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Purchasing performance measurement—views of purchasing managers, buyers and internal customers from different industries

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PURCHASING PERFORMANCE MEASUREMENT--VIEWS OF PURCHASING MANAGERS, BUYERS AND INTERNAL CUSTOMERS FROM DIFFERENT INDUSTRIES

by

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ABSTRACT

This study looks at five research questions to gain a better understanding and expand the body of knowledge in purchasing performance measurement.

The study concludes that there are significant differences in weighting the selected purchasing performance measures across the five industry types: electronics, utility, mining, government, and aerospace. This suggests that different industries should have different focuses when selecting their own mix of purchasing performance measures. Significant differences are found among the three respondent groups: purchasing managers, buyers, and internal customers. This indicates that the different roles played by the respondents might be the cause of the differences in weighting these purchasing performance measures. Significant relationships are found between the weights of the selected purchasing performance measures and purchasing responsibilities. No significant relationships between the weights of purchasing performance measures and types of commodities purchasing handles are found. Significant relationships are found between the respondents' ratings of their organizations' purchasing performance and the weights assigned to the selected purchasing performance measures and purchasing responsibilities.

The results of this study indicate that purchasing performance is a multi-dimensional construct that can be

evaluated with a weighted average of several measures. There is no universal weighting system for purchasing performance measures for all industries. Purchasing practitioners can gain insight from this study by examining the weights assigned by the sample from the industry that most nearly resembles their own. The results also indicate that the different perspectives of purchasing managers, buyers, and internal customers yield different weights for the selected purchasing performance measures. These different opinions should be taken into consideration if purchasing practitioners are to achieve overall corporate goals. Different strategies can be adopted to monitor purchasing performance, depending on what corporate goals need to be achieved.

The significant contribution of this research is that it has studied the opinions of not only purchasing people, but also of internal customers on a large scale. The findings provide more accurate information compared to that from previous studies. Purchasing, as one important function in the corporation, can achieve its objectives only when it takes the needs and objectives of other functional areas into consideration.

DEDICATION

I dedicate this dissertation to my wife, Lily H. Wang, for her ceaseless love, daily reassurance, and great inspiration. Her willingness to sacrifice made it possible to complete this dissertation. I also dedicate this dissertation to my parents, from the other side of the world, for their total support, encouragement, and prayers.

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CHAPTER 1

INTRODUCTION

Evaluating purchasing performance is a very difficult task because of a lack of valid measurement criteria. A recent survey conducted by the Center for Advanced Purchasing Studies (CAPS) shows that purchasing performance measurement is one of the most important concerns of purchasing executives (Fearon, 1986).

The purpose of this dissertation is to investigate several key issues in purchasing performance measurement. The focuses are on the similarities and differences of a number of purchasing performance measures from three respondent groups, purchasing managers, buyers, and internal customers, in five industry types, electronics, utilities, mining, governments, and aerospace, and on the relationships between the respondents' ratings of their organization's purchasing performance, the purchasing performance measures and the responsibilities, and types of commodities purchasing handles.

1.1 The Importance of Purchasing Performance Measurement

The importance of being able to measure and evaluate purchasing performance and its effects on overall organizational competitiveness and profitability is of major

interest to both practitioners and researchers. Fifty-six percent of the average manufacturing firm's revenue is spent with outside suppliers for a variety of materials, supplies, and services. When capital expenditures are included, this figure rises to 60 percent (U.S. Bureau of the Census, 1985). This means that more dollars are spent for purchased products and services than for all other expenses combined, including labor, overhead, and taxes. Thus, the effectiveness of the purchasing function can have a significant impact on many firms' performance.

The impact of the purchasing function on an organization's performance has been recognized for many years (Ammer, 1974, pp. 5-15). Purchasing decisions have a major effect on profitability, due to their leverage on profit margins, inventory investments, and hence, return on assets (Leenders, et al., 1989, pp. 11-16). Any function having this significant effect on overall operations deserves top-management attention and should be monitored on a regular basis. Although purchasing has gained a significant role in many areas today (Fearon, 1988, p. 16), confusion still exists as to what role the purchasing function plays in a given organization.

1.2 Need for Research

Since 56-plus percent of the average manufacturing firm's revenue is spent on outside suppliers for a variety of materials, supplies, and services, the effectiveness of

the purchasing function can have a significant impact on many organizations' profits and success. A better understanding and control of purchasing performance will enable management to audit purchasing performance so that unsatisfactory performance can be detected and rectified. Good purchasing performance aids in achieving the desired goals of an organization (Dobler, et al., 1984, p. 561).

Although the purchasing function is important to the firm's performance, research to date in this area is far from adequate. Previous research has examined the activities, characteristics, and effectiveness of the individual buyer rather than the purchasing function as a unit or how to manage the purchasing function to enhance its contribution to the organization (Adamson, 1979, pp. 25-32; Farmer, 1981, pp. 20-24).

Numerous authors have addressed the issues related to purchasing performance measurement. A number of questions have been asked, such as: How do firms currently measure purchasing performance? What are the key purchasing performance measures? How are the measures computed and presented? What are the advantages and disadvantages of these measures? What dysfunctional or negative behavior is associated with these measures? Are there any organizational and/or environmental factors related to the measures used? Can all organizations use similar measures in evaluating purchasing performance? How do the internal

customers who use purchasing service rate the measures in their organizations? Are there any organizational and/or environmental factors related to the internal customers' ratings of measures? What is the relationship between purchasing measures and purchasing responsibilities? How does the measurement relate to the types of commodities purchased? Answers to these questions are of interest to both researchers and practitioners.

The functions performed by purchasing departments or purchasers in organizations depend on many variables, such as the nature of the organization, types of industries, corporate goals, organization structures, types of commodities purchased, kinds of responsibilities purchasing assumes, value of the purchased items, volume of purchased materials, frequency of purchases, and buying procedures. The purchaser's role also depends on the interrelationships among the functional areas (such as production and operations, financing, marketing, accounting) and their expectations of the purchasing function (Cavinato, 1987, p. 11).

In order to develop effective and efficient purchasing, the purchasing department needs to integrate the purchasing function with corporate strategic planning, to organize purchasing activities and staff in an efficient way, to motivate the individual purchasers in order to achieve corporate goals, and to control all activities properly.

It is relatively easy to measure the success of an organization in terms of total sales, market share, net income, dividends, shareholder's equity, or some other financial, accounting and marketing indicators. While the leverage effects of purchasing are more significant than most other functions in the organization, the achievements and successes of the purchasing function are not as apparent as that of other business functions. Often, purchasing is viewed too simplistically by many nonpurchasing executives (Cavinato, 1987, p. 11). Most organizations appreciate the need for a competently staffed purchasing function if purchasing is expected to make a significant contribution to the profitability of the firm. In order to ensure this, a periodic evaluation of the purchasing function should take place (Adams and Niebuhr, 1985, p. 2).

It is extremely difficult to measure purchasing performance. The difficulties of measuring purchasing performance include: legal issues, the interrelationships between the purchasing department and other divisions, and the problems in trying to show how they help to create profits, to increase sales, or to pay dividends to shareholders. First, it is not easy to tell which buyer or which purchasing activity contributes effectively to the overall success of the organization. Second, it is not easy to understand the similarities and differences of purchasing performance measures across different types of organizations

and among different interest groups. Third, it is difficult to understand the purchasing performance measures and purchasing responsibilities and types of commodities purchasing handles.

1.3. Statement of the Problems

While there are many issues in the area of purchasing performance measurement, this dissertation is particularly focused on the following research problems:

1. The differences and similarities in weighting a selected set of purchasing performance measures in terms of their relative importance across several selected industry types.
2. The differences and similarities in weighting the selected purchasing performance measures in terms of their relative importance among three selected respondent groups.
3. The relationships between purchasing responsibilities and the weights of the selected purchasing performance measures.
4. The relationships between the commodities purchasing handles and the weights of the selected purchasing performance measures.
5. The relationships between the respondents' ratings of their organization's purchasing performance, and the weights of the selected purchasing

performance measures, purchasing responsibilities, and the commodities purchasing handles.

1.4. Objectives and Contributions of this Research

The objectives of this dissertation are to:

1. Examine some key dimensions of purchasing performance measurement which are of major concern to purchasing researchers and practitioners.
2. Obtain a better understanding of the relationships among selected variables in evaluating purchasing performance. These variables include: purchasing performance measures; different types of industries; different perspectives of purchasing managers, buyers, and internal customers; purchasing responsibilities; types of commodities purchasing handles; and the ratings of purchasing performance of the respondents.
3. Expand the body of knowledge of purchasing performance measurement and provide some insights to practitioners for improving purchasing effectiveness and efficiency.

The findings of this research should contribute to the existing knowledge in purchasing performance measurement. These contributions should include:

1. The nature and characteristics of the relationships of selected purchasing performance

measures in different types of industries. It is hoped that a better understanding of the relationships of purchasing performance measures will enable organizations to better audit purchasing performance and to achieve corporate goals more effectively and efficiently.

2. The nature and characteristics of the relationships between the selected purchasing performance measures and the respondent groups of purchasing managers, buyers and internal customers. A better understanding of these relationships should strengthen cooperation between purchasing and other functional areas in the organization, and assist in achieving overall corporate strategies to be realized.
3. The nature and characteristics of the relationships between the selected purchasing performance measures and purchasing responsibilities. A better understanding of these relationships should provide purchasing with more control over purchasing activities and the measurement of appropriate tasks.
4. The nature and characteristics of the relationships between the selected purchasing performance measures and the commodities purchasing handles. A better understanding of

these relationships will enable purchasing managers to differentiate their application of the purchasing performance measures to different commodities.

5. The nature and characteristics of the relationships between the ratings of purchasing performance of the respondents, the selected purchasing performance measures, purchasing responsibilities, and types of commodities purchasing handles.

To determine what is effective and efficient purchasing performance, Chapter 2 reviews the literature of purchasing performance measurement; Chapter 3 details the research design and methodology; Chapter 4 discusses the research results; and Chapter 5 provides conclusions based on the research results.

CHAPTER 2

REVIEW OF LITERATURE

The review of the literature will cover three major issues:

2.1 A brief historical background of purchasing performance measurement;

2.2 Current approaches to purchasing performance measurement;

2.3 Needs for expanding the body of knowledge of purchasing performance measurement.

2.1 Brief Historical Background

Historically, it is one thing to recognize the need for purchasing performance appraisal and quite a different matter to develop meaningful methods for measuring performance (Leenders, et al., 1989, pp. 456-457). Leenders, et al., examined the historical development of purchasing performance appraisal. For several years prior to 1950, several committees of the National Association of Purchasing Agents (NAPA, now NAPM) attempted to develop a uniform statistical method of purchasing performance evaluation, which would apply generally to purchasing activities. These committees finally concluded that no one method would fit all situations, and in 1947, after studying the problem for 15 years, a committee of NAPA concluded

that: "It is impossible to establish an absolute yardstick for measuring the efficiency of all purchasing operations." Later studies confirmed this view (Leenders, et al., 1989, p. 457).

During the 1950s, increasing attention was given to developing new methods for the evaluation of the purchasing function. Many large corporations developed methods which met their specific needs. The accounting profession also expressed its interest and published results of research projects (Papaerman, 1980).

Continued interest in the subject of purchasing performance evaluation in the 1960s was evidenced by the publication of a comprehensive report by the American Management Association (AMA). Over 200 companies participated in the study, and 75 percent indicated that some methods of purchasing performance evaluation were used. Several ratios of purchasing performance were presented (Haas, et al., 1960).

In the 1970s and into the 1980s, purchasing has been more involved in strategic planning. However, the confusion still exists, as Leenders, et al., point out:

> "Research in organization theory and human behavior in organizations has produced greater understanding of how to organize for effective results. We have learned about the importance of clearly defining the purpose and the objectives or goals we expect a function and the employees in that function to achieve. A major problem in many organizations has been the lack of clearly defined objectives for the purchasing department and its personnel. Unless it can be determined what is to be evaluated, the question of how to make an evaluation has little meaning"

(Leenders, et al., 1989, p. 457).

In spite of the lack of clear objectives, some progress has been made in developing purchasing performance measures using several different approaches.

2.2 Current Approaches in Purchasing Performance Measurement

Firms are currently using a variety of methods to evaluate purchasing performance. These methods include:

1. The Strict Control Approach (also known as the paper audit approach) tries to keep purchasing as a conservator of the firm's assets, and creates paper audit and accounting systems to monitor and control purchasing activities (Reck, 1986).
2. The Budgetary Approach evaluates purchasing performance against predetermined requirements in financial or numerical terms (Reck, 1986; Rue & Byars, 1986).
3. Objective Measurements are quantifiable assessments in numerical terms; Subjective Measurements are judgmental evaluations of the subordinates' performance from the viewpoints of the superiors (Pooler, 1973; Croell, 1980).
4. Management-by-Objectives (MBO) is a process whereby management identifies common goals, defines the individual's areas of responsibilities in terms of the results expected

of them, and uses these measures as guides for assessing the performance of each member (Drucker, 1954; Croell, 1980; Reck, 1986).

5. The Profit Center Concept attempts to tie purchasing performance to overall corporate profitability. Under this concept, return on investment (ROI) is a key that measures divisional and overall profitability (Ammer, 1969).
6. The Strategic Approach to measuring purchasing performance focuses on determining whether or not the purchasing function develops strategies which maximize the effectiveness of corporate performance (Burt and Soukup, 1985; Reck, 1986).
7. The Systems Approaches attempt to relate purchasing performance to corporate strategy and specify the detailed performance criteria for individual buyers (Churchman, 1968; Adams and Niebuhr, 1985; Reck, 1986).
8. The Behaviorally Anchored Rating Scales Approach (BARS) is a method for evaluating employees across various performance dimensions that contribute to the employee's worth to the organization (Browning and Adams, 1980).
9. The Joint Evaluation Approach suggests that purchasing performance should be evaluated by the purchasing department, internal users and

suppliers. Those who evaluate the purchasing department's performance are either internal customers who utilize purchasing's services (Denton, 1965), or the external suppliers (Davies, 1985), or a combination of the internal customers, purchasing directors, buyers, and external suppliers (Hendrick and Ruch, 1987, 1988).

Each of these approaches is analyzed below.

Strict Control Approach

As noted above, the strict control approach sees purchasing as a conserver of the firm's assets, and creates paper audit trails and accounting systems to monitor and control purchasing activities (Reck, 1986).

Since 60 percent of the average manufacturing firm's revenue is spent on outside suppliers for a variety of materials, supplies, services, and capital products, the primary responsibility of the purchasing function (as viewed by top management) is to minimize the amount of money expended on those purchases. Thus, accounting procedures have been created to monitor and control purchasing activities. The main thrust of this approach is to ensure that individual buyers spend the purchasing dollars in such a way that their activities can be verified through documentation and audit trails. Such an approach allows for a minimal amount of judgment on the part of individual buyers in performing their tasks (Reck, 1986).

Budgetary Approach

The Budgetary Approach in purchasing performance measurement is widely used (Rue and Byars, 1986). A budget is a statement of expected results or requirements expressed in financial or numerical terms. Budgets express plans, objectives, and programs of the organization in numerical terms. Preparation of the budget is primarily a planning function. While budgets are useful for planning and control, they are not without their dangers. Perhaps the greatest danger is inflexibility, a special threat to organizations operating in an industry with rapid changes and high competition. Rigidity in the budget can also lead to subordinating organizational goals to budgetary goals. Furthermore this approach faces the inherent problem of setting good standards (Rue and Byars, 1986). To be effective, the purchasing budget should be integrated into corporate goals and objectives followed by forecasts of resources needed to meet the goals (Leenders, et al., 1989, p. 451).

Objective & Subjective Approaches

Two basic types of measurements are applied in evaluating the effectiveness of the purchasing function: (1) objective measures which are quantifiable; (2) subjective measures which cannot be expressed quantitatively and, hence, are more difficult to measure in definite terms. Not only must the accomplishment of tasks be measured, the

conditions that existed during the time period involved must also be considered, particularly the amount of purchasing activities (Pooler, 1973; Croell, 1980).

According to Croell, objective indicators of purchasing activities include:

(1) Dollar purchases
(2) Dollar sales per year
(3) Purchases/sales
(4) Number of purchase orders
(5) Number of purchasing employees
(6) Ratio of purchasing dollars to company total revenue
(7) Inventory investment (Croell, 1980, p. 23).

Croell lists the following objective measures:

(1) Cost savings
(2) On-time delivery of incoming materials
(3) Departmental operating expenses
(4) Quality of materials purchased
(5) Cost of materials purchased or standards costs
(6) Dollar value of materials on order
(7) Cancellation charges (Croell, 1980, p. 23).

The subjective measures can include the following items:

(1) Buyer's knowledge of commodities he or she manages.
(2) Buyer identifies and cultivates qualified suppliers.
(3) Buyer's knowledge of strengths and weaknesses of the supplier.
(4) Buyer's knowledge of and use of a follow-up technique.
(5) Buyer's knowledge of relevant laws and government regulations.
(6) Buyer's participation in developing procurement plans.
(7) Buyer's knowledge of end-item usage of materials.
(8) Buyer's compliance with procedures.
(9) Buyer's negotiating ability with suppliers.
(10) Buyer's professionalism.
(11) Buyer builds team relationships between suppliers and internal customers (Monczka, et al., 1979, pp. 14-16; Giunipero, 1988, p. 86; Hendrick and Ruch,

1988, p. 20).

The objective purchasing performance measures used alone have serious flaws in their ability to provide meaningful insights which then may be used to improve performance. Cost savings probably are the most difficult to quantify in meaningful terms. The basic problem is in defining just what constitutes a cost saving. A variety of guidelines may be applicable -- all of which give different results. On repetitively purchased items, a base price might be established at the beginning of the year. The base price is the purchase price in effect at that time. The price of any subsequent purchases would be compared with the base. If the actual price is less than the base price, a cost savings has been achieved. However, the base price is not static. If there are any general price changes, either up or down, the savings compared with the base price need to be changed; otherwise, the savings generated can be attributed to market conditions rather than the skill and efforts of the buyer.

The subjective or qualitative performance measurement approach is also important. This approach includes measures that relate purchasing's contributions to the overall effectiveness of the corporation. Croell indicates that a close working relationship between purchasing and other major departments is necessary. He suggests that the supportive roles of major interfacing departments should be

spelled out to all concerned. Clarity and good communications in setting objectives will contribute significantly to the teamwork required in achieving these types of objectives (Croell, 1980). Other authors categorize the subjective measurement approach as behavior control which is based on direct, personal supervision. Such behavior control is exerted when performance requirements are well-known, and when personal supervision is needed to promote efficiency and motivation (Rue and Byars, 1986).

Sorensen and Hoecherl (1986) indicate that objective measurement of purchasing performance is impractical, because it is very difficult to establish appropriate measures. Additionally, these authors suggest that the buyers' attitudes and efforts should be considered in evaluating buyers' performance. One way of accomplishing such an evaluation is to measure purchasing performance against plans.

Management by Objectives

Management by Objectives (MBO) is another approach used by many firms to evaluate purchasing performance. MBO is defined as:

> A process whereby the superior and subordinate managers of an organization jointly identify common goals, define each individual's major areas of responsibilities in terms of the results expected of them, and use these measures as guides for operating the unit and assessing the contribution of each of its members (Odiorne, 1965, p. 8).

Generally speaking, the merits of MBO can be summarized as:

(1) Employees can perform better when it is clear to them not only what is expected of them, but how their individual efforts contribute to the organization's overall performance;

(2) Employees usually want to have some say about the particular results that are expected of them;

(3) While performing, employees have a need to know how well they are doing;

(4) Employees want to be rewarded in line with their level of performance (Szilagyi, 1984, p. 185).

This approach focuses on the assessment of achievement of objectives in purchasing and materials management. It is accomplished internally by comparing departmental operating results with plans, budgets, and objectives; occasionally it is done by means of an audit conducted by someone outside the department or the company (Adams, 1985).

Because the purchasing function can make a significant contribution to a company's profit, any evaluation designed to measure individual performance should keep this as a primary goal in order to improve the productivity of the individual. Therefore, an objectives-oriented system is often considered the best strategy for performance appraisal. According to Adams, the benefits of this type of approach can best be achieved because:

(1) Employee rewards are tied directly to employee performance;

(2) Improvement goals are defined and set for all employees, especially information and service employees (Adams, 1985, p. 3).

MBO also produces a particularly serious problem in those job situations where output is difficult to quantify and relationships between employee inputs and measurable results cannot be established with precision. The MBO approach can hinder cooperation between departments and even among individuals within the same department. The department that adopts a "results-at-all-costs" mentality may actually decrease the overall productivity of the organization (Smith and Kendall, 1963, p. 153). In addition, a record of results depicting substandard performance may offer little in the way of helping the employee recognize and alter the behaviors that resulted in the poor performance.

Profit Center Approach

Ammer's classic article presents the "Profit Center Concept" (1969). His approach is that materials management should be tied to the firm's profitability, and that evaluations should be made in terms of price, quality, delivery and inventory level. Return on Investment (ROI) is the key measure and is believed to be truly "King" of inventory management, as purchasing interest swings from value analysis to materials management and to inventory management (Ammer, 1969; Pooler, 1965 and 1973).

The merit of the Profit Center Concept is that it ties purchasing performance to overall corporate performance.

This concept, when applied under materials management, will force cooperation between purchasing and production control, tighten inventory control, and improve efficiency in coordination and communication among the different departments (Ammer, 1969).

According to Bauer, every procurement decision should take into account its effect on overall company profitability. This requires an understanding of:

(1) Purchasing's impact on operational performance;
(2) Actual operation costs vs planned operation costs (Bauer, 1976, p. 4).

Poor purchasing can be traced to a lack of balance and planning, or even the simple refusal to acknowledge that unnecessary costs exist. He also points out that the trick is to distinguish between requirements needed to promote marketing or manufacturing performance and those designed to cover all bases, regardless of their effect on purchase costs. In this arena, decisions are often highly judgmental. Where purchasing and operating management do not constructively counterbalance each other, poor procurement usually results.

Many companies adopt the approaches that Du Pont and General Motors developed in the 1920s. Both Du Pont and GM decentralized profit responsibility to operating units and at the same time began to use ROI to measure their units' financial performance. They expressed future profit objectives in terms of return on divisional assets and began

to base projected performance on past results. Later Du Pont and GM formalized these ROI objectives into profit budgets.

ROI is a valid technique for measuring past profitability. In fact, it is the technique that allows a company to compare profitability among organizations or investments. But it is not a valid way to set future objectives, because the historical costs of assets -- on which ROI is based -- are meaningless in planning future action. Regardless of how much a company pays for a group of assets or what amount of differential cash flow it projects in investment proposals, the logical thing its managers can do -- once the assets are in place -- is to use the assets to maximize future cash flow and to invest in new assets when the return from these assets is expected to equal or exceed the company's cost of capital. The failure to make this distinction -- between measuring the past and projecting the future -- is the principal reason that companies continue to use ROI to measure the financial performance of their managers (Dearden, 1987, p. 85). Dearden further points out that companies should express profit objectives for both the profit center and its managers in terms of absolute dollars of profit, which are based on the projected potential of existing resources to generate cash flow (Dearden, 1987, p. 85).

Not only are historical accounting values of existing

fixed assets not relevant, but as soon as a new asset is added, neither the cost nor the projected savings are relevant to future planning except to ascertain how well estimates have been made (Dearden, 1987, p. 85).

Dearden points out, first, that a company can measure a profit center's financial performance only in absolute terms, while it can measure the division's manager only in relative terms. Managers' performance is limited by their own units' profit potential. Otherwise, managers of high profit divisions would always be considered successful and managers of low-profit divisions, marginal or unsuccessful. Second, the extent to which a manager can control an item of revenue or expense is irrelevant to measuring a profit center's performance. For example, the impact of gains or losses in translating foreign exchange is important to evaluating a subsidiary's profitability, but this impact is entirely irrelevant to judging the performance of that subsidiary's manager. Third, the methods used to measure managers affect the way they act. If companies measure ROI, their managers may do everything they can to optimize the ratio, and that may result in suboptimal decisions.

Dearden (1987, p. 88) recommends that evaluation of managerial performance involve the observation of managers' performance over a period normally exceeding the year covered by the typical profit budget.

Additional disadvantages of the Profit Center Concept

can be seen in the following areas: interdepartmental pricing policies when the departments involved do not agree on transfer pricing, extra paperwork, and short-term profit performance rather than long-term strategic achievements (Ammer, 1969).

Strategic Approach

A study conducted by the Center for Advanced Purchasing Studies (CAPS) indicates that purchasing has assumed an increased role or responsibility since 1980 in strategic planning, providing economic forecasts/ indicators, capital equipment buys, product development, new product evaluation, and traffic/transportation (Fearon, 1988, p. 16). This increased role recognizes the movement of the purchasing function to a top-level corporate support position, as opposed to only a material-acquisition-and-flow interest. This also implies that the people in purchasing must have broader abilities and an understanding of the overall mission and functioning of the organization. The data for this study were collected from 297 U.S. organizations in 23 industry groups. It provides a very comprehensive indication of developing trends (Fearon, 1988, p. 16). Thus, purchasing performance evaluation should be tied to corporate strategies.

Strategic issues in purchasing have also been recognized by several other authors. They believe that the purchasing function should be involved in developing

strategies that maximize corporate effectiveness. An increasing number of companies integrate long-run purchasing and material planning into the overall strategic plan of the company (Adams, 1985; Burt and Soukup, 1985; Reck, 1986). Although few doubt the need for some effective system support to evaluate and improve individual performance, many report dissatisfaction with the process (Burt and Soukup, 1985; Reck, 1986).

According to Reck (1986), purchasing can be viewed at two levels. The first level is the strategic level, which is primarily concerned with achieving a high level of integration between the purchasing function itself and the firm's overall strategy. The second level is the operational level, which is concerned with the actual performance of those activities necessary to carry out strategy. In order to become strategically oriented, purchasing needs to tie performance to the firms' target customers. Reck believes that the strategic level requires the participation and understanding of top management. Therefore, the integration of the purchasing function into a firm's strategy can be accomplished with no additional resources being consumed and with no noticeable changes in the organization's structure. Once the purchasing function becomes fully integrated into a firm's strategy, its operational level goals will at last become integrated with the overall goals of the firm. Thus, by measuring the

degree to which the purchasing function accomplishes these operational level goals, one actually measures the purchasing function's direct contribution to what the firm as a whole is trying to accomplish. This is in contrast to the more traditional purchasing performance evaluations which place continued emphasis on cost reduction and internal operating efficiency regardless of whether such activity actually relates to the accomplishment of the firm's missions (Reck, 1986).

In addition, integration of the purchasing function into the firm's strategic planning process reduces the waste and inefficiency of interdepartmental conflict. Since the firm's overall strategy is determined through an integrative effort that involves equal participation from all of the firm's key functional areas, the role that purchasing must play in supporting this strategy is clear (Reck, 1986).

According to Reck, a strategic planning process involves three very straightforward steps:

(1) Recognize the purchasing function's full potential to benefit the firm.

(2) Evaluate and integrate the purchasing function into the firm's strategy.

(3) Define functional roles and attitudes (Reck, 1986).

However, integration of purchasing performance into corporate strategy is not an easy job. To date, the reason that most firms' top management has not properly managed

their purchasing function is that no concept or procedure has been available to assist them in doing so.

Systems Approaches

The Systems Approaches attempt to relate purchasing performance to corporate strategy and specify the detailed performance criteria of individual buyers. Since the 1960s, computerized systems have made it possible to routinely evaluate purchasing activities and provide management with timely results of purchasing performance (Churchman, 1968; Adams and Niebuhr, 1985; Reck, 1986).

To improve performance of purchasing personnel in their activities, systems approaches have been advocated by many authors in recent years (Adams and Niebuhr, 1985; Reck, 1986). These approaches include computer-oriented measurement and integration of the purchasing function into corporate strategy.

Figure 2.1 illustrates the systems model recommended by Adams and Niebuhr for use in evaluating purchasing performance.

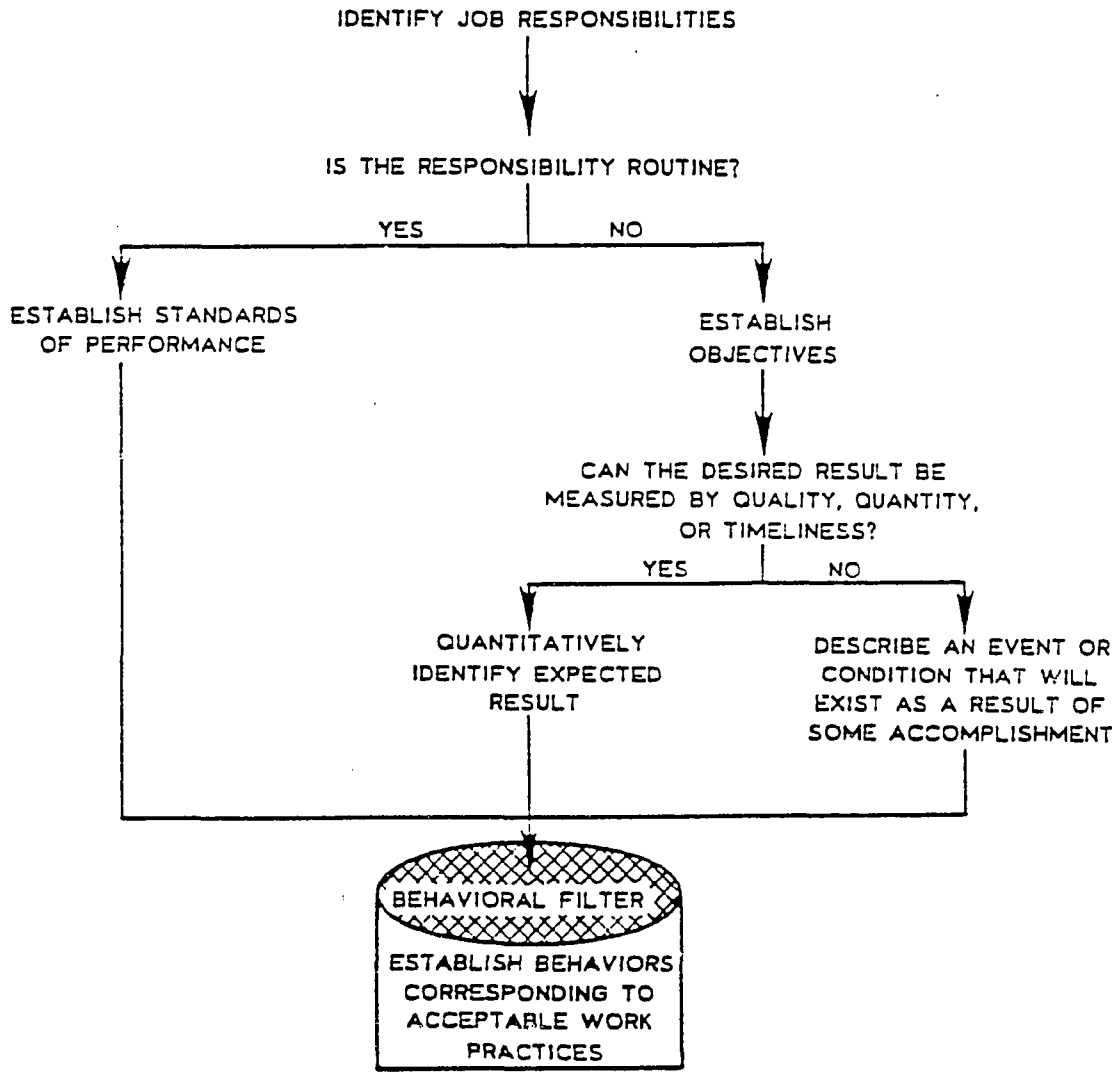


Figure 2.1

A Model for Achieving Improved Individual Job Performance in the Purchasing Department

In Adams and Niebuhr's model, the specific duties and responsibilities for the job position are defined. These responsibilities are categorized into two sets: routine and non-routine. Job expectations or objectives are determined. Depending on the degree of repetitiveness, expectations can take the form of either standards of performance or specific objectives. A behavioral filter is provided to enable the manager to judge subjectively individual accomplishments in light of expected job behaviors. They believe that this model is completely participative in the sense that the employee (subject to the manager's concurrence) establishes job responsibilities, recommends the standards of performance for each repetitive responsibility, and makes the initial suggestions regarding objectives for the next evaluation period. The employee may also suggest work practices that should be expected from an individual in his or her position. Adams and Niebuhr believe that this model is applicable to any position within the purchasing function. If the job is clerical in nature, for the most part, standards of performance will apply. If the job is more managerial in nature, objectives will make up the bulk of the evaluation. The mix between standards and objectives should be determined jointly by the manager and subordinate (Adams and Niebuhr, 1985).

However, Adams and Niebuhr's approach is conceptual with little empirical support. Like many systems

approaches, their model tends to specify the detailed criteria of the performance of individual buyers. As a result, the system approaches may lead to some role and image problems. With top management's attention gravitating to those functional areas which it views as most directly affecting sales and profits, such as marketing, sales, and finance, purchasing eventually comes to be viewed by top management as a dispensable function. That is, while the other functions are viewed as being directly responsible for bringing revenue into the firm, purchasing is viewed as the function which gives the better part of that revenue away. Thus, while the other functions are cast by top management in a very positive image as managers of gain, the purchasing function is cast in a very negative image as managers of loss. In addition, the systems approaches tend to have a few weak points which include:

(1) Omnipotent solutions to all problems that are unrealistic.

(2) Information flows in/out may hinder the adequate evaluation of performance. The larger the system, the more complicated the information requirement.

(3) Application of systems approaches in purchasing performance is against the traditional reward approach. Therefore, there may be insufficient motivation for buyers.

(4) Environmental restrictions and changes may force

redesign and realignment of the evaluation system with the corporate goals and strategies. This may cause extra work (Churchman, 1968).

Incomplete performance measurement systems arise as a result of top management's view that purchasing is the conserver of the firm's assets and leads to the development and widespread use of purchasing performance measurement systems which strongly emphasize cost minimization and internal operating efficiency. Reck's study (1986) on purchasing performance measurement in American business firms points out an overwhelming reliance by these firms on purchasing performance measures such as cost reduction, cost avoidance, price control, administrative cost control, and efficiency in responding to purchasing requests. Although such measures are extremely useful for reducing or eliminating unreasonable costs, once these costs are brought into line, such measures are inadequate for further improving purchasing performance. After purchasing costs have reached their optimal point, these measures continue to encourage buyers to reduce costs even further, often at the expense of quality, delivery service, and vendor relations.

Behaviorally Anchored Rating Scales Approach (BARS)

Another type of performance evaluation used to measure individual performance is Behaviorally Anchored Rating Scales (BARS). Essentially, BARS is a method for evaluating

employees across various performance dimensions that can contribute to the employee's worth to the organization. The scales used in BARS are developed around critical incidents relating to job performance (Browning and Adams, 1980). The use of BARS involves a determination of the wide range of employee behaviors (interpersonal skills, technical competence, etc.) that apply to the job, followed by a determination of the anchors associated with various rating categories ranging from unacceptable performance to excellent performance.

Compared with other appraisal approaches, BARS requires a rather extensive development process prior to implementation; therefore, the development of a BARS approach for performance appraisal is an extremely complex, time-consuming process that requires careful attention to specific descriptions of behaviors and detailed statistical analysis. Also, once developed, the manager is expected to monitor employee behaviors in some 10 to 15 task-related categories, including both desirable and undesirable behaviors, for each individual, throughout the evaluation period. This expectation is often unrealistic and impractical (Adams, 1985). On the other hand, pertinent job behaviors that are consistently associated with bad performance are extremely important for both the purchasing manager and the employee to recognize. Understanding the

specific behavior associated with poor results is the first step toward improved performance.

Joint Evaluation

An early study of purchasing performance measurement conducted by Denton (1965) focused on the evaluation of purchasing performance from the internal customers' perspectives.

The purchasing division is interested in what others in the company think of their performance. A great many people in the corporation submit requisitions and avail themselves of the services of the purchasing division; it is important to know what these people expect of purchasing.

In order to develop his survey, Denton interviewed a small sample of purchasers and a few internal customers in other departments of an oil company. Forty-two statements (See Appendix B) were developed which reflected the most significant aspects of purchasing performance. Questionnaires then were sent to a carefully selected sample of people who ordinarily either submitted requisitions to purchasing or approved the requisitions submitted by subordinates. The respondents were asked to subjectively evaluate the relative importance of these forty-two criteria on a 5-point Likert scale (Denton, 1965).

The mean factor scores from Denton's study are presented in Appendix C. The practical value of these analyses is that they may be used as a framework for

evaluating purchasing performance. The factorial design of this research reveals the relative importance of each criterion, but not the overall importance of these criteria. Denton's criteria are treated independently in the factorial design, and it is difficult to see the interrelationships among the criteria (Denton, 1965).

Denton's research is a case study; the performance was judged by internal customers without considering corporate strategic issues. His survey was conducted in one oil company from the perspective of the internal customers only; the relationship between the internal customers and the purchasing function was not addressed. It is of questionable external validity.

Davies (1985) examined the external suppliers' view of purchasing performance to provide guidelines for the efficiency of the purchasing function. A sample questionnaire surveyed vendors' opinions of buyers. The questionnaire covered many key elements of purchasing performance measurement, such as: a company's policy on gifts; communication between buyers and suppliers; rating of buyers in the areas of attitude, product knowledge, decisiveness, negotiation, open-mindedness, professionalism; and overall evaluation of buyers' performance. Davies conceptualized the audits of purchasing performance from the viewpoint of the internal customers and external suppliers.

According to Davies, because the basic purpose of the

purchasing task is to provide an optimum service to user departments, purchasing should be audited to determine the effectiveness of its service level and inventory level. It is clear that there are issues other than stockouts and production downtime that measure the overall effectiveness of the purchasing function, including:

(1) Speed of response

(2) Efficiency of communication

(3) Flow of information on requisitions

(4) Courtesy.

When purchasing understands the attitude necessary to serve its internal customers and to provide an efficient and effective service at optimum cost, the relationships with internal customers' departments can be improved considerably. However, Davies' study lacks empirical support.

Hendrick and Ruch (1987, 1988) captured the normative weights of 20 performance criteria in a Fortune 500 electronics manufacturing organization from the perspectives of four groups: buyers, purchasing managers, external suppliers, and internal customers. The importance of Hendrick and Ruch's study is that it attempts to evaluate purchasing performance from the perspectives of different functional areas. Other authors have studied the relationship between the purchasing department and other departments, and between buyers and vendors (Denton, 1965;

Dobler, et al., 1984; Cavinato, 1984; Leenders, et al., 1989; Davies, 1985; Heinritz, 1986).

In Hendrick and Ruch's study, 188 criteria were generated using the nominal group technique with selected purchasing managers, buyers, internal customers, and suppliers. By reviewing the literature and by using Pareto analysis, 20 criteria were concluded to be more important than the others (See Appendix D). The rank order of all these 20 criteria was evaluated by the participants, in terms of relative importance, in order to:

(1) Develop an operationally simple methodology for determining performance appraisal criteria for buyers in a specific setting;

(2) Capture criteria candidates from the constituent groups with which buyers (the target group) interact;

(3) Utilize the data to diagnose criteria congruence (or dissonance) within and among the groups;

(4) Through interactive feedback, attempt to develop consensus among the four groups as to the appropriate criteria, and the weight each should receive in performance appraisal;

(5) Determine which criteria are the "vital few" versus the trivial many (in a Pareto sense) and, among these, which can be combined into an overall performance index;

(6) Combine and analyze this information and suggest the criteria and weights which should be used.

The results of Hendrick and Ruch's study are shown in Appendix E. Hendrick and Ruch's attempt to interpret the relative importance of these criteria, in order to derive uniform performance measures that would be accepted by all

four groups, is worthwhile but the study has several flaws:

(1) The data collected for this study were from one electronic manufacturing firm and its suppliers, with a small number of respondents. One of their research objectives was to test a generalized methodology for developing performance criteria. It is questionable whether their results can be generalized.

(2) Hendrick and Ruch's studies focus largely on the individual buyers' performance, rather than the performance of the purchasing function as a whole.

(3) Interactions between purchasing performance measures, and purchasing responsibilities and the types of commodities that purchasing handles in different organizations are not examined.

(4) Hendrick and Ruch's study does not take into consideration the conflicting interest between buyers and suppliers. The mean scores of relative importance of some criteria used may be altered when suppliers are included. To some extent, the evaluations by suppliers conflict with those of buyers and purchasing managers, because their objectives are different. A review of the literature on boundary theory is needed to conceptualize interrelationships of the groups within the organization structure and boundary positions. Boundary positions have a number of unique properties that derive from their structural relationship with other roles, and from the fact that occupants of these positions must conduct transactions with external agents (Adams, 1976). These unique properties include:

   a. Boundary role person distance: The boundary person is more distant psychologically, organizationally, and often physically, from other members of the organization than they are from each other; he/she is closer to the external environment and to the agents of outside organizations.
   b. Dual representation: The boundary role person represents his organization to the external environment, as well as representing the external environment to his/her own constituency.
   c. Dual influence agent: The boundary role person is his/her organization's agent of influence over the external environment as

> well as the agent of external groups that influence decision making in his organization (Kolchin, 1978).

According to Kahn and his colleagues, the boundary role is susceptible to a high degree of conflict, not only from interorganizational sources (as in the relationship between the salesperson and purchasing agent) but from intraorganizational sources, such as the conflict between the purchasing agent and other departments within the organization (Kahn, 1973; Kolchin, 1978). When suppliers are included in the measurement study, there is too much complexity. Kolchin concludes that in a boundary position, role conflict exists with the potential for decreased satisfaction for the role incumbent and decreased organizational effectiveness. Role conflict is characteristic of the boundary position and must be addressed to minimize its negative effects and accentuate its positive ones.

2.3 Need for Expanding Knowledge of Purchasing Performance Measurement

The body of knowledge of purchasing performance measurement needs to be expanded in order to obtain a better understanding of the relationship between purchasing performance variables. Such an understanding would provide insights for judging and controlling purchasing activities and thereby improve corporate effectiveness and efficiency. To expand the body of knowledge of purchasing performance

measurement, the following questions need to be addressed:

1. What are the key measures currently used in evaluating purchasing performance?
2. What are the views of the relative importance of the purchasing performance measures in different types of organizations?
3. What are the views of the relative importance of these measures among purchasing managers, buyers, and internal customers?
4. What are the relationships between purchasing performance measures and purchasing responsibilities?
5. What are the relationships between purchasing performance measures and the commodities that purchasing handles?
6. What are the relationships between purchasing performance evaluation and purchasing performance measures, responsibilities, and commodities that purchasing handles?

Key Measures Currently Used in Evaluating Purchasing Performance

Many purchasing performance measures are currently used. Monczka, et al., (1979), conducted a survey on purchasing performance measurement and established 15 categories of more than 200 comprehensive purchasing performance measures. These categories of measures are

classified primarily according to their objectives:

(1) Price effectiveness -- Measures actual purchase prices against plan, market, or other purchases internal to the organization to determine how effectively purchasing dollars are being spent.

(2) Cost savings -- Measures current purchase price against prior price (cost reduction), or against the highest new quotation price, average quotation price, or price increase request (cost avoidance).

(3) Workload-in -- Measures the amount of work flowing into purchasing, including purchase requisitions, change notices.

(4) Workload-current -- Measures the amount of work on hand, both in terms of number of documents and/or standard hours of work.

(5) Workload-completed -- Measures the amount of work completed, including number of purchase orders placed and other jobs completed.

(6) Administration and control -- Measures such factors as elements of the administrative budget. This category also is used to establish staffing and other budget category expenses for control.

(7) Efficiency -- Measures the rate of purchasing output to a purchasing input, primarily labor hours. Measures the time needed to process requisitions through purchasing procedures.

(8) Vendor quality and delivery -- Measures vendor quality and vendor delivery performance. Vendor characteristics such as purchased items per vendor and annual dollar value of purchases per vendor also are measured.

(9) Materials flow control -- Provides data about the location of purchased materials, production quantity, requirements, and due dates for needed purchases. Monitors delivery performance by vendors and by buyers.

(10) Regulatory/societal/environmental -- Measures effectiveness in achieving certain levels of business with minority vendors and/or small businesses, in placing business on a competitive basis, and in meeting other regulations such as Equal Employment Opportunity goals.

(11) Procurement planning and research -- Measures how many procurement plans are established and/or the accuracy of price forecasts.

(12) Competition -- Measures the degree to which purchasing consolidated requirements, reduced sole-source situations, and increased the number of approved suppliers.

(13) Inventory -- Measures the inventory levels, turns, dollars and consignments where purchasing has inventory responsibility.

(14) Transportation -- Measures incoming transportation costs for which purchasing has direct/indirect responsibility.

(15) Purchasing procedure audits -- Measures the adherence to procedures required to issue purchase orders and contracts. Provides data about the number and type of errors in issuing purchase orders/contracts (Monczka, et al., 1979).

Almost all the above mentioned measures are currently used by practitioners. However, as purchasing has entered the strategic era in the 1980s, some significant changes have occurred. For example, Just-in-Time (JIT) purchasing focuses on a single source rather than multiple sources (Ansari, 1987). According to Leenders, et al., (1989, pp. 453-456) purchasing operating reports, which are prepared on a regular basis (monthly, quarterly, semiannually, or annually), can be classified under the following headings:

(1) Market and economic conditions and price performance

   a. Price trends and changes for the major materials and commodities purchased. Comparisons with (1) standard costs where such accounting methods are used, (2) quoted market prices, and/or (3) target costs, as determined by cost analysis.
   b. Changes in demand-supply conditions for the

major items purchased. Effects of labor strikes or threatened strikes.
c. Lead-time expectations for major items.

(2) Inventory investment changes

a. Dollar investment in inventories, classified by major commodity and materials groups.
b. Days' or months' supply, and on order, for major commodity and materials groups.
c. Ratio of inventory dollar investment to sales dollar volume.
d. Rates of inventory turnover for major items.

(3) Purchasing operations and effectiveness.

a. Cost reductions resulting from purchase research and value analysis studies.
b. Quality rejection rates for major items.
c. Percentage of on-time deliveries.
d. Number of out-of-stock situations which caused interruption of scheduled production.
e. Number of change orders issued, classified by cause.
f. Number of requisitions received and processed.
g. Number of purchase orders issued.
h. Employee work load and productivity.
i. Transportation costs.

(4) Operations affecting administration and finance.

a. Comparison of actual departmental operating costs to budget.
b. Cash discounts earned and cash discounts lost.
c. Commitments to purchase, classified by types of formal contracts and by purchase orders, aged by expected delivery dates.
d. Changes in cash discounts allowed by suppliers.

Purchasing has assumed an increased role or responsibility since 1980 in the following areas: strategic planning, economic forecasts, product development, new product evaluation, and traffic and transportation (See Appendix F). Purchasing performance in the above-mentioned

areas needs to be evaluated. Many other authors have also conceptualized the importance of purchasing performance measures in these areas (Bauer, 1976; Rao, 1977; Fisk, 1979; Monczka, et al., 1979; Spekman and Hill, 1980; Dobler, et al., 1984; Cavinato, et al., 1984; Burt, 1985; Heinritz, et al., 1986).

Other purchasing evaluation areas include inventory levels, losses or gains on scrap or surplus disposal, and costs of distribution (Dobler, et al., 1984; Cavinato, et al., 1984; Heinritz, et al., 1986; Fearon, 1988).

Views of the Relative Importance of Purchasing Performance Measures in Different Types of Organizations

Only a limited number of studies in the purchasing literature have compared purchasing performance measures in different organizational groups.

Moore, et al., made comparisons of some purchasing performance measures among three groups: manufacturing buyers, government buyers, and purchasing directors. They found that some differences exist among the three groups on a few purchasing performance measures. These purchasing performance measures were all criteria of personal competency, including:

(1) Ability to communicate firmly, politely, and professionally;

(2) Ability to respect the confidentiality of certain communications;

(3) Skill in being direct and practical in communications;

(4) Ability to formulate contracts;

(5) Ability to understand the techniques of value analysis;

(6) Ability to understand and apply budgets;

(7) Ability to accept and understand that a professional appearance is necessary for buying success (Moore, et al., 1984, pp. 8-14).

However, the categorization of the three groups does not provide meaningful understanding of the relationships among the three groups, since the managers could be either in the manufacturing sector or in the government sector. Their analyses focus only on the subjective type of personal competencies, rather than considering both the subjective type and objective type of purchasing performance measures.

Kostishack, Reck, and Monczka collected their research data from different organizational categories; however, they did not analyze the similarities and differences across the different organizational categories (Kostishack, 1973; Reck, 1978; Monczka, 1979).

Shealy investigated purchasing duties or tasks in manufacturing and service industries. Several of these duties or tasks are also purchasing performance measures. He concluded that generally speaking, the duties or tasks appear to be reasonably similar (Shealy, 1985).

It is not clear whether the weights of the purchasing performance measures would be different in different types of organizations.

Views of the Relative Importance of Purchasing Performance Measures among Purchasing Managers, Buyers, and Internal Customers

Several research articles in the purchasing literature have discussed purchasing performance measures from the perspectives of different groups, such as purchasing managers, buyers, internal customers, and suppliers (Denton, 1965; Davies, 1985; Hendrick & Ruch, 1987, 1988). However, these studies either lack empirical support (Davies, 1985), or lack generalization (Denton, 1965; Hendrick & Ruch, 1987, 1988), or lack consideration of the conflict of interests between buyers and their suppliers (Hendrick & Ruch, 1987, 1988).

The study conducted by Cavinato (1987) indicates that service to users is the element most frequently mentioned by non-purchasing personnel. Cavinato's study discusses the problem with traditional performance measurement that performance evaluations travel only upward in the firm. Thus, purchasing's accomplishments do not reach many of the interfacing departments and other peer groups in the organization. He claims that strong support from interfacing departments is essential in the development of an effective and efficient purchasing function (Cavinato,

1987, pp. 11-16). A better understanding of the relationships among purchasing personnel and non-purchasing personnel regarding purchasing performance measures is needed.

The Relationships between the Purchasing Performance Measures and Purchasing Responsibilities

Purchasing performance can be evaluated only within its scope of responsibilities, which covers a wide range of duties and varies from firm to firm. Purchasing performance measures are meaningful only when they relate to the activities of the purchasing function.

According to Haas, et al., the following are the ten most important responsibilities for purchasing:

(1) Approving the terms of a purchasing contract or order.
(2) Signing the contract or order.
(3) Follow-up functions, such as expediting delivery and tracing shipments.
(4) Managing traffic of incoming goods.
(5) Checking invoices on purchased items.
(6) Accepting or rejecting goods as satisfying or failing to satisfy specifications.
(7) Determining optimum inventory levels.
(8) Scheduling purchases to maintain optimum inventory levels.
(9) Disposing of surplus material and/or scrap.
(10) Determining optimum order quantities (Haas, et al., 1960, pp. 42).

According to Van Weele, the scope of the purchasing function can be characterized by three alternative models:

(1) A clerical function when purchasing has a low position in the organization. Under this model, purchasing performance measures include the number of orders handled, backlog, purchasing administrative lead time, authorization, and procedures. The focus is on efficiency.

(2) Purchasing as a commercial activity. Measures of purchasing cover areas such as cost reduction, negotiation, sourcing, with a focus on efficiency.

(3) Purchasing as a strategic business function. Under this model, purchasing is integrated in the strategic planning process. Measures of purchasing performance include cultivation of qualified suppliers, make/buy decision, integration with R & D, value analysis and value engineering, with a focus on effectiveness (Van Weele, 1984, p. 17).

Some of the 24 responsibilities studied by Monczka, et al., (1979, pp. 30-31), include:

(1) Determining what to buy
(2) Determining when to buy
(3) Determining where to buy
(4) Determining how much to buy
(5) Determining price
(6) Determining purchase inventory levels
(7) Signing contracts or orders
(8) Purchase market research
(9) Scrap and surplus disposal
(10) Processing invoices
(11) Traffic
(12) Forward planning (purchasing)
(13) Specifications
(14) Policy determination (purchasing)
(15) Price forecasting
(16) Standardization
(17) Value analysis
(18) Contract administration
(19) Receiving
(20) Incoming inspection
(21) Cost/price analysis (includes establishing standard costs)
(22) Negotiation
(23) Make or buy
(24) Expediting
(25) Tool commitment

According to Fearon (1988), the functions that report to purchasing include inbound and outbound traffic, warehousing or stores, inventory control, scrap/surplus

disposal, receiving, and incoming inspection. Other activities include strategic planning, product development, traffic and transportation, new product evaluation, capital equipment buys, personnel travel, market planning, economic forecasts, commodity futures trading, cash flow planning, and countertrade; purchasing has assumed responsibility and/or increased responsibility for all of these areas (Fearon, 1988).

The responsibilities of purchasing are sometimes shared with other departments, for example, the responsibility of work-in-process inventory is shared with the production department, or purchased product specifications are jointly determined by the purchasing, production, and engineering departments. In such situations, it is necessary to measure how much responsibility purchasing assumes in order to have precise measures on what should to be evaluated.

In addition, the types of commodities purchased also may have an impact on purchasing responsibilities. The purchased commodities can be categorized into raw materials, component parts, service, capital equipment, MRO items, packaging, and office equipment.

The Relationships between the Purchasing Performance Measures and the Commodities Purchasing Handles

Little has been written concerning the relationship between purchasing performance measures and the commodities for which purchasing is responsible. Intuitively, different

types of commodities require different emphases and involve different strategies and tactics. For example, purchasing capital equipment consumes more time and needs more negotiation than MRO items.

The Relationships between Evaluation of Purchasing Performance and Purchasing Performance Measures, Levels of Purchasing Responsibilities and Types of Commodities Purchasing Handles

The overall objectives of the purchasing function can be stated simply as obtaining the right materials with the right quality, in the right quantity, delivered at the right time and right place, from the right source, with the right service, and at the right price (Leenders, et al., 1989, p. 24). According to Leenders et al., a more specific statement of the overall goals of purchasing would include the following nine items:

(1) Provide an uninterrupted flow of materials, supplies and services required to operate the organization.
(2) Keep inventory investment and loss at a minimum.
(3) Maintain adequate quality standards.
(4) Find or develop competent vendors.
(5) Standardize, where possible, the items bought.
(6) Purchase required items and services at lowest ultimate price.
(7) Maintain the organization's competitive position.
(8) Achieve harmonious, productive working relationships with other departments within the organization.
(9) Accomplish the purchasing objectives at the lowest possible level of administrative costs (Leenders, et al., 1989, pp. 25-27).

According to Reck, purchasing objectives can be divided into six categories:

(1) profit potential;

(2) personal skills;
(3) departmental coordination;
(4) negotiation;
(5) interfirm coordination and,
(6) overall effectiveness (Reck, 1978).

These six objectives are converted into purchasing performance indices and are used by many authors (Reck, 1978; Kolchin, 1988).

Profit potential is the extent to which purchasing activities result in cost savings to the firm. Personal skills refer to the competence of the purchasers in conducting purchasing activities. Departmental coordination is the effort the purchasers spend in communicating, providing reports, arranging meetings, or providing liaison within the purchasing department or organization. Negotiation is measured by the extent of the negotiation process needed to produce favorable results. Inter-firm coordination is measured by the extent to which the purchasers arrange meetings with the members within their own firm and the vendors in order to improve cooperation. Overall effectiveness is measured by a self evaluation of total purchasing performance (Kolchin, 1988). These objectives can be measured either qualitatively or quantitatively.

The next chapter discusses the methodology that enables this research to achieve those objectives.

CHAPTER 3

METHODOLOGY

The philosophy of research is to identify testable questions that have not been thoroughly investigated in prior work (McGuigan, 1960). The methodology and research design of this study are based on this philosophy. The specific objectives of this study are to:

1. Examine dimensions of purchasing performance measurement which are of major concern to purchasing researchers and practitioners;
2. Obtain a better understanding of the interrelationships between the dimensions of purchasing performance measurement;
3. Expand the body of knowledge of purchasing performance measurement and provide some insights to practitioners for improving purchasing effectiveness and efficiency.

This chapter describes the research methodology for conducting the study. The chapter includes:

3.1 Variables selection and measurement

3.2 Validity of the study

3.3 Pilot study

3.4 Sample and data collection

3.5 Models

3.6 Hypotheses

3.7 Analysis

3.8 Summary

The details are presented below.

3.1 Variables Selection and Measurement

The variables selected for this study stem from a synthesis of the key purchasing performance measurement studies outlined in Chapter 2.

Dependent Variables -- selected purchasing performance measures (PPMs) are the dependent variables. PPMs can be generally categorized into two types: objective and subjective measures. This study surveyed the relative importance of these measures in achieving organizational goals as perceived by different respondents. Five objective measures and five subjective measures of purchasing performance were chosen for this study. Each objective measure yields a number, ratio, or percentage to evaluate some aspect of the performance of the purchasing department. These five objective measurement variables are:

PPM1: On-Time Delivery -- percentage of orders that arrive at the scheduled time, neither early nor late.

PPM2: Accuracy -- number of errors made by purchasing in such things as specifications, quantity, price, due date, etc.

PPM3: Quality of Purchased Items -- percent of items or

percent of orders that meet quality requirements.

PPM4: PO Cycle Time -- average time from the receipt of a request by purchasing until the purchasing order is sent to a vendor.

PPM5: Actual vs Target Cost -- actual cost of an item compared to the target (goal or standard) cost.

Subjective measures refer to critical dimensions of purchasing that can be evaluated only by judgment based upon observation. The five subjective measures selected for this study are:

PPM6: Commodity Knowledge -- how well the buyers know the items, vendors, prices, etc. for which they are responsible.

PPM7: Negotiating Ability -- how well the buyers can negotiate prices, terms of sales, delivery dates, and other conditions with suppliers.

PPM8: Cultivating Qualified Suppliers -- how well the buyers find and develop suppliers that meet quality and delivery standards.

PPM9: Teaming -- how well purchasing develops team or partnership relationships between suppliers and internal customers.

PPM10: Professionalism -- how well purchasing upholds standards of conduct, ethics, convention, courtesy, and other dimensions of professionalism.

Respondents were asked to assess the relative

importance of each set of measures from their perspective as manager, buyer, or internal customer. They were asked to weight (between 0 and 100) each set of the measures so that the total of the weights of each equals 100. Thus, when the respondents assign values to purchasing performance measures, the values are of a continuous nature, so that parametric statistics can be applied (Davis and Cosenza, 1985, p. 137).

Respondents then were asked to evaluate overall purchasing performance using both the set of objective measures and the set of subjective measures from their perspectives as manager, buyer, or internal customer. They were asked to weight the two sets (objective and subjective measures) whether they were equally important (50-50) or more weight on one set than the other (60-40, 70-30, 80-20, 90-10). This way, an overall assessment of all these measures can be calculated. When both the set of objective measures and the set of subjective measures are in the analyses, an adjustment is made: the measures are multiplied by their overall assessment from the respondents. For example, if the measure of On-Time Delivery is weighted 0.20, the overall assessment for objective measures is 0.80, the adjusted measure of On-Time Delivery is 0.16 (0.20 x 0.80).

The respondents were asked also to rate the current purchasing performance in their organization on each of the

10 criteria using the following scale:

1. Excellent (coded as 5) -- clearly superior performance, well above expectations; further improvement unlikely;
2. Good (coded as 4) -- above average, meets or exceeds reasonable expectations of performance;
3. Satisfactory (coded as 3) -- meets or exceeds minimal standards: improvement possible and desirable;
4. Needs Improvement (coded as 2) -- at or below minimal standards of performance; effort should be made to raise the level of performance;
5. Poor (coded as 1) -- clearly unacceptable performance, immediate action toward improvement required. Thus, the data collected here are continuous variables.

Independent Variables: Two independent variables examined in this study are types of organization (Xi) and role of respondents in the organization (Xj). Five industry types were selected to provide a broad spectrum of types of purchasing responsibilities. These included (1) electronics, (2) utilities, (3) mining, (4) government, (5) aerospace. Within each organization, respondents were drawn from three groups: (1) purchasing manager or supervisor with managerial authority in purchasing, (2) buyer or purchasing agent, (3) internal customer (i.e. user of purchasing

services). Thus, Xij represents respondents in a particular role in one type of organization. The organization types (Xi) are treated as clusters and the organizational roles (Xj) are considered subclusters in this study.

Mediator Variables: The selection of mediator variables to be examined is based on their theoretical or logical relevance to the effect under study. Mediators should explain how or why the effects occur between independent variables and dependent variables (Baron and Kenny, 1986). Two mediator variables are examined in this study: (1) the scope of responsibility of the purchasing department and (2) the types of commodities purchasing handles.

The mediators which cover the scope of purchasing responsibility include the following variables (MEAs):

MEA1: Determining What Items to Buy

MEA2: Determining When to Place Orders

MEA3: Determining Sources or Vendors

MEA4: Determining Order Quantities

MEA5: Determining Price for Items Purchased

MEA6: Signing Contracts or Orders

MEA7: Negotiating Contracts

MEA8: Receiving and Verification

MEA9: Controlling Traffic

MEA10: Incoming Inspection

MEA11: Processing Invoices

MEA12: Follow-up and Expediting

MEA13: Making Disposal Decisions for Scrap and Surplus Materials

MEA14: Determining Specifications of the Purchased Items

MEA15: Forecasting Purchasing Needs

MEA16: Make or Buy Decisions

MEA17: Cost/Price Analysis

MEA18: Value Analysis

MEA19: Commodity Future Trading

MEA20: Countertrade/Offset Planning/Execution

MEA21: Cash-Flow Planning

MEA22: Determining Optimal Inventory Levels for Stocks of Materials

MEA23: Developing Product Specifications

MEA24: Evaluating New Product Design and Specifications

MEA25: Formulating Strategic Purchasing Plans

Respondents were asked to rate the levels of responsibilities of their purchasing department for each mediator on a five-point scale:

1. Total Responsibility (coded as 5) -- this decision or function is within the normal duties and responsibilities of the purchasing department; purchasing is held accountable for the results.
2. Primary Responsibility (coded as 4) -- purchasing makes decisions and performs functions with inputs from other organizational units; responsibility is shared but purchasing bears the major part;

3. Joint Responsibility (coded as 3) -- purchasing performs this function in combination with one or more other organizational units; decision making and responsibility are shared nearly equally;
4. Some Responsibility (coded as 2) -- purchasing is involved and provides some input; responsibility is shared but others are held primarily accountable;
5. No Responsibility (coded as 1) -- purchasing is not accountable and has no input to the decision; purchasing simply follows orders or allows someone else to perform this function.

Those responsibilities that are not applicable are coded 0. Thus, the data collected here are continuous.

The following mediators are the types of commodities which each firm's purchasing department might handle (MEBs):

MEB1: Raw materials

MEB2: Component parts

MEB3: Services

MEB4: Capital equipment

MEB5: MRO items

MEB6: Packaging

MEB7: Office supplies and equipment

Respondents simply checked whether they handle these commodities or not. If they handle that particular type of

commodity, it is coded as 1, otherwise 0. Thus, the data here collected are of a dichotomous nature.

3.2 Validity of the Study

This study was evaluated for validity using the framework developed by Davis and Cosenza. Validity is concerned with the degree of confidence researchers and managers can have in the results of the study. In other words, validity is concerned with limiting research errors so the results are accurate and usable (Davis and Cosenza, 1985, p. 106).

Internal validity can be defined as the degree to which the results of the study can be relied upon as being correct. Internal validity is essential if a study is to be meaningful to managers. Without it one cannot be confident that the relationships identified in the investigation are either well-grounded or justifiable given the conditions of the study (Davis and Cosenza, 1985, p. 107).

Campbell and Stanley define seven factors affecting internal validity. These factors, along with actions that were taken to control these factors, are discussed below.

1. History: the effect that specific events occurring between the first and second measurement (in addition to the experimental variable) have on the research outcome or the dependent variable. Since the survey was conducted during the period in which there were no extraordinary events in the

business environment and since only one measure was taken, this factor was not applicable.

2. Maturation: the process within the experimental subjects which is a function of passage of time. Examples include growing older, growing tired, and growing hungry. The effect of maturation on internal validity was controlled by minimizing the total time required for completing the questionnaire. The majority of the respondents completed the questionnaire within 10 minutes.
3. Instrumentation: changes in the calibration of the measuring instrument or changes in the observers or scores used may produce changes in the measurements obtained. The factor was controlled by using only one written questionnaire for data collection; there was no change in the measurement instrument during the survey.
4. Statistical regression: This factor suggests that unreliability, or error of measurement, will produce changes in scores on different measurement occasions. These scores are subject to misinterpretation if subjects are selected on the basis of extreme scores at their initial measurement session. To control this effect, the participants in this survey were "volunteers", and they had the right not to return their

questionnaires.

5. Selection: when dependent variable scores for two or more different groups of subjects are being compared, differences between groups could be due to special selection procedures employed in constructing the comparison groups. This invalidity was ruled out by using randomly selected volunteers. Volunteers, according to previous research, are known to possess those characteristics of the population in general (Rosenthal and Rosnow, pp. 101-113).
6. Mortality: the effect of a loss of respondents in the study setting. To control for the effects of mortality, incomplete data were dropped from the data analysis. Subjects were processed through the experiment to obtain equal cell sizes, as equal numbers of questionnaires were sent to the respondents. The responses represent fairly equal across five industry types and three respondents groups (Figure 3.1).
7. Testing: the effects of performing the same task repetitively may impact the internal validity of the research. To control for the testing effect, no respondent repeated the questionnaire.

External validity can be defined as the degree to which the study's results can be generalized across populations,

settings, and other similar conditions. A research study has validity on the basis of several conditions associated with it (Davis and Cosenza, 1985, p. 108). Three conditions violate external validity and the methods to control external validity for this study are presented below:

1. Testing interaction: the artificial effects created by testing respondents reduces generalizability to nontesting situations. This study did not use any artificially manipulated method to collect data from the practitioners.
2. Selection interaction: the effect that the type of respondents has on a study's results may limit its generalizability. To avoid such violation, this study collected data from five industry types, in contrast to earlier research that focused either on one firm, or one type of industry.
3. Setting interaction: the artificial effects that are created by the specific setting of the study may not be replicable in other situations. To avoid this invalidity, this study treated all respondents in all organizations equally in a generic setting.
4. For research to have external validity, the strength and range of variables associated with a study should approximate the strength and range of

variables in other situations to which the research results are to be generalized. Within this study, the dependent variables cover 10 important purchasing performance criteria. The assessment of the purchasing function on these ten criteria from three respondent groups gives a true evaluation, not only from purchasing personnel, but also from internal customers, who came from many functional areas such as: administration, production, engineering, maintenance, and administration.

The mediator variables cover all major purchasing responsibilities and commodities. The independent variables include five major industry types and three major roles associated with the purchasing function. These further strengthen the validity of this study. In this manner, the research instrument, a questionnaire was developed.

3.3 Pilot Study

A pilot study was conducted prior to the actual survey. The objectives for the pilot study were: (1) to examine and reexamine the validity discussed earlier, (2) to determine the clarity and usefulness of the questionnaire, (3) to refine the procedures for the actual survey, (4) to estimate the time required to complete the survey questionnaire and the length of time for questionnaire turn-around.

After several rounds of discussions with the committee

and experts, the survey questionnaire was revised. Then eight copies of the questionnaire were sent to practitioners (two purchasing managers, two buyers, four internal customers) for their evaluation of biases and ambiguities in the questionnaire.

The pilot study was successful in meeting its objectives, as it provided the researcher with much relevant information. The respondents commented that the research would be useful, since knowledge about purchasing performance evaluation from the perspectives of purchasing managers, buyers, and internal customers is an area in which research is needed. The questionnaire itself was reasonably clear and straight-forward. There was no major misunderstanding of the content of the questionnaire. Only minor changes were made to improve the clarity of the questionnaire.

In each organization, copies of the questionnaires were distributed by the purchasing executive to volunteer respondents. A telephone follow up was made by the researcher to maximize the response rate. Data collection was completed in six weeks.

3.4 Sample and Data Collection

Cluster and multistage sampling techniques were applied to ensure the selection of a valid and representative sample.

Cluster sampling is applicable when the available

sampling frame does not provide a list of all potential respondents, but rather a list of the places in which respondents might be found. In cluster sampling, the natural segment (or cluster) is the sampling unit used. In this method, the sampling frame is identified, and from this population, specific clusters are chosen, either through simple or stratified random sampling. The technique of controlling the size of the samples selected from different subgroups of the population is known as stratification. By using this technique, the population is divided into theoretically meaningful or empirically important strata before the sample is drawn. In this study, the sampling first targeted five industry types which served as clusters: (A) electronics, (B) utilities, (C) mining, (D) government, (E) aerospace.

In multistage sampling, a cluster is chosen from a sampling frame, then this cluster is sampled as well (Crano & Brewer, 1986, p. 183). In this study, the three sub-clusters include: (a) purchasing managers, (b) buyers, and (c) internal customers. Sampling respondents were chosen randomly from the selected organization in three subclusters from five clusters. This permitted a sample to be selected for each of the strata. A proportionate stratified sampling from each cluster ensures that this study draws a balanced group of respondents from (A) electronics, (B) utilities, (C) mining, (D) government and, (E) aerospace. This study

also drew balanced respondents from the subclusters: (a) purchasing managers, (b) buyers, and (c) internal customers. The respondents from subclusters were drawn in a random fashion, as the purchasing executives were asked to randomly distribute the questionnaire to the internal customers. It was desirable to have three organizations from each cluster and a minimum of three respondents from each organization in each subcluster.

Random sampling serves two fundamental goals: efficiency and economy. Efficiency refers to balancing the costs of conducting a sampling survey in relation to the precision of research results. One of the central preoccupations of many sampling approaches is devising means by which the precision of estimates can be enhanced without resorting to an unmanageable sample size, or to provide population values of low variability. Economy refers to the reduction of the expenses involved in sampling and data collection (Crano and Brewer, 1986, p. 182).

In a random sample, every member of the population has an equal probability of being selected every time a unit is drawn for inclusion in the sample. The probability of selection is equal to the sampling fraction, and is calculated simply by dividing the number of units to be included in the sample by the total number of units in the population.

A target sample was selected from several states,

ranging from the east to west coasts. Figure 3.1 shows the clusters and subclusters in this study.

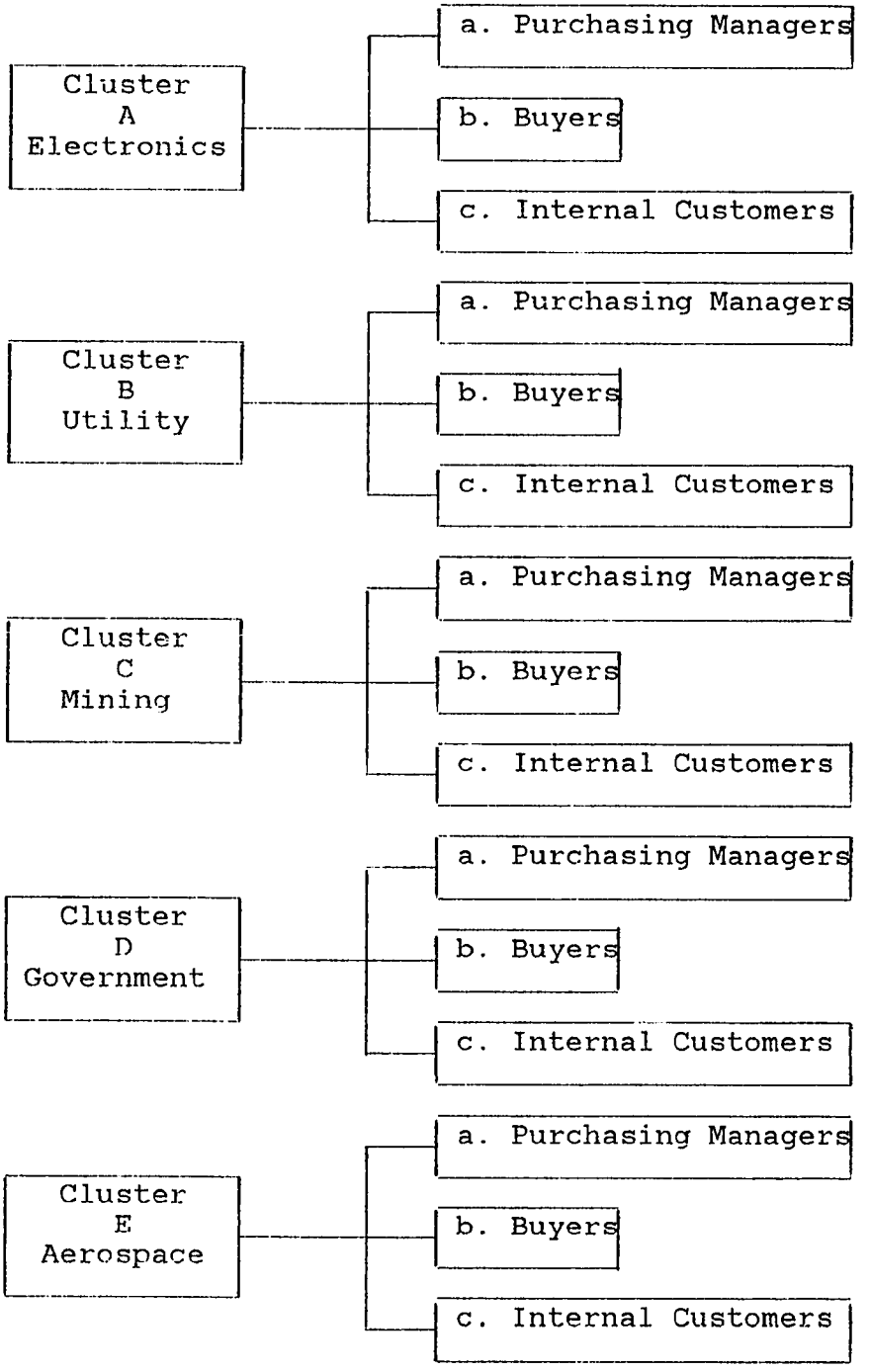


Figure 3.1
Clusters and Subclusters

To reach the target sample, the data collection in this study was performed in two phases. The first phase involved contacting the purchasing executives in the organizations from the five clusters in the target sample. The purchasing executives were informed about the purpose and the procedure of this survey, and asked to select randomly an equal number (between three and five) of purchasing managers, buyers, and internal customers to complete the survey questionnaires.

In the second phase, the survey questionnaires were delivered, via purchasing executives, to the respondents in the participating organizations. A self-addressed and stamped return envelope was enclosed so that the respondent could return the questionnaire directly to the researcher and the information the respondent provided could be kept confidential. Follow-up techniques were applied in order to obtain a desirable response rate.

Three hundred questionnaires were initially sent out to the respondents through the contacts of the purchasing executives in 15 large organizations. An additional 150 questionnaires were sent to those 15 organizations from which insufficient responses were received. Meanwhile, the purchasing executives in three additional organizations were contacted for cooperation in this survey. Sixty five questionnaires were delivered to those three organizations. Two hundred and sixty one questionnaires were returned by the deadline. Two hundred and fifty eight questionnaires

were completed. In order to balance groups and subgroups, one utility company was dropped from this study, since no internal customers from that company responded. Another utility company, later contacted, was dropped from this study, because the research received enough responses from three companies in this industry. One mining company, later contacted, was also dropped from this study. Thus, 240 usable responses were obtained for this study out of 483 questionnaires sent to those 15 organizations. The returned questionnaires represent a 50 percent response rate. Table 3.1 shows the distribution of respondents in matrix form of the clusters and subclusters.

Table 3.1

Matrix of the Clusters and Subclusters

	Subclusters & #			
Clusters & Respondents	Purchasing Managers	Buyers	Internal Customers	Subtotal
A. Electronics 3	14	12	14	40
B. Utilities 3	14	23	19	56
C. Mining 3	9	12	23	44
D. Government 3	13	15	15	43
E. Aerospace 3	21	14	22	57
Subtotal	71	76	93	240

3.5 Models

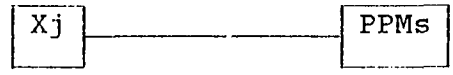
The relationships between purchasing performance measures and five industry types can be expressed by the following model:

where:

Xi: Five industry types (clusters) -- (A) electronics, (B) utilities, (C) mining, (D) government, (E) aerospace

PPMs: Purchasing performance measures (dependent variables)

The relationships between purchasing performance measures and three respondent groups can be expressed by the following model:



where:

Xj: Three respondent groups (subclusters) -- (a) purchasing managers, (b) buyers, and (c) internal customers

PPMs: Purchasing performance measures (dependent variables)

The relationships between purchasing performance measures and purchasing responsibilities can be expressed by the following model:

where:

MEAs: Mediators -- Purchasing responsibilities

PPMs: Purchasing performance measures (dependent variables)

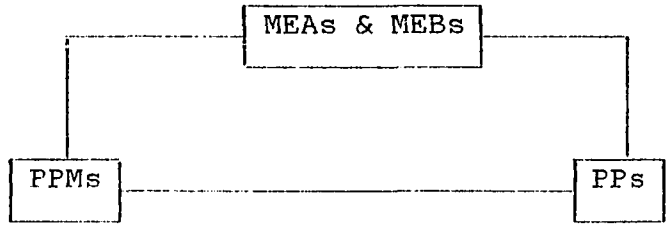
The relationships between purchasing performance measures and the types of commodities purchasing handles can be expressed by the following model:

where:

MEBs: Mediators -- commodities that purchasing handles

PPMs: Purchasing performance measures (dependent variables)

The relationships between purchasing performance and purchasing performance measures, purchasing responsibilities and the types of commodities purchasing handles can be expressed by the following model:



where:

PPMs: Purchasing performance measures

MEAs: Mediators -- Purchasing responsibilities

MEBs: Mediators -- commodities that purchasing handles

PPs: New dependent variables -- purchasing performance

3.6 Hypotheses

The basic questions addressed in this study are to examine:

1. The differences and similarities of the relative importance of selected purchasing performance measures across the five industry types;
2. The differences and similarities of the selected purchasing performance measures in terms of their relative importance among the three selected respondent groups;
3. The relationships between the levels of purchasing responsibilities and the weights of the selected purchasing performance measures;
4. The relationships between the selected commodities that purchasing handles and the weights of the selected purchasing performance measures;
5. The relationships between the respondents' evaluation of their organization's purchasing performance and the weights of the selected purchasing performance measures, purchasing responsibilities, commodities that purchasing handles.

These are formulated into the following hypotheses:

H1: There is no significant difference in weighting the relative importance of the selected purchasing performance measures across the five industry

types.

The alternative hypothesis is that there is(are) significant difference(s) in weighting the relative importance of the selected purchasing performance measures across the five industry types.

Since the dependent variables are of an interval nature and independent variables are of a nominal nature, parametric statistics can be used in the data analysis (Davis and Cosenza, 1985, p. 137). Multivariate Analysis of Variance (MANOVA) in SPSSX is appropriate for testing this hypothesis. When a multivariate relationship is studied by proposing a dependency structure, data must include measures of a set of independent and dependent variables. The MANOVA procedure is a technique that examines the effect of a treatment (or grouping variables) on two or more dependent variables. MANOVA specifies dependent variables that are continuous variables, factors that are categorical variables, and covariates that are also continuous variables. Since MANOVA enables researchers to specify dependent variables with any combination of factor or covariates or both, it makes it easier to handle the data collected for this study (SPSSX, p. 479).

MANOVA uses the general linear model and follows a similar set of assumptions as an ANOVA. These assumptions are:

1. The dependent (or response) variable is normally

distributed in each of the populations being compared.

2. The distributions of the dependent variable in each population have the same variance. This assumption is called homogeneity of variance.

The MANOVA technique is analogous to univariate ANOVA, but with two important differences:

1. MANOVA provides more total information than performing single ANOVAs on each dependent variable in an analysis.

2. The use of MANOVA takes into consideration the fact that the dependent variables are correlated in some way. This, in itself, may hinder the analysis if separate ANOVAs are used (Davis & Cosenza, 1985, p. 411).

H1 in this study tests dependencies on ten dependent variables across five industry types. Ten ANOVAs can be run separately. This would produce ten separate F tests. These F tests, by chance alone, could be statistically significant. This way, the researcher could neither assess nor report the combined differences across groups on the two variables. Furthermore, independent ANOVAs could not take the correlations among dependent variables into account, while MANOVA calculates a combined set of parameters representing the dependent variables in the analysis. The test statistic needed to reject the null hypothesis is a

multivariate F statistic (Davis & Cosenza, 1985, p. 412).

In general, the null hypotheses in the MANOVA procedure are stated as: all of the k population distribution functions are identical, and alternatives are stated as: the k populations do not all have identical means. In this study, a 5% significance level for multivariate F was selected to determine whether to accept or reject the null hypothesis.

Multiple Discriminant Analysis was served as a supplement to MANOVA in the situations when MANOVA could not provide the research with satisfactory statistical results. Multiple Discriminant Analysis is a statistical analytical technique that examines the relationship between a nominally scaled dependent variable and a set of explanatory or independent variables. The set of independent variables must have interval scaling. Generally Multiple Discriminant Analysis is to determine whether a set of independent variables can significantly differentiate among two or more groups of study units. A 5% significance level was selected to reject or accept the null hypothesis.

If H1 is true, a conclusion may be drawn that these purchasing performance measures were equally weighted across the five industry types. It may provide meaningful information to researchers and practitioners as to whether they may use similar weights of purchasing performance criteria, regardless of the industry types.

If H1 is rejected, it may suggest that different types of organizations weight these criteria differently in achieving their corporate goals. It may also indicate that different organizations should have different emphases on these purchasing performance measures.

If H1 is rejected, these differences need to be further investigated in order to find out what differences exist across different types of industry. MANOVA's Univariate-F procedure involves examining the individual F statistics for each dependent variable in the analysis, and it is an appropriate means for the significant univariate effects. Based on the results of univariate-F tests on each dependent variable, multiple comparisons through the ANOVA procedure can be made to examine the similarities and differences between each pair of industry types (Davis, 1985, p. 412).

The following two sub-hypotheses are designed to examine the relationships between the objective set and subjective set of purchasing performance measures selected for this study and the five industry types.

H1a: There is no significant difference in weighting the relative importance of the selected objective purchasing performance measures across the selected five industry types.

H1b: There is no significant difference in weighting the relative importance of the selected subjective purchasing performance measures across the

selected five industry types.

The MANOVA procedure was also used to test these subset hypotheses. No data adjustment was made, since the study examines separately the objective measures and subjective measures. The decision rules stated for H1 also apply for these two subsets of hypotheses. If the null hypotheses are rejected, the study needs to investigate the differences by applying the ANOVA procedure. Multiple Discriminant Analysis is served as a supplement to MANOVA in testing these sub-hypotheses.

H2: There is no significant difference in weighting the relative importance of the selected purchasing performance measures among the three selected sub-cluster groups: purchasing managers, buyers, and internal customers.

H2a: There is no significant difference in weighting the relative importance of the five selected objective purchasing performance measures among the three selected subcluster groups.

H2b: There is no significant difference in weighting the relative importance of the five selected subjective purchasing performance measures among the three selected subcluster groups.

This set of hypotheses tests the relationship between purchasing performance measures and the three selected respondent groups: purchasing managers, buyers, and internal

customers. The MANOVA procedure was applied and a 5% significance level for multivariate-F statistics was selected to reject the null hypothesis. Multiple Discriminant Analysis was used as a supplement to MANOVA.

If H2 is true, it may indicate that the respondents have a generic view of the selected purchasing performance measures, regardless of their roles in purchasing activities. If the null hypothesis is rejected, the differences exist in terms of weighting these selected purchasing performance measures. Balanced purchasing performance measures from the three subcluster groups should be sought for achieving corporate goals.

If H2a and H2b are true, it would provide purchasing with a broad base of support for the set of purchasing performance measures (objective and subjective). A purchasing performance evaluation instrument then may be obtained.

If H2a and H2b are rejected, it would be interesting to find how the subcluster groups (purchasing managers, buyers, and internal customers), differ in their weights over these five objective and five subjective measures. These findings would provide insights for better understanding the relationship and the role of the purchasing function in the organization.

H3: There is no significant relationship between the weights of the selected purchasing performance

measures and the levels of purchasing responsibilities.

H3 simply states that the purchasing performance measures and purchasing responsibilities are mutually independent. In other words, H3 states that there is no correlation between the purchasing performance measures and purchasing responsibilities.

Since the data on purchasing responsibilities collected for this study are in interval form, the MANOVA procedure is also appropriate to test H3. As discussed earlier, Multivariate-F tests were performed through the MANOVA procedure; a 5% significance level was selected to reject the null hypothesis.

If H3 is accepted, it indicates that the purchasing performance measures and the set of purchasing responsibilities are independent.

If H3 is rejected, it indicates that the purchasing performance measures are related to the purchasing responsibilities selected for this study. Further investigations of all responsibilities associated with purchasing performance measures were performed using the MANOVA procedure. In other words, if H3 is rejected, when the significance level of multivariate F is less than 5%, univariate F-tests would be generated to find out in what dependent variables the significance exists. Then, regression analyses from the MANOVA procedure would be

conducted to test the significance between each dependent variable (purchasing performance measure) and each mediator (purchasing responsibility) via a t-Test. Attention should be paid only to the relationships between the dependent variables and independent variables when univariate F-tests show less than 5% significance level.

H4: There is no significant relationship between the weights of the selected purchasing performance measures and the selected commodities which purchasing handles.

As discussed in testing H3, the MANOVA procedure is also appropriate to test H4. The same decision rules for testing H3 are also applied to H4. The null hypothesis is rejected if the significance level of multivariate-F is less than 5%.

If H4 is accepted, it indicates that the purchasing performance measures and the types of commodities purchasing handles are independent. Therefore, a single set of purchasing performance measures can be applied to evaluate the purchasing function, regardless of what types of commodities it buys.

If H4 is rejected, it indicates that the purchasing performance measures are correlated with the types of commodities purchasing handles. Further investigations of univariate F-tests aid in determining what relationships exist between the purchasing performance measures and the

types of commodities purchasing handles.

In the last part of the questionnaire, respondents were asked to evaluate the performance of their purchasing department on the ten purchasing performance measures used in this study. This was done to determine if respondents assigned weights to the purchasing performance measures based, in part, on their evaluation of how well the firm was performing on each of the criteria. Relationships between performance evaluations and the mediator variables can also be tested. The following hypotheses were formulated:

H5: There are no significant interrelationships between the respondents' ratings of their organization's purchasing performance and the weights assigned to the selected purchasing performance measures, purchasing responsibilities, commodities purchasing handles.

H5a: There is no significant relationship between the respondents' ratings of their organization's purchasing performance and the weights assigned to the selected purchasing performance measures.

H5b: There is no significant relationship between the respondents' ratings of their organization's purchasing performance and the selected purchasing responsibilities.

H5c: There is no significant relationship between the respondents' ratings of their organization's

purchasing performance and the commodities purchasing handles.

The purpose of H5 is to test the relationships between these variables, by using the respondents' ratings of their organization's purchasing performance as dependent variables, the weights assigned to the selected purchasing performance measures, and the responsibilities and commodities as independent variables.

The alternative hypothesis of H5 is that there is a significant relationship between the respondents' ratings of their organization's purchasing performance and the weights assigned to the selected purchasing performance measures, purchasing responsibilities, and types of commodities purchasing handles. The decision rules for testing H1, H2, H3 and H4 are also appropriate for testing H5. The null hypothesis should be rejected at the 5% significance level in multivariate-F tests through the MANOVA procedure. Any set of variables in H5 should be dropped if it has no relationships with other sets of variables in the precedent tests in this study. Any hypotheses should also be dropped if the variables show no relationships among themselves.

The remaining hypotheses are designed to gain a better understanding of the nature of the relationships between the dependent, independent, and mediator variables.

The alternative hypothesis of H5a is that there are significant relationships between the respondents' ratings

of their organization's purchasing performance and the weights assigned to the selected purchasing performance measures. The alternative hypothesis of H5b is that there are significant relationships between the respondents' ratings of their organization's purchasing performance and the selected purchasing responsibilities. The alternative hypothesis of H5c is that there are significant relationships between the respondents' ratings of their organization's purchasing performance and the commodities purchasing handles.

3.7 Analyses

Statistical analyses were performed to find, as objectives of this study, the relationships between the variables of the questions of interest discussed earlier within the five industry types (clusters) and three respondent groups (subclusters). The procedures are as follows:

1. A series of frequency tables were generated to identify certain numerical relationships between the variables of interest.
2. Pearson correlation coefficients were performed to see the relative strength of linear association between the variables (Pfaffenberger, 1981).
3. Based on the results from the first two analyses, multiple analysis of variance (MANOVA) was appropriate for testing the hypotheses. Multiple

Discriminant Analysis in SPSSX procedure was also applied to supplement MANOVA.

Table 3.2 presents a summary of the hypotheses, variables, scaling, and analysis procedures.

Table 3.2

Hypotheses, Variables, Scaling and Analyses

Hypothesis	Variables	Scaling	Analysis
H1: Differences in weighting PPMs across 5 industries	10 PPMs & 5 industries	Interval & nominal	MANOVA & Multiple Discriminant Analysis
H1a: Differences in weighting objective PPMs across 5 industries	5 objective PPMS & 5 industries	Interval & nominal	MANOVA & Multiple Discriminant Analysis
H1b: Differences in weighting subjective PPMs across 5 industries	5 subjective PPMs and 5 industries	Interval & nominal	MANOVA & Multiple Discriminant Analysis
H2: Differences in weighting PPMs among 3 respondent groups	10 PPMs & 3 respondent groups	Interval & nominal	MANOVA & Multiple Discriminant Analysis
H2a: Differences in weighting objective PPMS among 3 respondent groups	5 objective PPMS & 3 respondent groups	Interval & nominal	MANOVA & Multiple Discriminant Analysis

Table 3.2 (Continued)

Hypothesis	Variables	Scaling	Analysis
H2b: Differences in weighting subjective PPMS among 3 respondent groups	5 subjective PPMS & 3 respondent groups	Interval & nominal	MANOVA & Multiple Discriminant Analysis
H3: Relationships between PPMs & MEAs	10 PPMs & 25 MEAs	Interval	MANOVA
H4: Relationships between PPMs and MEBs	10 PPMs & 7 MEBs	Interval & Nominal	MANOVA
H5: Inter-relationships among PPs, MEAs, MEBs & PPMs	10 PPs, 25 MEAs, 7 MEBs & 10 PPMs	Interval & Nominal	MANOVA
H5a: Relationships between PPs & PPMS	10 PPs & 10 PPMs	Interval	MANOVA
H5b: Relationships between PPs & MEAs	10 PPs & 25 MEAs	Internal	MANOVA
H5c: Relationships between PPs & MEBs	10 PPs & 7 MEBs	Interval & Nominal	MANOVA

3.8 Summary

This chapter has described the research methodology, including the research objectives, variables selection, validity of this study, sample and data collection, tentative models, hypotheses, and analysis.

The three objectives this study are to:

1. Examine dimensions of purchasing performance measurement;
2. Obtain a better understanding of the interrelationships between the dimensions of purchasing performance measurement;
3. Expand the body of knowledge of purchasing performance measurement and provide some insights to practitioners for improving purchasing effectiveness and efficiency.

Ten dependent variables of purchasing performance measures were selected. An interval measurement scale was used for these ten dependent variables. Five types of industry and three respondent groups served as independent variables. The measurement of these independent variables was nominal (categorical). Twenty five purchasing responsibilities were treated as mediators with interval measurements. Seven commodity types were treated also as mediators with nominal measurements.

The validity of this study is based on the research theory and pilot study. This study satisfies both internal

and external validity requirements.

The data were collected by sending questionnaires to the respondents. A 50% response rate was achieved, which provides a valid sample size for data analyses.

The models show only a general framework among the variables. The relationships of these models need to be explored.

Five basic hypotheses are derived to examine the relationships among the variables. The key relationships of these variables include:

1. The relationships between the weights of the purchasing performance measures and five types of industry;
2. The relationships between the weights of the purchasing performance measures and three respondent groups;
3. The relationships between the weight of the purchasing performance measures and the levels of purchasing responsibilities;
4 The relationships between the weights of purchasing performance measures and the types of commodities purchasing handles;
5. The relationship between the respondents' ratings of their organization's purchasing performance and the weights of purchasing performance measures, the levels of purchasing responsibilities and the

types of commodities purchasing handles.

The MANOVA procedure is used in data analyses. The decision rules are to reject the null hypotheses if multivariate F-tests indicate less than 5% significance. Discriminant Analysis is applied as a supplement to the MANOVA procedure.

The research results are presented in Chapter 4.

CHAPTER 4

RESEARCH RESULTS

This chapter presents the results of this research. Five basic research questions were examined in this study:

4.1 The differences and similarities in weighting the selected purchasing performance measures across the five selected industry types.

4.2 The differences and similarities in weighting the selected purchasing performance measures among the three selected respondent groups.

4.3 The relationships between the purchasing responsibilities and the weights of the selected purchasing performance measures.

4.4 The relationships between the selected commodities purchasing handles and the weights of the selected purchasing performance measures.

4.5 The relationships between the respondents' ratings of their organizations' purchasing performance and the weights of the selected purchasing performance measures, purchasing responsibilities, and commodities purchasing handles.

This chapter discusses these questions with a presentation of research results and data analyses, and then concludes with a summary of the results.

4.1 The Differences and Similarities in Weighting the Selected Purchasing Performance Measures across the Five Selected Industry Types

The following hypotheses were formulated based on an examination of the differences and similarities of the relative importance of selected purchasing performance measures across the five selected organizational categories:

H1: There is no significant difference in weighting the relative importance of the selected purchasing performance measures across the five selected industry types.

The alternative hypothesis is that there is(are) significant difference(s) in weighting the relative importance of the selected purchasing performance measures across the five industry types.

To further investigate the relationships between the objective set and subjective set of the purchasing performance measures and five selected industry types, additional hypotheses were formulated:

H1a: There is no significant difference in weighting the relative importance of the selected objective purchasing performance measures across the five selected industry types.

H1b: There is no significant difference in weighting the relative importance of the selected subjective purchasing performance measures across the five selected industry types.

The mean values on ten dependent variables across the five selected industry types were generated from the frequency procedure in SPSSX. The following table presents all the mean weights across the five selected industry types and the overall mean weights of all industry types.

Table 4.1

Mean Weights on PPMs across Clusters
(Measures Adjusted)

Measures	Mean Weights ELEC.	UTIL.	MINING	GOVERN.	AERO	All Groups
ON-TIME	13.87	14.21	14.04	10.71	15.81	13.88
ACCURACY	7.60	11.43	10.04	9.81	8.64	9.58
QUALITY	16.65	13.06	13.85	15.04	14.74	14.55
PO CYCLE	6.70	8.69	9.94	11.18	7.85	8.83
AC/TARGET	7.95	6.54	8.62	8.01	11.03	8.49
KNOWLEDGE	11.39	10.48	11.16	12.28	8.21	10.54
NEGOTIATE	9.81	8.84	8.97	7.87	9.21	8.94
SUPPLIER	8.41	8.57	8.67	7.51	7.74	8.18
TEAMING	9.61	7.88	6.35	8.05	7.78	7.90
PROFESSIO	8.03	10.31	8.37	9.54	8.99	9.12

Figure 4.1 on the following page gives a visualized comparison of the mean weights across the five industry types.

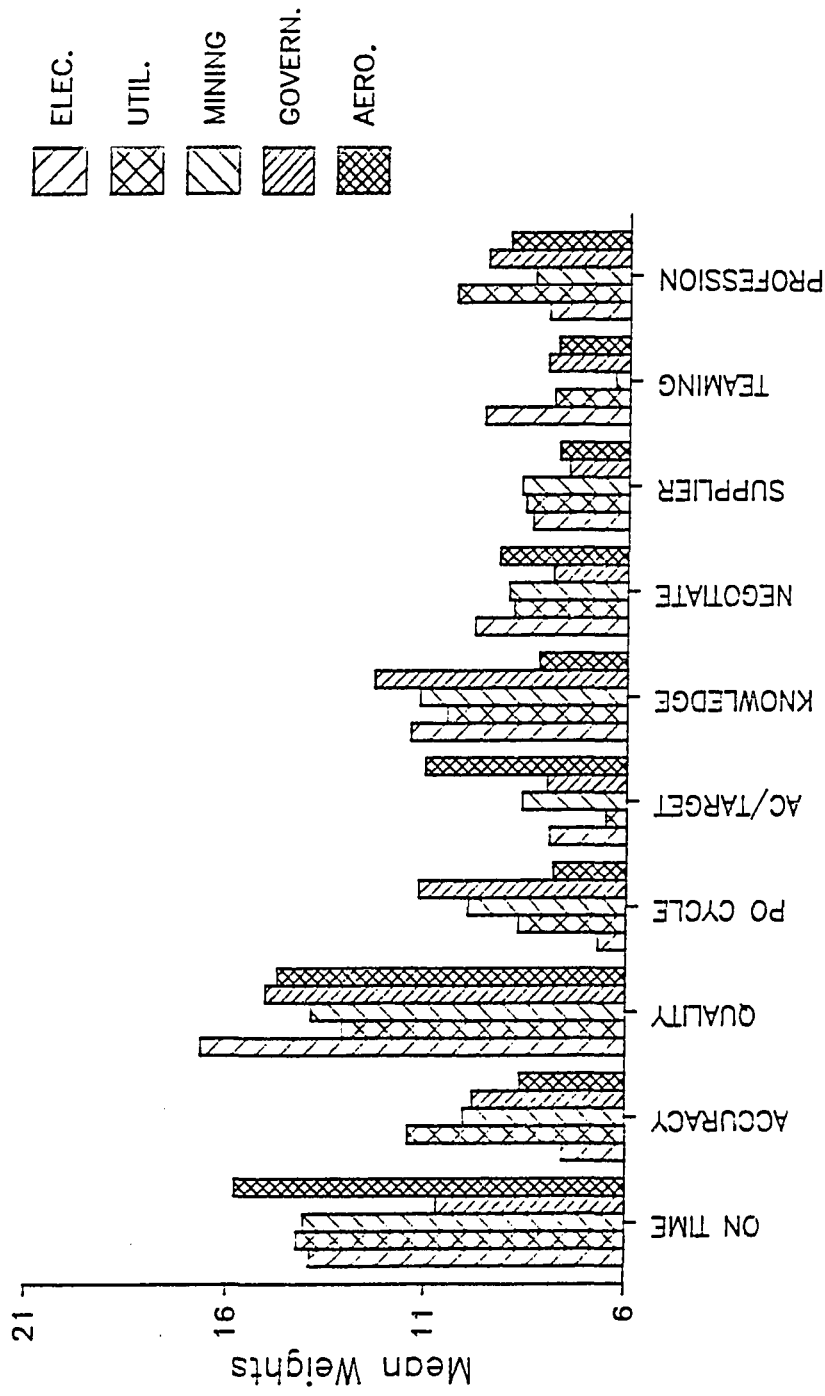


Figure 4.1
Adjusted Mean Weights on PPMs across Clusters

The Multivariate Analysis of Variance (MANOVA) in SPSSX procedure was performed to test H1. The decision rule is to reject the null hypothesis if the multivariate-F significance level is less than or equal to 5%. The multivariate-F tests show that the significance level is zero. Therefore H1 is strongly rejected.

Detailed investigations of the relationships between the dependent variables and the five selected industry types were conducted, also through the MANOVA procedure. Table 4.2 presents the results from the MANOVA procedure and the univariate F test results and their significance levels on the individual purchasing performance measures.

Table 4.2

MANOVA Results on PPMs across Clusters
(Measures Adjusted)
(Multivariate F = 0.00)

Measures	Univariate F	Sig.
ON-TIME	2.38	0.05
ACCURACY	2.51	0.04
QUALITY	1.18	NS
PO CYCLE	2.64	0.03
AC/TARGET	5.00	0.00
KNOWLEDGE	3.77	0.01
NEGOTIATE	0.97	NS
SUPPLIER	0.67	NS
TEAMING	2.50	0.04
PROFESSIONALISM	1.44	NS

NS = Not Significant

The univariate F tests show that significance levels are at or below 5% on more than one measure, therefore, the null hypothesis is rejected. Table 4.2 indicates that there

are significant differences across the five selected industry types on the following six measures: On-Time delivery, Accuracy, P.O. Cycle Time, Actual vs Target Costs, Commodity Knowledge, Teaming, while there are no statistically significant differences across the five selected industry types on the rest of the measures at the 5% significance level.

The focus should be placed then on the differences between the types of industry. As stated in Chapter 3, the ANOVA procedure in SPSSX was used to examine in detail the differences among the dependent variables of each pair in five industry types. The significance level of F-tests was set at the 5% level. The following table shows that the significance levels are less than 5% on the F-tests for each pair of industry types listed.

Table 4.3

ANOVA Results on PPMs across Clusters
(Paired Comparisons, Measures Adjusted)

Measure: On-Time Delivery
(Univariate F = 0.05)

Clusters	F	Sig.
Mining & Government	4.51	0.04
Government & Aerospace	10.07	0.00

Measure: Accuracy
(Univariate F = 0.04)

Clusters	F	Sig.
Electronic & Utility	6.38	0.01
Utility & Aerospace	4.61	0.03

Measure: PO Cycle Time
(Univariate F = 0.03)

Clusters	F	Sig.
Electronic & Mining	5.05	0.03
Electronic & Government	5.39	0.02
Government & Aerospace	4.33	0.04

Measure: Actual vs. Target Cost
(Univariate F = 0)

Clusters	F	Sig.
Electronic & Aerospace	7.30	0.01
Utility & Aerospace	18.06	0.00
Mining & Aerospace	4.35	0.04
Government & Aerospace	6.74	0.01

Table 4.3 (Continued)

Measure: Commodity Knowledge
(Univariate F = 0.01)

Clusters	F	Sig.
Electronic & Aerospace	9.30	0.00
Utility & Aerospace	5.72	0.02
Mining & Aerospace	10.03	0.00
Government & Aerospace	15.40	0.00

Measure: Teaming
(Univariate F = 0.04)

Clusters	F	Sig.
Electronic & Mining	9.06	0.00
Mining & Government	3.83	0.05

In order to test H1a, the mean weights for unadjusted purchasing performance measures were obtained through the SPSSX frequency procedure. This way, the data were not adjusted, and more information was maintained.

Table 4.4

Mean Weights on Objective PPMs across Clusters
(Measures not Adjusted)

	Mean Weights					All
Measures	ELEC.	UTIL.	MINING	GOVERN.	AERO	Groups
ON-TIME	25.52	26.33	25.05	19.26	27.19	24.90
ACCURACY	14.43	20.77	17.64	17.95	14.72	17.20
QUALITY	32.08	23.46	24.66	28.12	25.61	26.46
PO CYCLE	12.45	17.55	17.64	20.16	13.47	16.22
AC/TARGET	15.55	11.88	15.02	14.51	19.00	15.23

The multivariate and univariate tests in MANOVA were performed to test H1a. The multivariate test for the objective measures shows the F significance level at 0.002.

Therefore, Hla is rejected. There are significant differences in weighting the selected purchasing performance measures across the five selected industry types. The univariate tests of the significance of each of these five objective measures are presented in the following table.

Table 4.5

MANOVA Results on Objective Measures
Across Clusters
(Measures not Adjusted)
(Multivariate F = 0.00)

Measures	Univariate F	Sig.
ON-TIME	3.09	0.02
ACCURACY	3.58	0.01
QUALITY	2.58	0.04
PO CYCLE	3.44	0.01
AC/TARGET	4.77	0.00

The study concludes that there are significant differences in weighting the objective measures across the clusters. A more in depth study of the univariate F tests showed that different weights could be found in all five measures. Comparisons of all the objective measures for each pair of industry types were performed through the ANOVA procedure in SPSSX. The results are presented below.

Table 4.6

ANOVA Results on PPMs across Clusters
(Paired Comparisons, Measures not Adjusted)

Measure: On-Time Delivery
(F Significance = 0.02)

Clusters	F	Sig.
Electronic & Government	5.10	0.03
Utility & Government	7.14	0.01
Mining & Government	4.97	0.03
Government & Aerospace	11.17	0.00

Measure: Accuracy
(F Significance = 0.04)

Clusters	F	Sig.
Electronic & Utility	7.40	0.01
Utility & Aerospace	10.14	0.00

Measure: Quality of Purchased Items
(F Significance = 0.04)

Clusters	F	Sig.
Electronic & Utility	8.03	0.01
Electronic & Mining	5.21	0.03
Electronic & Aerospace	4.95	0.03

Measure: PO Cycle Time
(F Significance = 0.01)

Clusters	F	Sig.
Electronic & Utility	4.05	0.05
Electronic & Mining	4.61	0.04
Electronic & Government	7.88	0.01
Mining & Aerospace	4.46	0.04
Government & Aerospace	8.82	0.00

Table 4.6 (Continued)

Measure: Actual vs. Target Cost
(F Significance = 0.00)

Clusters	F	Sig.
Electronic & Utility	4.02	0.05
Utility & Aerospace	19.16	0.00
Mining & Aerospace	5.17	0.03
Government & Aerospace	6.12	0.04

Table 4.7 shows the mean weights of the subjective purchasing performance measures across five industry types.

Table 4.7

Mean Weights on Subjective PPMs across Clusters
(Measures not Adjusted)

	Mean Weights					All
Measures	ELEC.	UTIL.	MINING	GOVERN.	AERO	Groups
KNOWLEDGE	24.25	23.50	26.27	28.53	19.74	24.14
NEGOTIATE	20.53	18.71	20.00	16.93	23.51	20.07
SUPPLIER	18.65	18.95	19.52	16.40	18.21	18.37
TEAMING	19.80	17.11	14.57	17.44	17.77	17.31
PROFESSIO	19.78	21.73	19.64	20.70	20.77	20.11

MANOVA was used to test H1b. Because the variables are linearly dependent, the multivariate-F test could not be performed, although univariate F tests showed significance for three measures: Commodity Knowledge, Negotiating Ability and Teaming. Multiple Discriminant Analysis was performed. The results show that there are significant differences across five industry types. Thus H1b is rejected. The MANOVA results are presented in Table 4.8.

Table 4.8

MANOVA Results on Subjective Measures across Clusters
(Measures not Adjusted)
(No Multivariate F)

Measures	Univariate F	Sig.
KNOWLEDGE	3.85	0.01
NEGOTIATE	3.66	0.01
SUPPLIER	0.97	NS
TEAMING	2.58	0.04
PROFESSIONALISM	2.02	NS

NS = Not significant

From the test results presented here, we reject H1, H1a and H1b. There are significant differences in weighting the purchasing performance measures, both the objective and subjective sets of purchasing performance measures across the five industry types.

4.2 The Differences and Similarities in Weighting the Selected Purchasing Performance Measures among the Three Selected Respondent Groups

The following hypotheses were formulated from an examination of the differences and similarities of the relative importance of selected purchasing performance measures among the three respondent groups of purchasing managers, buyers, and internal customers:

H2: There is no significant difference in weighting the relative importance of the selected purchasing performance measures among the three selected sub-cluster groups: purchasing directors, buyers, and internal customers.

The alternative hypothesis is that there is(are) significant difference(s) in weighting the relative importance of the selected purchasing performance measures among three respondent groups.

If H2 is true, it may indicate that the respondents would have a generic view of the selected purchasing performance measures, regardless of their roles in purchasing activities. If the null hypothesis is rejected, the differences would exist in terms of evaluating the selected purchasing performance measures. Balanced purchasing performance measures from the three subcluster groups should be sought for achieving corporate goals.

To further investigate the relationships between the objective set and subjective set of the purchasing performance measures and the respondent groups, these additional hypotheses were formulated:

H2a: There is no significant difference in weighting the relative importance of the five selected objective purchasing performance measures among the three selected subcluster groups.

H2b: There is no significant difference in weighting the relative importance of the five selected subjective purchasing performance measures among the three selected subcluster groups.

These two hypotheses test the differences and similarities of two sets of dependent variables: objective

purchasing performance measures and subjective purchasing performance measures. The independent variables involved in the tests are the three selected respondent groups: purchasing managers, buyers, and internal customers. MANOVA was applied to investigate the relationship between the purchasing performance measures and the three subclusters. A 5% significance level in the multivariate-F test was selected to reject the null hypotheses.

If H2a and H2b are true, it would provide purchasing with an acceptable set of purchasing performance measures (objective and subjective). A purchasing performance evaluation instrument could then be developed.

If H2a and H2b are rejected, it would be interesting to learn how subclusters differ in their weights of these five objective measures and five subjective measures. These findings would provide insights into different perceptions of the role of purchasing in the organization.

To test H2, the mean weights on all ten purchasing performance measures for the three subclusters were obtained through the frequency procedure in SPSSX. The results are in Table 4.9.

Table 4.9

Mean Weights on PPMs among Subclusters
(Measures Adjusted)

Measures	Mean Weights Managers	Buyers	Customers	All Groups
ON-TIME	14.28	11.82	15.25	13.88
ACCURACY	8.00	9.28	11.05	9.58
QUALITY	15.74	14.71	13.51	14.55
PO CYCLE	6.74	7.91	11.19	8.83
AC/TARGET	9.32	7.86	8.36	8.49
KNOWLEDGE	10.55	11.39	9.83	10.54
NEGOTIATE	9.34	9.51	8.17	8.94
SUPPLIER	8.38	8.79	7.52	8.18
TEAMING	8.41	8.26	7.20	7.90
PROFESSIONAL	9.24	10.49	7.92	9.12

Figure 4.2 gives visualized comparisons of the mean weights on all ten measures among the three respondent groups for evaluating the purchasing performance measures.

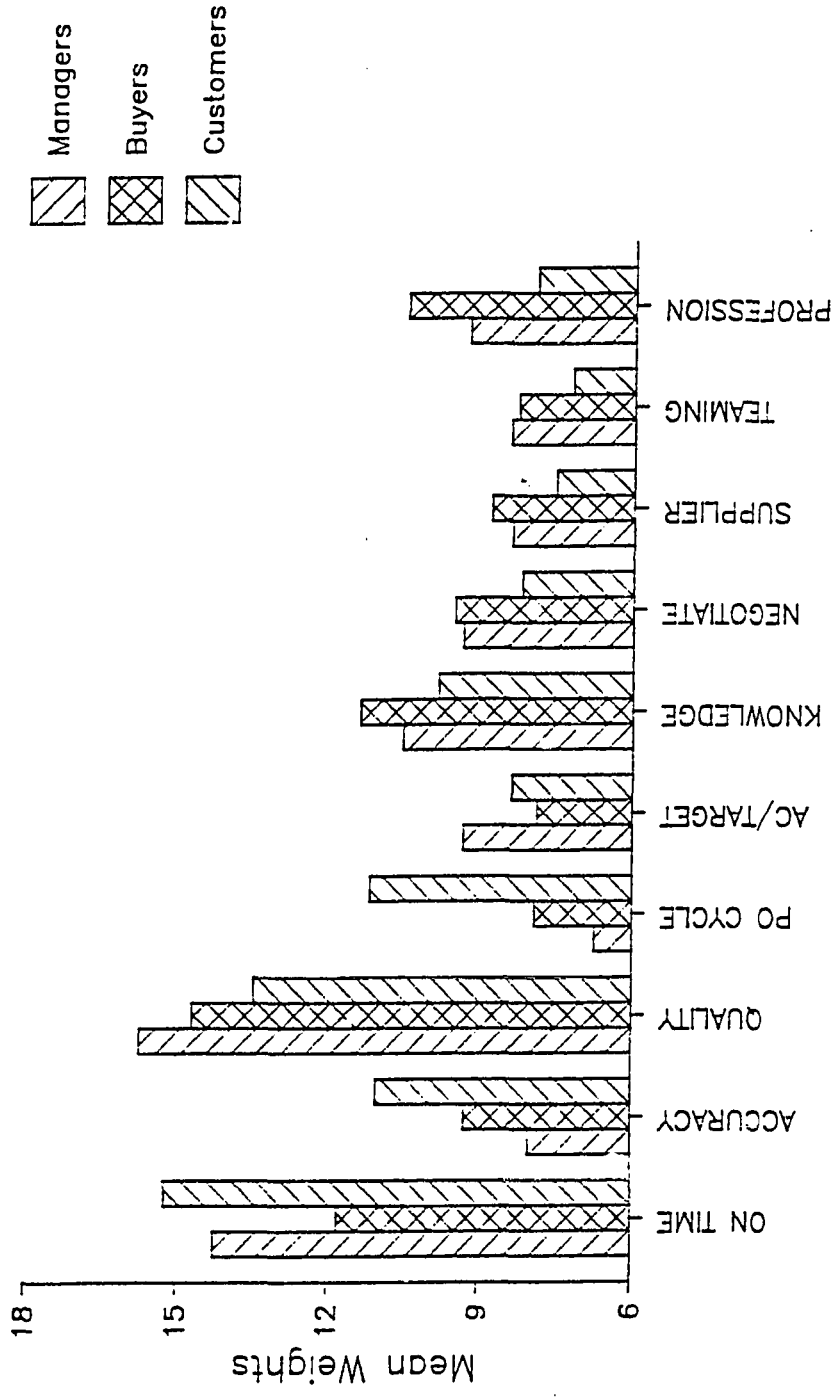


Figure 4.2

Adjusted Mean Weights on PPMs among Subclusters

The multivariate-F test and univariate-F tests were performed through MANOVA. The multivariate-F shows a significance value of 0.002. Therefore, H2 is rejected. The tests conclude that there are significant differences in evaluating these ten measures among the three respondent groups. The test results are illustrated in the following table.

Table 4.10

MANOVA Results on PPMs among Subclusters
(Measures Adjusted)
(Multivariate F = 0.002)

Measures	Univariate F	Sig.
ON-TIME	3.73	0.03
ACCURACY	4.75	0.01
QUALITY	1.44	NS
PO CYCLE	9.30	0.00
AC/TARGET	1.26	NS
KNOWLEDGE	1.52	NS
NEGOTIATE	2.14	NS
SUPPLIER	1.87	NS
TEAMING	1.61	NS
PROFESSIONALISM	5.14	0.01

NS = Not significant

The measures with significant univariate F values of less than 5%-- On-Time Delivery, Accuracy, PO Cycle Time and Professionalism -- were further investigated. The focus was on what differences exist between different industry types. As stated in Chapter 3, ANOVA was performed to make paired comparisons between the subclusters on these purchasing performance measures that show significant differences among the subclusters. Table 4.11 shows the ANOVA results.

Table 4.11

ANOVA Results on PPMs among Subclusters
(Paired Comparisons, Measures Adjusted)

Measure: On-Time Delivery
(F Significance = 0.03)

Subclusters	F	Sig.
Managers & Buyers	3.97	0.05
Buyers & Customers	6.70	0.01

Measure: Accuracy
(F Significance = 0.01)

Subclusters	F	Sig.
Buyers & Customers	10.67	0.01

Measure: PO Cycle Time
(F Significance = 0.00)

Subclusters	F	Sig.
Managers & Customers	14.72	0.00

Measure: Professionalism
(F Significance = 0.00)

Subclusters	F	Sig.
Buyers and Customers	9.86	0.00

It is interesting to learn that the majority of the differences exist between purchasing people and their internal customers. This may indicate that the two groups have different views about the purchasing function. It is important for the organizations to clarify these differences.

To test H2a, the mean weights of the objective measures

are presented in Table 4.12.

Table 4.12

Mean Weights on Objective PPMs among Subclusters
(Measures not Adjusted)

Measures	Mean Weights Managers	Buyers	Customers	All Groups
ON-TIME	26.48	22.76	25.44	24.90
ACCURACY	15.10	17.45	18.66	17.20
QUALITY	28.35	29.38	22.63	26.46
PO CYCLE	12.97	15.59	19.20	16.22
AC/TARGET	17.18	14.83	14.06	15.23

Unadjusted weights on five objective measures were used to test H2a. The multivariate-F test and univariate F tests were executed through the SPSSX procedure. The results are illustrated in the following table.

Table 4.13

MANOVA Results on PPMs among Subclusters
(Measures not Adjusted)
(Multivariate F = 0.00)

Measures	Univariate F	Sig.
ON-TIME	1.84	NS
ACCURACY	2.68	NS
QUALITY	5.74	0.00
PO CYCLE	5.96	0.00
AC/TARGET	2.53	NS

NS = Not significant

Based on the results from the table above, this study rejects H2a and concludes that there are significant differences in weighting these objective measures among the subclusters. ANOVA was applied to make paired comparisons on these measures that showed significant differences among

the subclusters. The results are shown below:

Table 4.14

ANOVA Results on PPMs among Subclusters
(Paired Comparisons, Measures Adjusted)

Measure: Quality of Purchased Items
(F Significance = 0.00)

Subclusters	F	Sig.
Managers & Customers	9.54	0.00
Buyers & Customers	8.30	0.00

Measure: PO Cycle Time
(F Significance =0.00)

Subclusters	F	Sig.
Managers & Customers	10.95	0.00

The mean weights of the subjective purchasing performance measures are presented in Table 4.15.

Table 4.15

Mean Weights on Subjective PPMs among Subclusters
(Measures not Adjusted)

Measures	Mean Weights Managers	Buyers	Customers	All Groups
KNOWLEDGE	23.04	24.22	24.91	24.14
NEGOTIATE	20.24	19.76	20.19	20.07
SUPPLIER	18.34	18.09	18.62	18.37
TEAMING	18.10	16.46	17.40	17.31
PROFESSIONALISM	20.28	21.46	18.87	20.11

The same procedure was followed to test H2b. Because the unadjusted weights of these subjective measures show linear dependency among the variables, the multivariate tests cannot be generated. The univariate tests results are

presented in Table 4.16.

Table 4.16

MANOVA Results on PPMS among Subclusters
(Measures not Adjusted)
(Multivariate F not available)

Measures	Univariate F	Sig.
KNOWLEDGE	0.05	NS
NEGOTIATE	0.06	NS
SUPPLIER	0.09	NS
TEAMING	0.84	NS
PROFESSIONALISM	1.76	NS

NS = Not significant

The univariate tests results show that the significance levels for all five measures were above 5%. Multiple Discriminant Analysis was performed to test the differences among the subclusters. The results do not show any significance. Therefore, this research accepts H2b.

4.3 The Relationships between the Purchasing Responsibilities and the Weights of the Selected Purchasing Performance Measures

The following hypotheses were formulated based on an examination of the relationships between the purchasing responsibilities and the selected purchasing performance measures:

H3: There is no significant relationship between the weights of the selected purchasing performance measures and purchasing responsibilities.

As discussed in Chapter 3, MANOVA was applied to test this hypothesis. The decision rule was if the multivariate-F test significance was less than or equal to 5%, the null

hypothesis should be rejected.

If H3 is accepted, it indicates that the purchasing performance measures selected for this study have nothing to do with purchasing responsibilities.

If the null hypothesis is rejected, further investigation on the relationships between purchasing performance measures and purchasing responsibilities is necessary.

Figure 4.3. presents the mean ranges across all the purchasing responsibilities from all the respondents in a descending order.

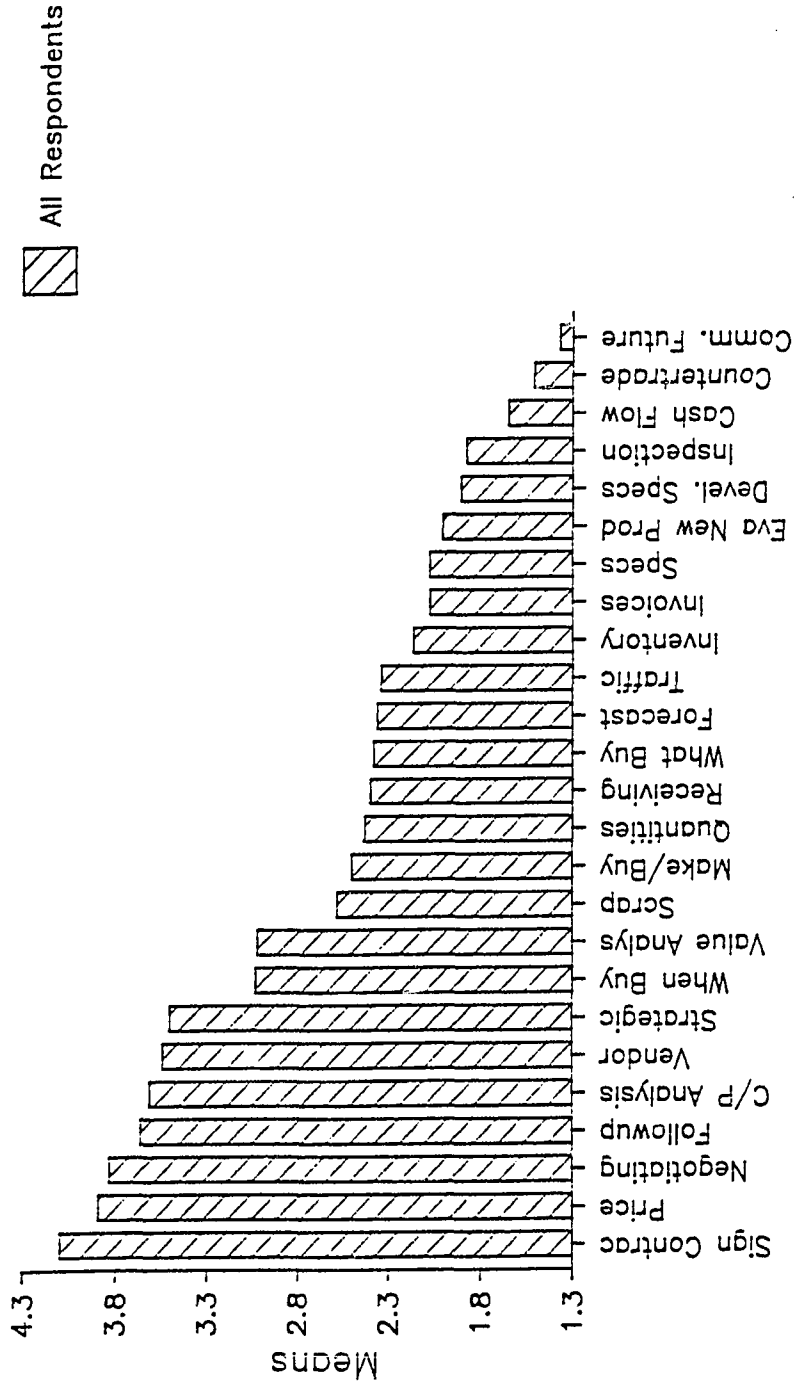


Figure 4.3

Mean Range of Purchasing Responsibilities

The multivariate F test presented in Table 4.17 shows that the significance of F is only 0.001. This strongly rejects the null hypothesis. The univariate tests on each measure provide clues to what significant relationships exist between purchasing performance measures and purchasing responsibilities. Table 4.17 shows these results.

Table 4.17

MANOVA Results on Relationships between PPMs & MEAs (Measures Adjusted) (Multivariate F = 0.00)

Measures	Univariate F	Sig.
ON-TIME	1.41	NS
ACCURACY	1.04	NS
QUALITY	0.93	NS
PO CYCLE	1.26	NS
AC/TARGET	2.25	0.00
KNOWLEDGE	1.54	NS
NEGOTIATE	1.66	0.03
SUPPLIER	0.96	NS
TEAMING	1.35	NS
PROFESSIONALISM	1.56	0.05

NS = Not significant

Significant relationships between purchasing performance measures and purchasing responsibilities exist for three variables. These variables are Actual vs Target Cost, Negotiating Ability, and Professionalism. Regression analyses, which are also available in the MANOVA procedure, were performed to examine the linear associations between purchasing performance measures and purchasing responsibilities. T statistics were obtained through the MANOVA procedure. The following table presents the results

of regression analyses between the measures and the corresponding purchasing responsibilities. The Beta values, which tell the slope of the regression lines, the t-values and the significance of t values are presented.

Table 4.18

Beta, t-Values and Significance of t Values between PPMs & MEAs

Measure: Actual vs Target Cost

Responsibilities	Beta	t-Value	Sig.
What to Buy	-0.21	-2.40	0.02
Vendor	-0.16	-2.08	0.01
Sign Contract	-0.23	-2.52	0.01
Negotiate	0.18	2.11	0.04
Receiving	0.24	2.36	0.02
Comm. Future	-0.16	-1.97	0.05
Countertrade	0.22	2.69	0.01

Measure: Negotiating Ability

Responsibilities	Beta	t-Value	Sig.
What to Buy	0.29	3.28	0.00
Traffic	-0.21	-2.38	0.02

Measure: Professionalism

Responsibilities	Beta	t-Value	Sig.
Sign Contract	0.24	2.60	0.01
Inventory	-0.23	-2.44	0.02

Seven responsibilities have significant relationships with purchasing performance measures over Actual vs Target Cost. The responsibilities Negotiating Contracts, Receiving, and Countertrade have positive relationships with this measure. The responsibilities Determining What Items

to Buy, Determining Source or Vendor, Signing Contracts or Orders, and Commodity Future Trading have negative relationships with this measure. However, the Beta values are all under 0.25.

Two responsibilities have significant relationships with Negotiating Ability: Determining What Items to Buy and Controlling Traffic. Determining What Items to Buy with a positive slope, indicates that the higher the responsibility, the more important is Negotiating Ability. Controlling Traffic has a negative slope. Neither Beta values are more than 0.30.

Two responsibilities have significant relationships with Professionalism: Signing Contracts or Orders and Determining Optimal Inventory Levels for Stocks of Materials. The former shows a positive slope with the dependent variable, while the latter shows a negative slope with the dependent variable.

Based on the information provided from MANOVA and the regression analyses, this study rejects the null hypothesis and concludes that there are significant relationships between purchasing performance measures and purchasing responsibilities. However, these figures should not be pushed too far in interpreting the relationships between the dependent variables and mediators. Some of the test results

showed the univariate-F significance at about or less than 10%.

4.4 The Relationships between the Selected Commodities Purchasing Handles and the Weights of the Selected Purchasing Performance Measures

The following hypotheses were formulated based on an examination of the relationships between purchasing performance and the commodities purchasing handles:

H4: There is no significant relationship between the weights of the selected purchasing performance measures and the selected commodities which purchasing handles.

As discussed in testing H3, MANOVA was applied to test the significance of this relation. Here an interval scale was used for the dependent variables, while an nominal scale was used for the mediator variables. MANOVA enables researchers to study the relationships between dependent variables and nominal variables. The decision rule is to reject the null if the multivariate-F has a significance level less than or equal to 5%.

If H4 is accepted, it indicates that the purchasing performance evaluation has nothing to do with what types of commodities purchasing handles. Therefore, a single set of purchasing performance measures can be applied to evaluate the purchasing function regardless of what types of commodities it buys.

If H4 is rejected, it indicates that the purchasing performance evaluation is correlated with the types of commodities purchasing handles. Further investigations of the relationships between grouped and paired variables should be conducted.

MANOVA tests between the weights of purchasing performance and each individual type of the commodities were performed. The results show that there are no significance differences between the two sets of variables. Therefore, this research accepts H4.

4.5 The Relationships between the Respondents' Ratings of their Organizations' Purchasing Performance and the Weights of the Selected Purchasing Performance Measures, Purchasing Responsibilities, and Commodities Purchasing Handles

To examine the relationships between/among the key dimensions of purchasing performance, the following hypotheses were formulated:

H5: There are no significant relationships between the respondents' ratings of their organizations' purchasing performance and the weights assigned to the selected purchasing performance measures, purchasing responsibilities and types of commodities purchasing handles.

H5a: There is no significant relationship between the respondents' ratings of their organizations' purchasing performance and the weights assigned to the selected purchasing performance measures.

H5b: There is no significant relationship between the respondents' ratings of their organizations' purchasing performance and the selected purchasing responsibilities.

The purpose of H5 is to examine the interrelationships between the sets of variables, by using respondents' ratings of their organizations' purchasing performance as dependent variables, the weights of the selected purchasing performance measures responsibilities and commodities as independent variables.

The alternative hypothesis of H5 is that there is a significant interrelationship between the respondents' ratings of their organization' purchasing performance and the weights assigned to the selected purchasing performance measures, purchasing responsibilities, and types of commodities purchasing handles. The decision rules for testing H1, H2, H3, and H4 are also appropriate to test H5. The null hypothesis should be rejected at the 5% significance level in Multivariate-F tests through the MANOVA procedure. The acceptance of H4 and a MANOVA test indicate that the commodities purchasing handles do not relate to purchasing performance measures. A MANOVA test also indicates that respondents' ratings of their organizations' purchasing performance was not related to the types of commodities purchasing handles. Therefore, the types of commodities purchasing handles were excluded in

further investigation.

The remaining hypotheses are designed to gain a better understanding of the nature of the relationships between the dependent, independent, and mediator variables.

The alternative hypothesis of H5a is that there are significant relationships between the respondents' ratings of their organizations' purchasing performance and the weights of the purchasing performance measures. The alternative hypothesis of H5b is that there are significant relationships between the respondents' ratings of their organizations' purchasing performance and the purchasing responsibilities.

H5c is dropped from the test, since there is no significant relationships between the respondents' ratings of their organizations' purchasing performance and the commodities purchasing handles. A MANOVA test was performed and proved that this was the case.

To test H5, the multivariate-F in the MANOVA procedure indicates that F equals zero. Therefore, the null hypotheses is rejected. The study concludes that there are significant interrelationships between the respondents' ratings of their organizations' purchasing performance and the weights of purchasing performance measures and purchasing responsibilities. The MANOVA test results for H5 are presented in the following table.

Table 4.19

MANOVA Results on
Relationships between PPs & PPMs with MEAs
(Measures Adjusted)
(Multivariate F = 0.00)

Performance	Univariate F	Sig.
ON-TIME	1.90	0.00
ACCURACY	1.39	NS
QUALITY	1.92	0.00
PO CYCLE	3.05	0.00
AC/TARGET	2.76	0.00
KNOWLEDGE	1.71	0.01
NEGOTIATE	2.33	0.00
SUPPLIER	1.99	0.00
TEAMING	1.54	0.04
PROFESSIONALISM	2.11	0.00

NS = Not significant

Table 4.20 presents beta, t-values and significance of t values which tell the relationships between the respondents' ratings of their organizations' purchasing performance and the weights of purchasing performance measures and the levels of purchasing responsibilities.

Table 4.20

Beta, t-Values and Significance of t Values between PPs and PPMs with MEAS (Measures Adjusted) (F Significance = 0.00)

Performance: On-Time Delivery

PPMs & MEAs	Beta	t-value	Sig.
Quantities	-0.21	-2.15	0.03
Make/Buy	0.15	2.01	0.05
Comm. Future	0.17	2.00	0.05

Performance: Quality of Purchased Items

PPMs & MEAs	Beta	t-value	Sig.
When Buy	0.22	2.82	0.01
Quantities	-0.28	-2.96	0.00

Performance: PO Cycle Time

PPMs & MEAs	Beta	t-value	Sig.
ON-TIME	43.30	2.40	0.02
ACCURACY	33.70	2.40	0.02
QUALITY	43.53	2.30	0.02
PO CYCLE	37.04	2.40	0.02
AC/TARGET	29.51	2.41	0.02
KNOWLEDGE	30.03	2.40	0.02
NEGOTIATE	24.03	2.40	0.02
SUPPLIER	22.77	2.40	0.02
TEAMING	24.84	2.40	0.02
PROFESSIONAL	27.47	2.40	0.02
What Buy	0.38	4.42	0.00
Quantities	-0.33	-3.69	0.00
Inspection	-0.22	-2.18	0.03
Scrap	0.15	2.03	0.04
C/P Analysis	0.20	2.38	0.02
Cash Flow	-0.20	-2.33	0.02
Countertrade	0.20	2.46	0.02

Table 4.20 (Continued)

Performance: Commodity Knowledge

PPMs & MEAs	Beta	t-value	Sig.
What Buy	0.24	2.64	0.01
Specs	0.25	2.54	0.01

Performance: Negotiating Ability

PPMs & MEAs	Beta	t-value	Sig.
What Buy	0.36	4.15	0.00
Quantities	-0.23	-2.46	0.02
C/P Analysis	0.27	3.07	0.00

Performance: Cultivating Qualified Suppliers

PPMs & MEAs	Beta	t-value	Sig.
Price	0.20	2.03	0.04
Evaluate New Prod.	-0.22	-2.33	0.02

Performance: Teaming

PPMs & MEAs	Beta	t-value	Sig.
What Buy	0.23	2.53	0.01
Inspection	-0.22	-2.06	0.04

Performance: Professionalism

PPMs & MEAs	Beta	t-value	Sig.
What Buy	0.22	2.52	0.01
When Buy	0.17	2.08	0.04
Invoices	0.20	2.26	0.03
C/P Analysis	0.30	3.42	0.00
Devel. Specs	0.20	2.03	0.04

To examine H5a, a study of the relationships between the respondents' ratings of their organizations' purchasing performance and the weights assigned to the selected

purchasing performance measures, the MANOVA test provides a zero multivariate F value. Thus H5a is rejected. There are significant relationships between PPs and PPMs. Table 4.21 gives more detailed results.

Table 4.21

MANOVA Results on
Relationships between PPs and PPMs
(Measures Adjusted)
(Multivariate F = 0.00)

Performance	Univariate F	Sig.
ON-TIME	2.80	0.00
ACCURACY	1.94	0.04
QUALITY	2.09	0.03
PO CYCLE	3.80	0.00
AC/TARGET	2.28	0.02
KNOWLEDGE	2.33	0.01
NEGOTIATE	1.72	NS
SUPPLIER	3.41	0.00
TEAMING	1.42	NS
PROFESSIONALISM	3.03	0.00

NS = Not significant

Significant univariate-F values can be found for all criteria, except Negotiating Ability and Teaming. Therefore, H5a is rejected. There are significant relationships between the respondents' ratings of their organizations' purchasing performance and the weights assigned to the selected purchasing performance measures.

The MANOVA results concerning H5b showed that the multivariate-F is zero. Therefore, the null hypothesis is rejected. There is a significant relationship between purchasing performance criteria and purchasing responsibilities. Table 4.22 presents the details.

Table 4.22

MANOVA Results on
Relationships between PPs and MEAs
(Measures Adjusted)
(Multivariate F = 0.00)

Performance	Univariate F	Sig.
ON-TIME	1.53	NS
ACCURACY	1.39	NS
QUALITY	1.81	0.01
PO CYCLE	2.79	0.00
AC/TARGET	2.40	0.00
KNOWLEDGE	1.48	NS
NEGOTIATE	2.71	0.00
SUPPLIER	1.37	NS
TEAMING	1.90	0.01
PROFESSIONALISM	1.86	0.00

NS = Not significant

The detailed examinations with beta, t-values and significance of t values through MANOVA procedure that check the linear associations between each dependent variable and the whole set of independent variables are shown in Table 4.23.

Table 4.23

Beta, t-Values and Significance of t Values between PPs and MEAS (Measures Adjusted) (Multivariate F = 0.00)

Performance: Quality of Purchased Items

Responsibilities	Beta	t-value	Sig.
When Buy	0.24	2.87	0.01
Quantities	-0.24	-2.53	0.01

Performance: PO Cycle Time

Responsibilities	Beta	t-value	Sig.
What Buy	0.18	2.14	0.03
When Buy	0.20	2.54	0.01
Quantities	-0.30	-3.32	0.00
Followup	0.20	2.71	0.01
Comm. Future	0.16	1.98	0.05

Performance: Actual vs Target Cost

Responsibilities	Beta	t-value	Sig.
What Buy	0.30	3.51	0.00
Quantities	-0.35	-3.79	0.00
Inspection	-0.22	-2.20	0.03
Scrap	0.16	2.11	0.04
C/P Analysis	0.24	2.73	0.01

Performance: Negotiating Ability

Responsibilities	Beta	t-value	Sig.
What Buy	0.40	4.76	0.00
Quantities	-0.22	-2.37	0.02
C/P Analysis	0.28	3.32	0.00

Table 4.23 (Continued)

Performance: Teaming

Responsibilities	Beta	t-value	Sig.
What Buy	0.24	2.70	0.01
Sign Contract	0.20	2.21	0.03
Inspection	-0.25	-2.25	0.02

Performance: Professionalism

Responsibilities	Beta	t-value	Sig.
What Buy	0.23	2.59	0.01
Sign Contract	0.21	2.28	0.02
Invoices	0.19	2.21	0.03
C/P Analysis	0.32	3.60	0.00
Devel. Specs	0.22	2.11	0.04

To summarize the findings in this study, H5, H5a, and H5b are all rejected. This study concludes that there are significant interrelationships between the respondents' ratings of their organizations' purchasing performance and the weights assigned to the selected purchasing performance measures and purchasing responsibilities.

4.6 Summary

This chapter has presented the research results. It will conclude with a summary of the research results in response to five major research questions. Table 4.24 summarizes the results of this research.

Table 4.24

Summary of Hypothesis Tests

Hypothesis	Results	Explanations
H1: No Significant differences in weighting PPMs across five industry types.	Reject H1. Significant differences exist at 0.000 level.	Quality of Purchased Items was the most important measure, followed by On-Time Delivery, Commodity Knowledge, and Accuracy. Government weighted On-Time Delivery less than Mining and Aerospace. Electronic and Aerospace weighted Accuracy lower than Utility. Electronic and Aerospace weighted PO Cycle Time lower than Mining and Government. Electronic, Utility, Mining, Government weighted Actual vs Target Cost less important than Aerospace. Aerospace weighted Commodity Knowledge less important than the others. Mining weighted Teaming less important than Electronic and Government.

Table 4.24 (Continued)

Hypothesis	Results	Explanations
H1a: No Significant differences in weighting objective PPMs across five industry types.	Reject H1a. Significant differences exist at 0.002 level.	Significant differences exist in all objective measures. Quality of Purchased Items was viewed the most important measure overall, followed by On-Time Delivery. Actual vs Target Cost was viewed the least important. Government viewed On-Time Delivery as less important than all others. Utility weighted Accuracy more important than Electronic and Aerospace. Electronic weighted Quality of Purchased Items more important than Utility, Mining and Aerospace. Government, Utility and Mining weighted PO Cycle Time more important than electronic and Aerospace. Aerospace weighted Actual vs Target Cost more important than Utility, Mining and Government. Electronic weighted it more important than utility.
H1b: No significant differences in weighting subjective PPMs across five industry types.	Reject H1b. Significant differences exist under 0.05 level.	Although Multivariate F was not available, univariate F tests showed that differences exist in Commodity Knowledge, Negotiating Ability, and Teaming. Discriminant Analysis confirmed this rejection.

Table 4.24 (Continued)

Hypothesis	Results	Explanations
H2: No significant differences in weighting PPMs among three respondent groups.	Reject H2. Significant differences exist at 0.002 level.	Significant differences exist among three respondent groups in On-Time Delivery, Accuracy, PO Cycle Time, and Professionalism. Managers and customers weighted On-Time Delivery more important than buyers. Customers viewed Accuracy as more important than buyers. Customers weighted PO Cycle Time more important than managers. Buyers weighted Professionalism more important than customers.
H2a: No significant differences in weighting objective PPMs among three respondent groups.	Reject H2a. Significant differences exist at 0.000 level.	Differences exist in Quality of Purchased Items and PO Cycle time among three respondent groups. Managers and buyers differed significantly from customers in Quality of Purchased Items. Customers viewed PO Cycle Time as more important than managers and buyers.
H2b: No significant differences in weighting subjective PPMs among three respondent groups.	Accept H2b.	Multivariate F test could not be generated. Multiple Discriminant Analysis confirmed that there were no significant differences in weighting purchasing performance measures among the three respondent groups.

Table 4.24 (Continued)

Hypothesis	Results	Explanations
H3: No significant relationships between PPMs & MEAs.	Reject H3. Significant relationships exist between PPMs and MEAs at 0.001 level.	Significant relationships exist in Actual vs Target Cost, Negotiating Ability, and Professionalism. Determining What to Buy, Determining Source or Vendor, Signing Contract, Commodity Future Trading are negatively related to Actual vs Target Cost. Negotiating Contract, Receiving and Countertrade are positively related to Actual vs Target Cost. Determining What to Buy is positively related to Negotiating Ability. Controlling Inventory has a negative slope.
H4: No significant relationships between PPMs and MEBs.	Accept H4. No significant relationships between PPMs and MEBs.	There are no significant relationships between PPMs and MEBs. Purchasing performance measures do not vary with types of commodities purchasing handles.
H5: No significant inter-relationships between PPs, & MEAs, MEBs PPMs.	Reject H5. Significant inter-relationships exist between PPs & PPMs, MEAs.	MEBs were dropped from the tests since they were not related significantly to the other variables. PPMs and MEAs significantly related to all PPs, except Accuracy.

Table 4.24 (Continued)

Hypothesis	Results	Explanations
H5a: No significant relationships between PPs & PPMS.	Reject H5a. Significant relation-ships at 0.000 level.	There are significant relationships between PPs and PPMs. Such significant relationships exist in all purchasing performance criteria except Negotiating Ability, and Teaming.
H5b: No significant relationships between PPs & MEAs.	Reject H5b. Significant relation-ships exist at 0.000 level.	The Univariate F tests found significant relationships between PPs and MEAs on the following criteria: Quality of Purchased Items, PO Cycle Time, Actual vs Target Cost, Teaming, and Professionalism.
H5c: No significant relationships between PPs & MEBs.	Accept H5c.	No overall multivariate F test could be generated. Tests of PPs and each individual MEBs were performed. There are no significant relationships between PPs and MEBs. This hypothesis is dropped from further discussion.

First, this research examined the similarities and differences on the purchasing performance measures across five industry types. It concluded that significant differences exist in purchasing performance measures across the five selected industry types. These results are as follows:

Quality of Purchased Items was weighted by all the respondents as the most important measure, followed by On-Time Delivery and Commodity Knowledge and Accuracy. This research concludes that there are significant differences in weighting the purchasing performance measures across five industry types. Specifically, the significant differences in the following measures exist between these industry types:

On-Time Delivery (between Mining and Government, between Government and Aerospace). On-Time Delivery was weighted to a lesser extent by the government sector than that by the mining and aerospace sectors. The conclusion might be that On-Time Delivery is less critical in the government sector (civilian) than in other types of industry.

Accuracy (between Electronic and Utility, between Utility and Aerospace). The mean weights by the electronic sector and aerospace sector were significantly lower than those of the utility sector.

PO Cycle Time (between Electronic and Mining, between Electronic and Government, between Government and Aerospace). This measure was weighted lower by the electronic and aerospace sectors than that by the mining and government sectors

Actual vs Target Cost (between Electronic and Aerospace, between Utility and Aerospace, between Mining and

Aerospace, between Government and Aerospace). The utility, electronic, government and mining sectors weighted this measure less important than the aerospace sector.

Commodity Knowledge (between Electronic and Aerospace, between Utility and Aerospace, between Mining and Aerospace, and between Government and Aerospace). Aerospace industry weighted this measure less than the other industry types.

Teaming (between Electronic and Mining, and between Mining and Government). Mining industry weighted this measure lower than electronic and government.

When the measures are not adjusted between objective and subjective categories, significant differences exist in all objective measures, as the Univariate F significance levels are all less than 5%.

As to the subjective measures, significant differences exist in Commodity Knowledge, Negotiating Ability, Teaming. Commodity Knowledge, Negotiating Ability and Professionalism were weighted higher than Cultivating Qualified Suppliers and Teaming.

Second, this research found that significant differences on purchasing performance measures exist among the three respondent groups. These differences are analyzed as follows:

Internal customers viewed On-Time Delivery more important than buyers, and purchasing managers viewed it more important than buyers. Buyers viewed Accuracy more

important than internal customers. Purchasing managers viewed PO Cycle Time less important than internal customers. Internal customers viewed Professionalism less important than buyers.

When the measures are not adjusted, significant differences were found only in objective measures among the three respondent groups. These were Quality of Purchased Items and PO Cycle Times. It was interesting that purchasing people weighted quality more important than the internal customers, while internal customers gave heavier weight to PO Cycle Times. No significant differences were found in subjective measures among three respondent groups.

Third, MANOVA results showed that significant relationships exist between purchasing performance measures and purchasing responsibilities. The Univariate F tests showed that Actual vs Target Cost, Negotiating Ability and Professionalism significantly related to purchasing responsibilities.

Determining What to Buy, Determining Sources or Vendor, Signing Contract, and Commodity Future Trading are negatively related to Actual vs Target Cost. In other words, the more responsibility purchasing has on those activities, the less the weight of Actual vs Target Cost. Negotiating Contract, Receiving, and Countertrade are positively related to Actual vs Target Cost. In other words, the more responsibility purchasing has, the heavier

the weights of Actual vs Target Cost.

Determining What to Buy is positively related to Negotiating Ability. Controlling Traffic is negatively related to Negotiating Ability.

Signing Contract is positively related to Professionalism. Controlling Inventory is negatively related to Professionalism.

Fourth, MANOVA did not find any significance relationship between purchasing performance measures and types of commodities purchasing handles. Therefore, this research concluded that there are no significant relationships between the types of commodities purchasing handles to purchasing performance measures.

Fifth, MANOVA demonstrated that significant interrelationships exist between the respondents' ratings of their organizations' purchasing performance and the weights assigned to the selected purchasing performance measures and purchasing responsibilities. Univariate F tests gave detailed information about the interrelationships between these variables. For example, Make/Buy is positively related to On-Time Delivery performance. The more responsibility the purchasing department has over Make/Buy decisions, the better On-Time Delivery performance. When to Buy is positively related to the performance criterion Quality of Purchased Items.

All purchasing performance measures are positively

related to PO Cycle Time. What to Buy, Scrap and Surplus Decision, Cost/Price Analysis, and Countertrade are positively related to PO Cycle Time, while Determining Order Quantity, Inspection, and Cash Flow Planning are negatively related to PO Cycle Time.

What to Buy and Incoming Inspection are positively related to Commodity Knowledge. What to Buy and Cost/Price Analysis are positively related to Negotiating Ability, while Determining Quantity is negatively related to Negotiating Ability.

Determining Price and Evaluating New Product are significantly related to Cultivating Qualified Suppliers. What to Bu , and Incoming Inspection are significantly related to Teaming.

What to Buy, When to Buy, Processing Invoices, Cost/Price Analysis, and Developing Product Specifications are significantly related to Professionalism.

This research found that significant relationships exist between the respondents' ratings of their organizations' purchasing performance and the weights assigned to the selected purchasing performance measures, as the Multivariate F significance level is zero. Univariate F tests further showed that significant differences also exist between both sets of variables, except Negotiating Ability and Teaming.

This research concluded that significant relationships

exist between the respondents' ratings of their organizations' purchasing performance and purchasing responsibilities, as the Multivariate F significance level is zero.

The next chapter, based upon the results presented in Chapter 4, draws conclusions and implications about the research results. It also discusses the limitations of this research and future research that is needed to expand knowledge in this area.

CHAPTER 5

CONCLUSIONS

This research has examined the relationships among a number of key dimensions of purchasing performance measurement.

The opinions collected from 240 practitioners, including purchasing managers, buyers, and internal customers from 15 organizations, represent a fairly large sample size and more complete data base compared to the previous studies (Denton, 1965; Davies, 1985; Hendrick and Ruch, 1987 and 1988). This chapter presents:

5.1 Implications of the research results.

5.2 Limitations of this research.

5.3 Contributions of this research.

5.4 Future research needed to expand knowledge in purchasing performance measurement.

5.1 Implications of the Research Results

The study has focused on five research questions to gain a better understanding and expand the body of knowledge in purchasing performance measurement. The results presented in Chapter 4 indicate that several significant relationships exist between the variables examined in this research. The implications and practical usefulness of these results are of more interest than the results

themselves. This section discusses the implications of the research results.

Across Five Industry Types

Since H1, H1a and H1b are rejected, this research concludes that there are significant differences in weighting these ten purchasing performance measures across the five selected industry types. This suggests that different industries should have a different focus when selecting their own mix of purchasing performance measures. Emphasis should be placed on those measures that received heavier weights than others.

Of the ten purchasing performance measures, Quality of Purchased Items was weighted the heaviest of all measures (measures adjusted), followed by On Time Delivery, Commodity Knowledge, and Accuracy. There are no significant differences for Quality of Purchased Items across the five selected industry types: electronics, utility, mining, government, and, aerospace. This indicates that, in this research sample, quality is the most critical issue in evaluating purchasing performance, regardless of industry type. This could be generalized to the other industry types. Many U.S. firms have been beaten by their foreign competitors because of the poor quality of their products. In the recent decade, more and more firms have realized that quality is the key to whether firms could be prosperous in the competitive environment. Top priority should be placed

on quality management in the purchasing function, since about 56 percent of the revenue dollar is spent on purchased materials or products. Improvement in quality management in purchasing should include training of professional purchasing personnel in evaluating the quality of purchased products. In addition, it should be beneficial to teach professional purchasing personnel the techniques and skills of quality management. These techniques and skills should include several commonly used statistical approaches, such as a P chart or R chart.

Although the results of this research have not indicated any significant differences in Quality of Purchased Items across five industry types, quality was viewed as more important in the electronics sector than in the other industry types. The degree of competitiveness in this sector could be a reason. One could generalize that the more competitive the environment an organization is in, the more important the quality issue. Purchasing managers should study their environment in order to determine what quality level they should achieve in their purchasing activities.

When quality is interpreted in a broad sense, it is not an isolated issue. Quality performance in purchasing should tie to other purchasing performance evaluation measures, such as vendor development and delivery.

On Time Delivery was viewed as the second most

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important measure in this survey. As more and more manufacturing firms are applying the Just-in-Time philosophy, on-time delivery becomes more critical. However, this research has found that the government sector weighted On Time Delivery as less important than all the rest of the industry types, and significantly less important than the mining and aerospace sectors. This implies that On Time Delivery was viewed as less critical by the government sector surveyed. This might be true because governments are not in a competitive environment. Late delivery might not cause serious damage to government operations, as compared to organizations such as the electronic, utility, mining, and aerospace firms this research surveyed. These firms have to compete in order to be prosperous. It is also true that in the government sector, bureaucracy and red tape are tolerated more than by those organizations in a competitive environment. However, it should be noted that this research only surveyed civilian governments. No government in military sectors were surveyed. On time delivery should be very important in the military sectors.

The results of this research indicate that the aerospace sector weighted Actual vs Target Cost as more important than the rest of industry types. This might be true because the aerospace organizations this research surveyed are heavily involved in contracting with the government. As required by law, the price of every

contracted item has to be very precise, since large variations from what the contract specifies would have severe negative effects. Therefore, purchasing professionals in the aerospace industry viewed this measure as more important than the rest of the industry types. This implication could be applied to other contracting or subcontracting purchasing activities in which target costs are clearly specified and tightly audited.

This research finds that the electronics sector gave more weight to Teaming than the rest of the sectors. This might be the case in the high technology fields, where harmonious relationships between the purchasing function and other functional areas, such as engineering, are crucial.

Among Three Respondent Groups

The rejection of H2 indicates that there are significant differences in weighting purchasing performance measures among the three respondent groups: purchasing managers, buyers, and internal customers. Specifically, these differences exist in On Time Delivery, Accuracy, PO Cycle Time, and Professionalism.

This indicates that the different roles played by the respondents might be the cause of the differences in weighting these purchasing performance measures. Why was this the case? Would these differences among the respondent groups hinder the purchasing function? Or would these differences hinder overall corporate performance? Detailed

examination of the differences between these purchasing performance measures among the three respondent groups should give some clues to these questions.

Good or bad purchasing performance is largely the perception of internal customers to whom purchasing provides a service, and also a result of the interfacing function between vendors and internal customers. Developing and maintaining good operating relations with the internal customers would result in better purchasing performance. The willingness to integrate purchasing activities with those of the internal customers in a team effort is a way to improve productivity. The role conflicts between purchasing and internal customers should be handled properly, not only at an interdepartmental level, but also at the corporate level. Purchasing should be marketed within an organization.

Overall, On Time Delivery was viewed by the three respondent groups as second-most important, only after Quality of Purchased Items. Internal customers viewed On Time Delivery as more important than did buyers. This indicates that on-time arrivals of purchased items are more crucial to internal customers. The purchasing function provides a linkage in delivering products and services from the suppliers to their internal customer departments. Delays may cause interruptions, or even shutdowns, in these functions in which the internal customers play their roles.

Early arrivals of purchased items may also cost the organization. This is a domino effect that may even lead to more severe damage to the whole organization. This should suggest to buyers that a better understanding of their performance is closely related to the performance of internal customers' departments.

Purchasing managers gave heavier weights to On Time Delivery than buyers did, but gave lower weights than did internal customers. This might indicate that purchasing managers can see a bigger picture than buyers in coordinating purchasing activities between the purchasing function and internal customers' activities.

Internal customers viewed PO Cycle Time as more important than did purchasing managers. Both purchasing managers and buyers gave this measure lesser weights. This should suggest that the turnaround time of a purchase order is of more concern to internal customers. Purchasing may improve purchasing performance by shortening purchase order cycle time. Computer usage and electronic data interchange enable the purchasing function to interact with their internal customers and external vendors in a speedy fashion. Those firms that have not installed electronic data interchange should conduct feasibility studies in this area. The National Association of Purchasing Management has been advocating a standard electronic data interchange system.

Buyers weighted Professionalism as more important than

did internal customers. This indicates that professional business conduct provides buyers with ethics in their daily activities, while internal customers might focus on some technical and concrete issues when they relate their requisitions to the purchasing function.

The results of this research indicate that purchasing should not differentiate in selecting a mix of subjective purchasing performance measures, since there is no difference over these measures among the three respondent groups.

In reviewing the results of this research, it is interesting to find that large differences exist between purchasing people (both purchasing managers and buyers) and internal customers. The weights given by purchasing managers normally were between the weights assigned by the buyers, on one end, and the internal customers, on the other end. This is because purchasing managers, with broader responsibilities than buyers who are involved in more concrete tasks, would view purchasing performance from a wider scope, as they are coordinators between the purchasing function with the other functions in the corporation.

In addition, this research has found that overall respondents generally preferred objective measures to subjective measures. There was no significant preference between purchasing managers and buyers, but significant preference between purchasing people (both purchasing

managers and buyers) and internal customers. It appeared the buyers did not differentiate objective measures from subjective measures. This might suggest that objective measures are more important in determining purchasing performance and those measures can be quantitatively measured.

Purchasing Performance Measures and Purchasing Responsibilities

This research rejects H3 and concludes that there are significant differences among weightings of purchasing performance measures for different purchasing responsibilities. These weighting differences exist particularly in Actual vs Target Cost, Negotiating Ability, and Professionalism.

The research results indicate that purchasing is most often responsible for Signing Contracts or Orders, followed by Determining Price, and Negotiating Contracts. These related purchasing responsibilities refer to two different dimensions of the purchasing role. Signing and negotiating contracts implies a high level of responsibility and interpersonal skills carried out over an extended period of time. The result is a contract which specifies price as well as all other conditions of purchase. Determining Price is a lower-level decision-making responsibility that may be as simple as using a list price or as complex as using formulas to determine optimal prices with price breaks,

freight rates, and other factors. It does, however, imply a significant responsibility for the purchasing function since an average of 56 percent of an organization's revenue dollars is spent on purchased items.

Negotiating Contracts is positively related to Actual vs Target Cost. In other words, the more contract negotiating responsibility the purchasing department assumes, the heavier the weights of Actual vs Target Cost. This suggests that in cases where the price and other terms of the contract are negotiable, the firm is setting cost targets and monitoring performance relative to expectations.

Signing Contracts is positively related to Professionalism. This suggests that the greater the responsibility for signing a contract, the more weight is given to professionalism. Training purchasing personnel in preparing and signing contracts, therefore, is one of the keys to improving the professional development of buyers.

Purchasing Performance Measures and Commodities

This research accepts H4: there are no significant relationships between purchasing performance measures and the types of commodities purchasing handles. In other words, purchasing performance evaluations need not to vary with the different types of commodities purchasing handles.

The strength of this finding, however, is limited by the industries included in this study.

Purchasing Performance Ratings, Purchasing Performance Measures, and Purchasing Responsibilities

This research rejects H5 and concludes that there are significant interrelationships between the respondents' ratings of their organizations' purchasing performance and the weights assigned to the selected purchasing performance measures and purchasing responsibilities. Purchasing performance measures and purchasing responsibilities are significantly related to all purchasing performance ratings, except for Accuracy. Understanding this fact, purchasing management could improve purchasing performance in these areas by directing the purchasing personnel to realize the importance of these measures in their purchasing activities.

5.2 Limitations of this Research

Steps were taken in designing and conducting this research to minimize threats to internal and external validity (see 3.2 for the detailed discussion). No violations of these kinds occurred.

Internal validity has to do with the certainty with which one can attribute a research outcome to the application of a treatment or manipulation that is under the rigid control of the researcher (Crano and Brewer, 1986, p. 23). Internal validity is essential if a study is to be meaningful to managers (Davis and Cosenza, 1985, p. 107).

The comments made by the practitioners in the pilot study and the survey indicated that this research was meaningful.

External validity is concerned with whether or not the research results can be generalized across populations, settings and other similar conditions (Davis and Cosenza, 1985, p. 108). Generalizability refers to the robustness of a phenomenon--the extent to which a relationship, once identified, can be expected to recur at other times and places under different environmental conditions (Crano and Brewer, 1986, p. 38). Since this research broadened the data base to five industry types rather than the limited data base in the early studies, more general conclusions can be drawn from the results.

Caution is needed when applying the findings of this research, since this study collected data from only five industries and only fifteen organizations. Further research is recommended in order to obtain analyses beyond these five industry types.

This research focused on a limited set of dependent and independent variables; this does not mean or imply that other measures are not important. Each individual firm could start with this set of five objective and five subjective measures and add or delete criteria to develop a unique set of measures to fit the organization's operating conditions and goals.

This research has also found that the respondents

preferred objective measures to subjective measures in evaluating purchasing performance (55% to 45%). The mix of objective and subjective measures should take corporate goals into consideration.

5.3 Contributions of this Research

Despite the limitations mentioned above, the results of this research should be useful in practice. Contributions can be summarized as:

1. Consistent with past research, the results of this study indicate that purchasing performance is a multi-dimensional construct that can be evaluated with a weighted average of several measures, some objective and some subjective. However, this study shows that significant differences exist in the weightings of the measures across industry types. There is no universal weighting system for purchasing performance measures for all industries.

   Purchasing practitioners can gain insight from this study by examining the weights assigned by the sample from the industry that most nearly resembles their own, but these weights should not be accepted without question. In the absence of additional research within an industry, firms in that industry should accept the challenge of assigning their own set of unique weights

commensurate with their goals and the conditions they face in the marketplace.

2. The research results indicate that the different perspectives of purchasing managers, buyers, and internal customers yield different weights for the selected purchasing performance measures. These different opinions should be taken into consideration if purchasing practitioners are to achieve overall corporate goals. Organizations are well-advised to incorporate internal customers' opinions into the purchasing performance evaluation system in order to meet corporate goals, and improve overall performance, rather than suboptimizing in individual functional areas.

3. The research indicates that there are significant relationships between purchasing performance measures and purchasing responsibilities. This provides purchasing with meaningful insights to improve purchasing performance. If more emphasis is placed on the positively correlated purchasing performance measures and purchasing responsibilities, the impact may be significant for improving purchasing performance. For those negatively related purchasing performance measures and purchasing responsibilities, the opposite

efforts should improve purchasing performance. No specific attention should be paid to those purchasing performance measures that are not related to purchasing responsibilities.

4. Purchasing performance evaluation should not vary with the different types of commodities purchasing handles, as this research has found there are no significant relationships between purchasing performance measures and the types of commodities purchased.

5. The respondents' ratings of their organizations' purchasing performance are significantly related to the weights assigned to the purchasing performance measures and purchasing responsibilities. Different strategies can be adopted to monitor purchasing performance, depending on what corporate goals need to be achieved. When positive correlations exist between purchasing performance measures and the corresponding purchasing performance ratings, more emphasis should be placed on those measures which result in improvement of purchasing performance.

The most significant contribution of this research is that it has studied the opinions of not only purchasing people, but also of internal customers on a large scale. The findings should give more accurate information compared

to that from previous studies. Purchasing, as one important function in the corporation, can achieve its objectives only when it takes the needs and objectives of other functional areas into consideration in order to achieve overall corporate goals and objectives.

The opinions from internal customers provide purchasing people with more information about their own customers. This way they can understand their co-workers better and respond more quickly to their needs.

5.4 Future Research

The field of purchasing performance measurement is one of the most important areas in purchasing, but it needs broader and more in-depth exploration. This research has explored only a few aspects of the whole area. More investigation is needed to find the relationships among the key dimensions of purchasing performance evaluation. These investigations should include:

1. Larger samples, across more industry types which may make the research more generalizable. This way, a better understanding can be obtained through more information.
2. More purchasing performance measures could be included in the analyses. Some other purchasing performance measures are important, although they were not included in this study.
3. CEOs should be included in the research, so that a

bigger picture can be obtained, in order to make comparisons and contrasts. Opinions should be collected not only at the functional levels, but also at the corporate level.

4. It may be necessary to bring in suppliers in future research.

5. Regroup the three respondent groups into two: purchasing people and their internal customers. This research suggests that significant differences exist largely between purchasing people and internal customers, rather than between purchasing managers and buyers.

These suggestions represent only a few of the many studies needed to better expand the knowledge of purchasing performance measurement.

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APPENDIX A

PURCHASING SURVEY

PURCHASING SURVEY

PART I

1. Check one item that best describes your role in the organization:

_____Purchasing Executive or Manager or Director
_____Buyer or Purchasing Agent

_____Internal Customer (user of purchasing services)
Your department _____

2. _____Your years of experience with this organization

_____Your total years of business experience

3. Check one or more of the following commodities that you are responsible for (including buying, administering, coordinating, managing or requisitioning):

_____Raw materials

_____Component parts

_____Services

_____Capital equipment

_____MRO items

_____Packaging

_____Office supplies and equipment

Others: _____

PART II

Listed on next page are decisions, duties, and responsibilities that may or may not be in the scope of responsibilities for the purchasing department in your organization. For each item listed, check one and only one response that best describes your purchasing department's responsibility. Responses are:

Total Responsibility - this decision or function is within the normal duties and responsibilities of the purchasing department; purchasing is held accountable for results.

Primary Responsibility - purchasing makes decisions and performs functions with inputs from other organizational units; responsibility is shared but purchasing bears the major part.

Joint Responsibility - purchasing performs this function in combination with one or more other organizational units; decision making and responsibility are shared nearly equally.

Some Responsibility - purchasing is involved and provides some input; responsibility is shared but others are held primarily accountable.

No Responsibility - purchasing is not accountable and has no input to the decision; purchasing simply follows orders or allows someone else to perform this function.

If you do not know purchasing' responsibility for a particular item, leave that item blank.

Check ONLY ONE Response for each item as it applies to the purchasing department in your organization:

		Total Responsibility	Primary Responsibility	Joint Responsibility	Some Responsibility	No Responsibility
1.	Determining what items to buy					
2.	Determining when to place orders					
3.	Determining sources or vendors					
4.	Determining order quantities					
5.	Determining price for items purchased					
6.	Signing contracts or orders					
7.	Negotiating contracts					
8.	Receiving and verification					
9.	Controlling traffic					
10.	Incoming inspection					
11.	Processing invoices					
12.	Follow-up and expediting					
13.	Decisions for scrap and surplus					
14.	Determining material specifications					
15.	Forecasting material needs					
16.	Make or buy decisions					
17.	Cost/price analysis					
18.	Value analysis					
19.	Commodity future trading					
20.	Countertrade/offset planning/execution					
21.	Cash-flow planning					
22.	Determining optimal inventory					
23.	Developing product specifications					
24.	Evaluating new product designs and specifications					
25.	Formulating strategic purchasing plans					

PART III

1. Below is a list of five OBJECTIVE measures of purchasing performance. Each measure would yield a number, a ratio, or a percentage to evaluate some aspect of the performance of the purchasing department.

   Please assess these measures in terms of their relative importance from your own perspective. For each measure, assign a weight (between 0 and 100) so that the total of the weights equals 100. (Do not evaluate your purchasing department's current performance; that will come later. Your weights are your assessment of the relative importance of these factors in determining overall purchasing performance).

Weight		Measures
_____	A.	On-time delivery: percentage of orders that arrive on time, not early and not late.
_____	B.	Accuracy: number of errors made by purchasing in such things as specifications, quantity, price, due date, etc.
_____	C.	Quality of purchased items: percent of items or percent of orders that meet quality requirements.
_____	D.	Purchase order cycle time: average time from the receipt of a request by purchasing until the purchasing order is sent to a vendor.
_____	E.	Actual vs. target cost: actual cost of an item compared to the target (goal or standard) cost.
100		Total (Check to make sure total equals 100).

2. Listed below are five SUBJECTIVE measures of purchasing performance. Each refers to a critical dimension of purchasing but they can be evaluated only by judgment based upon observation.

   Again please make your assessment of the relative importance of these items from your perspective. Please assign a weight (between 0 and 100) to each measure so that the total adds to 100.

Weight		Measures
_____	A.	Commodity knowledge: how well the buyers know the items, vendors, prices, etc. for which they are responsible.
_____	B.	Negotiating ability: how well the buyers can negotiate prices, terms of sale, delivery dates, and other conditions with suppliers.
_____	C.	Cultivating qualified suppliers: how well the buyers find and develop suppliers that meet quality and delivery standards.
_____	D.	Team building: how well purchasing develops team or partnership relationships between suppliers and internal customers.
_____	E.	Professionalism: how well does purchasing uphold standards of conduct, ethics, convention, courtesy, and other dimensions of professionalism.
100		Total (Check to make sure total equals 100).

3. From your perspective, you could evaluate overall purchasing performance using both the set of objective measures and the set of subjective measures. But would you consider them equally important (50-50) or would you place more weight on one than the other (60-40, 70-30, 80-20, 90-10)? Please indicate how you would weight the two types of measures:

Weight	Types of Measures
_____	Objective measures
_____	Subjective measures
100	Total

PART IV

Finally, please assess how well your purchasing department is performing on each of the measures. Please give your general impressions for each measure based on the following scale:

Excellent: Clearly superior performance, well above expectations; further improvement unlikely.

Good: Above average standards, meets or exceeds reasonable expectations of performance.

Acceptable: Meets or exceeds minimal standards; improvement possible and desirable.

Need Improvement: At or below minimal standards of performance; effort should be made to raise the level of performance.

Poor: Clearly unacceptable performance, immediate action toward improvement required.

Check ONLY ONE rating for each measure (if not applicable for a particular item, leave that item blank):

	Excellent	*Good*	*Acceptable*	*Need Improvement*	*Poor*
1. On-time delivery					
2. Accuracy					
3. Quality of purchased items					
4. Purchase order cycle time					
5. Actual vs. target cost					
6. Commodity knowledge					
7. Negotiating ability					
8. Cultivating qualified suppliers					
9. Team building					
10. Professionalism					

Thank you for participating in this survey!

APPENDIX B

SOME OF DENTON'S STATEMENTS CONCERNING PURCHASING PERFORMANCE

1. Determine the need for purchase or new equipment or parts
3. Control the tax status of materials ordered
4. Verify quantity and/or quality received from suppliers
5. Determine the financial desirability of purchases
6. Check a supplier for his efficiency and ability to do the job
7. Avoid difficulties with federal regulations
9. Determine the best timing for purchases
11. Suggest improvements for stock or repeat items purchased in quantity
12. Coordinate inventories and requisition quantities
14. Help assure adequate trade-in allowance on salvage or surplus items
15. Determine the supplier of equipment, etc.
16. Insure proper identification of material shipped to the field
17. Analyze performance of suppliers
19. Conduction tests to define the quality and performance of equipment, parts, etc.
20. Help write specifications to promote standardization
21. "Punch up" suppliers as needed to expedite delivery
22. Provide information to the field in time to meet their needs
23. Obtain comparative estimates and bids on all sizeable purchases
25. Check Specifications versus a supplier's offering on equipment
26. Obtain price protection in a fluctuating markets
27. Determine which supplier is to get an order
28. Insure that contractors' purchases are reasonably priced
29. Negotiate best price for equipment, supplies, services
30. Analyze "economic lot" purchases
31. Supply accurate price information to the field
33. Determine the most economical methods for shipping
34. Facilitate the disposal of excess inventory
35. Order minimum spare parts to provide insurance against breakdown
37. Keep the field informed as to their standing on credit for returns
38. Obtain Dun & Bradstreet reports on potential suppliers
39. Handle confidential material (viz., patents) with special care
40. Keep track of supplier's business problems and trends
41. Follow up on credits, shortages, and defects

APPENDIX C

RESULTS OF DENTON'S STUDY
(Statements are grouped into Factors)

FIGURE 1: MEAN FACTOR SCORES FOR TOTAL SAMPLE OF CUSTOMER RESPONDENTS

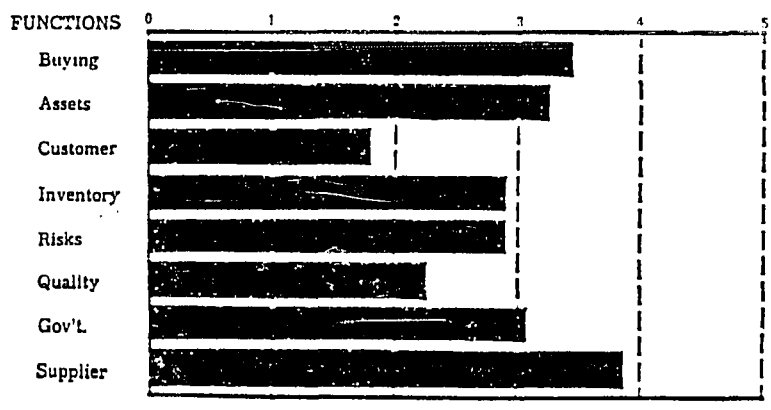
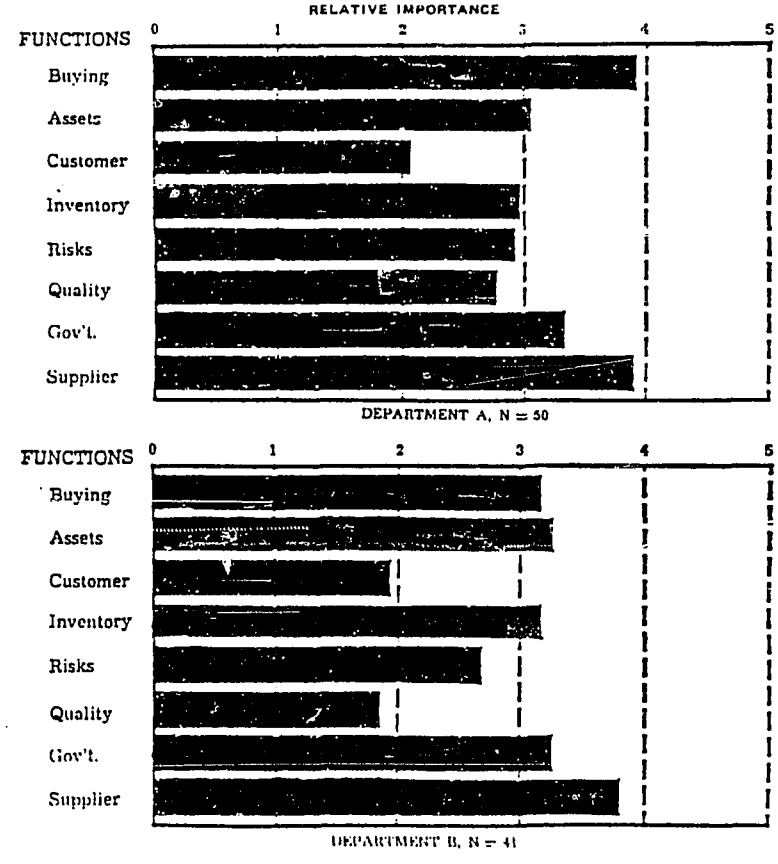


FIGURE 2: MEAN FACTOR SCORES FOR TWO DEPARTMENTS



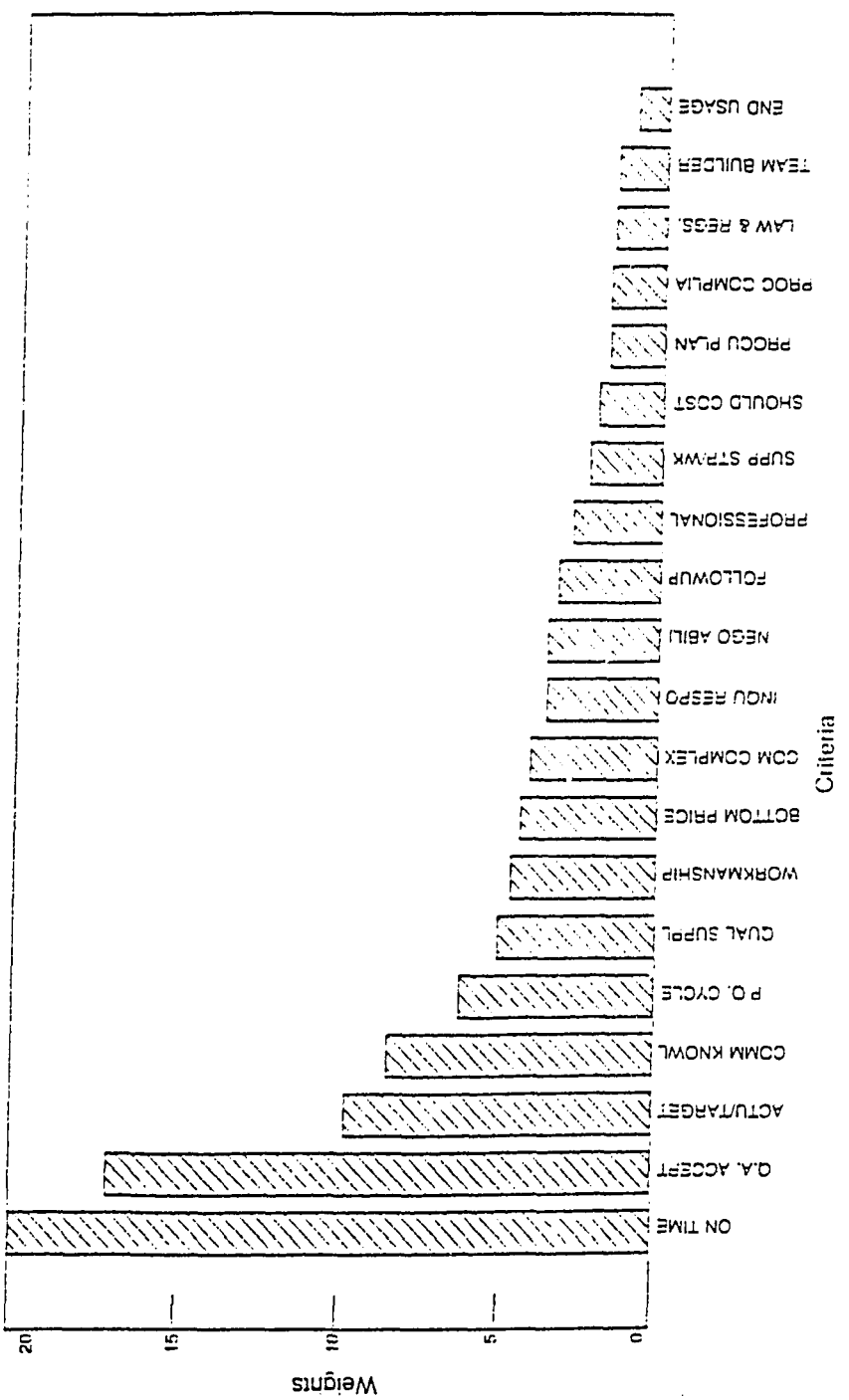
APPENDIX D

HENDRICK AND RUCH'S 20 CRITERIA FOR EVALUATING BUYERS' PERFORMANCE

1. Buyer's knowledge of commodities he or she manages.
2. Incoming quality acceptance rate of materials the buyer manages
3. Buyer identifies and cultivates qualified suppliers.
4. Buyer provides timely responses to inquiries in and out.
5. Buyer knows bottom price of materials he/she purchases.
6. Buyer's knowledge of strengths and weaknesses of supplier.
7. Buyer's knowledge of and use of follow up technique.
8. Buyer's knowledge of relevant laws and government regulations.
9. Buyer's PO placement cycle time.
10. Buyer's participation in developing procurement plans.
11. On time delivery by suppliers (not too early, not too late of materials buyer manages.
12. Buyer's knowledge of end item usage of materials.
13. Buyer's compliance with procedures.
14. Buyer's negotiating ability with suppliers.
15. Buyer's professionalism.
16. Complexity of commodities managed by buyer.
17. Actual vs target costs of the materials buyer manages.
18. Buyer's participation in developing "should cost" goals.
19. Accuracy and quality of purchaser's workmanship.
20. Buyer builds team relationships between suppliers and internal customers.

APPENDIX E

RESULTS OF HENDRICK & RUCH'S STUDY
Mean of Group Mean Weights Adjusted by
Group Influence Weights



APPENDIX F

FEAROH'S STUDY OF ACTIVITY AREAS IN WHICH PURCHASING HAS ASSUMED AN INCREASED ROLE/ RESPONSIBILITY (SINCE 1980) BY ORGANIZATION SIZE

	Total		Under $500 million		$500 to $1 billion		$1.1-5 billion		$5.1-10 billion		Over $10 billion	
NO. ORG. RESPONDING	292		81		44		108		31		28	
	#	%	#	%	#	%	#	%	#	%	#	%
ACTIVITY AREA												
Strategic Planning	125	43	29	36	27	61	49	45	11	35	9	32
Product Development	90	31	31	38	17	39	30	28	9	29	3	11
Traffic/Transportation	66	23	22	27	13	30	27	25	3	10	1	4
New Product Evaluation	77	26	24	30	15	34	31	29	5	16	2	7
Capital Equipment Buys	108	37	24	30	21	48	44	41	10	32	9	32
Personnel Travel	46	16	11	14	8	18	18	17	4	13	5	18
Marketing Planning	27	9	10	12	4	9	10	9	1	3	2	7
Providing Economic Forecasts/Indicators	120	41	34	42	19	43	50	46	7	23	10	36
Commodity Futures Trading	18	6	2	2	5	11	6	56	2	6	3	11
Cash-Flow Planning	38	13	14	17	9	20	13	12	2	6	0	---
Countertrade/Offset Planning/Execution	44	15	3	4	7	16	23	21	6	19	5	18

BIOGRAPHICAL SKETCH

Chiang-nan Chao was born in Heihe, Heilongjiang Province, China on April 26, 1949. He completed his high school education in Changchun, Jilin Province, in 1968. He received a medical training and worked as a barefoot doctor during 1968-72. He received his diploma degree from Jilin University in 1975, and was appointed as a lecturer there during 1976-79. He studied international law from 1979 to 1980. He received his Master of Business Administration degree from Lamar University, Beaumont, Texas, 1984. During his tenure at Arizona State University, he was elected as the vice president of Sigma Iota Epsilon, and received an Arizona State University Graduate Student Research Grant, and a National Association of Purchasing Management Scholarship. Since 1975, he has been consulting in doing business with China. He has several publications in international business, and in purchasing and materials management. Upon completion of his doctoral program, he will join the faculty of the College of Business, St. John's University in New York. His wife, Lily H. Wang, an accountant with two master's degrees in business, works with Coopers and Lybrand.