b>
<b>A.</b>	<b>THE DEFINITION.....</b>	<b>7</b>
<b>1.</b>	<b>Why Are Public-Sector Organizations Interested in ROI? .....</b>	<b>7</b>
<b>2.</b>	<b>Special Issues in Public Sector ROI .....</b>	<b>8</b>
<b>a.</b>	<i>No Revenues and Profits.....</i>	<i>8</i>
<b>b.</b>	<i>Absence of Hard Data.....</i>	<i>9</i>
<b>c.</b>	<i>Whose ROI? .....</i>	<i>9</i>
<b>d.</b>	<i>Government Services are Essential and, Therefore, Should not have this Level of Evaluation .....</i>	<i>9</i>
<b>e.</b>	<i>Restricted Range of Options to Correct Problems .....</i>	<i>10</i>
<b>B.</b>	<b>DEFENSE AS A PUBLIC GOOD.....</b>	<b>10</b>
<b>C.</b>	<b>VALUATION METHODS.....</b>	<b>13</b>
<b>1.</b>	<b>Market Approach.....</b>	<b>13</b>
<b>a.</b>	<i>Guideline Public Company Method .....</i>	<i>13</i>
<b>b.</b>	<i>Merger-and-Acquisition Method.....</i>	<i>15</i>
<b>c.</b>	<i>Prior Ownership Transaction.....</i>	<i>15</i>
<b>2.</b>	<b>Cost Approach.....</b>	<b>16</b>
<b>3.</b>	<b>Income Approach.....</b>	<b>17</b>
<b>III.</b>	<b>KNOWLEDGE VALUE-ADDED (KVA) .....</b>	<b>19</b>
<b>A.</b>	<b>INTRODUCTION.....</b>	<b>19</b>
<b>1.</b>	<b>The KVA Assumptions .....</b>	<b>19</b>
<b>2.</b>	<b>How to Apply KVA Methodology .....</b>	<b>21</b>
<b>B.</b>	<b>THE ADVANTAGES OF KVA.....</b>	<b>23</b>
<b>1.</b>	<b>In General.....</b>	<b>23</b>
<b>2.</b>	<b>KVA Methodology and the DoD.....</b>	<b>24</b>
<b>IV.</b>	<b>KVA METHODOLOGY FOR MARKET COMPARABLE .....</b>	<b>29</b>
<b>A.</b>	<b>INTRODUCTION.....</b>	<b>29</b>
<b>1.</b>	<b>Objective .....</b>	<b>29</b>
<b>2.</b>	<b>Method .....</b>	<b>30</b>
<b>B.</b>	<b>HYPOTHESIS.....</b>	<b>30</b>
<b>C.</b>	<b>RESEARCH DATA COLLECTION.....</b>	<b>30</b>
<b>1.</b>	<b>Benchmarking Data .....</b>	<b>30</b>
<b>2.</b>	<b>The Cryptology Carry-On Program (CCOP) Data.....</b>	<b>30</b>
<b>D.</b>	<b>APPLYING KVA METHODOLOGY.....</b>	<b>31</b>
<b>1.</b>	<b>KVA Assumption .....</b>	<b>31</b>

2.	Apply KVA Steps .....	32
a.	<i>Step One: Identify the Core Process or Sub Process in the DoD Desired to be Measured.....</i>	<i>32</i>
b.	<i>Steps Two and Three: Calculate the K as Common Units Produced by Each Process and Find the Total K.....</i>	<i>32</i>
c.	<i>Steps Four and Five: Derive a Proxy Revenue Stream and Develop the Value Equation Numerator by Assigning the Revenue Stream to Processes or Sub Processes .....</i>	<i>33</i>
d.	<i>Steps Six and Seven: Develop the Value Equation Denominator by Assigning Cost to the Processes and Calculate the Value Equation.....</i>	<i>34</i>
3.	The Cryptology Carry-On Program (CCOP) KVA Analysis.....	35
V.	CONCLUSIONS/RECOMMENDATIONS .....	39
A.	CONCLUSIONS .....	39
B.	RECOMMENDATIONS.....	40
	LIST OF REFERENCES .....	41
	INITIAL DISTRIBUTION LIST .....	43

## LIST OF FIGURES

Figure 1.	Private and Public Goods Supply and Demand Curve .....	11
Figure 2.	Assumption of KVA (From: Housel and Bell, 2001) .....	20
Figure 3.	The DoD Global Battle Space Market .....	27

THIS PAGE INTENTIONALLY LEFT BLANK

## LIST OF TABLES

Table 1.	Three Approaches to KVA (From: Housel and Bell, 2001).....	22
Table 2.	Sample of Processes in the DoD.....	32
Table 3.	Total K and Cost for Each Processes.....	33
Table 4.	Average Price Per Unit for Different Processes in the Private Sector.....	34
Table 5.	The KVA Metrics.....	35
Table 6.	USS READINESS CCOP Systems.....	35
Table 7.	P4 and P8 Revenue and Cost Allocation.....	36
Table 8.	P4 and P8 KVA Metrics.....	36

THIS PAGE INTENTIONALLY LEFT BLANK

## **ACKNOWLEDGMENTS**

The authors would like to thank their families for their patient and unselfish support showed during our studies at NPS and for the completion of this project as well. Furthermore, we would like to thank and express our deep appreciation to our project advisors, Dr. Thomas J. Housel, and Dr. Bill Gates, as well as to Mr. Glenn Cook for their precious help. Lastly, we are grateful to the faculty and staff of the Naval Postgraduate School for giving us the tools required to look at the world in a different way and for inspiring our belief that every problem has a solution if you just work hard enough at it.

THIS PAGE INTENTIONALLY LEFT BLANK

## **I. INTRODUCTION**

### **A. PURPOSE/PROBLEM STATEMENT**

The DoD uses its inputs (equipment, personnel, weapons, etc.) and through its core processes (operations) produces the public good of defense for citizens of every country. In this process, the DoD uses tools for estimating and analyzing the cost of defense outputs without using tools for valuing the defense outputs in terms of revenues.

The value of the service that the DoD provides to each country should be translated into its value as an organization. Is there any way to value the defense process? To answer this question, it is necessary to first discover if it is possible to use the typical valuation methods and the financial ratios that the private sector cites to indicate profitability and organizational performance. All of these ratios use the revenues that private companies generate from their operations as numerator. Seemingly true, the problem is that DoD cannot use these ratios since it does not generate revenues as a nonprofit organization.

### **B. BACKGROUND**

One role government plays in microeconomics is to provide certain goods and services including national defense. What characteristics distinguish this good from the types of goods typically provided by the private sector (houses, cars, computers, etc.)? National defense is a public good; indicating two things. First, consumption of the good by one person does not reduce the amount available for others to consume. Thus, all people in a nation must “consume” the same amount of national defense (the defense policy established by the government). Second, the benefits from a public good cannot be withheld from anyone no matter how much a person contributes toward providing it. Everyone benefits, perhaps in differing amounts, from national defense, including those who do not pay taxes. Once the government organizes its resources for national defense, it necessarily defends all residents against foreign aggressors.

Public-sector agencies of all types are suddenly taking a keen interest in developing skills and implementing evaluation processes that include return on investment (ROI). Some professionals agree that public-sector entities should also build

greater accountability into their processes. However, there also are those who do not understand how ROI could possibly fit into the public sector. Regardless of the position, ROI is a topic of discussion among public-sector organizations and the latest “stopping-off” place for the ROI trend.<sup>1</sup>

It is a truism that we live in an era of accelerated change and no organization can survive without increasing its own pace of decision-making. Hence, an increased emphasis on realistic planning is being recognized; in fact, the U.S. Congress has mandated this emphasis in legislation, as with the Government Performance and Results Act (GPRA) of 1993. It requires governmental agencies to develop strategic plans and performance plans that evaluate the success of the strategic plan.

The intent is to make the DoD more accountable to their ultimate customer -- the taxpayers. However, there is a significant amount of 'translation' required to convert the language of the private sector into terms that are appropriate for nonprofit and governmental organizations. The translation has usually been underestimated in the sincere attempt to emulate private-sector business practices. However, the goal of planners is to define appropriate metrics for performance. Therefore, it is important to clarify these distinctions.

All governmental agencies, like the DoD, exist only to fulfill their charter or mission, which is an “inherently governmental function”. The DoD has the authority to conduct its mission as delegated by congressional statute. Moreover, by law, the DoD is prohibited from direct competition with the private sector in providing its services. Hence, the DoD is constrained to work within its authorized mission. At the same time, private corporations are prohibited from engaging in activities authorized for the DoD only. These exclusions are described in the Constitution (e.g., the Department of Defense has the authority to develop weapon systems and hire personnel to operate them).

The key metric for DoD performance, therefore, is not financial in nature, but rather mission effectiveness. From this discussion, it sounds as if the whole intent of the

---

<sup>1</sup> Patricia P. Phillips, “ROI in the Public Sector.” Ed. Patricia Phillips. Alexandria, VA: American Society for Training and Development, 2002. <<http://www.astd.org/NR/rdonlyres/779B0547-EB1F-48E5-8776-7808107FD010/0/Whitepaper.pdf#search=ROI%20in%20the%20public%20sector>> [August 2005].

GPRA, to improve governmental performance and results for the taxpayers, is questionable. If DoD has a political right and need to exist, regardless of its level of performance, what is the role for performance assessments? Why it is necessary to value the defense output process?

Indeed, there is an important role for the GPRA, but it is not based on strategic needs. Its value lies elsewhere -- in something that should be pervasive throughout the government: the GPRA's focus is on the effectiveness and efficiency of the agency's authorized work.

Since the DoD has its assigned mission, the metric for success of that mission will be unique. Success is thus defined specifically by the DoD's charter. "Performance" in this context means, "How well is the DoD doing its mission?" Metrics of performance answer the question "How do you know how well the DoD is doing?" The answer may take the form of a balanced scorecard on the mission-oriented workforce.

In addition to mission work, every agency also contains a support workforce that does the same kinds of tasks: business systems such as payroll and human resources, financial data accounting, utilities, facilities, maintenance, file management, forms processing, and other kinds of office work that are "generic" -- essentially the same in all agencies. These support functions are necessary, but they do not relate directly to the mission of the DoD -- although they do play a role in its effectiveness and the viability of the organization. The important difference between generic and specific (mission-related) metrics is that the generic metrics can be benchmarked across other organizations. This provides a way for the DoD to compare its processes with the best practices in the private sector, and to identify processes with exceptionally high or low efficiency.

The DoD has a completely different market place compared to the market place of other commercial organizations. Nevertheless, this global "battle space market" in which it participates, has several similarities with capital markets, since both markets are:

- Populated by various entities competing and cooperating for scarce resources and "market share";
- Characterized by complexity, flux, change, turbulence, randomness, risk, uncertainty;

- Described by means of observable, historical empirical data on activities and transactions used to reconstruct the past and predict future risks and rewards;
- Replete with knowledge gaps, surprises, data smog, information fog and so forth;
- A hotbed of games and strategies with the goals of minimizing and mitigating risk and maximizing or optimizing rewards (e.g., positive outcomes such as mission success, increased revenues, gain of market share);
- Constructing high barriers to entry (Demoralization);
- Taking out competitors through “first mover advantage” or “hostile takeovers” (Destruction); and
- Aggressive legal tactics regarding intellectual property or aggressive marketing/ advertising tactics regarding product (Suppression).

By examining the DoD as an organization, it seems difficult to apply any of the popular valuation methods to value its output. The reason is that the prerequisite for such an implementation, specifically for applying the market approach method, is that the subject company (DoD) must be in the same industry as the guideline company. However, if there is insufficient transactional evidence in that sector, the evaluator can select firms in other industries that are similar to the subject company in investment characteristics, such as markets, products, growth and cyclical variability.

Therefore, it is necessary to narrow the spectrum of DoD activities in such a way as to provide a number of processes comparable to the private sector; common processes that produce the same output. This creates a market of different organizations that do not compete with one another, but follow the same processes to produce their outputs. Using the financial ratios, it is then possible to investigate which of those organizations are efficient.

### **C. RESEARCH OBJECTIVES**

The objective of this research is (1) to investigate which of the popular market valuation methods can be applied to the DoD and 2) to use the most effective method to adjust the financial fundamental variables of the DoD and make them more comparable to the private sector. Furthermore, an attempt will be made to discuss some issues

relating to this research, and particularly, with the usefulness of converting the defense output into units to make them comparable with the private sector.

#### **D. METHODOLOGY**

Implementation of the market valuation methods requires using financial ratios to index organization performance. The first step for this research is to find processes in commercial organizations that are comparable to some of the DoD processes. The logic behind this step is that common processes produce common outputs. The second step is to convert the output of those processes into common units. The Knowledge-value added method (KVA) will be applied for this step.

KVA is a methodology that allows any organization to calculate the economic performance of core processes by providing an objective way to allocate revenue to the process at any level within the organization. Knowing how much revenue corporate knowledge is producing allows the organization to improve their effectiveness and efficiency dramatically.<sup>2</sup>

After creating common units, the market comparable price per unit will be calculated. This price is the notional price per unit allocated to the DoD based on the market price per unit of the comparable output of similar commercial organizations. The derived price per unit can be used to develop a revenue stream for the DoD.

---

<sup>2</sup> Cesar G. Rios, Return on Investment Analysis of Information Warfare System, Master's Thesis, Naval Postgraduate School, Monterey, California, September 2005, p. 59.

THIS PAGE INTENTIONALLY LEFT BLANK

## II. RETURN ON INVESTMENT/VALUATION METHODS

### A. THE DEFINITION

Return on Investment (ROI) has been defined in many ways, but it generally quantifies past, present, and potential future performance of an organization or business. More specifically, the return on investment in assets is a measure of performance determined by the percentage relationship of earnings to assets.<sup>3</sup> Many companies and organizations view ROI both as a goal and as a measure of profit and asset performance.

#### 1. Why Are Public-Sector Organizations Interested in ROI?

The *President's Management Agenda 2002* clearly outlines the need for government agencies to show results for their programs. Additional reasons include:

- **Pressure from taxpayers to show how government funds are being used.** During the past 50 years, public expenditures in the United States and countries throughout the world have increased. Taxpayers in all countries are concerned that government services are not adding enough value.
- **A consistent lack of results or alignment.** Many public-sector programs have had unclear results—sometimes nonexistent results—forcing greater focus on impact and ROI.
- **Increased cost for programs and initiatives.** New programs and processes are expensive, particularly those involving human resources and technology. This creates more focus on accountability.
- **Previous evaluation methods for government programs do not answer the questions being asked.** Unfortunately, there is a great divide between traditional program evaluation and training measurement and evaluation. It is true that the methodologies from each follow similar standards and good research practices. The difference, however, is that program evaluation does not answer the questions being asked today: What is the bottom-line result of the program? In addition, the effects of other influences are often ignored in these types of evaluations. ROI provides a new dimension to program evaluation.

---

<sup>3</sup> Clarence B. Nickerson, *Accounting Handbook for No Accountants*, 3<sup>rd</sup> Ed. New York: Van Nostrand Reinhold Co., 1986, p. 73.

## 2. Special Issues in Public Sector ROI

In applying ROI, public-sector agencies must consider several issues specific to their organizations.

### a. *No Revenues and Profits*

Most government agencies do not generate profits, particularly those connected with social and military programs. At times, there is a perception that a ROI value can only be developed when there are profits and revenues. This is far from the truth. As the equation below shows, the numerator in the ROI equation represents net benefits derived from either the profit margin or cost savings.<sup>4</sup>

$$\text{Percentage ROI} = \frac{\text{Earnings}}{\text{Investment}}$$

In practice, even private-sector ROI evaluations develop monetary benefits based on cost savings. When productivity is improved, quality is enhanced and cycle times are reduced; the result is cost savings. Thus, when considering ROI, public-sector organizations should consider those program benefits that save time, improve quality, and increase productivity. These benefits will be converted to monetary value and compared to costs.<sup>5</sup>

However, it should be mentioned that the absence of a profit motive, and of an individual or group with a claim to the economic benefits from reductions in costs, weakens the DoD's incentive to minimize the cost of achieving given objectives. Contracts for the design and production of weaponry are often written on a cost-plus basis, under which the contractor receives a payment from the government equal to costs plus some predetermined "profit." Therefore, the contractors have little incentive to minimize costs. If, on the other hand, the contractor simply receives a fixed price for the

---

<sup>4</sup> Patricia P. Phillips, "ROI in the Public Sector." Ed. Patricia Phillips. Alexandria, VA: American Society for Training and Development, 2002. <<http://www.astd.org/NR/rdonlyres/779B0547-EB1F-48E5-8776-7808107FD010/0/Whitepaper.pdf#search=ROI%20in%20the%20public%20sector>> [August 2005].

<sup>5</sup> Ibid.

output of defense goods, he has a strong incentive to minimize costs, but the contractor must bear the risk of increases in the price of inputs and of other outcomes that cannot be predicted perfectly.

***b. Absence of Hard Data***

Sometimes the perception exists that hard data are not available in government agencies—only intangible, soft data. This is not necessarily the case. Even the simplest government unit can measure output, quality, cost, and time—the four major categories of hard data.

***c. Whose ROI?***

The ROI is a comparison of monetary benefits with the costs from the viewpoint of a certain constituency. Multiple constituencies must be served with a government agency, perhaps exceeding the number usually found in the private sector. For example, in a typical public-sector ROI impact study, six major groups are interested in the outcome: program participants, the immediate manager of the participants who support the program, the sponsor who initiates or approves the program, top administrators who manage the agency, the lawmakers who create laws and regulations concerning the accountability of programs, and taxpayers who are concerned about the use of tax dollars. In the private sector, the ROI is typically developed from the perspective of the organization.<sup>6</sup>

***d. Government Services are Essential and, Therefore, Should not have this Level of Evaluation***

Many government services are essential and must be provided, regardless of the accountability or contribution. This is not always the case in the private sector, where programs can be altered, changed, or replaced if they are not working properly. However, many public-sector programs require a large investment of resources. These programs should undergo comprehensive evaluation including ROI to ensure that they are operating effectively. If they are not, adjustments can be made to increase their effectiveness.<sup>7</sup> The meaning of effectiveness in this research is the degree to which a

---

<sup>6</sup> Patricia P. Phillips, “ROI in the Public Sector.” Ed. Patricia Phillips. Alexandria, VA: American Society for Training and Development, 2002. <<http://www.astd.org/NR/rdonlyres/779B0547-EB1F-48E5-8776-7808107FD010/0/Whitepaper.pdf#search=ROI%20in%20the%20public%20sector>> [August 2005].

<sup>7</sup> Ibid.

system's features and capabilities meet the user's needs with minimum cost. Furthermore, efficiency is the ratio of the effective or useful output to the total input in any system.<sup>8</sup>

*e. Restricted Range of Options to Correct Problems*

Unlike the private sector where a range of options is available to correct problem programs, the public sector may not have the option to make radical changes or discontinue programs that show little value. However, many options are available to improve the program in terms of effectiveness and its connection to the desired results.

On the surface, these five issues appear to be impediments to implementing ROI. However, they are often myths that must be dispelled in order for public-sector organizations to make progress in this important area.<sup>9</sup>

**B. DEFENSE AS A PUBLIC GOOD**

From the perspective of economists, the question that should be answered is how is it possible to determine how much defense the government should provide? The objective is to provide the amount where the marginal value individuals receive from defense equals the marginal cost of providing that unit. For private goods in perfectly competitive markets, this occurs where aggregate demand and supply curves intersect. The difference with public goods is in calculating the aggregated demand. How should the aggregate demand curve for public goods be determined? The answer is to sum the individuals' curves.

For private goods, the aggregate demand is the horizontal sum of the individuals' demand curve, because everyone pays the same price but consumes different quantities; individuals must consume the same quantity of the public good although they receive different values from that quantity. Thus, the aggregate demand curve is the vertical sum of the individuals' curves. Figure 1 illustrates this concept.

---

<sup>8</sup> <<http://www.answers.com/topic/efficiency>> [December 2005].

<sup>9</sup> Patricia P. Phillips, "ROI in the Public Sector." Ed. Patricia Phillips. Alexandria, VA: American Society for Training and Development, 2002. <<http://www.astd.org/NR/rdonlyres/779B0547-EB1F-48E5-8776-7808107FD010/0/Whitepaper.pdf#search=ROI%20in%20the%20public%20sector>'> [August 2005].

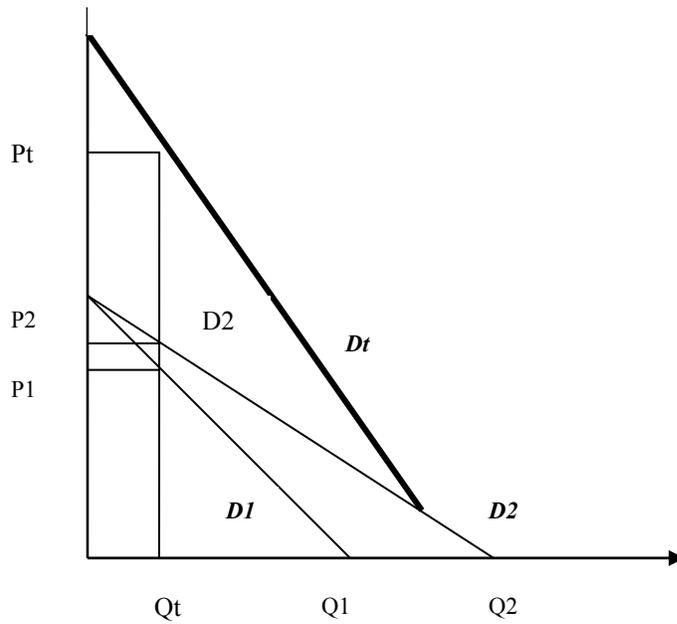
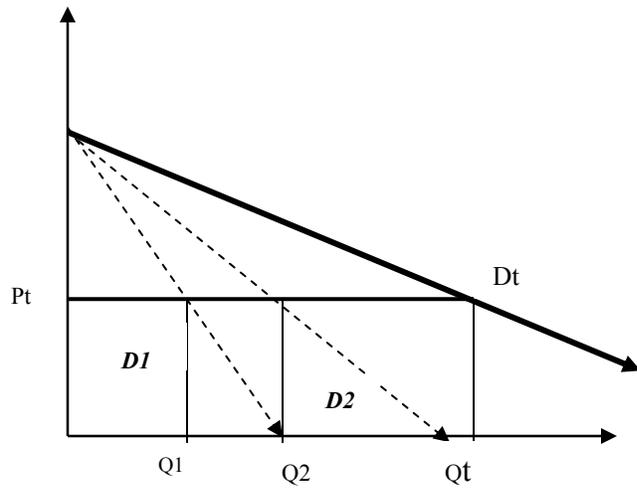


Figure 1. Private and Public Goods Supply and Demand Curve

These two features of national defense cause an important “free-rider” problem. Since people benefit whether or not they contribute toward defense, each person has an incentive to wait for others to provide the public good and get a “free ride.” In addition,

because a free-rider's consumption does not reduce the amount available for others to consume, even those who pay have little incentive to prevent free-riding by others.

As a result of free-riding, an individual acting alone to provide national defense would produce too little. Each person would provide defense until the incremental benefits equaled the incremental costs. However, for society as a whole—that is, for all individuals—the incremental benefits exceed the incremental costs because once an individual provides some of the public good, all people benefit from it and cannot be excluded. This free-rider behavior provides one of the important traditional arguments for government provision: impose taxes on all individuals and then provide public goods. Government, in principle, eliminates free-rider behavior and can produce the “right” amount of national defense and other public goods.<sup>10</sup>

The DoD itself has only a weak incentive to operate efficiently. Since the military services have sharply defined tasks with little overlap, each service is, in effect, a monopolist in its defined missions. The Army, for example, is prevented from flying fixed wing aircraft, thus giving the Air Force a near monopoly in providing close air support for ground operations. Acting as a monopoly in this case, the Air Force provides this certain service without wondering if the Army could provide the same service not only at a lower cost but by generating higher revenue for the DoD as well.

Moreover, each service is likely to be better informed than Congress about the cost of providing given defense services, and the efforts of the services to maximize their budgets can lead them to provide defense at a higher cost than necessary. The lack of revenues in comparison with the unlimited, under certain circumstances, cost, are the reasons for making consumers think about whether or not the money they pay through taxes is spent efficiently.

Investment financial ratios could provide the DoD the ability to evaluate which services (Army, Navy, etc.) operate more efficiently. Based on the results of these ratios, The DoD could decide how to allocate the available budget, setting the efficiency of its services as a criterion. The accuracy of the efficiency could be ensured not only in terms

---

<sup>10</sup> <<http://www.econlib.org/library/Enc/Defense.html>>. [October 2005].

of cost savings but in terms of the amount of revenues each of its services generate as well. Therefore, the DoD could create an internal market of certain military processes having as competitors its own services.

### **C. VALUATION METHODS**

Business people are trained to make and to evaluate business and economic projections and then use them as a basis for decision-making. Whenever they are valuing a business, business ownership interest or security, generally, there are three basic accepted approaches: the asset-based approach, the income approach and the market approach. In certain cases, a combination of approaches may be appropriate. Whatever the approach, it will be based on a going-concern or on a liquidation premise, depending on the circumstances.

#### **1. Market Approach**

The market approach compares the subject to similar businesses, business-ownership interests and securities that have been sold on the open market. In this approach, there must be meaningful and relevant data available for analysis. It is essential that the business valuator ask the right questions if the data and the value measures derived are to be of practical use.

Among the methods for the market approach are the guideline public company method, the merger-and-acquisition method, and analyses of prior transactions of ownership interests in the company being valued. The first two involve developing relevant valuation ratios (market multiples) derived from transactional pricing information and underlying financial data for the selected “guideline companies” and then applying these ratios to value the corresponding data of the subject company.<sup>11</sup>

##### ***a. Guideline Public Company Method***

Guideline companies (public and private) are those that provide a reasonable basis for comparison to the investment characteristics of the company being valued. Ideal guideline companies are in the same industry as the subject company. However, if there is insufficient transactional evidence in that sector, the valuator might

---

<sup>11</sup> Richard W. Wise. “Caveat for a Market Approach.”  
<[http://www.camagazine.com/index.cfm/ci\\_id/19240/la\\_id/1.htm](http://www.camagazine.com/index.cfm/ci_id/19240/la_id/1.htm)> [October 2005].

select firms in other industries that have a similar characteristic to the subject company, such as markets, products, growth and cyclical variability.

While guideline-company empirical data can typically be found in transactions involving controlling or minority interests in publicly held or private companies, the concern here is with using and interpreting data that the valuation analyst gleans from a transactional database.<sup>12</sup>

Using the guideline public company method, market multiples are derived from share trading prices of companies engaged in similar business lines, assuming their shares are actively traded in a free and open market. The guideline-company data are gathered to develop value measures that can be applied to the subject company's fundamental financial and other data and correlated to reach an indication of value for the subject firm's issued shares. It is critical that the valuation analysis distinguish between invested capital and equity.

The value measure, or valuation ratio, is determined by dividing the price of the guideline company shares by a financial variable (such as earnings, cash flow, earnings before interest and taxes, or revenue), calculated from the financial data of the guideline company. The valuation ratios are then applied to the subject, after making the appropriate adjustments to ensure consistency in accounting conventions, the timing of the price data used in the valuation ratios, the selection of the underlying data used to compute the valuation ratios, and so on. Adjustments are also made for minority or controlling interests as well as marketability.

In summary, the computation and application of the valuation ratios provide an estimate concerning the pricing of the subject business considering all relevant factors, using public data, of the price that would be paid for the common stock of a closely held firm, assuming it was traded in an active market or on an exchange.

---

<sup>12</sup> Richard W. Wise. "Caveat for a Market Approach." <[http://www.camagazine.com/index.cfm/ci\\_id/19240/la\\_id/1.htm](http://www.camagazine.com/index.cfm/ci_id/19240/la_id/1.htm)> [October 2005].

***b. Merger-and-Acquisition Method***

In the merger-and-acquisition method, valuation ratios are derived from open-market transactions of significant interests in companies engaged in the same or similar lines of business as the subject. The factors considered in judging a reasonable basis for comparing the subject to similar businesses, business ownership interests, or securities that have been sold in the open market include sufficient similarity of qualitative and quantitative characteristics; extent and verifiability of data known about the similar investment; whether or not the price of the similar investment was obtained in an arm's length transaction as a result of a forced or distressed sale or other situation that may not provide evidence of fair market value; and the relevance of market conditions at the transaction date and those at or proximate to the valuation date for purposes of the subject valuation.

The analysis involves comparing the respective qualitative and quantitative factors relating to the company being valued to those of the guideline companies, including, if appropriate, dissimilarities with respect to minority, control and market-ability. The calculation and use of these valuation ratios (pricing multiples) are intended to provide meaningful insight as to the value of the business being appraised, considering all relevant factors.<sup>13</sup>

In brief, the valuation analyst must be extremely careful in the following areas: selecting meaningful (i.e., comparable) guideline companies; selecting the underlying data used to compute the valuation ratios; selecting the time periods and/or the averaging methods used for the underlying data; computing the valuation ratios; and determining the appropriate price data to be used as the numerator in the ratio.

***c. Prior Ownership Transaction***

The market approach values the asset based on comparison with sales of similar assets. This is by far the preferred approach of the accounting standard setters. The transaction price, as a ratio of an asset attribute such as sales, is used to derive a

---

<sup>13</sup> Richard W. Wise. "Caveat for a Market Approach." <[http://www.camagazine.com/index.cfm/ci\\_id/19240/la\\_id/1.htm](http://www.camagazine.com/index.cfm/ci_id/19240/la_id/1.htm)>. [October 2005].

market multiple. This market multiple is then applied to the attribute of the asset being assessed to indicate the value of the subject asset.

As many multiples as possible should be derived, e.g., sales, earnings before interest and taxes. This is the best method in an ideal world as a true 'market value' is available. In practice, however, the world is not ideal and it can be difficult to find sufficiently detailed publicly available information on sales of similar assets. Nonetheless, this method can usually be applied as a cross check to other methods of valuation using industry rules of thumb and the like.

To understand market multiple, it is first necessary to be familiar with the term price earnings ratio (P/E). Market multiple usually refers to the price earnings ratio for a particular market index. For example, the Standard and Poor's 500 index is a collection of 500 U.S. stocks including industrial, financial, utility and transportation stocks. Each week Barron's (a financial weekly) publishes the P/Es for a variety of market indices. These statistics can be found in the Market Week section of Barron's. The market multiple is essentially an average of the combined P/E ratios of all the stocks in a particular index.

Analysts speak of the market multiple quite frequently. Most of the time they are referring to the P/E for the S&P 500 or the P/E for the Dow Jones Industrial average. Sometimes it is hard to tell to which index they are referring. Analysts love to compare an individual stock's P/E with the market multiple. If the P/E of a given stock is less than the market multiple, an analyst will likely say, the stock trades below the market multiple or the stock trades at a discount to the market. If an individual stock's P/E is below the market multiple, it could be selling for less than what it is worth.<sup>14</sup>

## **2. Cost Approach**

The cost approach is based on the concept that a company is worth the market value of all its assets minus the market value of all its liabilities. For this reason, not only is each balance sheet asset/liability identified, valued and included in the on the balance sheet, but also each off-balance-sheet asset/liability (tangible and intangible). Bringing

---

<sup>14</sup> <<http://www.enterpaige.com/Moneywords.htm>> [October 2005].

the historical cost of each and every asset and liability to its current market value is time-consuming and difficult and may involve additional experts to value specific categories of assets (i.e., real estate or machinery and equipment).

Variations of the cost approach are generally used to value holding and investment companies and asset-intensive companies such as those in natural resources and utilities. Asset-based methods are also reliable in early-stage companies where book values can be used as a reasonable proxy for fair market value. A particular form of the cost approach, the excess earnings approach, is regularly used to value professional practices and service companies.

### **3. Income Approach**

The income approach is based on the concept that a company is worth the present value of its future earning power. Future economic income is projected out from the valuation date using historical trends and management's professional judgment as to the future growth of the company. If the recent history of the company's cash flows is stable and its future growth is incremental and sustainable, a single projection will be made into perpetuity.

If the recent history of the company's cash flows has peaks and valleys and/or its future will involve high or uneven rates of growth, projections will be made for each year of five years (one business cycle), and then a single projection will be made from the fifth year out into perpetuity.<sup>15</sup>

Either way, the projected cash flows will be converted back to present value using a total rate of return on investment comparable to the rate of return available in the market on investments of similar risk and other characteristics. The resulting estimate of value is adjusted for whether a controlling or minority ownership interest is being valued and for the marketability or lack of that ownership interest. The income approach is generally used to value operating companies and/or specific projects employed by management within an operating company.<sup>16</sup>

---

<sup>15</sup> T. Housel and A. Bell, *Measuring and Managing Knowledge*. Boston: McGraw-Hill, 2001, p. 83.

<sup>16</sup> T. Housel and A. Bell, *Measuring and Managing Knowledge*, p. 85.

THIS PAGE INTENTIONALLY LEFT BLANK

### **III. KNOWLEDGE VALUE-ADDED (KVA)**

#### **A. INTRODUCTION**

Since using the prominent financial tools to value the organization performance does not provide enough information to the organization, especially for a public institution or new company that does not have any historical data; the Knowledge Value Added (KVA) method is rapidly applied by many companies to measure their company performance. After this method was created and developed by Drs. Thomas J. Housel and Valery Kanevsky, more than 60 companies worldwide have been applying this method to measure the value of knowledge embedded in company core processes, technology, and employees.

The reason for KVA's growing acceptance as a applicable measurement tool lies in its sound theoretical underpinning, its practicality, and its simplicity of use for companies competing in the evolving knowledge-intensive global business environment.<sup>17</sup> KVA, as the fourth methodology for the valuation of processes that is relatively new and not well known throughout industry, describes a theory and methodology for estimating return on knowledge (ROK) rather than determining return on investment (ROI).

The KVA methodology basically provides a way to measure the value of knowledge assets deployed in a core process, objectively. Valuation using this method is accomplished through two return ratios, not only returns on knowledge (ROK), but also returns on process (ROP). The primary difference between KVA and other methodologies is that KVA uses people's knowledge and system as a way to describe process output in a common unit. The common unit does not have to be identical for every process and does not have to be reflected only in terms of money.

#### **1. The KVA Assumptions**

Before applying the KVA method to measure company performance, it is necessary to understand the overall KVA concept and understand and accept the

---

<sup>17</sup> The International Engineering Consortium, Knowledge Value-Added (KVA) Methodology, Web ProForum Tutorials, p. 1.

underlying assumptions that are the basic foundation of the process. Figure 2 depicts the underlying assumptions of the KVA model.

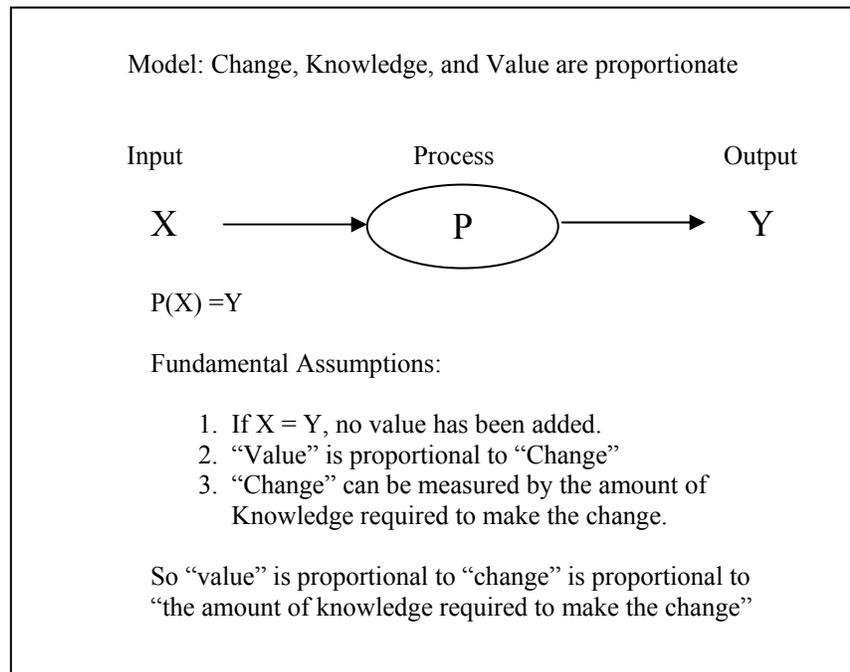


Figure 2. Assumption of KVA (From: Housel and Bell, 2001)

The fundamental assumptions are solid where the KVA derives its validity as a knowledge measurement method. By accepting these assumptions, the KVA methodology can be used to show that knowledge and change are proportional and can be used as surrogates for the value resulting from a process. It logically follows that if a process produces an output different from any given input, then that change is proportional to the amount of value resident within the process, assuming the change produces the correct output.

By possessing knowledge of the process needed to produce the change, then it is necessary to have the amount of change introduced by the knowledge. From an organizational perspective, this could be a great value because the measurement and application of knowledge produces a standard unit of output, thus allowing different processes to be evaluated on a level playing field.

Another benefit that KVA produces is a ratio of output over input. In conventional ways of valuing processes, the cost that goes into a process has been a key factor. Nonetheless, cost has its limitation, while some functions within an organization are direct revenue producers, therefore, producing the numerator for the equation, most are very hard to determine. A good example of what was described follows. Say there is a dishwasher in a Chinese restaurant. The dishwasher does not generate any revenues for the restaurant. However, without the dishwasher, the restaurant will not be able to serve the customers satisfactorily since there would not be enough clean plates and glasses available for all customers. In this case, it is possible to state that the dishwasher does not generate direct revenues for the restaurant. So, the dishwasher is considered a cost center. As a cost center, it is judged on its ability to wash and ensure there are enough plates and glasses available for all customers and keep it clean. If it succeeds, it has met its goals.

The dishwasher is a part of the larger process that produces goods and services sold to customers. The restaurant earns revenue, and not just by the chef or the waitress. For this reason, the dishwasher plays a part in revenue generation as the dishwasher produces enough value to justify the cost. By applying the concept of KVA to the dishwasher and every other role in the restaurant, defining the surrogates and determining the value produced by the dishwasher as well as overall revenue can be allocated to the dishwasher. This will help the restaurant owner to determine which role within the restaurant actually produces the most value, and can better allocate cost, bonuses, and so forth.

After discussing the aforementioned four methodologies, only the KVA method produces a numerator, which is very critical to valuing the process. Having a ratio provides a more complete measure of return. For those valuation processes not using the numerator, and cost as a denominator, there can never be a clear portrait of the value of the process.

## **2. How to Apply KVA Methodology**

What makes KVA a simple and attractive approach is that this method is so simple that it can be applied in seven steps and yet it is strong enough to produce the

desired level of granularity should managers desire a more comprehensive view of the organizational process. Housel and Bell have defined three different ways to establish the value of knowledge embedded in the firm's core process, the people and the system of an organization. Table 1 summarizes each step of the process.

Steps	Learning Time	Process Description	Binary Query Method
One	Identify core process and its sub processes.		
Two	Establish common units and level of complexity to measure learning time.	Describe the products in terms of the instruction required to reproduce them and select unit of process description.	Create a set of binary yes or no questions such that all possible outputs are represented as a sequence of yes or no answers.
Three	Calculate time to execute each sub process.	Calculate the number of process description words, pages in a manual, and lines of computer code pertaining to each sub process.	Calculate the length of sequence of yes or no answers for each sub process.
Four	Designated sampling time period long enough to capture a representative sample of the core processes final product or service output.		
Five	Multiply the learning time for each sub process by the number of times the sub process executes during the sample period.	Multiply the number of process words used to describe each sub process by the number of times the sub process executes during sample period.	Multiply the length of the yes or no string for each sub process by the number of times the sub process executes during sample period.
Six	Calculate cost to execute knowledge (learning time and process instruction) to determine process costs.		
Seven	Calculate ROK and ROP and interpret the results.		

Table 1. Three Approaches to KVA (From: Housel and Bell, 2001)

- Learning Time: Learning time uses the basic measure of how long it takes to learn how to perform a given function. That learning time is then multiplied by the number of times that function is performed over a given period of time.
- Process Description: Describes products in terms of the number of instructions required to reproduce them. The number of instructions is then multiplied by the number of times the process executes.
- Binary Query Method: Create a comprehensive set of yes/no questions such that all possible outputs are represented. Multiply the length of the yes/no string for each sub process by the number of times the sub process executes.

While it does not matter which of the processes are applied, KVA can still be measured in other ways. What is important is that all the knowledge in a process or company be measured in the same manner to ensure common comparisons (Housel and Bell, 2001). The main purpose of this technique is to measure the amount of knowledge within a core process and to allocate revenue to that knowledge and also to state that knowledge can be measured in terms of revenue. The ration of this measurement could be calculated using the ROK index below.

$$ROK = \frac{TOTAL\ KNOWLEDGE}{TOTAL\ COST}$$

Now that this process can be measured by an index, the new processes or several alternative processes can be adequately compared to each other based on the ROK index of its process. It is then possible to start implementing the best process.

## **B. THE ADVANTAGES OF KVA**

Globalization in business, economic and technological changes and technological shift make all global business activities recreate how they do business. Many companies worldwide have now realized that the human asset is the most important asset in the organization. They try to value the human asset, not in terms of payment, incentives or bonuses, but in terms of how much knowledge is embedded in every employee. The KVA methodology, as a frontier to introduce a formulation to measure knowledge capital, provides the advantages for the organization either publicly or privately to know how to better develop the knowledge within the organization.

### **1. In General**

As the primary method to measure the knowledge capital within the company, this method would assess the worth of the people who possess the accumulated knowledge about an organization. They are the individuals who leave the office every night and some may not return, storing everything in their head of the know-how acquired while receiving full pay. Their brains are repositories of knowledge accumulated over untold hours of listening and talking while not delivering any goods or services to the paying customer. The employees' minds, and the files they manage, carry a share of

the company knowledge capital. This makes every employee a custodian of the most important assets the firm owns, even though these assets never appear on any financial report.<sup>18</sup>

KVA, as a knowledge measurement, makes possible the initial estimate for allocating revenue or sales dollars to various core processes or functional areas (usually no more than eight to ten). The real goal is to establish relative orders of magnitude for the amount of knowledge embedded in core processes. The analyst may thus avoid a subjective debate over which processes are more important or valuable than others.

Furthermore, KVA also provides managers a means of framing decisions about how best to deploy, redeploy, or eliminate knowledge, which comes in handy when decisions are made about how best to automate a core process. The real issue is how to redeploy knowledge from people and procedures or work rules into information technology that can be executed more rapidly, therefore more often, and at a lower cost.

## **2. KVA Methodology and the DoD**

The metric-dollar value is primarily used in assessing contribution in a commercial business.<sup>19</sup> A problem will exist when applying the dollar-value in the DoD case where different methods are used to assess how to value the system or people contribution to the DoD mission, combat effectiveness and mission accomplishment. Most methods fail to value those missions in comparable units of measure. The only metric that can be measured in the DoD case is cost. Another problem that still exists in the DoD case is the translation of output into financial terms. Whereas in the private sector, a price per unit is assigned to the output, there is no comparable pricing mechanism in the DoD or public organization. This circumstance always creates problems when conducting empirical financial analysis.

---

<sup>18</sup> Paul Strassmann. Calculating Knowledge Capital. Knowledge Metrics. <<http://www.destinationkm.com>> [01 October 1999]. p. 1.

<sup>19</sup> Myron Cramer. "Measuring the Value of Information." Atlanta, GA:Georgia Tech Research Institute. <<http://iw.gtri.gatech.edu>> [20 July 2005]. p. 2.

To address the aforementioned problem, the KVA methodology provides a new source of raw data for use in capabilities investment decisions and capabilities portfolio management. This data:

- Provides a common unit of output for all process, never available before;
- Describes, in common units, the performance of the operational infrastructure, including information technology. Since it is mined at the operational/process level, it is the most directly representative of the ongoing performance of the organization at the sub-organizational level;
- Can be collected and presented as a detailed or aggregated level as decision makers require;
- Makes it possible to develop a numerator for valuation measures, instead of having to rely on estimates built from cost, “market comparables,” or the “process elimination” approach.
- Makes it possible to provide traditional external-market oriented corporate finance with new concepts, such as the internal “knowledge” market, the firm and the Knowledge Asset Pricing Model that offer fresh insight and solve some common estimation problems.
- Will allow the DoD to populate the traditional real options analysis model with valid data to enable reasonable quantitative assessment of risk (volatility) and uncertainty (probability), given the attributes of the DoD “markets.”

The DoD actually participates as the major player in an external market, as previously mentioned, the “global battle space market.” In addition, it constitutes an internal market (called the *k-market*, i.e., knowledge market). Both markets bear important similarities to the global markets in the corporate arena. At the DoD *k-market*, the DoD commands are “investors” in portfolios assets (capabilities) for use in the DoD core processes and infrastructure. Even though the DoD and corporate market terms and definitions are different and military context represents the ultimate in high stakes “investment” activity, this project will demonstrate that the difference between both organizations is that of degree rather than kind. By using the KVA methodology,

financial ratios and the cutting edge financial predictive tools can be effectively applied to the DoD activities in the internal *k-market* as well as the external *global battle space market*. Figure 3 demonstrates these concepts.<sup>20</sup>

---

<sup>20</sup> Thomas. J. Housel, and Sarah K. Nelson, Option-Based Approach to capabilities Based Planning <Executive Summary> Given by Thesis Advisor as data.

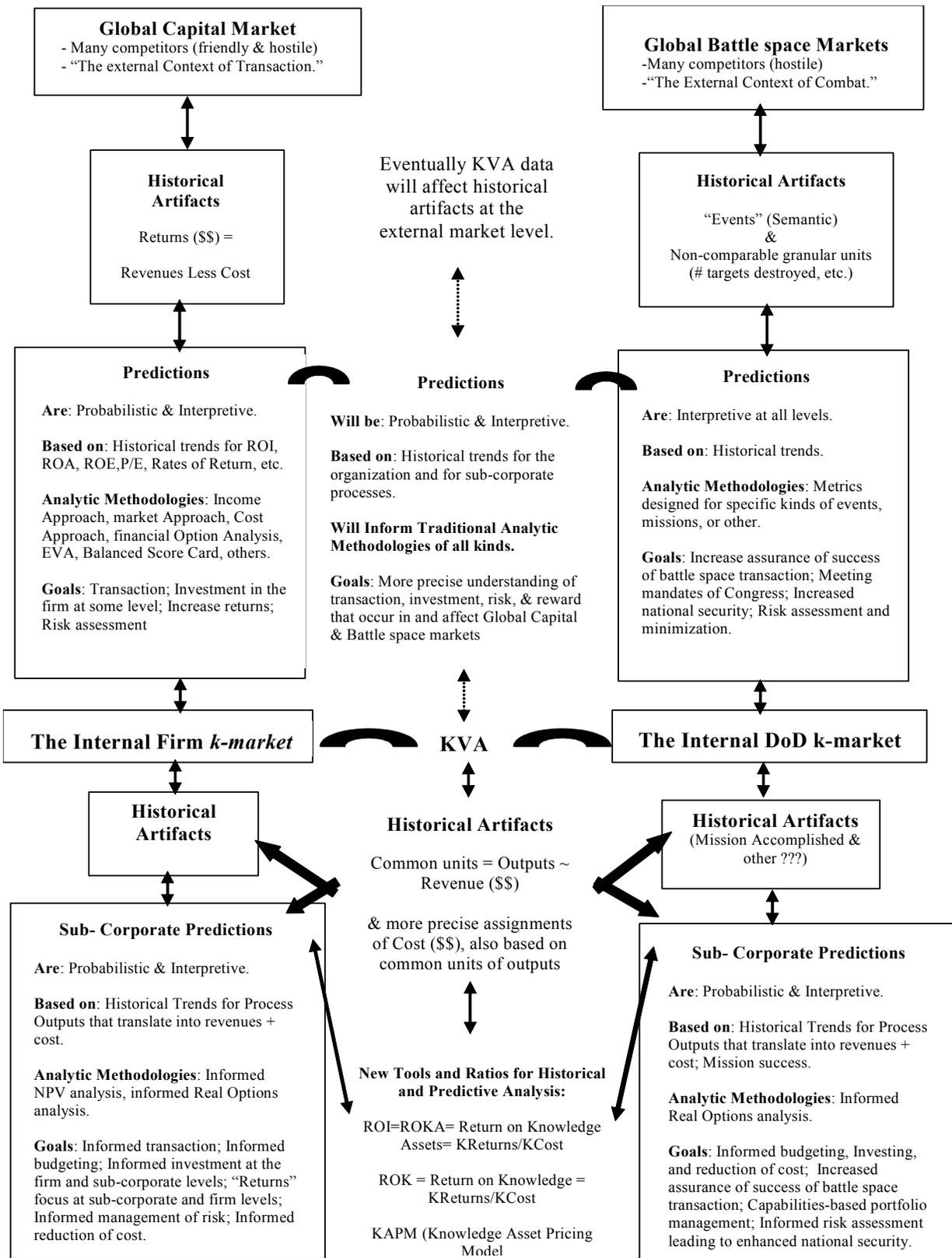


Figure 3. The DoD Global Battle Space Market

THIS PAGE INTENTIONALLY LEFT BLANK

## **IV. KVA METHODOLOGY FOR MARKET COMPARABLE**

### **A. INTRODUCTION**

Measuring the non-profit organization's performance has become a big problem, especially because government institutions use taxpayer money to finance their activities. This forces public organizations to use knowledge as a common unit to measure their performance using the market comparable methodology. With the KVA methodology, the organization must define and draw how the work flows within the organization. The key step of this technique is to describe every process and sub processes. This will easily enable the organization to measure the knowledge embedded in every process. The measurement could be in cost, learning time or the working process. The KVA is based on the assumption that humans and technology in the organization add value by taking inputs and changing them into outputs through the organization's core processes.<sup>21</sup> The amount of change process produced within the organization can, in reality, be a measure of value or benefit.

#### **1. Objective**

The main objective of this project is to investigate the possibility of using the KVA methodology to value a non-profit organization, such as the DoD. The DoD as a non-profit oriented organization is a unique organization that produces public goods for the people across the country. This government organization is a monopoly organization that never really has competitors to provide similar services. It turns the DoD into a single player in the market that provides defense service. The obligation of the DoD is only to inform the taxpayers on how they spend their funding and what the purpose of the spending is. The market, as a best judge for measuring or valuing how efficiently products or services are produced will never be able to measure the DoD outputs, because DoD never generates revenue as a numerator to valuing their return. The KVA

---

<sup>21</sup> T. Housel and A. Bell, *Measuring and Managing Knowledge*. Boston: McGraw-Hill, 2001. pp. 92-93.

methodology in this project will enable non-profit organizations to approximate revenue by using market prices, assuming the same private-sector processes or sub processes exist within the DoD.

## **2. Method**

This project will utilize some data from previous research about KVA. These data will provide a simple illustration about how to measure the DoD process output by using the price per unit from the market with which it is assumed to be comparable. By using the market price from the private sector, this project will calculate revenue for the DoD. Knowledge is the common denominator for both the private and public sectors. In this case, how each organization develops knowledge and how the knowledge flows within the organization is the key.

## **B. HYPOTHESIS**

There is a way for the DoD to compare some of its processes with similar private-sector processes. By doing so, the DoD can identify which of its processes have exceptionally high or low efficiency. In order to apply the market comparables as a performance metrics in the DoD, the KVA methodology could be useful to convert the output of certain comparable processes into common units and to discern the revenues that the DoD process generates.

## **C. RESEARCH DATA COLLECTION**

### **1. Benchmarking Data**

The benchmarking data is data about the value of the knowledge (K) actually embedded in the some of the defense organization processes or sub processes and in the private sector that is assumed to be comparable. This data, already measured and checked as scientific data, can be used to develop another research project related to the KVA Methodology.

### **2. The Cryptology Carry-On Program (CCOP) Data**

The Cryptology Carry-On Program (CCOP) is a product of the Advance Cryptology Systems Engineering program, which develops state-of-the-art Intelligence, Surveillance and Reconnaissance (ISR) capabilities in response to Combatant Command requirements for a quick-reaction surface, subsurface and airborne cryptology carry-on capability. Data from this project are used here only as an example to demonstrate the

KVA methodology to enable a non-profit organization to generate revenue as a numerator in ROI calculation and measure their performance efficiency just as private organizations does.

#### **D. APPLYING KVA METHODOLOGY**

As explained in the previous chapter, the KVA methodology makes it possible for public companies to measure their performance. This method uses the knowledge that requires changing a measurement and describing it as a unit. To accomplish the analysis, it is necessary to extract the historical data and establish metrics formatted in the same manner as common financial metrics. KVA provides metrics at a sub-organization level to analyze and allocate of cost and revenue across a sub process for accounting purposes.

The DoD, as public company, produces public goods that are not for a person, but for everyone in the country. They need to measure their performance regularly to help them improve their services to the country. Since the DoD does not produce a tangible product as an output and never generates any kind of revenue, either in sales or cost savings, it would be difficult to measure their performance using the prominent financial method discussed in Chapter II. The KVA methodology will be used to approximate revenue and use it to measure DoD process efficiency using the ROI equation. There are many steps that must be followed to use this method. These steps will be described to illustrate how to apply this concept.

##### **1. KVA Assumption**

Before applying the KVA methodology, the underlying assumption of KVA must be clearly defined. The statements that follow are the assumptions of KVA.

- Humans and technology in an organization take inputs and change them into outputs through the organization's core processes.
- By describing all process outputs as common units (i.e., Knowledge required to produce the outputs) it is possible to assign revenue, as well as cost, to those processes at any given point in time.
- All outputs can be described in terms of time required to learn how to produce them.
- Learning time is measured in common units of time and is also a surrogate for knowledge. Thus, units of learning time can also be called common units of output.

- Having a common unit of output makes it possible to compare all outputs in terms of cost per unit as well as price per unit, since revenue can now be assigned at the sub-organizational level.
- Once cost and revenue stream have been assigned to sub-organizational output, normal accounting and financial performance and profitability metrics can be applied to them.

**2. Apply KVA Steps**

The following steps are all that are required to apply the KVA method. These steps are the application of the three approaches (Table 1) discussed in Chapter II. The following measures a sample of different sub processes in the DoD that are comparable to the private sector using KVA’s seven steps. The data below are presented as an example to apply the KVA steps. All data<sup>22</sup> in this discussion are only representative of the many processes and sub processes in the DoD that can be measured.

**a. Step One: Identify the Core Process or Sub Process in the DoD Desired to be Measured**

This process is used to investigate and define what processes or sub processes to measure using the KVA methodology. Table 2 provides the example of the process in the DoD.

Process	Description
Search/Collecting data	Create and Record the Flight schedule for Training
Review Request/Tasking	Maintenance Process Request

Table 2. Sample of Processes in the DoD

**b. Steps Two and Three: Calculate the K as Common Units Produced by Each Process and Find the Total K**

This step puts all processes or sub processes in common units to make them comparable to the private sector. The meaning of K in this step is the value of the

---

<sup>22</sup> All data is provided by Prof. Thomas Housel. It is already calculated and corrected as valid data. The purpose of this data for the reader is a sample to apply the KVA method and demonstrate its method to measure DoD performance.

knowledge in each process or sub process. It could represent the learning time or the total time to complete those tasks. The next table is the total K and the total cost from each activity of each process.<sup>23</sup>

<b>Process</b>	<b>Total K</b>	<b>Total Cost</b>
Search/Collecting data	18.16	416
Review Request/Tasking	5.42	90.47

Table 3. Total K and Cost for Each Processes

***c. Steps Four and Five: Derive a Proxy Revenue Stream and Develop the Value Equation Numerator by Assigning the Revenue Stream to Processes or Sub Processes***

Before applying this step, it is necessary to establish either the proxy revenue assumption or price per unit from the private sector. Proxy revenue assumptions are based on the following assumption: if a commercial entity or organization produces comparable outputs as a non-profit oriented organization, such as the DoD, and the processes required to produce those outputs are comparable, certain inferences can be derived. First, if the processes are comparable, the outputs of the commercial sector are comparable to the non-profit organization. Second, if market forces have placed a “value” or price per unit on the comparable commercial outputs yielding a revenue stream for the commercial entity, that price can also be applied to the non-profit organization. Third, the derived price per unit can be used to develop an analytical or hypothetical revenue stream for the non-profit organization.<sup>24</sup> For the purposes of this project, different processes from different companies that have similarities with the processes described in Table 2 will be used.

---

<sup>23</sup> The calculation of the K was already calculated by the previous research given and approved by the project advisor as valid data.

<sup>24</sup> Cesar G. Rios, Return on Investment Analysis of Information Warfare System, Master’s Thesis, Naval Postgraduate School, September 2005, p. 28.

Process	Total K (As-Is)	Total Cost (\$) (As-Is)	Cost Per Unit (\$) (As-Is)	Total Revenue (As-Is)	Price per unit (\$) (As-Is)
Earl Security (small home security company) Units in hours - Bimonthly, ergo numbers multiplied by 6	425,576	\$88,344.00	\$0.21	\$799,998.00	\$1.88
First Sierra Financial (units in hours)	288	\$54,158.28	\$188.05	\$354,158.28	\$1,229.72
SpectraNet International	1,387	\$11,520.00	\$8.31	\$11,520.00	\$8.31
T&C Biconal Antenna Consulting Project - Hughes Space and Communications Company	4,464	\$399,000.00	\$89.38	\$440,000.00	\$98.57
Toyota Motors Sales Units in hours - Every 22 days or Monthly, ergo multiplied by 16.50909 or 12	45,888	\$130,224.00	\$2.84	\$46,454,254.55	\$1,012.34
Richwood Industries Units in hours	23,805	\$1,757.75	\$0.07	\$952,180.00	\$40.00
NOVA Chemical Railcar Loading Process - Daily, ergo numbers multiplied by 365	55	\$2,400.00	\$43.64	\$47,658.00	\$866.51
Airtouch Telephone Customer Care Flex-Rep	88,892	\$96,020.00	\$1.08	\$2,910,000.00	\$32.74
Morey Bodyboard - Matel	770.81	\$9,631.99	\$12.50	\$770.81	\$1.00
Internet Productions	95,500	\$618,528.00	\$6.48	\$1,042,500.00	\$10.92
Stentor	4,127	\$48,597,713.30	\$11,775.55	\$1,000,000.00	\$242.31
Average price per unit.					<b>\$322.21</b>

Table 4. Average Price Per Unit for Different Processes in the Private Sector

Table 4 provides a price per unit from the private sector that is comparable to the DoD activities. From that price, it is then possible to generate revenue by calculating the total K from each process or sub processes.

***d. Steps Six and Seven: Develop the Value Equation Denominator by Assigning Cost to the Processes and Calculate the Value Equation***

This step calculates the revenue that can be used as a numerator to apply the ROI formula. Table 5 provides the average price per unit that can be applied to obtain revenue for the processes in the DoD. By looking at Table 5, total cost is the denominator for the ROI evaluation.

Process	Total K	Total operating Income (Total K * 322.21)	Total Cost	ROI as a Ratio
Search/Collecting data	18.16	5851.3336	416	13.0657
Review Request/Tasking	5.42	1746.3782	90.42	18.314

Table 5. The KVA Metrics

### 3. The Cryptology Carry-On Program (CCOP) KVA Analysis

The Cryptology Carry-On Program already investigated making all data measurable and applicable. Many assumptions were made to create those numbers. A few, for example, are cost assumptions derived from the U.S. Navy salary information, and the proxy revenue assumption using two private business corporations to generate the total revenue for intelligence as a common unit comparable with the CCOP processes. The final result from that research illustrates how KVA is applicable to measure or value non-profit organizations. In this part, the discussion about applying KVA to generate revenue as a numerator will use the proxy revenue assumption instead of price per unit.

The sub processes of the CCOP systems are defined in Table 6 only to explain of which sub processes are involved in this system.

<i>P1</i>	Review request/Tasking
<i>P2</i>	Determine Op/Equip Mix
<i>P3</i>	Input Search Function/Coverage Plan
<i>P4</i>	Search/Collection Process
<i>P5</i>	Target Data Acquisition/Capture
<i>P6</i>	Target Data Processing
<i>P7</i>	Target Data Analysis
<i>P8</i>	Format Data for Report Generation
<i>P9</i>	QC Report
<i>P10</i>	Transmit Report

Table 6. USS READINESS CCOP Systems

Two of the sub processes will be used from the research to illustrate the computation using the KVA steps. The sub processes are *P4* and *P8*. Table 7 explains the Knowledge (K) that flows in the humans of each sub process. The Proxy Revenue Assumption for this system is **\$893,000** and total **K** for all sub processes is **\$75,424,588.68**.<sup>25</sup>

	<b>Sub Process Name</b>	<b>Total K</b>	<b>% of total K per Sub Process</b>	<b>Proxy Revenue Assigned to Sub process</b>	<b>Cost Assigned to Sub Process</b>
<i>P4</i>	Search/Collection	18,509,025.80	24.5398 %	\$ 219,140	\$ 64,642
<i>P8</i>	Format Data for Report Generation	3,514,082.12	4.6591 %	\$ 41,605	\$ 52,252

Table 7. P4 and P8 Revenue and Cost Allocation

Table 8 shows the KVA metrics resulting from placing the number above in the ROI equation. The formula for this equation is:

- $ROI = \text{Revenue} / \text{Cost}$

	<b>Sub Process Name</b>	<b>ROI as Ratio</b>	<b>ROI as %</b>
<i>P4</i>	Search/Collection	2.39	239 %
<i>P8</i>	Format Data for Report Generation	- 0.204	- 20.4 %

Table 8. P4 and P8 KVA Metrics

From the sample using the KVA methodology above, it is clear that it is possible to measure the performance of a non-profit organization using the market comparable method. The point is ensuring the total K for each process or sub process is comparable to the private sector and determining the cost of each process or sub process. The challenge is to ascertain the correct way to calculate the revenue of that process or sub process. It is developed by searching the price-per-unit or Proxy Revenue Assumption from market or private sector process comparable to the process or sub process in the

---

<sup>25</sup> All data and numbers are taken from the previous research about the CCOP system and used as an example from the research to apply KVA in a different way.

DoD. After all data are collected, it is then possible to calculate the return equation used by the private organization to measure or value their performance in a non-profit organization such as the DoD.

THIS PAGE INTENTIONALLY LEFT BLANK

## V. CONCLUSIONS/RECOMMENDATIONS

### A. CONCLUSIONS

Although the key metric for DoD performance is not financial in nature, but rather mission effectiveness, currently it appears that the Department of Defense (DoD) is facing the challenge of discovering a tool for a more comprehensive analysis based on the prominent valuation methods. This broader analysis provides the opportunity to measure its performance more accurately. Unlike the private sector, the DoD does not pay attention to whether its investments have any value in terms of revenues. The DoD's reasoning is that since it is a nonprofit organization, the proceeds going to the production of weapons do not have as their objective increasing sales.

The effectiveness of those weapons in the battlefield undoubtedly remains the primary objective of the DoD. Nevertheless, decision makers should start considering that an extremely effective organization could simultaneously be extremely inefficient. Based on this logic, if the DoD turns out to be an inefficient organization, the taxpayers' money is spent without an appropriate economic analysis.

Thus, the challenge for the DoD is to discern how an efficient organization compares to other profit making-organizations. Such a comparison would be almost impossible by examining DoD as a whole because the prerequisite for such an implementation, specifically for applying the market approach method as a valuation method, is that the subject company must be in the same industry as the guideline company.

According to this method, the valuation analyst must be extremely careful in selecting meaningful (i.e., comparable) guideline companies. Therefore, it is necessary to narrow the spectrum of DoD activities to identify a number of processes comparable to the private sector; Those common processes that produce the same output. Thus, it is possible to create a market consisting of different organizations that do not compete with each other.

Furthermore, the implementation of the market valuation method requires using financial ratios as an index of organization performance. This is attainable by converting the DoD's output to common units with profit-making organizations and multiplying those common units by the appropriate price data to be used as the numerator in the ratio.

## **B. RECOMMENDATIONS**

A method exists for the DoD to compare some of its processes with similar private sector processes. By doing so, the DoD can identify which of its processes has exceptionally high or low efficiency. In order to apply the market comparable as a performance metrics in DoD, the KVA methodology could assist in converting the output of certain comparable processes into common units and to discover the revenues that the DoD process generates.

Moreover, using investment financial ratios could allow the DoD to evaluate which services (Army, Navy, etc.) operate more efficiently. Based on the results of these ratios, the DoD could decide how to allocate the available budget setting as a criterion the efficiency of its services. The accuracy of the efficiency measure could be ensured not only in terms of cost savings but also in terms of the amount of revenues each of its services generate. Therefore, the DoD could create an internal market of certain military processes having as competitors its own services.

## LIST OF REFERENCES

- Cramer, Myron. "Measuring the Value of Information." Atlanta, GA:Georgia Tech Research Institute. <<http://iw.gtri.gatech.edu>> [20 July 2005].
- Housel, T. and Bell, A. *Measuring and Managing Knowledge*. Boston: McGraw-Hill, 2001.
- Housel, T. El Sawy, O., Zhong, J., and Rodgers, W. "Models for Measuring the Return on Information Technology: A Proof of Concept Demonstration." 22<sup>nd</sup> International Conference on Information Systems. December 2001.
- Housel, T., Jansen, E., Pavlou, P. and Rodgers, W. "Measuring the Return on Information Technology: A Knowledge-Based Approach for Revenue Allocation at the Process and Firm Level." Monterey, California: Naval Postgraduate School, August 2005.
- Nickerson, Clarence B. *Accounting Handbook for No Accountants*. 3<sup>rd</sup> Ed. New York: Van Nostrand Reinhold Co., 1986.
- Phillips, Patricia P. "ROI in the Public Sector." Ed. Patricia Phillips. Alexandria, VA: American Society for Training and Development, 2002.  
<<http://www.astd.org/NR/rdonlyres/779B0547-EB1F-48E5-8776-7808107FD010/0/Whitepaper.pdf#search='ROI%20in%20the%20public%20sector'>> [July 2005].
- Pratt, Shannon P., Reilly, Robert F. and Schweichs, Robert P., "Valuing a Business." 4<sup>th</sup> Edition, McGraw-Hill Publishing, 2000.
- Rios, Cesar G. *Return on Investment Analysis of Information Warfare System*, Master's Thesis, Naval Postgraduate School, Monterey, California, September 2005.
- Strassmann, Paul. Calculating Knowledge Capital. Knowledge Metrics.  
<<http://www.destinationkm.com>> [01 October 1999].
- The International Engineering Consortium, Knowledge Value-Added (KVA) Methodology, Web ProForum Tutorials.
- Walsh, David. "Knowledge Value Added: Assessing both Fixed and Variable Value." Business Process Audits.Com. White Papers. Business Process Audits.Com, 13 August 1998. <<http://www.businessprocessaudits.com/kvawalsh.com>> [06 June 2005].

THIS PAGE INTENTIONALLY LEFT BLANK

## INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center  
Ft. Belvoir, Virginia
2. Dudley Knox Library  
Naval Postgraduate School  
Monterey, California
3. Thomas J. Housel  
Naval Postgraduate School  
Monterey, California
4. Bill Gates  
Naval Postgraduate School  
Monterey, California
5. Robert N. Beck  
Naval Postgraduate School  
Monterey, California