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EXPANDED APPLICATIONS AND BENEFITS
OF A TAXONOMY OF GOODS
PROCURED BY THE FEDERAL GOVERNMENT

by

Kimberley Ann Beeson

June 1993

Thesis Advisor:

David V. Lamm

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Expanded Applications and Benefits
of a Taxonomy of Goods
Procured by the Federal Government

by

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Submitted in partial fulfillment
of the requirements for the degree of

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ABSTRACT

Recent research has proposed the transformation of contracting from a management art to a science. To this end, a description and classification of the subject matter has been undertaken and a model developed that classifies goods procured by the Federal Government. A great deal of effort has been given to validation of this model. The rudimentary model has been refined and purposes for its application have been presented. This thesis offers three potential applications and benefits of the previously developed taxonomical structure for classifying goods procured by the Federal Government. These potential applications are identification and utilization of commercial items, workload management and staffing.

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I. INTRODUCTION

A. BACKGROUND

A retrospective look at Government contracting reveals dynamic changes sweeping through all aspects of the field. During the past decade, the realm of Government procurement has been filled with controversy and duality of purpose. Relying on fiscal policy and legislative directives, the Federal Government today is expected to "stimulate balanced economic development, curb environmental abuses, promote health education and scientific progress, assimilate underprivileged groups into the mainstream of social life and so on." (Judson 1986) Legislative oversight and directives also address the need to recognize the professional status of the acquisition workforce, provide for increased vigilance and responsibility in the financial arena and respond to a downsizing in the underlying structure of the support system.

Rapid change and conflicting legislative directives create an environment that can be difficult to interpret and define. In the last few years, the need to organize and define these changes through a systematic and orderly process was recognized. "This systematic approach concept implies that the contracting phenomena are an orderly, explainable

phenomena and thus have the potential to be studied as a science." (Park, 1986, p. 12)

Organizing the field of contracting as a science requires that the subject matter be accurately described and classified. The objective of a classification system is to provide order to the subject matter and to aid in the development of related theories. (Park, 1986, p. 90) Pursuant to this requirement, several classification studies have been undertaken. These studies cover not only the classification of goods, but contracting literature and contracting officer tasks as well. (Heuer, Kingston and Williams, 1977, Fowler, 1987, Sweeney, 1989, Page, 1989, Wenger, 1990 and Prendergast, 1991) Of these studies, Brian Wenger (Wenger, 1990) and Jack Prendergast (Prendergast, 1991) establish the most promising classification scheme. Wenger developed this scheme drawing largely from existing product classifications in the field of marketing. His method integrated product classification into a scientific taxonomical structure similar to those used in biology or zoology. He used this underlying framework to create a systematic method to categorize goods purchased by the Federal Government. His taxonomical classification organizes goods procured by the Federal Government based on certain of the good's inherent characteristics. He then designed a rating system that places the goods, based on those inherent characteristics, on a continuum from simple to complex.

The taxonomical model developed by Wenger was further validated and revised by Prendergast. After ascertaining the validity of the classification scheme, the next step was to identify potential applications. In their works, both Wenger and Prendergast suggest areas where the application of the taxonomy might be beneficial. A follow-on study by Edward Sheehan reexamined the taxonomy for the purpose of more fully developing potential benefits. Sheehan suggests two compelling reasons for pursuing practical applications. The first is to bridge the gap between researchers and practitioners in the contracting field and the second is to provide direction for future research and refinement of the model. (Sheehan, 1992, pp. 2-3)

Based on the recommendations of these previous studies, the researcher selected the areas of staffing, workload planning and commercial item identification for further examination. According to Wenger, the types of goods bought by a Government procurement office could affect that office's level of staffing and internal organization. (Wenger, 1990, p. 19) In his analysis, Prendergast suggests that the taxonomy could be used in workload planning. "Segregation of items within the commodity can provide recognition by decision makers on the amount of effort required to make a purchase for an item." (Prendergast, 1991, p. 87) This information could then be used to balance workload and match personnel strengths to job requirements. Additionally, he envisions the use of

the taxonomy as a tool for the identification of goods suitable for procurement under commercial products acquisition initiatives. (Prendergast, 1991, pp. 87-88)

B. OBJECTIVES

The primary objective of this study is to examine previously identified, but undeveloped applications for Wenger's taxonomy of goods procured by the Federal Government and evaluate their potential benefits. Specific objectives of the study are:

1. Examine the potential application of Wenger's taxonomy in the areas of identification of commercial and non-developmental items, staffing and workload planning.
2. Evaluate these three areas, detailing how the classification scheme would apply to each, and discuss the anticipated benefits from their applications.
3. Validate the continuing requirement that the taxonomy be useful.

C. RESEARCH QUESTIONS

The following research questions served as a guide and were addressed within this study:

Primary Research Question:

How can the Wenger taxonomical structure for classifying goods procured by the Federal Government be further applied and its benefits expanded?

Subsidiary Research Questions:

1. What additional applications, beyond those currently identified, could be made of the taxonomy for classifying goods?
2. What benefits could be derived from employing the taxonomy?
3. How can the taxonomical classification structure be refined and improved?
4. How can this classification structure be used as a behavior predictor in the procurement of goods by the Federal Government?

D. RESEARCH METHODOLOGY

The research for this thesis was conducted by the following means:

- Comprehensive literature review
- Preparation of a survey instrument
- Selection of buying activities to complete the survey
- Follow-on interviews
- Data analysis
- Application of the data to the classification scheme.

The researcher conducted an in-depth review of literature relating to the development of contracting as a science, development of taxonomies relating to contracting and procurement research and all other literature specifically related to the Wenger taxonomy. Results of the literature review are described later in this chapter.

The surveys were then prepared and the activities selected to participate in the data collection. The survey was designed to solicit background information on the perception of contracting personnel on issues involving staffing, workload planning and identification and procurement practices for commercial items. Surveys were sent to the Aviation Supply Office in Philadelphia, Ships Parts Control Center, Mechanicsburg, PA and the Kings Bay, GA Detachment of Naval Supply Center, Charleston, SC. The feedback from these three activities provided opinions from buyers with various levels of expertise responsible for the procurement of a wide variety of goods.

E. SCOPE, LIMITATIONS AND ASSUMPTIONS

The scope of the research was limited to previously suggested, but undeveloped applications of the Wenger taxonomical structure for the classification of goods procured by the Federal Government.

The following limitations apply:

1. All discussions of proposed applications and resulting benefits are theoretical. Goods procured by the Federal Government are not yet classified according to the proposed scheme.
2. Results of the survey reflect the opinions of the participants in a theoretical 'what if' scenario.

The following assumptions were also made during this study:

1. The Wenger taxonomy could be used to classify all of the goods procured by the Federal Government.
2. Deficiencies exist in the current methods used to classify goods (FSC or SIC), particularly in their application in the Government procurement and contracting arenas.

F. LITERATURE REVIEW

The basic resource for this study is Brian Wenger's graduate thesis "A Taxonomical Structure for Classifying Goods Purchased by the Federal Government." (Wenger, 1990) Follow-on theses by Prendergast and Sheehan (Prendergast, 1991 and Sheehan, 1992) expanded on Wenger's taxonomy, providing both a validation of the selected characteristics and potential applications.

The theory and logic of taxonomical classification for behavioral sciences are provided by Edwin A. Fleishman and Marilyn K. Quaintance in their book Taxonomies of Human Performance: The Description of Human Tasks. (Fleishman and Quaintance, 1984) This text also provides a well-developed blueprint for future studies in classification. Methodologies for developing and evaluating new taxonomies are detailed throughout the book. Potential benefits and applications are discussed in largely generic terms.

In his article, "Product Characteristics and Marketing Strategy," Gordon E. Miracle breaches the gap to provide specific applications for a classification of products. (Miracle, 1965) The most beneficial aspect of this article is that it develops a mindset for taxonomical application followed up with practical examples. He encourages the reader to explore the classificatory system as well as the implications of its application and utilization.

G. ORGANIZATION OF STUDY

The primary objective of this research effort is the development of potential applications and anticipated benefits for the Wenger taxonomy of goods procured by the Federal Government. Chapter I presented the basic research questions, methodology, scope, limitations and assumptions. The background of general taxonomical development and a more in-depth discussion of the Wenger model are presented in Chapter II. The survey results are presented in Chapter III.

Chapters IV, V and VI present the selected applications of the identification of commercial and non-developmental items, staffing, and workload planning. Staffing and workload planning are discussed from the human resources development perspective based on a review of work analysis and management models. These chapters are interspersed with examples of specific contracting situations and how application of the taxonomy could be beneficial.

The final chapter, Chapter VII, recaps the research questions and how they are addressed within the thesis. Conclusions and recommendations based on the results are made and suggestions for further research are presented.

II. BACKGROUND

A. PURPOSE

The purpose of this chapter is to present the concept of contracting as a science, examine related classification schemes and taxonomies and how they are used in procurement.

B. INTRODUCTION

The idea of contracting as a science was introduced by Robert Williams and Paul Arvis in a journal article in 1985. (Williams and Arvis, 1985, pp. 26-35) This research was followed up by Steven Park in his 1986 master's thesis. (Park, 1986) Park recommended the development of a systematic and organized method for dealing with the field of contracting. He suggested that there are four distinct characteristics or requirements that the subject matter should meet to be considered a science. These criteria include:

1. A distinct subject matter.
2. The description and classification of the subject matter.
3. The presumption of underlying uniformities and regularities concerning the subject matter.
4. The adoption of the method of science for studying the subject matter. (Park, 1986, p. 41)

For the purposes of this research, these criteria are applied to the field of Government contracting. The subject matter is limited to goods that are procured by the Federal Government. Description and classification of these goods are based on a taxonomical model previously developed by Wenger and later refined and validated by Prendergast. The uniformities and regularities are described by the six characteristics established in the taxonomy. Those six include:

1. Complexity
2. Customization
3. Maintainability
4. Unit Cost
5. Documentation
6. Item Attention

These characteristics are further defined along a continuum or spectrum ranging from simple to complex. Expanded discussion and definition of the Wenger model are provided later in this chapter.

Although this system for classification is not currently in use, the methodology is established and available should the taxonomy be adopted at a future time. The Wenger model is structured to allow for the basic classification of any good. At this point, however, it may be important to note that there

are some limitations of this taxonomy. Although this classification does not provide an in-depth analysis or an all-inclusive description of an individual good, it does provide critical detail on characteristics deemed essential from the buyer's strategic perspective for the procurement of goods within the Federal Government. The six characteristics are not the only descriptive elements pertaining to a particular good. A case could certainly be made for the inclusion of at least a dozen or more additional characteristics. Grouping techniques and cluster analysis have established these six as an adequate means of describing the essence or essential qualities of a good for procurement purposes.

The requirement for a description and classification of the subject matter has been the driving factor in the classification research done in the procurement arena.

C. DEFINITIONS

To maintain the integrity of this research as a stand alone work, certain terms used within the text may require or benefit from definition. These terms primarily relate to the development and discussion of classification schemes and taxonomies.

- **Classification**- The ordering or arrangement of entities into groups or sets on the basis of their relationships, based on observable or inferred properties.

- **Classificatory System**- The end result of the process of classification, generally, a set of categories or taxa.
- **Identification**- The allocation or assignment of additional, unidentified objects to the correct class, once such classes have been established by prior classification.
- **Taxon (plural Taxa)**- A group or category in a classificatory system resulting from some explicit methodology.
- **Taxonomy**- The theoretical study of systematic classifications including their bases, principles, procedures, and rules. The science of how to classify and identify. (Fleishman and Quaintance, 1984, p. 22)

D. **SYSTEMS OF CLASSIFICATION**

The development of taxonomical classification schemes is primarily associated with scientific research and methodologies. Throughout history, man has strived to make sense of his environment and the objects and activities existing within it. Man's basic method of sorting has been through the recognition of differences and similarities in those objects and activities. Robert Sokal provides a succinct definition of the purpose of classification:

The paramount purpose of a classification is to describe the structure and constituent objects to each other and to similar objects, and to simplify these relationships so that general statements can be made about the classes of objects. (Sokal, 1974, p. 1116)

The amount of information available in a given field can be overwhelming if it is not adequately organized and presented. For any particular field, the vast amount of information

available virtually makes it impossible for an individual researcher or practitioner to remember and access relevant data. To deal with this abundance, Sokal developed a set of criteria for classification systems. In his research, he found that for a classification system to be adequate, it should meet at least these basic goals.

1. Economy of memory.
2. Ease of manipulation.
3. Ease of information retrieval.
4. Description of the structure and relationships of constituent objects. (Sokal, 1974, p. 1116)

The most common classifications and taxonomies exist within the physical sciences particularly in the studies of biology and zoology. Prendergast provides an excellent synopsis of taxonomical development and use in the scientific arena in his work "Application of a Taxonomical Structure for Classifying Goods Procured by the Federal Government." (Prendergast, 1991)

The current vein of procurement research attempts to define structural relationships among goods using techniques developed in scientific classification.

E. CLASSIFICATION STUDIES AND TAXONOMIES IN PROCUREMENT

1. Government Classification Schemes

In his original research, Wenger identified two major systems for the classification of goods purchased by the Federal Government: the Federal Supply Classification and the Standard Industrial Classification. (Wenger, 1990, p. 17) During the literature review, this researcher also found additional characteristic-based classifications that could be included among the systems available to classify goods. They include the designation of small and large purchases based on the dollar value of transactions and the designation of goods as commercial off-the-shelf or non-developmental items. Although these two particular schemes do not fit the stringent requirements of a taxonomy or of a developed classification system, they are examples of attempts to classify goods based on their inherent characteristics.

a. Federal Supply Classification

The Federal Supply Classification (FSC) is a system used to separate categories of goods based on groups and classes within a commodity group. Class is determined primarily by the physical and performance characteristics of the good. To assist in supply management, goods that are often requisitioned together are included in the same class. This system was designed specifically to accommodate goods that are already in at least one of the supply systems of the

Federal Government. (Federal Supply Classification Cataloging Handbook, H2-1, 1989, p. ii)

The FSC designator of group and class serves principally as an aid in logistics management and supply support. It offers little insight into the actual procurement process.

b. Standard Industrial Classification

The Standard Industrial Classification (SIC) is structured as an economic classification. It is used to describe and organize business establishments based on their primary activities or predominant products. The SIC serves as a means of collection for the tabulation and presentation of statistical data on U.S. businesses. This system does not classify goods based on inherent characteristics. It does classify business establishments based on the characteristic nature of the goods produced or handled. (Federal Supply Classification Cataloging Handbook, H2-1, 1989, p. 4)

2. Procurement Research

Over the past few years, research has flourished in the procurement field, particularly in the development of classification schemes. As presented earlier in this chapter, much of the research being conducted today is related to the development of contracting as a science. Several research projects have subsequently been undertaken based on earlier findings and recommendations. Park's recognition of the need

for classification studies to develop contracting as a science is the impetus for many of these works.

Two of these studies followed along the lines of the task-oriented classifications and taxonomies discussed by Edwin Fleishman and Marilyn Quaintance. (Fleishman and Quaintance, 1984) The first study, undertaken by Clark Fowler, developed a taxonomic structure of procurement tasks. (Fowler, 1986) The second work, authored by Asa Page, more specifically addressed a taxonomy of tasks performed by contracting officers. (Page, 1989) Studies have also been done to organize and classify procurement literature. Recent classifications of contracting literature were completed by Richard Sweeney (Sweeney, 1989) and David Smith (Smith 1991).

The emphasis of procurement research has taken a more specific turn toward the classification of goods and the utility of such a classification.

At this stage of the taxonomy's development, it is appropriate to consider its usefulness by examining practical applications and benefits. This is necessary for two reasons. First it is important to bridge the gap between researchers and practitioners.

The second reason to consider practical applications is to provide direction for future research and refinement of the taxonomical model. (Lamm, Wenger, Prendergast and Sheehan, 1993)

Satisfaction of the criteria for usefulness compelled Sheehan in his research for applications and benefits of the

Wenger model. It is to the same end that the current work progresses.

To better understand the potential applications and benefits, it is necessary to have a basic understanding of the development and refinement of Wenger's original model. The following section provides that discussion.

F. THE WENGER TAXONOMICAL MODEL

Wenger's model was developed to classify goods procured by the Federal Government. He determined that the systems available for classification of goods, the Federal Supply Classification and the Standard Industry Classification, did not provide procurement personnel with enough information to make informed decisions or develop adequate procurement strategies. Through his model, he sought to develop a set of characteristics that would provide both procurement researchers and practitioners with increased strategic insight. (Wenger, 1990, p. 25) Much of the foundation of the original model is derived from existing marketing research. The following section describes the relationship between Wenger's procurement model and marketing classification research.

1. Basis in Marketing Classification Schemes

In his original research, Wenger employed a product characteristics classification scheme developed in 1965 by Gordon Miracle (Miracle, 1965) Miracle created this scheme as

a marketing aid. His system provides a link between product characteristics and the development of marketing strategy. He contends that there is an observable relationship between a product's characteristics and the appropriate marketing mix needed for that product. (Miracle, 1965, p. 15)

Miracle organized his classification around nine product characteristics shown in Table 2-1. Using those characteristics, he created a matrix which displayed the range of values for each on a five-point scale from very low to very high. Table 2-2 illustrates this matrix.

Each product was then assigned a value for all nine characteristics. An average score then determined into which of the five groups the product would fall, Table 2-3 shows the relationship between the group and the type of products within it. By determining where a good falls in the spectrum, a strategy could be developed based on the characteristics. The information gleaned from the taxonomy can serve as a directive for policy decisions and marketing strategy. It provides guidance to the strategist, allowing for focus on pertinent characteristics and associated marketing techniques.

2. Wenger's Original Model

Wenger compiled a list of 22 preliminary characteristics, drawing from his own experience and the works of Miracle and Judson. (Wenger, 1990, p. 27) He presented

TABLE 2-1
PRODUCT CHARACTERISTICS

1. Unit value
2. Significance of each individual purchase to the consumer
3. Time and effort spent purchasing by consumer
4. Rate of technological change
5. Technical complexity
6. Consumer need for service (before, during and after the sale)
7. Frequency of purchase
8. Rapidity of consumption
9. Extent of usage (number and variety of consumers and ways in which the product provides utility)

(Miracle, 1965, p. 20)

this list to an expert panel of twelve Fellows of the National Contract Management Association. With the input of the expert panel, he was able to narrow the list down to twelve characteristics. Those twelve characteristics, once established, have been the foundation for the subsequent works of Prendergast (Prendergast, 1991) and Sheehan (Sheehan, 1992). The twelve characteristics are provided below.

1. Change
2. Complexity

TABLE 2-2
PRODUCT CHARACTERISTIC MATRIX

| Characteristic | Group I | Group II | Group III | Group IV | Group V |
|----------------|-----------|----------------|----------------|---------------|-----------|
| 1. | very low | low | medium to high | high | very high |
| 2. | very low | low | medium | high | very high |
| 3. | very low | low | medium | high | very high |
| 4. | very low | low | medium | high | very high |
| 5. | very low | low | medium to high | high | very high |
| 6. | very low | low | medium | high | very high |
| 7. | very high | medium to high | low | low | very low |
| 8. | very high | medium to high | low | low | very low |
| 9. | very high | high | medium to high | low to medium | very low |

(Miracle, 1965, p. 20)

-
- 3. Customization
 - 4. Maintainability
 - 5. Homogeneity
 - 6. Consumption
 - 7. Unit Cost
 - 8. Documentation
 - 9. Item Attention
 - 10. Sources

TABLE 2-3
PRODUCT GROUPINGS

| | |
|-----------|---|
| Group I | Candy bars, soft drinks, razor blades |
| Group II | Small hardware items, proprietary pharmaceutical, dry goods |
| Group III | Radios, televisions, tires, athletic equipment |
| Group IV | Farm machinery, automobiles, quality household furniture |
| Group V | Steam turbines, electrical generators, machine tools |

11. Criticality

12. Stability (Lamm and Wenger, 1990, p. 3)

Appendix A provides a complete definition of each characteristic along with the rating scales used.

Using cluster analysis, Wenger determined that the list of attributes could be further reduced to six without changing the overall ranking of a good. The six remaining characteristics are:

1. **Complexity** describes the good's technical intricacies. The degree of a good's complexity may be thought of in terms of the skill and expertise needed to produce the good. Another way to determine complexity is whether the good is a system, subassembly, component, piece part, or raw material.

2. **Customization** is the degree to which the good is manufactured to the buyer's specifications. Some goods, those that are strictly commercial, have no amount of customization while others are produced exclusively for a buyer, e.g., the Government.

3. **Maintainability** refers to the amount of maintenance considerations associated with the good. In other words,

how frequently, if at all, maintenance is required on the good. Some goods are virtually maintenance free while others require a great deal of maintenance throughout their lives.

4. **Unit Cost** is the good's cost to the buyer. Generally speaking, as a good becomes more unique to the buyer's requirement, the unit value is increasing.

5. **Documentation** is another characteristic external to the good yet often a necessary part of it. Frequently the Government requires substantiating documentation in the form of drawings, technical manuals, and certifications for some types of goods while for others little at all is required.

6. **Item Attention** given by the buyer refers to a single-item versus volume or mass buying. When a buyer deals with small dollar-value items like common bolts and rivets, the focus is on a mass quantity of these types of goods. Contrast this with the acquisition of an F-14 aircraft where the buyer's attention is focused on a single item.
(Wenger, 1990, p. 85)

Wenger applied his research to twenty-one divergent goods ranging from sandpaper to nuclear reactors. He solicited input from a wide variety of sources including contracting and procurement officials from both the public and the private sectors. Figure 2-1 provides an example of the matrix used by Wenger to classify those twenty-one items.

Once the taxonomical model was established, the next step in the process was to validate the scheme. Jack Prendergast used Wenger's model with the original twelve characteristics as the basis for his verification. He refined the research methodology by limiting two critical dimensions

| | Good: | | | | | | N = |
|------------------------|------------------|-------------------------------|------------------------------|---------------------------------|---------------------------------|--------------------------------|------------|
| | Avg Value | Simple (1.00-1.99) | Basic (2.00-2.99) | Moderate (3.00-3.99) | Advanced (4.00-4.99) | Complex (5.00-5.99) | |
| Complexity | | | | | | | |
| Customization | | | | | | | |
| Maintainability | | | | | | | |
| Unit Cost | | | | | | | |
| Documentation | | | | | | | |
| Item Attention | | | | | | | |
| Overall Score | | | | | | | |

KEY:
+ : UPPER END OF THE CATEGORY
0 : MIDDLE OF THE CATEGORY
- : LOWER END OF THE CATEGORY

FIGURE 2-1

in the scope of the research. Input sources were restricted to buyers from the Navy Aviation Supply Office and the Defense General Supply Center. The range of goods selected for classification were limited to homogeneous groupings of equipment-type items.

Through the use of cluster analysis, Prendergast validated Wenger's model and confirmed the six remaining attributes. After careful evaluation of the data, he reached the same conclusion regarding which characteristics among the original twelve could be labeled as noncontributing. "Based on these

findings, the researcher therefore concludes that the scheme established for the classification of Government goods is valid, and can be a useful tool in procurement (Prendergast, 1991, p. 80)." Figure 2-1 presents the matrix format of the taxonomy with the six characteristics and five categories.

3. Sheehan's Applications

The utility of the taxonomy is determined by the degree to which it could be successfully applied. Sheehan's work presents an excellent summary of taxonomical application, covering both generic and contracting aspects. (Sheehan, 1992, Ch. III) There is little need to reproduce that entire effort in this presentation. This section summarizes his research and provides a short summary of the three areas of application that he developed.

One of the most beneficial products of his work is the list of 23 areas for potential application of the taxonomy. This list serves as the springboard for future development of applications. The first three items on the list below are the areas covered by Sheehan in his research.

1. **Market Research**
2. **Policy Guidance**
3. **Training/Education**
4. Staffing
5. Procurement Reviews

6. Budgeting
 7. Legislative Development
 8. Regulations/Procedures
 9. Contract Type Selection
 10. Contracting Method
 11. Change Control
 12. Break-out Decisions
 13. Unsolicited Proposal Procedures
 14. Industrial Base Decisions
 15. Profit Guidelines
 16. Source Selection Procedures
 17. Administrative Procedures
 18. Clause Selection
 19. Specification Selection
 20. Configuration Control
 21. Independent Research and Development (IR&D)
Policy
 22. Acquisition Strategy
 23. Workload Management
- (Sheehan, 1992, p. 48)

G. SUMMARY

This chapter has introduced the general principles of classification and discussed the various types of classification schemes already in use for goods procured by the Federal Government. It also presented a brief overview of

the taxonomy of goods developed by Wenger in 1990. Subsequent research by Prendergast and Sheehan was also examined. The next chapter provides insight into the results of the survey.

III. SURVEY RESULTS

A. INTRODUCTION

In this chapter, the researcher will explain how the survey was devised to solicit background information from buyers at various levels of Government procurement. The survey was designed as an adjunct to the literature review and was not intended as a stand alone instrument for statistical analysis. The actual results of the survey along with their relevancy and importance are discussed.

B. SURVEY PREPARATION

The survey was designed to solicit general information from buyers with a variety of experiences and backgrounds. It was developed to supplement the literature review and to assist the researcher in identifying potential deficiencies or problem areas that could benefit from application of the taxonomy. The questions were related to the three areas of potential application chosen for this study. The areas include staffing, workload management and the use of commercial items and technology. The survey also briefly exposed the participants to the taxonomy and requested feedback and opinions on its potential for application and implementation. The survey and the accompanying cover letter are contained in APPENDIX B.

The survey was divided into three parts. Part I was designed to provide a biographical profile of the respondent. Part II contained a series of questions about staffing, workload management and commercial items. Part III briefly described the attributes used in the taxonomy and asked the participants to evaluate the usefulness of the taxonomy in the three chosen areas of application.

A five-point scale was used wherever possible throughout the survey to give the participants a broad range of response. For most questions, the participants were given the following response options: Strongly Agree; Agree; No Opinion; Disagree; and Strongly Disagree. In cases where these options did not apply, an appropriate alternate five-point scale was used.

C. DATA COLLECTION

1. Selection of Buying Activities

In order to get a variety of responses, three buying activities were selected for participation. Two of the activities chosen, Navy Aviation Supply Office and Ships Parts Control Center, are Inventory Control Points (ICPs) and the third, Naval Supply Center Charleston, Kings Bay Detachment is a Stock Point. The Navy Aviation Supply Office was selected because of its participation in prior classification research. The other two were picked because of the researcher's access to personnel and the willingness of the commands to designate

coordinators to assist in the administration of the surveys.

2. Survey Response Statistics

Survey response for this project was excellent. A total of 120 surveys was distributed to the three buying activities. Of that number, 117 or 97.5% were returned to the researcher. This phenomenal rate of return can be attributed to the cooperation of the coordinators at each of the three sites. Surveys were mailed directly to the coordinators, who then distributed them to the participating buyers. Once the surveys were completed, the coordinators returned the entire package to the researcher. The coordinators at each location provided a knowledgeable point of contact for both the participants and the researcher. The use of the coordinators helped to overcome the inertia faced by many survey respondents to independently return the surveys. They also provided the respondents with a sense of validity and importance regarding their participation in the survey.

Appendix B contains the actual survey and the responses are annotated in the survey document for each question. Statistical data are given in conjunction for each part of the survey in the following section.

D. DATA ANALYSIS

The data are analyzed separately in each of the next three sections.

1. Part I-Demographics

A wide variety of contracting personnel responded to the survey. Most of the respondents were GS 1102 series with grades ranging from GS-7 to GM-14. Naval Supply Center, Charleston had some GS 1105 series personnel participate in the survey. Experience in Government contracting ranged from 28 years to less than two months. A breakdown of participants indicated a broad cross-section of personnel grade level and experience. The majority of the participants had been in their current positions between two and five years. Table 3-1 gives a demographic breakdown of respondents.

2. Part II-Background Information

In the area of job-related experience, over 90% responded that their levels of training were adequate for the types of goods purchased and the types of tasks required in their position descriptions. The majority indicated that while they had an above average working knowledge of the goods for which they were responsible, that knowledge was based on the use of specifications rather than on personal knowledge of the goods themselves. Overall staffing was deemed adequate in 84% of the responses. Table 3-2 shows the mean, median and standard deviation of the survey responses for Part II.

Workload management responses were less favorable. While 75% of the respondents said that workload was assigned efficiently in their divisions, only 48% felt that work

**TABLE 3-1
DEMOGRAPHIC DATA**

| <u>TITLE</u> | <u>PERCENT</u> |
|--------------------------------------|----------------|
| SUPERVISORY PURCHASE AGENT 1105 | 03 |
| PURCHASING AGENT 1105 | 16 |
| SUPERVISORY CONTRACT SPECIALIST 1102 | 16 |
| CONTRACT SPECIALIST 1102 | 43 |
| SUPERVISORY CONTRACT NEGOTIATOR 1102 | 02 |
| CONTRACT NEGOTIATOR 1102 | 10 |
| CONTRACTING OFFICER 1102 | 03 |
| NAVAL OFFICER | 03 |
| PROCUREMENT ANALYST | 03 |
| | |
| <u>GRADE</u> | |
| GS 5 | 03 |
| GS 7 | 09 |
| GS 9 | 21 |
| GS 11 | 43 |
| GS 12 | 10 |
| GM 13 | 07 |
| GM 14 | 05 |
| GM 15 | 02 |
| | |
| <u>YRS K EXPERIENCE</u> | |
| 0-2 | 09 |
| 3-5 | 20 |
| 6-9 | 33 |
| OVER 10 | 38 |
| | |
| <u>YRS GOVT EXPERIENCE</u> | |
| 0-2 | 02 |
| 3-5 | 10 |
| 6-9 | 31 |
| OVER 10 | 57 |
| | |
| <u>YRS CURRENT POSITION</u> | |
| 0-2 | 40 |
| 3-5 | 31 |
| 6-9 | 22 |
| OVER 10 | 07 |

TABLE 3-2
SURVEY RESPONSES PART II

| QUESTION | MEAN | MEDIAN | STD DEV |
|-----------------|-------------|---------------|----------------|
| 1. | 1.73 | 2.00 | 0.64 |
| 2. | 1.64 | 2.00 | 0.69 |
| 3. | 2.35 | 2.00 | 0.96 |
| 4. | 3.20 | 3.00 | 0.84 |
| 5. | 2.97 | 3.00 | 0.46 |
| 6. | 2.76 | 2.00 | 1.17 |
| 7. | 1.85 | 2.00 | 0.90 |
| 8. | 1.74 | 1.00 | 0.92 |
| 9. | 2.34 | 2.00 | 0.91 |
| 10. | 2.86 | 3.00 | 1.14 |
| 11. | 2.59 | 2.00 | 1.10 |
| 12. | 2.54 | 2.00 | 0.90 |
| 13. | 3.49 | 4.00 | 1.04 |
| 14. | 3.28 | 4.00 | 1.24 |
| 15. | 2.42 | 2.50 | 0.89 |
| 16. | 2.61 | 2.00 | 1.12 |
| 17. | 3.16 | 3.00 | 1.16 |
| 18. | 3.36 | 3.00 | 0.94 |
| 19. | 2.41 | 2.00 | 0.98 |
| 20. | 2.30 | 2.00 | 1.10 |
| 21. | 2.58 | 2.00 | 1.04 |
| 22. | 2.91 | 3.00 | 1.00 |
| 23. | 2.22 | 2.00 | 0.77 |
| 24. | 2.47 | 2.00 | 0.92 |

N = 117

assignments took into account the amount of time necessary to successfully complete each action. Some 56% believed that their division had personnel who were underutilized at the same time that others were being assigned additional work. Slightly more than half indicated that there was enough flexibility in their work center to accommodate fluctuations in incoming workload and to redistribute tasks accordingly.

In the area of commercial and non-developmental items, it was clear that very little consensus exists on their use. Approximately half the participants did not pursue the procurement of commercial items even when they obviously met the requirements of the customer. One written comment received succinctly summed up the attitude toward commercial items by saying "I do not have the time or resources to identify these items, nor am I tasked with this goal or process." More than 50% of those asked, indicated that the buyers did not have a system available to them that readily enabled them to identify commercial or non-developmental substitutes. The majority agreed, however, that if such a system were to be developed, that they would be more inclined to pursue the use of commercial substitutes.

3. Part III-Buyer Evaluation of the Taxonomy

Over 80% of the participants responded positively to the use of the taxonomy in the three areas of application: workload management; staffing; and use of commercial and non-

developmental items and technology. A summary of responses is found in Table 3-3.

TABLE 3-3
SURVEY RESPONSES PART III

| QUESTION | MEAN | MEDIAN | STD DEV |
|-----------------|-------------|---------------|----------------|
| 1. | 2.22 | 2.00 | 0.93 |
| 2. | 2.23 | 2.00 | 0.87 |
| 3. | 2.35 | 2.00 | 0.82 |
| 4. | 2.48 | 2.00 | 1.00 |
| 5. | 2.59 | 2.00 | 0.96 |
| 6. | 2.29 | 2.00 | 0.91 |
| 7a. | 3.23 | 3.00 | 1.04 |
| 7b. | 2.95 | 3.00 | 1.02 |
| 7c. | 2.87 | 3.00 | 1.05 |
| 7d. | 3.27 | 3.00 | 1.17 |
| 7e. | 3.29 | 3.00 | 1.20 |
| 7f. | 3.27 | 3.00 | 0.99 |
| 8. | 2.63 | 2.00 | 0.99 |

N = 117

E. SUMMARY

In developing the questionnaire, the researcher had hoped to uncover areas of obvious concern to contracting personnel. The results of the survey did not uncover any such glaring concerns. To the extent that the survey is indicative of the buyers' opinions, it appears that staffing is adequate and

personnel have the appropriate mix of training and experience to complete their assigned tasks. Workload management and distribution of work were areas that respondents indicated that improvement could be used.

The survey served the purpose for which it was designed, to supplement the literature review. A simple spreadsheet analysis was performed to determine percentages and identify trends. This methodology was adequate to uncover the information desired from the data. Data available from this type of questionnaire would not necessarily benefit from a more in-depth statistical analysis.

Participants were also generous with their comments. These comments were particularly useful to the researcher in expanding the understanding of the existing work environment. Many of these comments have been incorporated into the discussion and generated examples used later in this study.

IV. APPLICATIONS: COMMERCIAL AND NON-DEVELOPMENTAL ITEMS

A. INTRODUCTION

The purpose of this chapter is threefold. The literature review and survey responses provided background information regarding the history and usage of commercial items within the Federal Government and the Department of Defense. Barriers to full and effective use of commercial items are discussed. Finally, elements of the taxonomy are reviewed to determine how current obstacles could be overcome through its application. The usefulness of the taxonomy is not limited to overcoming obstacles. Its application also benefits areas already successfully integrating commercial and non-developmental items into their buying plans. The most encompassing resource on the subject of commercial item procurement was the relevant chapter of the 'Section 800' Panel report.¹ The researcher attempts to show how application of the Wenger model could assist in the implementation of several of the panel's recommendations.

¹This report is formally titled "STREAMLINING DEFENSE ACQUISITION LAWS: Report of the Acquisition Law Advisory Panel to the United States Congress". January 1993. Chapter 8 of the report deals specifically with commercial items. [hereafter "the Section 800 Panel Report"]

B. DEFINITIONS

Before proceeding any further with a discussion of commercial and non-developmental items, it would be helpful to define some basic terms involved.

- Commercial Item- Product that is sold or licensed to the general public for other than Government purposes or has not been sold or licensed to the general public, but is developed or is being developed primarily for use for other than Government purposes. This can also include an item that is produced in response to a Government drawing or specification if the company involved would ordinarily use customer drawings or specifications to produce similar items for the general public using the same workforce, plant or equipment. (Section 800 Panel Report, 1993, p. 8-17)
- Commercial Practices- The normal contracting practices, legal responsibilities, reporting requirements, etc., by which most commerce is conducted in the United States. (Moteff, 1993, p. 1)
- Non-developmental Item- Similar to commercial items, however the products can be either military-unique or commercial oriented. This term refers to products that can be purchased with little or no need for additional development. (Moteff, 1993, p. 2)
- Products- . . . term ranging from raw materials to fabricated components to individual subsystems to large integrated systems. (Moteff, 1993, p. 1)
- Technology- The knowledge, techniques, equipment, facilities and people that go into designing, developing, manufacturing, and supporting a product. (Moteff, 1993, p. 1)

C. BACKGROUND

To control escalating expenditures and better use scarce procurement dollars, the Department of Defense and Congress are reexamining Government policies and directives in a number

of areas. One critical area being subjected to closer scrutiny is the use of commercial and non-developmental technology. Beyond increased interest in commercial and non-developmental technology, Congressional oversight has extended to other areas of Government procurement. Cost savings is one in a number of objectives Congress is revisiting. Through procurement policy, Congress seeks to address several socioeconomic issues and fiscal oversight objectives. In its attempt to legislate procurement philosophy and behavior, Congress has embraced a multitude of sometimes conflicting objectives.

In the current environment of drawdown, the Section 800

Panel reports:

...continued reliance by DOD on defense-unique products can only mean higher costs and loss of industrial base for DOD. One of the principal solutions for this dilemma is to encourage DOD agencies to use commercial products to the maximum extent possible. (Streamlining Defense Acquisition, 1993, p 8-11)

Procurement of commercial and non-developmental products offers Federal agencies, and the Department of Defense in particular, the opportunity to lower costs. This can be accomplished in a variety of ways. Commercial and non-developmental products do not require the extensive research and development funding that Government-unique items demand. When used in major systems, commercial and non-developmental technology and products can drastically reduce the time between major milestones and the length of the acquisition

phases. Procurement of commercial items with existing production lines and facilities would also reduce acquisition lead time. Federal agencies would be able to take advantage of innovations and efficiencies available in the commercial marketplace. The advantages of incorporating commercial and non-developmental products into procurement policy appear straight forward and compelling.

Although the advantages are apparent, other barriers seem to prevent Federal agencies from procuring commercial and non-developmental items. The issues challenging Congress and procurement officials in expanding the use of commercial technology include the unnecessary burden or overuse of both Government material and contractual specifications and the identification of commercial goods that could replace current Government unique items. The Department of Defense faces additional challenges in incorporating commercial and non-developmental technologies into the procurement process. Currently, DOD procures a vast array of commercial products, however, most of these commodities fall into the category of consumable office products and supplies. The areas of communications and data processing systems are an exception. DOD has recently procured some highly advanced technical communications and navigation systems from available commercial technology. However, most major military systems have been traditionally regarded as strictly military unique

in terms of the actual systems and their underlying technology bases.

The need to integrate commercial technology into Government procurement plans is largely based on cost savings. "In June 1986, the President's Blue Ribbon Commission on Defense Management (the Packard Commission) again emphasized the benefits to DOD of using commercial items: lower costs and shorter lead times in fielding new products and systems." (Streamlining Defense Acquisition, 1993, p. 8-3) Products that are made to military specifications with dedicated military technology are likely to cost more than similar items produced with commercial technology. The Center for International and Strategic Studies (CSIS) released a report in 1991 offering compelling evidence of savings available from use of commercial and non-developmental technologies. The report estimates that the range of costs for individual items procured by DOD can be as high as 15 times greater than equivalent commercial items. When major systems are viewed as a whole, these costs can be at least 25% higher. Hewlett Packard provides an example of two similar products and their cost history. The company offers a radar simulation device to the commercial market for \$200,000. The customized military version, with the same basic characteristics but offering less agility in field usage has a price tag of \$1,000,000. (CSIS Study, 1991) The technical complexity of both systems is comparable. The difference in cost is largely made up in the

unique design, testing and inspection requirements of the military system. The production runs for the military system are typically much smaller, resulting in higher overhead being applied to individual units. Most of this overhead took the form of non-recurring costs for specialized design and product and process testing and resulted in a cost differential of \$800,000. By demanding a system just unique enough to remove it from the general production run, DOD forfeits the economies of scale that Hewlett Packard has developed on its general production run. Despite the difference in cost, Hewlett Packard officials said that there was no evidence to suggest that DOD received a technically or materially superior product. The Packard Commission echoed the same thoughts.

No matter how DOD improves its organization or procedures, the defense acquisition system is unlikely to manufacture products as cheaply as the commercial marketplace. DOD cannot duplicate the economies of scale possible in products serving a mass market system to select and perpetuate the most innovative and efficient producers . . . (President's Blue Ribbon Commission on Defense Management, Final Report, 1986, p. 60)

Contractors specializing in defense contracts often employ a substantially larger number of employees in their Government contracts divisions than their commercial counterparts employ. The unique reporting requirements of Government contracts necessitate the additional personnel. The salaries of these additional personnel contribute significantly to the high overhead applied to Government contracts.

D. STATUS OF COMMERCIAL AND NON-DEVELOPMENTAL ITEMS

The use of commercial and non-developmental products and technology has been the subject of Government study since at least 1972. The Commission on Government Procurement recommended that commercial products be used to replace Government unique items. (Commission on Government Procurement, 1972, Part D) Congress took an active role in pursuing commercial product procurement in 1984 by enacting the Competition in Contracting Act (CICA). CICA directed procuring agencies to "promote the use of commercial products whenever practicable." (10 U.S.C. 2325)

The mandate for increased use of commercial and non-developmental items within DOD has been clearly defined in law. The myriad of legislative and policy directives leaves DOD procurement officials with little doubt about congressional intent and commercial products. The successful implementation of these laws and regulations is another story.

Existing law has not, however, been successful in achieving the benefits of commercial-military integration and has not resulted in broad use of commercial items in DOD systems. The reasons for this are complex. While opposition to commercial items within the defense procurement community has been cited as a factor, recent congressional and Government studies, expert commentary and testimony before the Panel suggested procurement statutes (and implementing regulations) themselves as a major barrier to greater use of commercial items. (Streamlining Defense Acquisition, 1993, p. 8-1)

The following section provides a more in-depth discussion of these barriers.

E. BARRIERS TO INTEGRATION OF COMMERCIAL TECHNOLOGY

Barriers to integration of commercial and non-developmental technology into Federal acquisition fall into two general categories, regulatory and administrative. Regulatory barriers include the following:

- the use of unique military specifications and standards;
- cost/price data requirements and unique Government accounting methods;
- the Government's rights to technical data;
- unique contract requirements including socioeconomic programs. (Moteff, 1993, p. 3)

...in the aftermath of the enormous expansion during the 1980s of laws applicable only to Federal contractors, the barriers to greater use of commercial items are primarily the statutes that require Government contractors to adopt unique, expensive business practices on pain of extraordinary civil and criminal penalties. Over and over again, the Panel heard testimony that mandatory, Government-unique business methods and systems in four areas create the greatest barriers: accounting systems; specifications and standards; rights in technical data; and Government-specific statutes that mandate fundamental changes in business practices. (Streamlining Defense Acquisition, 1993, p. 8-7)

The administrative barriers to effective use of commercial and non-developmental products are less tangible and cannot be defined in the same definitive terms as the regulatory ones. Administrative barriers include such areas as training, personnel inertia and lack of buyer understanding.

Training is perceived as a key element in the successful implementation of policy and directives regarding the use of commercial items. Although procurement personnel receive

ongoing training in a variety of areas, an inclusive course in commercial purchasing, market analysis, and price analysis is not yet available. (Moteff, 1993, p. 8)

"Besides the usual inertia encountered when changing the operating practices in a very large organization, there are many constituent groups served by each or all of these regulations." (Moteff, 1993, p. 9) These constituencies include operational users, contracting officers, both large and small defense contractors, and Government audit agencies.

F. APPLICATION OF THE TAXONOMY

1. Introduction

Utilization of the taxonomy of goods procured by the Federal Government could assist in the procurement of commercial and non-developmental items in several ways. The classification of goods based on the six characteristics (Complexity, Customization, Maintainability, Unit cost, Documentation, and Item attention) and their ratings in each category (Simple, Basic, Moderate, Advanced, and Complex) would provide the framework for buyers attempting to maximize the use of commercial and non-developmental items. This applies to areas where commercial and non-developmental products have not been used as well as to those where commercial products are routinely procured. In the latter case, application of the taxonomy would be used to improve the processes involved.

In providing examples, the researcher has attempted to use goods that have been previously classified according to the taxonomy. Most of the examples are drawn from Wenger's original research. (Wenger, 1990, Appendix A)

2. Specific Applications and Benefits

a. Identification of Substitutes

The taxonomy could be used to identify potential substitutes for particular goods or categories of goods. This application requires that the categorical ratings assigned to the six individual characteristics be examined individually to fully utilize the information that the taxonomy can provide. It is not enough to identify a good as Simple or Basic in its overall composite category. A good that attains an overall average value in the Moderate category may be rated that way because the scores of the individual characteristics were all grouped around the Moderate ratings. It is also possible that the Moderate rating is the result of averaging the values from the far ends of the spectrum. Unless the individual characteristics are visible, the overall classification of the good may not provide the buyer with a distinct perspective of the good.

Examination of the categorical ranking for each of the six characteristics can provide insight about whether substitutes are likely to be available. Results from the researcher's survey indicate that complexity and customization

are the two most influential characteristics when considering commercial products.

Products that fall between the Simple and Moderate categories for complexity are often those that would be most likely to have identifiable substitutes. The more complex an item becomes, the more likely it is to have a unique or specific application. As the uniqueness of a product or its end item application increases, it becomes more difficult to identify valid or suitable substitutes.

For example, the same simple adjustable wrench or flathead screwdriver can be used to tighten bolts or screws on any number of different pieces of equipment. In contrast to a generic tool such as the adjustable wrench, special tooling may fall into the Advanced or Complex category. Customization is another key factor in assessing an item for potential substitutes. Most unique military items have high levels of customization. If an item has no unique application, the level of customization would be expected to be in the Simple or Basic range. Goods with lower levels of customization tend to have broader applicability and consequently a greater potential for substitutability. The same adjustable wrench used in an earlier example can be used for tightening many sizes and types of nuts and bolts. However, a 1/2" wrench designed to be used with that specific size of nut or bolt cannot be successfully substituted for a 3/16" wrench. The more customized a good becomes, the more specific its intended

application generally becomes. A buyer looking for goods with potential substitutes would want to key in on those items with low levels of customization.

The other characteristics provide the buyer with a sense of checks and balances. If maintainability falls along the upper ends of the scale, this can signal the buyer that questions need to be answered about maintenance and who will provide it. If maintenance requirements are highly specialized and can only be performed by a limited number of trained technicians, it is highly likely that this may cause the number of substitutes to be limited. On the other hand, if maintenance is simple, it would not be a barrier to others concerned with entering the market with potential substitutes.

Documentation requirements can also be limiting factors in the identification of substitutes. Depending on the level and depth of the requirements, potential substitutes may fail the validity check if they do not have the appropriate documentation. An example here is with items that come under the auspices of the Navy's Level I and SUBSAFE monitoring programs. What appears to be a simple hex nut of standard dimensions may actually be a pedigreed, highly documented item. While that item would be physically substitutable for a similar generic piece, it would not be an appropriate substitute. In a system requiring these pedigreed parts, an undocumented replacement is totally unacceptable.

If the system does not require a pedigreed part, it makes little sense to substitute the higher priced alternative.

Items with low unit cost can alert the buyer to areas where potential substitutes could exist because of the feasibility of competition. Low unit costs usually accompany items that fall on the lower ends of the spectrum in other attributes. High unit costs can normally be associated with the other inherent characteristics of a good or at least be indicative of some aspect of their nature. Some element of the good should be driving the unit cost. If there is no relationship between the elements and the cost, this should indicate to the buyer that more extensive cost analysis needs to be performed.

The same type of reasoning can be applied to item attention. Where item attention is high, there is usually some element of the good which is driving the level of buyer interest. If item attention ranks at one extreme of the spectrum or the other, it should correlate with the remaining attributes. Low item attention should be indicative of a fairly standard good, with established specifications and availability of sources. In his original work, Wenger identified several goods in this category. The following goods were evaluated as Simple or Basic in the category of Item Attention:

- Flat washers
- Bottled salad dressing
- Paper towel dispensers
- Filing cabinets

Levels of complexity and customization would most likely be limited so as not to require high levels of buyer attention. This was found to be the case with these goods, as they were also rated as Simple or Basic in complexity and customization. (Wenger, 1990, pp. 126-127) Based on what has been determined about low complexity and customization levels, indicators should be to the buyer that this item has a higher probability of having existing or potential substitutes.

Item attention is also affected by such aspects of contracting as compliance with socioeconomic mandates, Small Business, Small Disadvantaged Business and 8A set-asides and established competition goals. Sometimes, a Simple good being procured from a small disadvantaged business will require a much higher level of item attention than would normally be warranted for a good in that category. The Contract Specialist has many more i's to dot and t's to cross when dealing with socioeconomic programs or mandated set-asides. Although the item itself may be simple, a higher level of expertise or experience is required in dealing with the intricacies in many contract provisions of set-aside programs.

b. Recognition of the Competitive Environment

The necessity to ensure that competitive procurement takes place is of vital importance to buyers at all levels. In the procurement of commercial goods, there is a tendency to assume the existence of competition based solely on their commercial status. This may be true for items that consistently rank in the lower ends of the spectrum but does not necessarily extend to items in the more advanced categories. For Simple and Basic items, there may be lesser barriers to entry and exit in the marketplace. The taxonomy may provide us with a means of identifying specific barriers and linking them with the characteristics of the taxonomy. By establishing this connection, expectations of competition may be readable from the taxonomy. An example of a barrier might be the cost of machinery and tooling associated with more complex or customized goods.

Competitive procurement of goods at the higher end of the spectrum may require more effort than for those at the other end of the spectrum. The buyer is compelled to give more thought to the existence of competition. The taxonomy may help refine our views of the competitive forces of the marketplace and what causes prices to be considered fair and reasonable. By examining the characteristics, it may become evident that fair and reasonable prices are not guaranteed through competition. Understanding the nature of goods allows for more effective cost analysis. The classification provides

another dimension to this determination. It asks the buyer to look beyond market or catalog prices and evaluate the good on its intrinsic nature. It also alerts the buyer that although more than one source may exist, it is still necessary to look at the good from the taxonomical perspective to see if the price makes sense given the general nature and character of the item.

In a situation where competition is limited, the use of the taxonomy could help the buyer determine if introduction or expanded use of competition would be beneficial. It would also allow the buyer to analyze the price structure and assess the reasonableness of a monopoly price.

Knowledge of the characteristics of items could assist in the determination of those products that would be good candidates for competitive procurement. In cases where documentation is low and a technical data package does not exist, items with low end complexity, maintenance and customization would be good candidates. Examples of items with relatively low complexity, maintenance and customization that are readily substitutable are pneumatic chisels and cold food counters. In this situation, where form, fit and function and end use are well developed, the use of functional or performance specifications would be adequate. Competition would be easier to foster in this environment because it

allows for the processes to be defined by a manufacturer's existing capabilities.

When an item has a well-developed technical data package, a review of the existing documentation requirements will let the buyer know if it already contains the data package. If the documentation does not include the data package, the cost of obtaining the data rights will probably cause the cost of introducing competition to increase. The same is true of licensing agreements. The data may exist and be available, however the cost of obtaining it for the purpose of competition may be prohibitive. A guided missile is an example of a developed system with extensive existing documentation. The cost of transferring data rights in a mature system may be more costly than continuing production with a single source. In this case, the buyer's ability to assess cost reasonableness through application of the taxonomy may indicate that the best price is available from the single source.

If maintainability requirements are high, it may be difficult to introduce competition. In order to meet high maintenance requirements, it may be essential to know the exact configuration of an item. A system requiring highly interactive modular components might not be the best candidates for competition. In a system such as this, precise configuration compliance is necessary for all parts to efficiently interact. This compatibility requirement does not

make it suitable for form, fit and function types of competition. Introducing competition for highly complex goods may also have an adverse effect on logistic support. Competition which results in multiple configurations will drive up the cost of logistic support.

High technical complexity may also indicate a large number of interfaces that could make competition more difficult. The more complex a system becomes, the less appealing production competition may appear. Where complexity is high and technology is pushing the state of the art, problems will exist in trying to introduce competition. The technology may be available to only one manufacturer. The degree of customization may also be associated with high tooling costs. If the cost is too high, and the tooling serves only a small portion of a contractor's total production line, it is less likely that he will be willing to make the investment in order to compete.

c. Increased Buyer Awareness

As available resources dwindle, it becomes increasingly more important that buyers have a better sense of the goods that they procure. Smart spending and best value are key concepts for which buyers are responsible. One of Prendergast's findings was that buyers have little knowledge about the goods that they buy. "In a world where contracting officials are routinely asked to make judgments concerning

best value, and fair and reasonable prices, it is imperative that they are knowledgeable about the goods that they are purchasing." (Prendergast, 1991, p. 97)

The crucial part of knowing an item is the ability to discern which aspects or attributes are critical. The taxonomy gives us the tools to pinpoint those critical aspects. The point Prendergast made was that most buyers would not recognize the items that they buy if they were placed before them. Knowing what an item looks like can be important, but recognizing its other attributes may be just as, if not more, strategically important in the overall procurement process. Examination of the taxonomical characteristics can provide the buyer with a knowledge of the item beyond its immediate physical description. Training can be tailored to concentrate on those characteristics falling at the high end of the spectrum.

In the case where an item ranks highly in complexity, a knowledge of its physical attributes can provide the buyer with a better understanding of it. In this instance, it may be important to actually expose the buyer visually to the item and even take it apart so that the buyer can understand the necessity for the good's specifications.

For an item ranking in the upper end of the spectrum for customization, the buyer might benefit from more in-depth knowledge of the process or processes used to manufacture the item. A visit to the plant or manufacturing

site might be the key to the buyer's understanding of the process. It would not be as important to know what the final product looks like as it would be to know what went into the process of customizing it. The development and manufacture of a submarine periscope are an example of high level customization. The more unique the item, the more likely that the process is a determining factor in the specifications and the cost. By understanding the process, the buyer can better evaluate a fair and reasonable price. If the process is highly customized and the item has limited demand, the buyer may expect less competition in the field. Depending on the volume of demand for the item, it may be unreasonable to expect large numbers of firms to be willing to enter into competition.

A rating in the upper half of the spectrum in the category of maintainability should indicate to the buyer that repair and maintenance are integral parts of this item. It may be beneficial to expose the buyer to the actual repair facilities or repair process. If the buyer knows who will be performing the maintenance and how it will be accomplished, it can aid in the development of the proper types of warranties. Maintenance factors rank highly in goods such as nuclear reactors. In the procurement of the system, the buyer is looking not only for the end product, but also an accompanying support system for maintenance and repair.

For commercial items, there are fewer requirements on the contractor for documenting how costs were established. Unit cost of items available commercially is assumed to be fair and reasonable based on the competitive forces of the marketplace. Any cost analysis done by the buyer will be based primarily on internal research since cost or pricing data is not required. Items with high unit cost signal to the buyer that some type of check needs to be performed to determine if the price is reasonable. If the unit cost is high, it should be in line with the ranking of the other attributes. The taxonomy provides the buyer with a checklist for internal research on cost reasonableness.

Similarly, if documentation requirements are high, training for the buyer should include a review of the actual documentation. The buyer would gain insight into what the documentation entails and why it is needed to support the item. If the Government is paying a lot of money for documentation on an item, a periodic review by the buyer may turn up instances where the high level of documentation is no longer required. Early in its lifecycle, documentation may have been crucial to the procurement of a good. However, as the item reaches a level of lifecycle maturity, it may not be essential to continue to pay for the same high level of documentation. A good example of an item in this category is the general office microcomputer. In the early stages of development, this item required extensive documentation.

Office computers have reached a stage in their lifecycle evolution that the amount of documentation required is similar to what is required for an electric typewriter. State of the art in computer chips is advancing so rapidly that it does not pay to require expensive documentation since it is quickly outdated.

A good with a ranking in the upper half of the spectrum in the category of item attention alerts the buyer that there is some aspect of this procurement that requires more than cursory oversight. Visibility of the rankings in the other categories may give the buyer a better understanding of what it is about the item that demands attention. It may be any number of things ranging from high dollar value to contract type to the lack of an adequate number of sources.

d. Assessment of Warranties

The purchase of commercial goods is normally accompanied by implied warranties of merchantability. This tells the buyer that the manufacturer backs the performance of the good when it is used in a reasonable manner in its intended environment. This type of warranty is sufficient for most consumable type goods. Items that fall in the Simple or Basic categories may not merit specific or explicit warranties. Low cost items and those with no maintenance requirements would not necessarily be good candidates for customized warranties.

The taxonomy allows the buyer to focus on the nature of a good and make a judgment about whether the good merits an explicit warranty. It gives the buyer a framework to determine what aspect of the good will drive the need for a warranty and which items are candidates for warranties. Microcomputers designed for general office use may not require more than the standard warranty that accompanies the purchase. Automated data processing equipment that is highly customized and configured for a specific user and application would probably require an explicit warranty. The warranty would most likely specifically cover the unique configuration and software running the system.

G. SUMMARY

This chapter has presented the limited circumstances in which the Federal Government procures commercial items and non-developmental technology. Between legislators and procurement officials, there is a perception that the use of commercial and non-developmental technologies must become more prevalent. Changes in the fiscal environment mean that procurement personnel must look to maximize the limited resources available and one way to accomplish this is through the use of existing products and technologies. This process can surely benefit from the application of the taxonomy of goods procured by the Federal Government. The next chapter

will present a discussion and applications of the taxonomy to the area of workload management.

V. APPLICATIONS: WORKLOAD MANAGEMENT

A. INTRODUCTION

Managers are responsible for coordinating and controlling the activities of subordinates. To do this efficiently, the manager must have a good understanding of the nature of the work that is performed and the types of skills necessary to complete those activities. Coordinating and controlling incoming workload requires that several decisions be made regarding the definition of the work involved and the organization of the activity and its workers. Walker points out that work can be defined in terms of the variables involved. "Various aspects of work can be analyzed, depending on the particular applications desired: work outputs, activities or tasks performed or competencies required." (Walker, 1980, p. 144) Workload planning coordinates these various aspects of work with available resources, including labor and financial, and estimates of incoming work to determine how many and what types of employees will be needed. From this information, a work distribution pattern is developed, based on some type of productivity measure, and the decision is then made about how the incoming work will be apportioned.

Among the decisions to be made are how much specialization will be required between workers and what criteria will the organization use to group jobs and personnel. The degree of specialization desired requires a tradeoff between control and coordination. The more specialized a worker becomes, the greater the control the manager can exert over individual tasks. However, it also becomes more difficult for the manager to coordinate tasks among multiple workers, particularly if the tasks are sequential. A worker who performs multiple tasks, coordinates the transition between them as part of that particular work process. When those tasks are divided among specialized workers, the manager or some intermediary becomes responsible for coordination.

The manner in which jobs are grouped together plays an important role for specialization required. There are several ways that jobs can be structured within the organization. "Organizational structure is defined as the framework in the organization that defines how tasks are divided, resources are deployed and departments are coordinated." (Daft, 1988, p. 231) The following is a list of the criteria around which procurement organizations are commonly structured.

1. Knowledge and skills- Positions are grouped by specialized knowledge and skills that buyers bring into the workplace.
2. Functional grouping- Positions are grouped around the processes or activities that are performed and the items to be procured. There is a tendency to treat similar types of goods as homogeneous groups.

3. Customer- Teams are designated to deal with all aspects of a specific customer's needs. All procurements for a particular customer are made by a single team.
4. Location- Positions are grouped by physical location. This is the broadest and most common method of organization and is usually combined with one of the other types of groupings.

The Kings Bay Detachment of the Naval Supply Center, Charleston provides an example of how these criteria are applied. The location criterion is used to limit the physical area from which customers can be drawn. Teams are then established and tasked with providing for the needs of specific customer commands at that location. The functional grouping is also used to designate those personnel who will deal specifically with small purchase transactions. This group is responsible for all purchases under \$25,000 regardless of the requesting command or customer.

B. WORKLOAD MANAGEMENT AND PRODUCTIVITY MEASURES

1. Introduction

Effective workload management begins with a thorough analysis of the work to be performed. It is here that specific tasks are defined and productivity standards are set. "Detailed information on job tasks is required to establish precise standards of performance and opportunities for improved efficiency in job performance." (Walker, 1980, p. 145) Work analysis provides managers with the foundation or

cornerstone upon which other human resources planning is built. Guidelines and requirements for this analysis have been established.

A work analysis method should provide data in a form that is suited for efficient analysis. The data should be obtained, summarized and classified so that they can be processed and classified for the intended purposes with ease. The emphasis should be on codable, concise information rather than (simply) narrative descriptive data. The method should also provide for consistency in the patterns of work . . . it seeks to describe. (Walker, 1980, p. 155)

An essential element in the development of the work analysis is the skills inventory. It has been described as "the basic tool for assessing the supply of people and talents within the organization . . . " (Glueck, 1978, p. 116)

The skills inventory accomplishes two functions. The first identifies the skills associated with a particular activity and the second identifies the individuals having those skills. Identification of required skills is imperative. The composite performance of those skills is crucial in determining the productivity of an activity and how efficiently key tasks are completed.

2. Productivity Measures

a. Generic Definitions

There are many methods of productivity measurement available for use. The common feature of all of them is that in some form they provide a ratio of outputs to inputs. "In simple terms, productivity is the organization's output of

goods and services divided by the inputs." (Daft, 1988, p. 646)

In their 1990 masters thesis, Summerour and Wilson provide an excellent synopsis of several existing productivity measurement systems. Some models presented emphasize inputs while others focus on outputs. The models also vary from highly specific input/output elements to partial or inferred elements. In dealing with white-collar employees with administrative duties, it is more difficult to define productivity. Tasks performed by this group of employees do not always relate to a specific or measurable unit of output. This is often the case in defining productivity measures for contracting functions. (Summerour and Wilson, 1990)

b. Productivity Measures in Contracting

"Without a uniform means for measuring productivity or contract workload, management will continue to be limited in its ability to: (1) assess the performance of the organization, (2) project personnel requirements, (3) forecast workload requirements, or (4) prepare budgets and improve productivity." (Wright and Cummings, 1980, p. 75)

Productivity measures in Government organizations are usually tied to funding or resource allocation. Contracting in the Federal Government is no exception. Units of work are defined as a means of determining reimbursement or funding levels for contracting activities.

The Naval Supply Systems Command (NAVSUP) has developed one such measurement system in the attempt to correlate funding and productivity. The system, known as Productive Unit Resourcing (PUR), closely ties the budget process to work analysis. "The PUR system provides headquarters (NAVSUP) with a more qualified means to measure the workload-funding-productivity relationship." (Morris, 1987, p. 1) This relationship is further discussed by Fink:

It was intended that PUR, by linking workload and funding through a unit-rate connection, would enable headquarters (NAVSUP) to answer quantifiably this question and other similar questions involving workload, funding and productivity. The question in this case being: Assuming X productivity per worker and Y financial resources available to pay workers, how much work (output) can be accomplished? (Fink, 1988, p. 10)

Under the PUR system, different types of jobs or tasks within the contracting office are analyzed in terms of man-hours of work effort. In contracting, each 13 man-hours makes up one unit of work. For large purchases (over \$25,000), assignment of work units for a particular transaction is derived from algorithms based on the contract type used and its dollar value. Small purchases are somewhat less complex in that each purchase request translates to one unit of work despite the complexity of the transaction involved. (NAVSUPINST 7000.21A, 1986, p. 4)

Once the rate is determined, each activity under the PUR system is responsible for the development of a phasing plan. During this process workload is anticipated and the

cost rate is established for different tasks. (NAVSUPINST 7000.21A, 1986, p. 4) In order to adequately cover cost center expenses, tasks performed within the cost center must be clearly defined and understood. Assignment of tasks must also be evaluated at this point to ensure that each grade level of personnel is performing at the optimum task level. Without this understanding, the cost center supervisor cannot hope to recover cost center expenses.

The application of the PUR system to contracting is an example of a Governmental attempt to draw a relationship between workload planning, funding and productivity. Although the system has created an essential bridge among these three functions, it does not consider all relevant factors. Among the two most notable deficiencies are:

- It covers only completed actions. There is no allowance for work-in-progress.
- It considers only two dimensions of the transaction. The current measurement considers dollar value and contract type. It does not consider any of the good's inherent characteristics. (Prendergast, 1991, p. 89)

C. APPLICATION OF THE TAXONOMY TO WORKLOAD MANAGEMENT

1. Introduction

To gain maximum benefit from application of the taxonomy to workload management, it is necessary for the scheme to be fully operationalized and all goods classified.

2. Specific Applications and Benefits

a. Identification of Skills and Linkage with Tasks

In their work on taxonomies, Fleishman and Quaintance, discuss the need for structured task-descriptive data to identify the procedures, tools and equipment and conditions associated with a particular job. (Fleishman and Quaintance, 1984, p. 9) The taxonomy has the potential to provide that essential structure to the development of tasks associated with specific categories of goods.

After the classification of goods occurs, Sheehan suggests

. . .the individual categories would be studied to identify the specific competencies required in procuring those goods. These competencies encompass two aspects, both the task or skill itself, and the degree of skill required in performing the task. (Sheehan, 1992, p. 92)

Using the taxonomy in such a way would feed directly into the current personnel system operated for Federal employees by the U.S. Office of Personnel Management. Within the GS-1102 series, jobs are graded and classified on these same two aspects of skill competency.

In conjunction with a recent study conducted by the U.S. Merit Systems Protection Board, the Federal Acquisition Institute identified tasks important to the 1102 series.

These experts identified 20 tasks that they believed were critical for almost all contract specialists to perform well. Review of these tasks showed that they were performed by most of people working in this area. In fact each task was performed by the vast majority of the

contract specialists who were in nonsupervisory positions.
(U.S. Merit Systems Protection Board, 1992, p. 7)

Table 5-1 provides a listing of those critical tasks.

TABLE 5-1
CRITICAL TASKS

CRITICAL TASKS FOR GS-1102 SERIES

1. Conduct market research
2. Review statements of work
3. Determine competition requirements
4. Identify price-related factors
5. Review business management factors
6. Identify contract type
7. Prepare requests for proposal
8. Determine low bids
9. Review technical evaluations
10. Evaluate offers
11. Conduct cost analysis
12. Determine competitive range
13. Develop negotiation strategy
14. Conduct negotiations
15. Determine standards of responsibility
16. Respond to protests
17. Monitor compliance
18. Identify contractual remedies
19. Determine contract modifications
20. Research claims

(U.S. Merit Systems Protection Board Report, 1992, p. 9)

For example, one of the critical skills listed is to review technical evaluations. The degree of skill or knowledge level a buyer requires to effectively evaluate a technical evaluation will depend largely on the degree of complexity of the good involved. For buyers of goods with low or very low complexity, the transaction may not even involve a technical

evaluation. On the opposite end of the scale, where very high technical complexity is found, the buyer would require well-developed skills in the area of technical evaluation. For intermediate levels of technical complexity, buyers would need the same types of skills but not at the same high level of competency.

For each of the 20 tasks listed, the essential elements of the skill could be defined in terms of the various characteristics associated with a category of goods. First, a minimum or basic skill level associated with each task would be defined regardless of the taxonomic category with which a good is associated. As goods in each category are further defined, more information will be available to link skills and skill levels to efficient transaction processing for that category.

A hierarchy of skills would then be established where skill competencies are developed based on the elements of a basic or minimum competency level. Once the hierarchy of skills is developed, an assessment of the personnel within an organization can be accomplished.

The basic tools for assessing the supply of people and talents available within the organization are the skills inventory. The inventory, in its simplest form is a list of the names, certain characteristics and skills of the people working for an organization. (Glueck, 1978, pp. 116-117)

Identifying skills associated with characteristics of goods allows for optimum organization of personnel

resources. Based on the mix of goods procured by an activity and the variety of skills required, managers can better determine which type work distribution best fits the circumstances. Organization of work effort is discussed in the next section.

b. Organization of Work Effort

In offices where multiple tasks are performed, it is often difficult to determine how those tasks can be most efficiently organized. As presented earlier in this chapter, contracting activities tend to align the distribution of work along the lines of the knowledge and skills of the employees, a functional grouping based on the type of goods procured or a team concept.

An analysis of the types of goods for which an activity is responsible, together with an accurate skills inventory for existing personnel, could assist management in strategically organizing workload for maximum efficiency. For an activity that is responsible for procuring goods distributed in a full range of categories, and whose personnel skills are equally distributed, management is fortunate in having the option of organizing work either along the lines of product or customer orientation. Activities with responsibility for a limited range of goods could be organized by the individual category of goods. Where it is apparent that personnel have specific skills and competencies,

it might be most productive to organize along the lines of the knowledge and skills of the employees. This would allow for the development of centers of excellence for the procurement of specific categories of goods. Personnel identified as having strong skills associated with transactions involving Advanced or Complex goods could be grouped to take advantage of this specialization.

The taxonomy could potentially identify gaps in the workload distribution system. Inequities in distribution of work to particular groups or individuals might become apparent once distribution patterns were analyzed according to the classification scheme. Also, areas where work is not being accounted for or not being performed may be uncovered. Contract administration is one area that is often slighted in both the development of productivity measures and in actual performance when resources become restricted.

The taxonomy provides managers with a tool to refine organizational design in response to changing resources and inputs. As skill levels increase or decrease, alternate organizational designs could be developed to improve or maximize efficiency of operations. The same is possible if the mix of incoming transactions shifts or if the customer base changes significantly.

c. Refine Productivity Measures

Application of the taxonomy would allow for improvement in at least one of the two areas in PURS productivity measures previously defined as deficient. Currently, PURS allocation is based simply on dollar value and contract type. The taxonomy would allow for multidimensional input into the PURS calculations. As Prendergast points out in his assessment of the application of the taxonomy to PURS,

The use of a classification scheme, such as that proposed in this project, would take into consideration the inherent characteristics of an item (including unit cost), and could help simplify the budget process. Complex buys versus simple buys could be identified and given appropriate weights. (Prendergast, 1991, p. 89)

Examining the individual characteristics described by the taxonomy may reveal which skill or competencies are required. Skills and task factors could be incorporated into the productivity measurement. In situations where application of the taxonomy has identified higher skill level requirements because of the nature of the good, that recognition could be tied into the number of productive units allowed for a particular transaction.

In looking at the characteristic of complexity, the rate of technical change to which a good is subject is evaluated. At one end of the spectrum, in the Simple category, goods are characterized by a low rate of change. At the other end, in the Advanced or Complex category, goods are subject to a high degree of change. For example, where a

good is highly complex, the negotiation process may be more complicated and take longer than for a simple good. Items associated with state of the art technology are often less stable in design and more likely to be involved in design transformation. Contract specialists working with transitional products must also be prepared to deal with additional contract changes and modifications.

Procurement of goods with high levels of customization requires that buyers have the ability to understand and effectively apply specifications. Often, the more customized an item, the more likely it is to rely on Government-unique specifications. Highly customized goods may also require explicit warranties to cover atypical or distinctive configurations. Contract specialists dealing with these types of transactions would need to have skills in developing the appropriate warranties and a knowledge of configuration management. They would also be called on to employ good human relations capabilities in their capacity as liaison between customer and contractor. These types of transactions for highly customized goods frequently involve lengthy negotiations and extensive discussions with potential contractors. All these efforts have an impact on productivity and the speed with which the transaction can be completed. The taxonomy presents a means of identifying these items and allowing for additional efforts to be incorporated into productivity measures.

Similarly, transactions pertaining to goods with above average documentation requirements may call for skills in developing complex and time-consuming statements of work. Solicitations where high levels of documentation are involved may require more than one iteration. The Request for Proposal may be issued in draft form, discussions held for clarification and then issued in final form. These factors could cause the procurement of items ranking in the Advanced or Complex category to require additional time or personnel resources allocation and may drive more workload than items requiring little or no associated documentation.

The same might be true where increased item attention is required and an item is procured only on an individual basis. Higher item attention may be directly related to longer lead times. More personnel resources in terms of man-hours are likely to be required for the procurement of these items compared to goods bought in large quantities with little individual item attention.

Where maintainability is an issue, explicit warranties may be necessary. The development of these warranties could be time consuming and place additional demands on buyers compared to items having low maintenance requirements.

In the area of unit cost, the PUR system does a good job in incorporating this characteristic into its measurement of productivity. It is one area where application

of the taxonomy might not have a direct effect on productivity measures. It also does not appear that the application of the taxonomy would have any direct impact on the PUR system in the area of recognizing work in progress. Indirectly, however, knowledge gained from the application of the taxonomy could assist in the assessment of the anticipated duration of various transactions based on the nature of the goods involved. Distribution of work could be planned to provide for a mix of transaction types that would allow for a continuous flow of incoming work credits.

d. Backlog Management

In its simplest form, backlog can be defined as the number of items pending at the end of a given reporting period. The figure is usually referred to in terms of the number of days that would be required to complete this work in the absence of any other incoming work. Once a backlog number is derived, it must be put into some type of context. Backlog figures alone do not provide management with any strategically important information. The numbers should be reviewed in terms of how much effort and what level of resources would be required to reduce or maintain the backlog. A certain level of backlog is necessary to maintain continuity of operations. Incoming work input does not always flow in evenly spaced increments. Some pending work is needed so that when the

capability of available resources exceeds incoming work, those resources are not left idle.

Acceptable levels of workload backlog will vary by command based on the types of goods procured and the number and skill level of the personnel available to process outstanding purchase requests. To account for these variations among commands, gross backlog figures are translated into crew days of backlog. This is done by taking the total backlog for a reporting period and dividing by the average daily number of transactions or work units processed during the same period. (Gannaway, 1985, p. 37)

The failure of the system to recognize that all purchase requests are not created equally makes it difficult to realistically calculate the amount of time and effort that would be required to reduce or eliminate backlog. An activity having a backlog of 500 purchase requests for items in the Simple or Basic category does not directly compare to an activity having a backlog of 500 purchase requests for goods in the Complex or Advanced categories. The amount of time to complete the transactions as well as the skills and knowledge required is greater for the more complex goods.

Application of the taxonomy would be useful in the identification of candidates for transfer of workload among contracting activities. In his 1985 study, Geoffrey Gannaway explored the possibilities of transferring workload among contracting activities to improve efficiency and response time

to customer requests. (Gannaway, 1985) He developed a criterion for screening small purchase documents for transfer to other activities based on the backlog, productivity and areas of specialization and expertise of both the transferring and receiving activities. The process requires that documents be screened and categorized in one of three categories: documents that should not be transferred; documents that should be transferred; and documents that could be transferred. Where an activity has demonstrated expertise or the items to be purchased are highly complex, Gannaway recommends that the documents be retained in-house. (Gannaway, 1985, p. 75) In cases where the activity does not have experience with a particular category of goods, it may be more efficient to transfer the purchases to an activity that specializes in or has the expertise to expedite the transaction.

Application of the taxonomy would also allow the receiving activity to analyze the types of purchase requests it should accept for processing. If an activity has been targeted to receive backlog of a certain type, it must be able to determine if those incoming documents could be processed efficiently. Just because an activity is specialized in the processing of a particular category of goods does not mean that it should accept backlog of that type from other activities. The receiving activity needs to evaluate its own

backlog profile to determine if accepting outside work will affect total productivity positively or negatively.

D. SUMMARY

This chapter has presented various aspects of workload management and planning. Key factors in effective workload distribution and management are an understanding of the nature of work involved and recognition of the skills needed for successful completion of that work. The taxonomy could be used to segregate items by category to allow for recognition of effort involved in the related transactions. Once skill levels were assessed, buyers could be linked to the procurement of categories of goods requiring their skills. The next chapter presents the area of staffing and suggests improvements in the process through the taxonomy.

VI. APPLICATIONS: STAFFING

A. INTRODUCTION

Besides planning, organizing, directing and controlling, staffing is considered one of the integral functions of a manager. The staffing process is a continuous flow of both external and internal events and activities that result in the appropriate manning of jobs within an organization. The process is far more complex than is often perceived.

In many cases, improved control of staffing is being achieved through closer attention to the actual nature of the work. Analysis and planning of work activities, organizational changes and specific job requirements are an increasingly important part of needs forecasting. (Walker, 1980, p. 14)

Staffing is not simply the selection of an employee from an external source. It encompasses the design and analysis of jobs, initial labor planning, the development and maintenance of adequate sources of potential employees, recruitment, methods of evaluating competing applicants as well as the actual decision to hire a selected applicant. Once an employee is hired, the internal process continues with orientation, indoctrination and training. The process also includes the internal control systems used to maintain staffing at adequate levels based on an organization's overall level of operation. This activity is managed internally through transfers, demotions, promotions, separations and

retirements. Established career development and training paths also enable management to forecast availability of qualified employees for future placement. (Daft, 1988, p. 336)

To adequately provide for effective staffing, a number of decisions have to be made about how the functions will be organized, what level of skills will be required and what level of administration will be required. The next section discusses these considerations in more detail.

B. STAFFING CONSIDERATIONS

Effective staffing requires that data be available from the organization to determine the number of personnel required, as well as the particular types of skills and education needed. The staffing process does not occur in a void. Once a qualified candidate is identified, other external factors affect the hiring process. Legal statutes and Government regulations impose the most common limitations on selection.

Before the search for qualified employees begins, each position must be clearly defined in terms of duties and responsibilities. This is accomplished through a process known as job analysis. Without job analysis, realistic specifications and requirements for new employees cannot be made.

1. Job Evaluation

Job evaluation "is a process of gathering and examining information on the principal work activities in a position and the qualifications (skills, knowledge, abilities . . .) necessary to perform these activities." (Walker, 1980, p. 144) Walker goes on to discuss the need for thorough evaluation:

In analyzing an organization's staffing requirements, managers are seeking information on the work action being performed and not just on how many people are needed. It is important to know how the work is distributed among the positions in an organization in order to determine additional staffing requirements, opportunities for staffing reduction or for reallocation of work for improved staff utilization. (Walker, 1980, p. 148)

a. Job Analysis

Job analysis is the first step in the job evaluation process. It presents the actual elements or facts about the job as it currently exists. The purpose of the analysis is to make a factual statement about the duties and responsibilities associated with the job. Both qualitative and quantitative aspects of the job are represented in this phase. The job analysis is not a measure of an employee's performance in that position. As Locke and Latham point out:

In specifying the critical knowledge, skill, or behavior required of a person in a given job or position, job analysis identifies what a person must do in the job. If it is judged that the person has the aptitude to do what is required but lacks the skills, job analysis identifies the content of training programs needed to correct the deficiency. (Locke and Latham, 1984, p.86)

b. Job Descriptions

The formal product of the job analysis process is the written job description. The description is a short, factual statement that accurately describes the job. Generally, the job is identified by a job title that reflects the duties and responsibilities involved. The description also contains the organizational unit and level of authority within the unit to which a job is assigned. A short summary of the job's purpose is an essential lead-in to the specific duties and responsibilities required. The more quantitative aspects of the job description help determine the level at which the incumbent enters the organizational hierarchy. Elements such as number and type of employees supervised, scope of authority within the organization and previous experience are factored into the employee placement decision.

In the Government sector, the job description is integrated into the position description used by the Civilian Personnel Office in the administration of the GS-1102 series.

2. Government Regulations

Title VII of the Civil Rights Act of 1964 provides the mandate against discrimination in employment based on race, color, religion, sex, or national origin. Later laws, based on the concept of equal employment opportunity, have made discrimination because of age or the existence of a disability illegal. Affirmative Action goals and plans are also used to

ensure that groups that have been traditionally underrepresented in the workplace are included in staffing plans. These regulations apply to nearly all work environments, not just in the Federal Government.

C. STAFFING IN THE FEDERAL PROCUREMENT ENVIRONMENT

In 1986, the Packard Commission reported the DOD acquisition workforce was "undertrained, underpaid, and inexperienced." (President's Blue Ribbon Commission on Defense Management, Final Report, 1986, p. 123) In addition, the Commission expressed concern that there would be a continuing loss of qualified acquisition personnel due to frustration over inefficient and confusing procurement rules, regulations, and policies; inadequate supervision; and lack of clear qualification standards for the GS-1102 series. To reverse this trend, the Commission recommended attracting qualified new personnel and improving the training and motivation of existing employees.

Although these deficiencies were identified in 1986, it was not until the Defense Authorization Act for Fiscal Year 1991 was passed, that many of these issues were directly addressed. The Defense Acquisition Workforce Improvement Act (DAWIA) was offered by Congressman Mavroules for inclusion in that act.

The Defense Acquisition Workforce Improvement Act (DAWIA) developed a career program for personnel in the Federal

acquisition field. This framework established organizational responsibility and set minimum policy objectives for each of the following elements of a career program: accession, education, training, experience, assignment, promotion and retention. These elements cover almost the entire spectrum of the staffing process.

Successful implementation of DAWIA is of great importance to the Department of Defense and to Government procurement as a whole. The ability to integrate these professional standards will significantly impact future staffing processes. The Defense Acquisition Workforce Improvement Act also serves as a means for providing feedback and fine tuning of personnel issues in the acquisition work force. Heaton examines the importance of this process adjustment in organizations such as the Department of Defense.

When learning and work are taken over by hierarchical organizations, they are sliced into tasks or jobs. The organization then decides how the jobs or tasks are to be performed and who will perform them. In other words, planning is separated from doing; it follows that without special provisions for feedback and adjustment, a static, unimproving pattern of operation is established. (Heaton, 1977, p. 24)

D. APPLICATION OF THE TAXONOMY IN STAFFING

1. Introduction

In his work, Wenger suggests that staffing levels for Government procurement offices could be determined by the

types of goods bought by that office. In those offices where a cross-section of goods is procured, the office could be internally organized so that individual buyers are responsible for goods that show similar characteristics. (Wenger, 1990, p. 19) There are many other facets of the staffing process that could also benefit from the application of the taxonomy of goods.

2. Specific Applications and Benefits

Use of the taxonomy of goods procured by the Federal Government would assist managers and supervisors in the development of effective staffing plans. This would be accomplished in several ways and would require the taxonomy to be operationalized with goods classified according to the scheme. First, the taxonomy would be used to develop a basic foundation of essential task-descriptive data for proper job evaluation and design. The second would be in the evaluation of the many phases of the staffing process itself. Finally, the taxonomy could prove useful in the implementation of the Defense Acquisition Workforce Improvement Act mandated by Congress in 1990.

a. Job Evaluation Factors

(1) Job Analysis

Application of the taxonomy would give a central thread or focal point for the performance of job analysis. It would provide a model and a specific vocabulary

for the analysis of procurement-related work activities throughout the Federal Government. As discussed in Chapter V, the taxonomy would facilitate the creation of task - descriptive data and present those data in a standard format. The taxonomy would also provide managers with the necessary tools to perform effective job analysis based on standardized concepts.

The job analysis process evaluates not only skill and task requirements, but personal abilities as well. In their 1992 report, the U.S. Merit Systems Protection Board presented nine basic abilities that were identified as essential to the performance of duties as a contract specialist. These nine abilities were defined through job analyses conducted by the Federal Acquisition Institute. (U.S. Merit Systems Protection Board Report, 1992, p. 10) These abilities are presented in Table 6-1. The taxonomy could be used to associate these abilities and the level of competency in each of them with particular categories of goods. For example, analytical abilities are needed to some extent by all personnel, however, those dealing with Complex or Advanced categories of goods would utilize those abilities to a greater degree. The same is true of writing ability. Personnel procuring Simple or Basic goods may be using standardized contractual vehicles such as Blanket Purchase Agreements or Basic Ordering Agreements that do not require extensive writing abilities. Those dealing with more unique

TABLE 6-1
CRITICAL ABILITIES

CRITICAL ABILITIES FOR GS-1102 SERIES

1. Directing Work Activities
2. Planning and Organizing
3. Human Relations Ability
4. Analytical Ability
5. Oral Communications
6. Writing Ability
7. Ability to Innovate
8. Ability to Initiate Action
9. Conducting Negotiations

(U.S. Merit Systems Protection Board Report, 1992, p. 11)

items in complex categories may be required to write extensively since these items will require more than standardized contract clauses.

(2) Skill Competencies and Knowledge Factors

"Job requirements may be defined in skill and knowledge terms, based upon work activities actually performed on the job." (Walker, 1980, p. 151) As previously discussed in Chapter V, the taxonomy would allow skills and knowledge factors to be associated with particular categories of goods.

(3) Accurate Position Description Development

The development of an accurate skills hierarchy requires an understanding of not only the skills and knowledge needed by contract specialists but also of the level of competency needed. Recognition of skills associated with various procurement tasks would allow managers to tailor

position descriptions to the specific workload at their activity.

(4) Grade Level Management within GS-1102 Series

The taxonomy would provide for uniformity if it is used as a foundation for developing a hierarchical classification of skills associated with the various grade levels of the procurement-related job series (1102/1105). It could be used as a benchmark for what knowledge and skills are required at each grade level to effectively procure different categories or types of goods. A common knowledge base could improve the mobility of procurement personnel. One of the factors preventing many lower and mid grade employees from changing jobs may be the major differences in the mode of operations among Federal procurement activities. Currently, there is little uniformity of skills and requirements among the various organizations. (U.S. Merit Systems Protection Board Report, 1992)

b. Staffing Process Evaluation

Before the staffing process can begin, a thorough job analysis is needed to determine what skills, competencies and abilities are required at an activity. An assessment of skills inventory for existing personnel is also needed. "Application of work (job) analysis data have included manpower planning, organization design, identification of

training needs, setting of performance objectives and determining employee selection." (Walker, 1980, p. 145)

(1) Initial Work Force Planning

This phase of the staffing process is closely related to the development of job specifications and job design. If these two areas are not clearly defined, it is almost impossible to complete this planning phase. This initial labor planning can be considered the most important phase because it is here that shortages of personnel with specific skills are revealed. Deficiencies in training are also revealed during this process. Recognition and compliance with Federal employment laws are determined in this phase as well as Merit Employment Systems requirements for Civil Service.

During this phase, the workload of an activity is evaluated. This evaluation would identify the categories of goods procured by the activity and relate them to the skills and competencies needed to efficiently process the workload. The inventory of skills and competencies for existing personnel can then be compared to the requirements and deficiencies identified. The gaps and deficiencies identified would then generate the requirements for additional personnel.

(2) Development and Maintenance of Employee Sources

In this phase of the staffing process, management is asking the question "from where do qualified employees come?" Sources are considered from both the internal and external pool of personnel resources.

Internally, sources are developed and maintained by ensuring the development of skills in current employees through a well-constructed training program. Careful attention to career path development of existing employees also ensures that vacancies can be filled internally by qualified candidates.

Application of the taxonomy would benefit this phase by enabling the development of standardized training and also by associating specific skills and skill levels with particular categories of goods.

(3) Recruitment

Recruiting is defined by Daft as "the activities or practices that define the desired characteristics of applicants for specific jobs." (Daft, 1988, p. 342) The taxonomy would assist managers in better defining the characteristics desired in new hires based on the competencies required to fulfill the activity's mission. Skills, abilities and competency levels could be tied to both entry-level and full-performance level positions.

(4) Evaluation Criteria for Competing Applicants

For applicants applying from internal sources, the taxonomy would provide a means of assessing skills and competencies based on a standardized and consistent criteria. The implementation of the taxonomy would be less useful in the evaluation of candidates from outside sources. However, it is possible to evaluate candidates on the nine critical abilities for contract specialists recognized by the FAI listed in Table 6-1. Depending on the responsibilities of the position to be filled and the categories of goods involved, the level of competency or the degree of ability in each of these areas can be rated and compared.

(5) Orientation, Indoctrination and Training

A thorough understanding of job requirements and related skills is a prerequisite to the development of effective training. This can be accomplished through a complete job or work analysis as described in Chapter V. Work analysis is often used to identify training and development needs for employees at all levels of an organization. Training may thus be tailored to needs identified for groups of employees.

The advantage of using job requirements for training needs analysis is that it enables an organization to provide building blocks for development, not just merely ad hoc programs. It has the potential of identifying the sequences of experience necessary to equip an individual for assignment to specified types of positions. (Walker, 1980, p. 151)

The taxonomy would provide the basis for commonality and standardization among orientation, indoctrination and training programs. Sheehan points out the advantages of using the taxonomy to develop a tailored training approach. "The taxonomy addresses directly the need to establish training and education requirements based on the level of complexity of the duties carried out by the individual." (Sheehan, 1992, p. 94)

(6) Internal Maintenance of Staffing Levels

Transfers, demotions, promotions, separations and retirements are the most common ways to control internal levels of staffing. The main advantage of the taxonomy is that it would give managers a common means of determining and assessing performance criteria. Skills, abilities and competencies could be associated with specific grade levels. Maintenance of staffing levels would be facilitated if training, position descriptions and job design were developed based on the classification of goods and the recognition of standardized requisite skill requirements. A manager at one activity would be familiar with the type of training exposure an individual at a particular grade level would be expected to have even if he were not aware of the specifics of the job that person was performing.

c. Implementation of DAWIA

The Defense Acquisition Workforce Improvement Act calls for both increased mobility and educational requirements within the acquisition workforce. To realize the goal of a more mobile workforce, acquisition personnel will need the types of training and skill development that will allow them to comfortably move between different types of jobs and activities. Currently, there is little standardization among Federal agencies about what is required of a contract specialist working, for example, as a GS-12. A manager at one agency, looking to hire an individual from another agency, has virtually no idea what type of training or skills that person may possess at a given grade level. If the taxonomy were used to identify skills and skill levels, movement of personnel would become easier.

This identification of skills and skill levels would enable procurement personnel to better measure career path development, with the taxonomy providing the means of assessing competency and knowledge factors. It also provides a means for standardized performance evaluation.

E. SUMMARY

This chapter presented an overview of the staffing process and how it functions in the procurement environment. There are several aspects of the process that could benefit from the application of the taxonomy of goods procured by the Federal

Government. It is also important to note that there are other areas within the staffing process that would not necessarily directly benefit from the application of the taxonomy. The next chapter presents the conclusions and recommendations resulting from this study.

VII. CONCLUSIONS AND RECOMMENDATIONS

A. INTRODUCTION

This chapter presents the conclusions and recommendations resulting from this research effort. It also addresses the primary and secondary research questions and discusses areas for future research.

B. CONCLUSIONS

The following conclusions have been drawn from the research conducted in this study:

1. **The integrity of the categorical rating of each of the six characteristics should be maintained.**

Much of the early research done by Wenger and Prendergast focused on reducing the total number of characteristics that the classification system would use to describe goods. To this end, cluster analysis was used to remove six of the original twelve characteristics defined by Wenger. (Wenger, 1990) In an independent study using cluster analysis, Prendergast also reduced the original twelve to six characteristics. (Prendergast, 1991) Both were correct in their assessment that the removal of the six characteristics had little affect on the overall score or rating of a good. However, in the application of the taxonomy, the overall score

plays a less important role than the individual characteristic's rating. It is the visibility of these individual qualities that provides value to the buyer or the researcher.

2. **The taxonomy of goods procured by the Federal Government would be useful in the recognition and utilization of commercial and non-developmental items and technologies.**

The declining industrial base and the shrinking levels of Government spending provide an incentive to recognize and utilize available products and technologies. Using the characteristics of goods defined in the taxonomy, products can be more easily evaluated for potential commercial substitutes. This appears to be particularly useful in the Simple and Basic categories of goods.

3. **The taxonomy of goods procured by the Federal Government would improve workload management in contracting activities.**

Workload management would benefit from the application of the taxonomy in several ways. First, it would facilitate accurate identification of skills, abilities and competencies associated with procurement transaction processing. This identification of skills can then be linked with specific tasks. Once tasks and skills are related for specific categories of goods, decisions can be made as to the most efficient organization of the work effort based on the types

of goods an activity procures. Activities with dissimilar mixes of goods and employee skill levels may choose different organizational setups. Two activities with the same mix of goods, but with different levels of employee expertise may organize differently to take advantage of the available skill levels and knowledge. Productivity measures can also be refined to reflect the nature of the effort involved in transactions related to the assigned workload. The taxonomy also provides insight into the management of backlog and the potential for transfer among various contracting activities.

4. **The taxonomy of goods procured by the Federal Government would be useful in the staffing process for contracting activities.**

The taxonomy provides a sense of structure and relationship among skills, competencies and procurement tasks. Skill levels associated with individual categories of goods are identified. Management is given the tools to tailor the staffing requirements for an activity based on the particular mix of goods procured by that activity. It also provides the ability to fine tune staffing requirements if the mix of goods changes. The taxonomy provides managers and human resource specialists with the tools necessary to conduct effective job analyses. From the analysis, decisions can be made for all phases of the staffing process. The information made available by the taxonomy assists managers in the development

of staffing plans, recruiting, hiring and internal management of staffing levels.

C. RECOMMENDATIONS

1. Research efforts should be targeted to specific procurement issues.

Much of the research done on Wenger's taxonomy has centered on the validation of the classification scheme as a prerequisite to discussion of potential applications. The focus of future works should be application specific with an emphasis on developing methods of implementation. From the experience of this researcher, the transition from the theoretical 'what if' to the operational 'how' will not be simple.

There are a myriad of issues in the procurement arena that require attention. Many of these issues are not new, and have not responded to traditional remedies or additional regulation and oversight. Identification of the issues would provide focus for future research. Mastering the philosophy of the taxonomy is difficult since it breaks with traditional thinking about goods. To date, the taxonomy has been presented in theoretical format and that makes dealing with the concepts in the abstract even more difficult. The taxonomy offers tremendous potential benefit but in order to

enjoy those benefits, the taxonomy must be put into a readily usable format.

Application of the taxonomy would provide beneficial insight into specific procurement issues such as implementation of electronic data interchange systems, the matching of companies and products in the Mentor-Protege program and in the evaluation of procurement from specialized sources like the Federal Prison Industries. The taxonomy would also prove useful in the evaluation of lifecycle costs, engineering change proposals and make or buy plans.

2. Knowledge gained from application of the taxonomy of goods procured by the Federal Government should be used to streamline procurement procedures.

Studies conducted over the past twenty years have been filled with recommendations to streamline the procurement process. During this same twenty year period, procurement oversight and regulation have multiplied ten-fold. The result has been that attempts to streamline processes and procedures have been thwarted by this proliferation of regulation. The most recent study published by the Section 800 Panel advocates streamlining procedures to respond to the current fiscal and operational environment. (Streamlining Defense Acquisition Law, 1993) The cumulative results of these studies indicate that something else is required because the traditional remedy of increasing regulation has failed. An alternative instrument for change is needed. The taxonomy could provide

the alternative. Through its application, lawmakers and practitioners have the ability to focus on a good's characteristics and tailor policies and procedures accordingly.

3. Continue to validate the relationship among tasks, competencies, abilities and specific categories of goods.

Throughout the research on this taxonomical scheme, a number of assumptions and suppositions have been made regarding the relationships among categories of goods and associated skills and competencies. For the most part, these assumptions have been accepted as valid. Future research should attempt to validate these relationships and establish direct correlation between tasks and skills.

D. RESEARCH QUESTIONS

Answers to the primary research questions proposed in Chapter I are presented below.

Primary Research Question:

How can the Wenger taxonomical structure for classifying goods procured by the Federal Government be further applied and its benefits expanded?

This research effort explored the application of the Wenger taxonomical structure to the areas of commercial item

identification and utilization, workload management and staffing. The potential payback of improvement, regardless of the magnitude, in these three areas is tremendous. This payback is reflected in both dollar savings and efficiency improvements.

Subsidiary Research Questions:

1. What additional applications, beyond those currently identified, could be made of the taxonomy for classifying goods?

-Streamlining the use of Government specifications as proposed by the Section 800 Panel Report.

-Improved Decision-making processes for small purchases, particularly in automated contracting systems.

-Implementation of the Defense Acquisition Workforce Improvement Act through the development of educational programs and curricula.

2. What benefits could be derived from employing the taxonomy?

The major benefit of the application of the taxonomy in any area is the establishment of a specific frame of reference, vocabulary and knowledge base. The taxonomy provides a foundation for the development of a logical and sequenced thought process for approaching contracting and procurement issues.

The taxonomy provides managers with the ability to customize and tailor many facets of the procurement process based on an analysis of the characteristics of the goods for which an activity is responsible. The goal is to move towards a streamlined and responsive operation through feedback and fine tuning.

3. How can the taxonomical classification structure be refined and improved?

The information gained from the application of the taxonomy could be used to develop customized templates or checklists for individual categories of goods. As more goods are classified, the results of that classification can be used to verify the initial assumptions made by Wenger and Prendergast. As more goods are evaluated, any number of factors may be subject to refinement or improvement. For example, using cluster analysis on a limited number of goods, Prendergast defined the width of each of the ranges as 0.8. Also, as larger numbers of goods are classified, the width of the ranges defined for each category of the characteristics could change.

Selected applications could be targeted and applied to specific issues. The application of training as presented by Sheehan may have important implications in the implementation of the Defense Acquisition Workforce Improvement Act. The requirements in DAWIA for a professional workforce will

require intensive training efforts. With the application of the taxonomy, much of the training could be focused on specifically identified deficiencies. The time and effort dedicated to specialized training would be more productive and provide a greater payback when compared to general purpose training efforts.

4. How can this classification structure be used as a behavior predictor in the procurement of goods by the Federal Government?

The link between a category of goods and the skills and knowledge level needed to effectively complete a transaction may automatically trigger a whole series of behaviors. A good recognized to be in the Complex category for technological change should automatically raise a flag in the buyer's mind indicating that special attention may need to be paid to change clauses, modifications and configuration management. As buyers become more familiar with the taxonomy and the information available from it, more behaviors should become automatic.

E. RECOMMENDATIONS FOR FURTHER RESEARCH

1. The thought processes developed in the taxonomy of goods could be expanded and applied to services procured by the Federal Government.

A parallel taxonomical structure could be designed based on the inherent characteristics of services. Scott

Allen presented this idea in a 1991 study. (Allen, 1991) There are many similarities between Allen's research on services and the studies about the goods procured by the Federal Government. In large part, his research was based on Wenger's taxonomy for goods. It would not be necessary for the two systems to be combined. Parallel taxonomies would provide many of the same benefits such as economy of memory, ease of manipulation of data, ease of information retrieval and a common description of the structure and relationships of contracting tasks, competencies and abilities. (Sokal, 1974, p. 1116)

2. Develop a method of data collection for goods procured by the Federal Government.

One of the problems encountered in this research effort was trying to draw conclusions from the relatively small number of goods that have been classified to date. Future research should focus on gathering the information from, either existing documentation and sources or from a unique data collection scheme. It may be possible to modify current systems to gather the necessary data.

The methods used by Wenger and Prendergast required heavy involvement from the buyers of specific goods. While this method yielded adequate information, it was cumbersome and time consuming. Using buyer evaluation requires and assumes a working knowledge of the goods themselves. As

discovered by both previous researchers, this is not always an accurate assumption.

Integration of data collection directly into the procurement tracking system is one alternative. Data collection could be tied to the creation of the procurement action. This method, however, does not overcome the reliance on the knowledge level of the buyer for accurate input. Another possibility is to derive as much information as possible from various systems files at the ICP level. Through the use of electronic data interchange, this information could be 'pulled' into a central file to be sorted and updated.

3. Develop an expert system to be used in conjunction with electronic data interchange (EDI) and automated contracting systems.

There is a strong movement towards the implementation of EDI and the use of automated decision making systems, particularly in the small purchase area. In order to make automated decisions, logic sequencing must be built into the process. The taxonomy can provide the basis for much of that logic. In many areas, small purchase requirements are advertised through electronic bulletin boards, where prospective suppliers have the opportunity to bid through the bulletin board. Once bids are received at the contracting activity, they must be evaluated. Much of the evaluation process can be accomplished through automated systems. The key to evaluation is the development of the criteria by which

proposals are to be judged. The taxonomy provides an excellent set of criteria which could be built into the evaluation logic. It would allow for the inherent characteristics of the goods to be evaluated consistently. A system such as this could also prove to be an excellent source for retrieval of information to be fed back into the classification for update and refinement.

F. SUMMARY

This chapter presented the conclusions and recommendations resulting from this study. Both the primary and subsidiary research questions were addressed. Recommendations for areas for future research were included in this chapter.

APPENDIX A
CHARACTERISTIC DEFINITION AND SCALES

1. **Change** describes the good's rate of technological transformation. With some goods, their rate of technological change is very low. Their design is fixed and rarely, if ever, changes. Contrast this with those goods that are characterized by state-of-the-art technology and a high rate of technological obsolescence.

SCALE:

- 1 Very low rate of technological change
- 2 Low rate of technological change
- 3 Medium amount of technological change
- 4 High rate of technological change
- 5 Very high rate of technological change

2. **Complexity** describes the good's technical intricacies. The degree of a good's technical complexity may be thought of in terms of the skill and expertise needed to produce the good. Another way to determine complexity is whether the good is a system, sub-assembly, component, piece part, or raw material. For scoring purposes, 1 indicates little or no technological complexity with 5 being very high complexity.

SCALE:

- 1 Very low technical complexity
- 2 Low technical complexity
- 3 Medium technical complexity
- 4 High technical complexity
- 5 Very high technical complexity

3. **Customization** is the degree to which the good is manufactured to the buyer's specifications. Some goods, those that are strictly commercial, have no amount of customization while others are produced exclusively for a buyer, e.g., the Government. Goods that are not customized should be scored 1 with those developed exclusively for the Government scored 5.

SCALE:

- 1 No amount of customization

- 2 Low degree of customization
- 3 Medium amount of customization
- 4 High amount of customization
- 5 Made exclusively for the Government

4. **Maintainability** refers to the amount of maintenance considerations associated with the good. In other words, how frequently, if at all, is maintenance required on the good. Some goods are virtually maintenance-free while others require a great deal of maintenance throughout their lives.

SCALE:

- 1 No maintenance required
- 2 Low maintenance requirements
- 3 Medium maintenance requirements
- 4 High maintenance requirements
- 5 Very high maintenance requirements

5. **Homogeneity** represents the number of other goods that are similar and ready substitutes for the good under consideration. Typically, the more common the use of the good, the greater the amount of homogeneity. Highly homogeneous goods should be scored 1 and those with little or none scored 5.

SCALE:

- 1 Very high homogeneity
- 2 High homogeneity
- 3 Medium homogeneity
- 4 Low homogeneity
- 5 No homogeneity

6. **Consumption** refers to the how rapidly the good is used by the buyer. Some goods are consumed on a continuing basis and require constant replenishment. Others are of a more permanent nature resulting in much less frequent buying.

Rapidly consumed goods should be scored 1 and 5 used for goods that are rarely consumed or replaced.

SCALE:

- 1 Very rapid consumption, constant replenishment
- 2 Rapid consumption constant replenishment
- 3 Moderate consumption and replenishment
- 4 Low rate of consumption
- 5 Very low consumption and replenishment

7. **Unit cost** is the good's cost to the buyer. Generally speaking, as a good becomes more unique to the buyer's requirement, the unit value is increasing. To score, use 1 for low unit cost and 5 for very high.

SCALE:

- 1 Very low unit cost
- 2 Low unit cost
- 3 Medium unit cost
- 4 High unit cost
- 5 Very high unit cost

8. **Documentation** is another characteristic external to the good yet many times a necessary part of it. Frequently the Government requires substantiating documentation in the form of drawings, technical manuals, and certifications for some types of goods while for others little at all is required. When scoring, a 1 would indicate a good purchased with no accompanying documentation while 5 is for goods accompanied by drawings, technical manuals, etc.

SCALE:

- 1 No associated documentation
- 2 Low amount of documentation
- 3 Medium amount of documentation
- 4 Great deal of documentation
- 5 Very high amount of documentation

9. **Item attention** given by the buyer refers to single-item versus volume or mass buying. When a buyer deals with small dollar-value items like common bolts and rivets, the focus is on a mass quantity of these types of goods.

Contrast this with the acquisition of an F-14 aircraft where the buyer's attention is focuses on a single item.

SCALE:

- 1 Complete volume-type attention
- 2 Mostly volume-type attention
- 3 Good that could be either volume or single item.
- 4 Good that is usually single-item attention
- 5 Good that is always single-item attention.

10. **Sources of supply** refers to the number of available sources that provide the same basic type of good. Some types of goods have associated with them a great number of alternate sources while others of a more specialized nature are more restrictive.

SCALE:

- 1 Virtually unlimited number of suppliers
- 2 High number of suppliers
- 3 Adequate number of suppliers
- 4 One or two sources
- 5 No sources exist

11. **Criticality** refers to the buying urgency associated with the good or the necessity of having the good available for the buyer to purchase. This characteristic of a good can be quite dynamic, but some goods, by their nature, may rarely be characterized as critical to the buyer.

SCALE:

- 1 Never characterized as a critical item
- 2 Rarely a critical item
- 3 Sometimes approached as critical
- 4 Usually characterized as critical
- 5 Always purchased under critical situations

12. **Stability** refers to the nature of the requirement. With some goods their demand is constant and seldom varies. On the other hand, demand for certain types of goods is much more volatile and uncertain depending on the need

for the good and perhaps the technology that is available.

SCALE:

- 1 Good that is extremely stable
- 2 High degree of stability
- 3 Moderate amount of stability
- 4 Low amount of stability
- 5 Highly unstable good

APPENDIX B

This appendix provides the survey used to obtain buyer input from the buying activities.

My name is LT Kim Beeson and I am a student at the Naval Postgraduate School in Monterey, CA. I am conducting a survey for use as input to my Master's thesis and would like to solicit your views on a recently developed system for classifying goods purchased by the Federal Government.

This system was developed at the Naval Postgraduate School as an alternative to classifying goods based on the Federal Supply Classification (FSC group) and the Standard Item Classification (SIC). Several theoretical uses have been identified for this new classification scheme. The objective of my research is to determine if these theoretical applications can be translated into practical ones. That is why I am looking to people like you who are actually involved in the ongoing procurement process for feedback and advice.

I have identified three areas where use of this classification scheme might provide promising and positive results. The areas in which I would appreciate your opinions are staffing, workload planning and procurement of commercial off-the-shelf and non-developmental items.

The survey is divided into three parts and should not more than 15 minutes to complete. The first part asks about your background. In Part II, the questions are designed to help me identify existing problem areas in staffing, workload planning and the procurement of commercial and non-developmental items. Finally, Part III provides background information on this new classification scheme and asks for your opinion in assessing its potential benefits.

Thank you in advance, for your input. If you have questions, please feel free to contact me at your convenience.

LT Kim Beeson
SMC 2725
Naval Postgraduate School
Monterey, CA 93940
Work Phone: (408) 656-2536

PART I

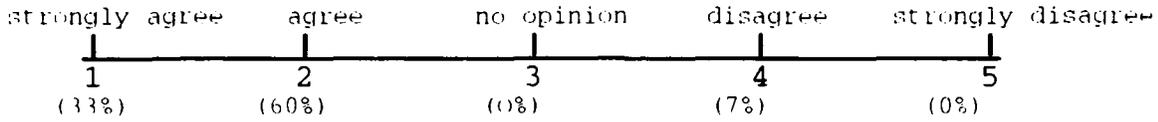
DEMOGRAPHICS:

1. Job Title: _____
2. Code: _____
3. Series/Grade: _____
4. Years of Contracting experience: _____
5. Years of Government experience: _____
6. Years in current position: _____

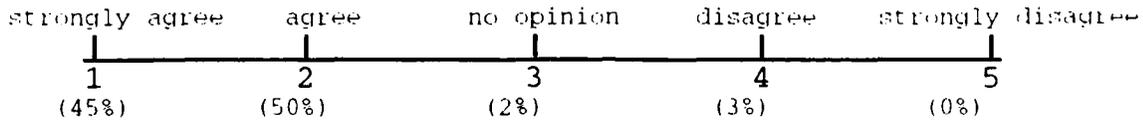
PART II

BACKGROUND INFORMATION:

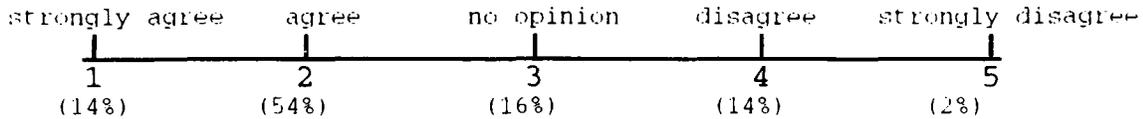
1. My training and experience are adequate for the types of goods that I purchase.



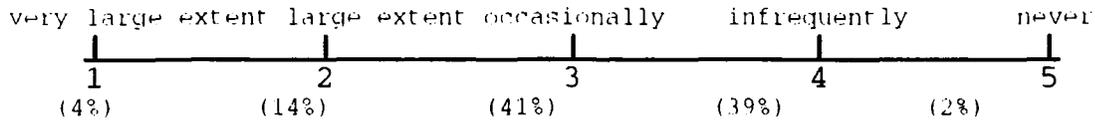
2. For the range of goods which my branch/division procures, various levels of skill and effort are required to complete the procurement action.



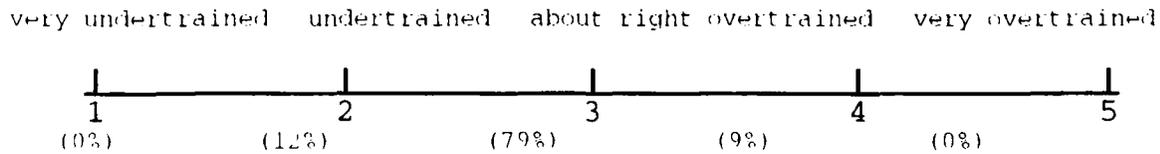
3. The tasks which I perform are adequately described in my position description.



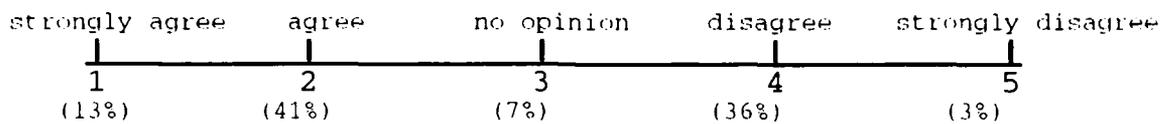
4. The extent to which I am required to perform tasks which are not in my position description can be described as:



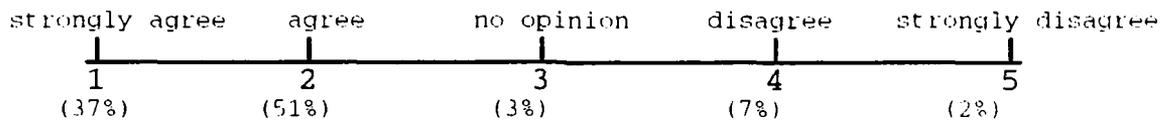
5. The degree to which I am trained for the types of tasks which I perform.



6. I am familiar with and have a good working knowledge of the majority of the goods that I buy.



7. I buy goods based on their specifications rather than on personal knowledge of the goods themselves.



8. Select the statement which best describes the staffing in your organization.

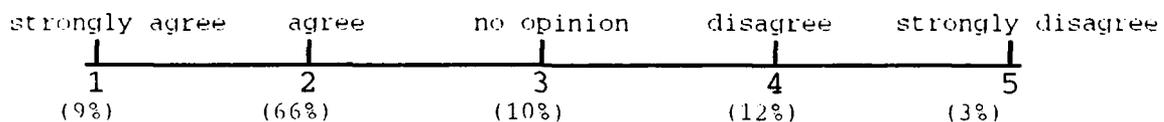
a. Overall staffing is adequate and key billets are filled with qualified personnel. (50%)

b. Overall staffing is adequate, however, some key billets are unfilled or filled with non-qualified personnel. (34%)

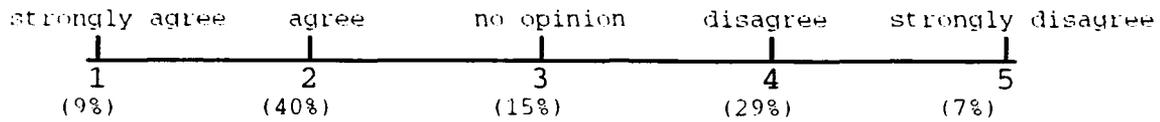
c. Overall staffing is inadequate, however, key billets are filled with qualified personnel. (7%)

d. Overall staffing is inadequate and key billets are unfilled or filled with non-qualified personnel. (9%)

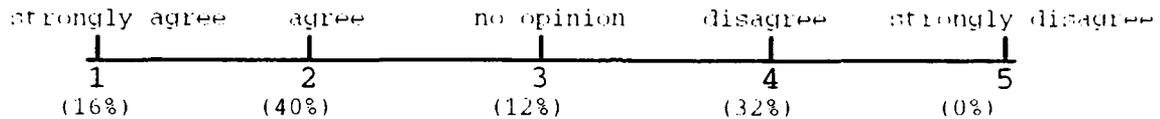
9. The workload in my branch/division is assigned efficiently.



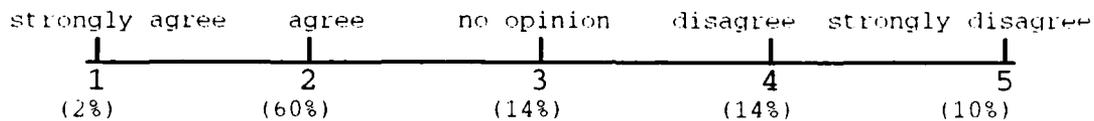
10. The manner in which work is assigned in my branch/division takes into consideration the amount of time and effort required to successfully complete each action.



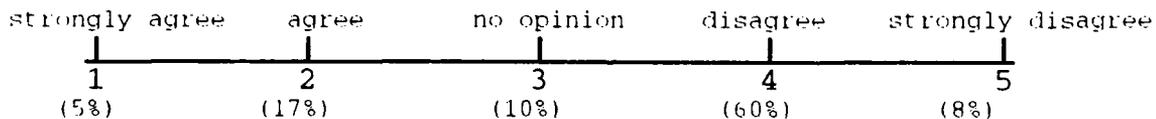
11. In my branch, there are some personnel who are under-utilized while others are being assigned additional work.



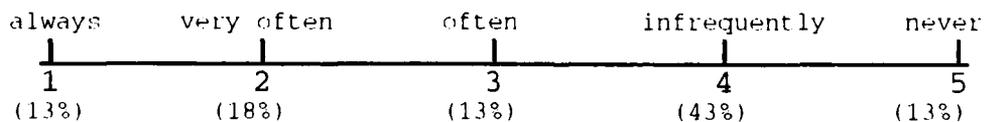
12. My branch redistributes work based on fluctuations in the amount of incoming work.



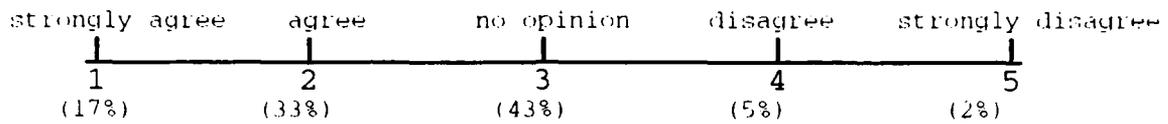
13. There is little flexibility in my branch/division to allow for redistribution of incoming work.



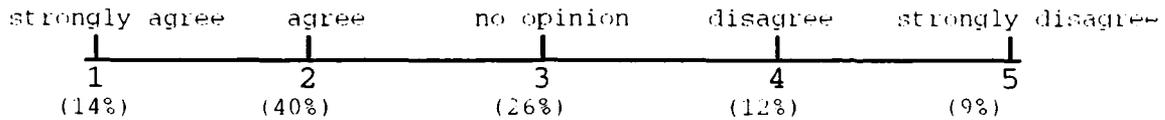
14. The extent to which my organization procures commercial-off-the-shelf and non-developmental items whenever possible or practical is:



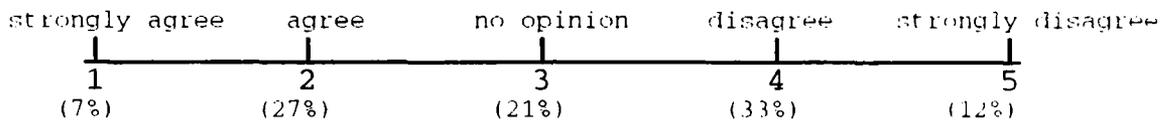
15. If I am faced with a situation where commercial or non-developmental items obviously meet the requirement, I actively pursue their procurement.



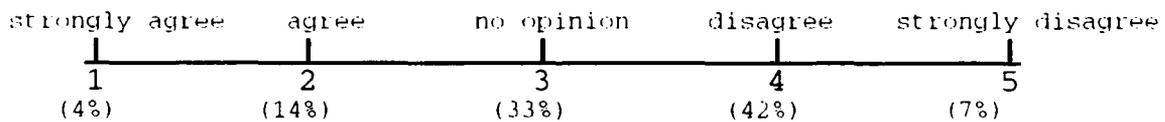
16. In a situation where commercial or non-developmental items might meet the requirement, I actively pursue their procurement.



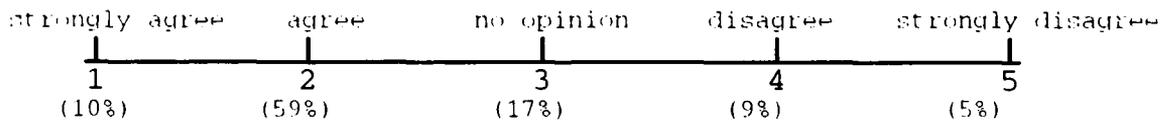
17. In my experience, commercial and non-developmental items are used to the maximum extent possible.



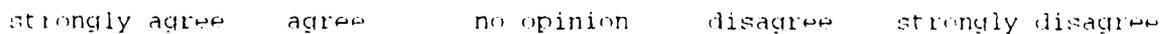
18. In my experience, the procurement of commercial or non-developmental items is too difficult to pursue on a regular basis.

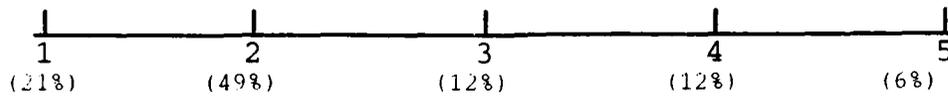


19. I am comfortable purchasing commercial or non-developmental items to fill the material requirements of my customers.

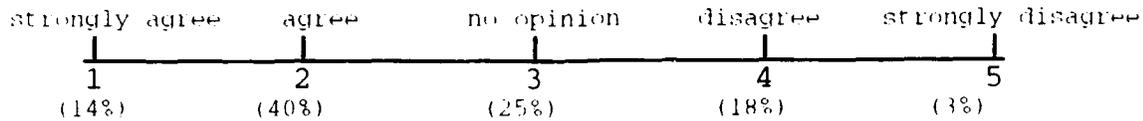


20. It is often difficult to identify areas where available commercial products meet the requirements of my customers.

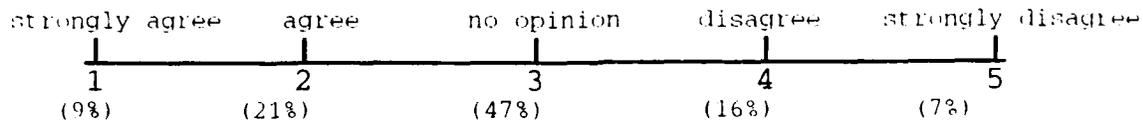




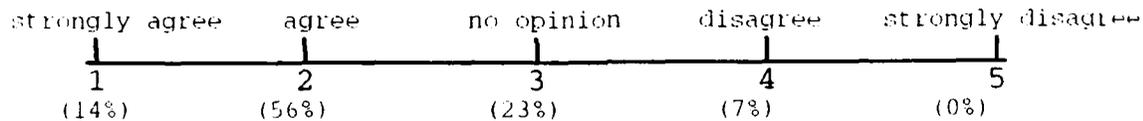
21. I would like to more fully utilize commercial and non-developmental items, however, I do not have the time or resources to identify these items.



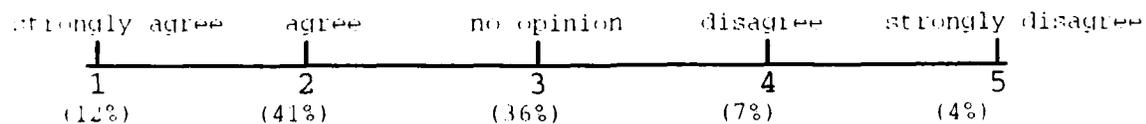
22. I often have a difficult time convincing my customers that a commercial item meets their requirements.



23. If commercial and non-developmental items were more easily identifiable, I would be more inclined to pursue them.



24. There is currently no system which readily identifies commercial or non-developmental items.



PART III

BUYER EVALUATION:

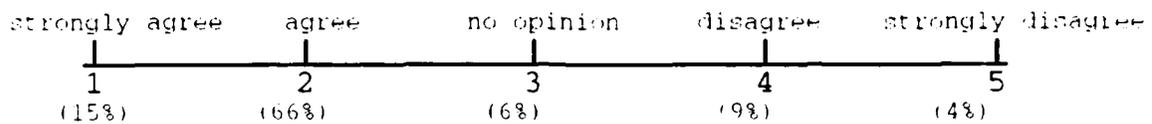
The current system of procurement based on end-item application or FSC group does not always accurately reflect the amount of effort and expertise involved in the buying process. The classification system developed at the Naval Postgraduate School rates goods on a scale from Simple to Complex based on six characteristics. These characteristics are common to some degree in all goods procured by the Federal Government. This system would designate items as Simple, Basic, Moderate, Advanced or Complex, depending on how they are rated in the six characteristics. For example, a Simple good would be one with low technical complexity, no customization, no maintenance requirements, no documentation, and bought in volume, such as a bolt. On the other end of the spectrum would be an F-14 aircraft which would be rated Complex.

These ratings could provide for more realistic assessments of the level of effort and expertise required in procurement of an item, allowing for improvements in staffing, workload planning, and identification of potential commercial and non-developmental items.

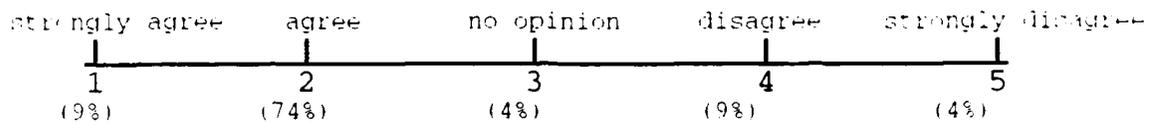
The following are the six characteristics and a brief description of each:

1. **Complexity**- describes the good's technical intricacies. A good's complexity may be determined by the skill and expertise needed to produce it or whether it is a system, subsystem, component, piece part or raw material.
2. **Customization**- the degree to which a good is produced to a buyer's specifications. Commercial items have no customization while major systems are produced almost entirely to specification.
3. **Maintainability**- refers to the frequency and necessity of maintenance a good requires.
4. **Unit cost**- the cost of the good to the buyer. Generally, the more customized or unique a good is, the higher its unit cost.
5. **Documentation**- refers to the substantiating documentation (tech manuals, drawings and certifications) required to accompany the good.
6. **Item Attention**- refers to the amount of attention the buyer gives a good. Bolts and rivets are examples of volume type buys, whereas an aircraft acquisition would receive single item attention.

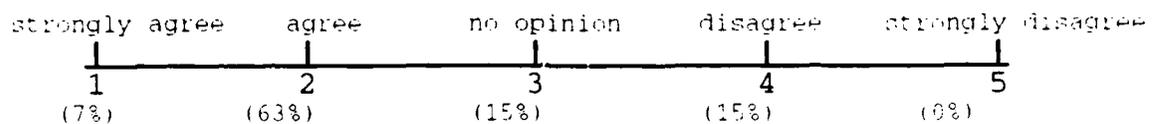
1. Based on the description provided, a classification of this type would aid supervisors in more efficiently distributing the workload.



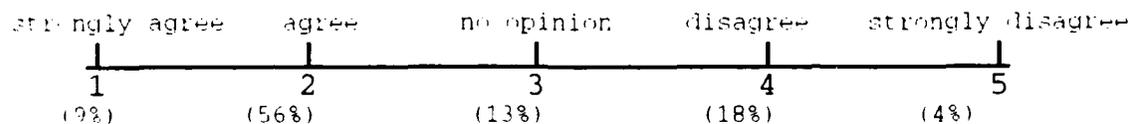
2. It appears that this system would recognize the different levels of expertise required in purchasing within an FSC group or for an end item application.



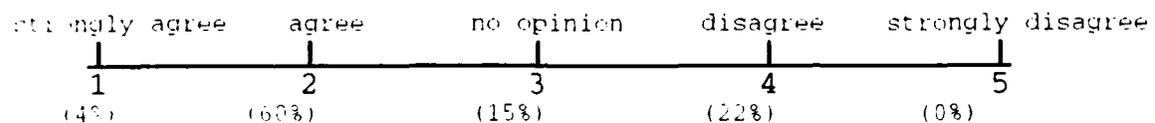
3. This system could allow for more equitable workload distribution.



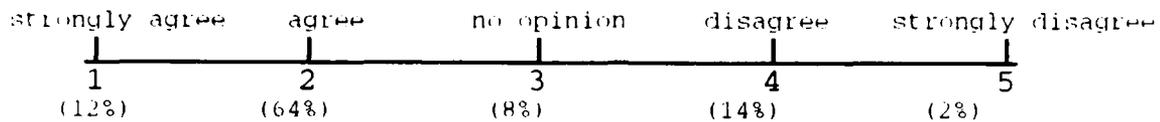
4. This classification system could allow for a better definition of tasks in my position description.



5. Incorporating this goods classification into a position description could make it easier to identify areas where personnel are working outside of their position description.

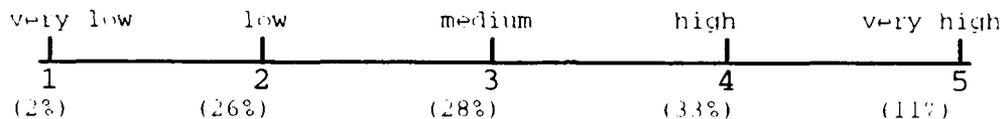


6. This system could help improve job-related training by starting with elementary skills associated with simple items and progressing to advanced skills required for complex items or systems.

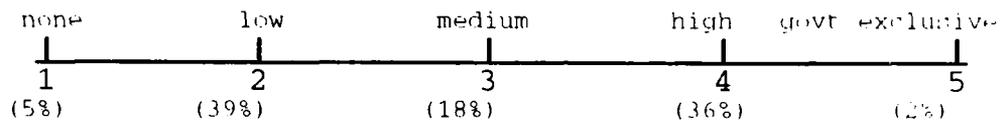


7. The commercial and non-developmental items I am involved with generally have the following characteristics:

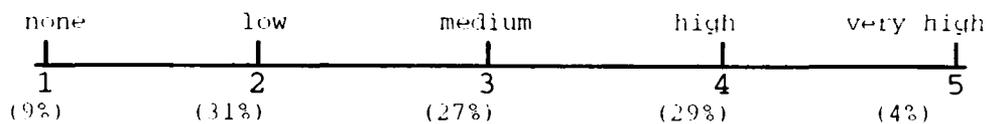
a. Level of technical complexity.



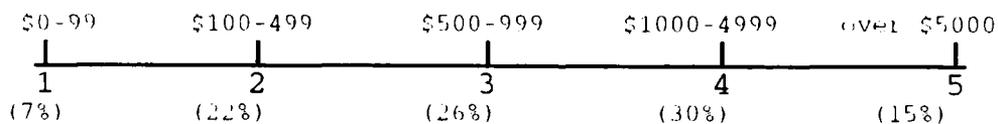
b. Degree of customization.



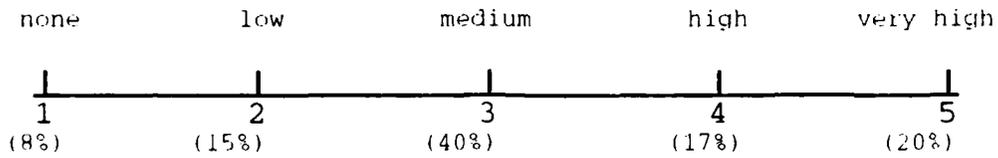
c. Degree of maintenance requirements.



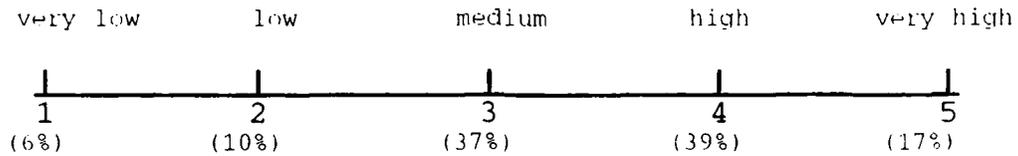
d. Average unit cost.



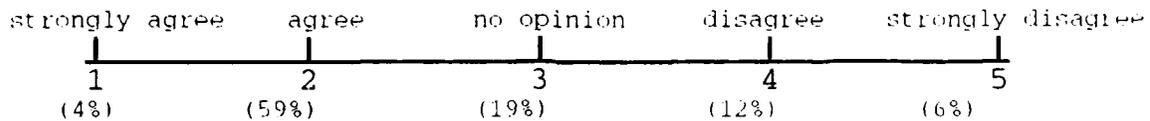
e. Level of associated documentation.



f. Degree of buyer attention for an individual item



8. This classification scheme could assist buyers in more readily identifying potential commercial and non-developmental items.



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