DLA-93-P20058

DEVELOPMENT OF A DEFENSE LOGISTICS AGENCY MARKET BASKET

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OPERATIONS RESEARCH AND ECONOMIC ANALYSIS OFFICE

DEPARTMENT OF DEFENSE
DEFENSE LOGISTICS AGENCY

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FOREWORD

The Defense Logistics Agency (DLA) Market Basket was developed to inform top management of the Agency's performance in providing its customers quality supply support in an efficient and timely manner. The original concept for the Market Basket was proposed by a DLA Quality Management Board (QMB). Development of the Market Basket involved the construction of a representative sample of goods for each of the Agency's Inventory Control Points, except Defense Fuel Supply Center and Defense Personnel Support Center - Subsistence. These samples were then used to analyze the Agency's performance. This approach closely followed that used by the U.S. Department of Labor, Bureau of Labor Statistics in developing the Consumer Price Index. This Study produced four indicators that track the Market Basket's performance over time. These indicators were developed with the guidance from several key DLA staff members. We would like to thank Mr. Michael Pouy (DLA's Directorate of Supply Operations, Supply Management Division) and Mr. Stuart King (Office of Policy and Plans, Organization Position Management and Military Manpower Division) for their insight and technical knowledge during the formulation of these indicators.

Christine L. Gallo.

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EXECUTIVE SUMMARY

Working within the guidelines of the Total Quality Management philosophy, a Defense Logistics Agency (DLA) Quality Management Board (QMB) conceived an idea of developing a set of performance measures to track the Agency's success in building an effective relationship with its suppliers. These measures focused on three areas of interest: Affordability, Sustainability, and Availability. QMB members thought these indicators could be used to build a stronger working relation with Agency suppliers and, consequently, improve procurement prices and delivery terms. These benefits could then be passed on to the Agency's customers through better item pricing and improved supply availability.

As the Study progressed, the Executive Director for Plans and Policy Integration (DLA-P&PI) requested that the performance measures be shifted from a supplier orientation to a customer and Agency orientation. Development of these measures involved the creation of a Market Basket comprised of a representative collection of goods that the Agency supplies to its customers. The Basket is a study sample against which performance measures are taken.

This report documents DLA's Operations Research Office (DORO) Field Operations Activity's efforts of transforming an idea into a working business tool which assists top management in assessing the Agency's performance. The Market Basket uses stratified, random sampling techniques to obtain representative samples efficiently. Market Baskets were developed for each of the Agency's Inventory Control Points (ICP), except Defense Fuels Supply Center and Defense Personnel Support Center - Subsistence.

This study closely employs the general methodology used by the U.S. Department of Labor, Bureau of Labor Statistics' Consumer Price Index. The Basket performance measures are called "Indicators." Four indicators measure the change in the Market Baskets' performance over time: Price (the QMB's Affordability measure), Sustainability, Availability, and Quality. Each indicator is composed of several related components. Indicator values will be updated on a quarterly basis, based on data collected from the sample items in the Market Basket.

Prototype development of a DLA Market Basket model was successfully completed using third and fourth quarter of Fiscal Year 1992 data. Market Baskets for each ICP were developed using statistical sampling techniques. Performance indicator values and supporting item level data were also obtained. An evaluation of the resulting indicator values demonstrated that there may be value to using the Market Basket approach as an efficient means for top management to measure the Agency's wholesale supply performance. Analysis of the supporting data generated by the model appeared to be one approach in explaining performance values and in isolating where business improvements may be needed.

Market Basket implementation, as a centrally administered management support tool, will require an additional analytic effort which should be performed under a follow-on DORO project. Upon approval of the Market Basket concept, additional validation of both the methodology and data should be conducted. This effort should include DLA Headquarter's and Centers' staff participation and input. Market Basket performance results will also be compared to results generated from analyzing a Center's total eligible population. If the Market Basket is implemented as an internal management tool, performance goals should also be established by top management for each indicator. Implementation will also require the support from a central design activity and Information Processing Center-Richmond to transfer the prototype Market Basket model into a standard production system.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

LIST OF TABLES

SECTION 1
INTRODUCTION

1.1 BACKGROUND

In November 1991, a Defense Logistics Agency (DLA) Quality Management Board (QMB) conceived an idea to develop a representative collection of DLA managed goods. This collection was to be identified as the DLA Market Basket. The Market Basket was to be a study population from which performance measures would be taken. As described by the QMB, the Market Basket was to be used as a tool to measure "how much an improved relationship with industry improves DLA's ability to support its customer, the military services." The Market Basket would be used as a barometer to assess how well the Agency does in supporting its customers. The QMB also envisioned using the Market Basket as a decision support tool for strategic business planning and forecasting. The QMB's target goals were to be stated in terms of ensuring availability, sustainability, and affordability of DLA managed items.

The focus of a Market Basket changed slightly during the course of the study. This change came about when DLA's Executive Director for Plans and Policy Integration (DLA-P&PI) (formerly Deputy Assistant Director for the Office of Policy and Plans (DLA-LD)), expanded upon the QMB's idea of developing an Agency Market Basket as a measurement tool. DLA-P&PI saw merit in using the Market Basket approach for evaluating the Agency's performance of providing efficient and quality support to its customers. In opting for a more direct approach, DLA-P&PI dropped the idea of associating improved relationships between DLA and industry with improved service to the Agency's customers. The three original measurement areas were retained and a fourth measure, material quality, was added to this effort. For clarification purposes, the affordability measure was redefined as a Price measure. The four measures became known as the Agency's Performance Indicators.

1.2 SCOPE

1) Development of a Market Basket project is limited to National Stock Numbered (NSN) items from the Agency's four hardware centers (Defense Construction Supply Center (DCSC), Defense Electronic Supply Center (DESC), Defense General Supply Center (DGSC), Defense Industrial Supply Center (DISC)) and medical and clothing/textile items from Defense Personnel Support Center (DPSC(Medical) and DPSC(Textile)). Items from Defense Fuels Supply Center (DFSC) and DPSC(Subsistence) may be addressed as a follow-on project, if requested.

2) The scope of the analysis is to develop a methodology for calculating four performance measurement indicator values and an overall Agency performance index. The four indicators are defined as: Price, Availability, Sustainability, and Quality. The Agency index is a weighted average of the four indicators.

3) The base year for the analysis is Fiscal Year 1990 (FY90).

4) Only NSN items with procurement activity within the past 5 years are considered.

5) Stocked and non-stocked NSNs are considered.

6) Consumable Item Transfer NSNs are considered if a procurement action occurred and if required supporting data is available.

1.3 OBJECTIVES

1) Develop an automated process which uses statistical methods to construct a representative Market Basket of goods.

2) Develop a set of measurement indicators which can monitor the rate of improvement within each performance area. These indicators are to be robust in nature and possess an adequate level of information to allow upper Agency management to conduct strategic planning and performance reporting to other Department of Defense (DoD) agencies.

3) Identify appropriate data elements that accurately define each performance measure. Use these elements to develop equations to calculate indicator values.

4) Develop procedures for evaluating the status of basket items and changing the composition of the basket, as required.

SECTION 2
METHODOLOGY

2.1 GENERAL DESCRIPTION

A Market Basket was developed for each DLA supply center, except DFSC, since most supply activity is controlled by these organizations. The development of the Baskets were conducted in two phases and closely followed the general methodology used by the U.S. Department of Labor, Bureau of Labor Statistics in calculating the Consumer Price Index (CPI). The first phase involved determining the appropriate basket size and the selection of goods (NSNs) to fill the Basket. Stratified sampling techniques were used in this step to insure each Basket contained a statistically representative sample of a center's active population. The selection of goods was made by random selection of items within each sample stratum. The second phase involved developing performance rate equations for each indicator. This process required the identification of appropriate data elements to define the indicators and the formulation of the equations.

The prototype Market Basket computer model was designed in a modular fashion and was run on the Information Processing Center-Richmond (IPC-R) mainframe computer using the DLA Integrated Data Bank (DIDB) data. All production programs were written in Common Business Oriented Language (COBOL). This language was selected so programs could easily be transferred to a central design activity if the project is implemented.

2.2 MARKET BASKET DEVELOPMENT

The initial step in developing each basket was to identify the Centers' eligible population. This was accomplished by screening the Centers' contract history files for all NSNs that had contract activity within the past 5 years. The size and composition of the Market Baskets were then determined by using a stratified sampling method called "optimum allocation, variable method"[1]. This technique involved segmenting the Centers' NSN population into predefined variable stratums or sub-populations. The population was stratified or segmented by average total annual contract value. This value was based on an NSN's average total annual contract value over the past 2 years (FY91- FY92). This variable was selected because it insured the availability of pricing information. A total of six stratums were used to divide a Center's population. The spread of the dollar ranges between each stratum varied. Stratum ranges also varied by Center. These variations were based on differences in demographic information of each Center's average total annual contract value. The object in setting the ranges was to minimize the stratums' standard deviation. Overall sample sizes were minimized by reducing the average annual contract dollar value variations within each stratum.

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[1]Herbert Arkin, Handbook Of Sampling For Auditing and Accounting, Third Edition: ed. (Englewood Cliff, N.J.:Prentice Hall, Inc., 1984) p. 175.

An overall basket size was obtained by accumulating each of the six stratum sample sizes. Determination of the appropriate stratum sample size was based on optimum allocation by using the following formula[2]:

$$n_i = \frac{N_i \sigma_i * \Sigma^{6}_{i=1} (N_i \sigma_i)}{N^2((1/z) * SE_x)^2 + \Sigma (N_i \sigma_i^2)}$$

where:

n_i = i^{th} stratum sample size
N = Center's population size
N_i = i^{th} stratum population size
σ_i = i^{th} standard deviation (in dollars)
z = Selected confidence level (set at 95 % = 1.96)
SE_x = Allowable sampling error (set at $25.00)

The next step was to randomly select the appropriate number of NSNs for each Basket stratum. This was accomplished by sorting the NSNs within each stratum in ascending order. Each NSN was then tagged with a stratum record number. A mixed congruential random number generator[3] was then used to create a set of stratum random numbers. The range of these random numbers was set between one and the last record number of each stratum. The number of the randomly generated numbers equalled that of the stratums' sample size. The stratums' random number lists were then sorted in ascending order. A Market Basket NSN listing was generated by matching the random number for each basket stratum to the appropriate stratum NSN record number.

2.3 PERFORMANCE INDICATOR DEVELOPMENT

2.3.1 INTRODUCTION

The four performance indicators are: Price, Sustainability, Availability, and Quality. The first three indicators were identified by the QMB while the last one was identified by DORO. Selection of these measures was based on the study sponsor's desire to obtain an overall pulse on how well DLA was accomplishing its mission of providing its customers reasonably priced, high quality material, in a timely manner. Each indicator identified the rate of change in the performance rate from the last Basket update. Update runs were made on a quarterly basis. The value for each performance rate was determined by a set of mathematical equations. These equations were composed of several related data elements. These equations were reviewed by several functional experts at both DLA Headquarters and DORO. Weighting schemes were used in the rate equations to indicate the relative importance of each data element.

[2] See footnote 1

[3] Frederick S. Hillier and Gerald J. Lieberman, Induction To Operations Research, Fourth Edition: ed. (Oakland, CA.: Holden-Day, Inc., 1986), p. 803.

2.3.2 PRICE INDICATOR

The Price Indicator tracks both the change in a Basket's average contract unit price and the average standard unit price. Contract unit price is the price DLA paid a supplier for one unit of material. This price is identified in an item's procurement contract. Standard unit price is the unit price DLA charges its customers for one item. An item's standard unit price is normally set at the beginning of each fiscal year and includes the item's most recent contract unit price plus a cost recovery charge. This charge is added by each center to recover operating expenses for managing, storing, and shipping material. The cost recovery charge is a percentage of an item's contract unit price.

The Price Indicator is based on the rate of change in the Price Rate between consecutive calendar quarters. The Price Rate equation uses Fiscal Year 1990 as the benchmark in determining the change in prices. This equation is composed of two components. One component addresses the change in average contract unit price from FY90 while the other addresses the change in the Basket's average unit standard price from FY90. The Price Rate is obtained by taking a weighted average of the two components. In the prototype model both components were weighted equally. The Rate equation is:

$$\text{Price Rate} = 100 * \left(\left(W_1 * \frac{\text{Current Ave Contract Unit Price}}{\text{FY 90 Ave Contract Unit Price}}\right) + \left(W_2 * \frac{\text{Current Ave Std Unit Price}}{\text{FY 90 Ave Std Unit Price}}\right) - 1\right)$$

where:

W_1 = weight factor for the rate of change in the average contract unit price.
W_2 = weight factor for the rate of change in the average standard unit price.

and:

$$W_1 + W_2 = 1$$

Several clarifications need to be pointed out on how the average prices are determined. First, contract unit price information is based on contracts that have been delivered within the past 5 years. Second, Current Average Contract Unit Price is the average contract unit price of all basket items. An item's current contract unit price is identified by the most recent contract price within the past 5 years. A Basket item's FY90 average annual unit price is based on the most recent average annual contract unit price for FY87 through FY90. This approach is needed to handle the situation in which a Basket item may not have any contract awards in a specific year. Third, average price values are based on only those Basket NSNs in which complete pricing information is available. Consistency of Price rates between updates cannot be obtained when Basket items are missing data. As an example, an item may not have had any contract deliveries prior to FY91. This results in the item having a current unit price but not a FY90 contract unit price.

The Price Indicator value is determined once the Price Rate has been updated. This value is simply the difference between the current Price Rate and the previous quarter's rate. As an

example, a center's Price Indicator value of +.2 points, represents a .2 point increase in a center's weighted average Market Basket price over the past quarter. The indicator equation is:

Price Indicator = Current Price Rate - Previous Quarter's Price Rate

The percent change in the Price Indicator from the previous quarter is obtained by:

Percent Change In Indicator = 100 * (Current Price Indicator /(100 + Previous Quarter Price Rate))

The Percent Change In Indicator value identifies the percent change in average prices when compared to the previous quarter.

2.3.3 SUSTAINABILITY INDICATOR

This indicator is established to provide DLA management with a performance assessment of the Agency's ability to support customer near-term peacetime and mobilization material requirements as well as the responsiveness of the Agency's material acquisition process. Key components that are included in the Sustainability Indicator are: average inventory position, average acquisition processing time, percent of basket items that are on long term contract, and average number of vendors per item. The Rate equation used to define the Indicator value is:

$$\text{Sustainability Rate} = 100 * ((W_1 * \text{Average Inventory Position}) + (W_2 * \text{Average Acquisition Processing Time Goal Rate}) + (W_3 * \%\ \text{of Basket With Long Term Contracts}) + (W_4 * \text{Vendor Base Goal Rate}))$$

where:

$$W_1 + W_2 + W_3 + W_4 = 1$$

One objective in developing this rate is to have the rate's value vary between 0 and 100. To accomplish this, each component is normalized. Weighting factors are applied to designate the relative importance of a component to the overall rate value. The sum of the weights are to equal one. Discussions on how values are determined for each component are provided in Appendix A.

A Sustainability Indicator value is obtained by the following equation:

Sustainability Indicator = Current Sustainability Rate - Previous Quarter's Sustainability Rate

The percent change in the Sustainability Indicator from the previous quarter is obtained by:

Percent Change In Indicator = 100 * (Current Sustainability Indicator / Previous Quarter Sustainability Rate)

2.3.4 AVAILABILITY INDICATOR

Focus of this measure is the assessment of the Agency's performance in filling customer requisitions. This assessment includes an analysis of back ordered requisitions, processing time in filling requisitions, and the number of requisitions that are cancelled due to stock outs (fill or kill requisitions). The analysis of back orders includes an examination of the percentage of Basket items which have back orders placed against them, the average age of back ordered requisitions, and the average percent of annual demand quantity that is on back order.

The approach used in developing this indicator is similar to the other indicators. This indicator is based on the rate of change in the performance rate from the previous quarter. The Rate equation is composed of several components. Each component is weighted to indicate its relative importance to the overall rate value. The most recent four quarters of requisition history are used to assess timeliness of processing requisition. Discussions on how values are generated for each component are provided in Appendix B. The Availability rate equation is:

$$\begin{aligned}\text{Availability Rate} = 100 * (1 - ((W_1 * \text{Ave NSN Non-fill Rate}) + \\ (W_2 * \%\text{ of Basket NSNs on Back Order}) + \\ (W_3 * \text{Ave \% of Back Order Qty Against Annual Demand Qty}) + \\ (W_4 * (\text{Ave. Back Order Age of Basket} / 100)) + \\ (W_5 * (\text{Ave Requisition Processing Time} /100)) + \\ (W_6 * (\text{Ave Fill-Kill Cancellation Rate})))\end{aligned}$$

where:

$$W_1 + W_2 + W_3 + W_4 + W_5 + W_6 = 1$$

As with the other indicators, the Availability Indicator value is the rate of change between the current Availability Rate value and the previous quarter. The Indicator equation is:

$$\text{Availability Indicator} = \text{Current Availability Rate} - \text{Previous Quarter's Availability Rate}$$

The percent change in the Availability Indicator from the previous quarter is obtained by:

$$\text{Percent Change In Indicator} = 100 * (\text{Current Availability Indicator} / \text{Previous Quarter Availability Rate})$$

2.3.5 QUALITY INDICATOR

The Quality Indicator is a performance measure that makes an assessment about the quality of material managed by each center. This quality assessment is based on the following three categories:

1. Average number of Product Complaints
2. Average number of Packaging Complaints
3. Average performance from Laboratory Testing

The original source for this information is from the centers' Customer Depot Complaint System (CDCS) data files, contract history files, and DLA's System for Analysis of Laboratory Testing (SALT) database. Pertinent information is obtained from these three data sources and fed into DLA's prototype model for Automated Best Value Model (ABVM)[4] transactional data set. This data set is updated on a monthly basis. The ABVM transactional data set is then used to obtain the required data for calculating the Quality Indicator rate values. The rate equation is:

$$\text{Quality Rate} = 100 * ((W_1 * \text{Ave Product Quality Rate}) + (W_2 * \text{Ave Packaging Quality Rate}) + (W_3 * \text{Ave Lab Test Rate}))$$

where:

$$W_1 + W_2 + W_3 = 1$$

Values for the Quality Rate are based on a weighted average of the three Quality components. Discussions on how values are generated for each component are provided in Appendix C. The weighting values for each component are based on the relative importance of the component to the overall Quality performance assessment. Values for each component rate are normalized between zero and one. This approach allows the feasible value for the Rate equation to range between 0.0 and 100.0. The approach allows for meaningful interpretation of the rate (e.g., a value of 80 indicates that 80 percent of the basket population have no quality deficiencies detected). The approach used in developing the Quality Rate equation is similar to that used in ABVM. Assessment in the rate of change in the Quality Rate value between quarters is obtained from the Quality Indicator value. This value is obtained by the following equation:

$$\text{Quality Indicator} = \text{Current Quality Rate} - \text{Previous Quarter's Quality Rate}$$

The percent change in the Quality Indicator from the previous quarter is obtained by:

$$\text{Percent Change In Indicator} = 100 * (\text{Current Quality Indicator} / \text{Previous Quarter Quality Rate})$$

2.3.6 OVERALL AGENCY AND CENTER PERFORMANCE INDICATORS

Summary performance index values for the Agency and Centers are obtainable once the individual center indicator values are determined. These summary statistics provide management with an overall assessment of the performance of the Centers and the Agency in accomplishing its supply operations mission. These summary indices are obtained by the following equations:

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[4] Paul Grover, Randell Wendell, Major Mark Melius (USA), and Donna Smith, Defense Logistics Agency Vendor Rating System (Renamed Automated Best Value Model after publishing report), Blue Cover Report DLA-92-P10164, September 1992, Defense Logistics Agency Operations Research and Economic Analysis Office, Cameron Station Alexandria, VA

$$\text{Center Performance Index} = (W_1 * \{\text{-Price Indicator}\}) + (W_2 * \text{Sustainability Indicator}) + (W_3 * \text{Availability Indicator}) + (W_4 * \text{Quality Indicator})$$

and

$$\text{Agency Performance Index} = (W_1 * (\Sigma \{\text{- Center's Price Indicator}\} / M)) + (W_2 * (\Sigma \text{ Center's Sustainability Indicator} / M)) + (W_3 * (\Sigma \text{ Center's Availability Indicator} / M)) + (W_4 * (\Sigma \text{ Center's Quality Indicator} / M))$$

where:

$W_1 + W_2 + W_3 + W_4 = 1$
M = Number of Supply Centers

2.4 MARKET BASKET MODIFICATIONS

Modifications should not be made to a Basket's composition or size. Changing a Basket will result in inconsistent indicator values and an inaccurate assessment of the true performance of a center's Basket. An annual evaluation should be conducted to assess whether Basket NSNs have become inactive or deleted from Center management. If such a situation occurs, a replacement NSN needs to be obtained from the same stratum. The replacement NSN should contain properties similar to that of the leaving NSN. The previous quarter's indicator data files will need to be rerun prior to calculating new indicator values. In the case that indicator values are determined by using base year figures, an adjustment equation will be required if the new NSN does not have a base year value. The following equation can be used to make the adjustment:

$$\text{New NSN Base Year Value} = A_a * (B_b/B_a)$$

where:

A_a = New NSN's Data Value at Period A.
B_a = Old NSN's Data Value at Period A.
B_b = Old NSN's Data Value at Base Year.

Complete reconstruction of the Centers' Market Baskets may be required if DLA experiences a major composition change in the items it manages. An example of this would be a Department of Defense policy directive that states DLA will take over supply management of the Services' repairable items. Another possible time to reconstruct the Baskets is when quarterly updates produce results that fail to fluctuate to the same degree as initial updates. This may occur after a long period of time (perhaps 10 years or so).

SECTION 3
MARKET BASKET INDICATOR ANALYSIS

This section provides an analysis of the prototype model results. The reader should clearly understand that the results presented in this section are from a prototype model and are provided only to demonstrate the model's abilities. Fictitious center designations are used in this section to insure anonymity between Center's performance. One should find that the product of this study effort is a powerful management tool which, when used correctly, can provide upper management with the ability to make an objective assessment of the organization. Results from the model can be used to isolate and identify areas for improvements. Size and composition of the Centers' Market Baskets, as well as performance indicator values, are based on supply and acquisition data as of 30 September 1992. Previous quarter performance rates are based upon 30 June 1992 data values.

3.1 CENTER BASKET SIZES

The number of NSNs that comprise each Center's Basket is displayed as Table 3-1. These figures are based on a confidence level of 95 percent. On average, the Basket size is about 3.4 percent of the eligible population size. Though exact indicator values can be easily obtained by analyzing the entire population, a statistical sample of the population allows for a manageable number of NSNs to be investigated. These investigations are warranted in determining the root causes of performance shortcoming. The composition of each Center's Basket is determined by stratified sampling techniques and is based on an NSN's averaged annual total dollar value.

	Center 1	Center 2	Center 3	Center 4	Center 5	Center 6	DLA TOTAL	CENTER AVERAGE
No. Eligible NSNs	56,754	54,846	45,351	67,251	5,322	1,283	230,807	38,368
No. NSNs in Basket	767	1,316	414	2,220	299	84	5,100	850
Percent of Eligible Population In Basket.	1.4	2.4	0.9	3.3	5.6	6.5		3.4

Table 3-1 Demographics Of Agency's Market Basket Population

3.2 OVERALL AGENCY INDICATOR PERFORMANCE

Figure 3-1 displays the Agency's Market Basket Performance Index for the fourth quarter FY92. This figure shows the Agency's overall performance improved by 1.3 points when compared to the Agency's third quarter performance. All of the available indicators showed improvement over third quarter figures, with the Availability Indicator leading the way. Center Six was the major contributor to the high Availability value. On the other hand, Center Four's Availability performance dropped 15.1 points. Later discussions will provide insight into the reasons for Center Four's and Center Six's performance.

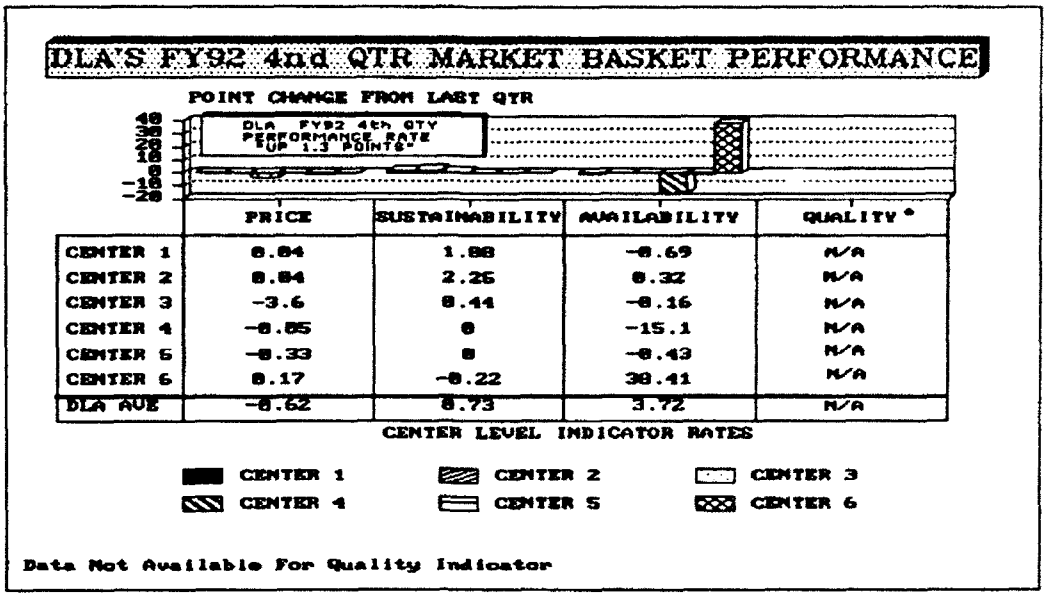

Figure 3-1 4th Qtr FY 92 DLA Market Basket Index

There are several positive statements that can be made about the Agency's fourth quarter performance. First, the Agency's prices went down slightly (.62 points) during the fourth quarter. Discussions in Section 3.3 will highlight the specific reasons for the favorable pricing situation. Second, Sustainability Indicator values have gone up .73 points. Discussions in Section 3.4 will provide further elaboration on the Agency's positive Sustainability value. No data is provided for the Quality Indicator due to the fact that DORO did not have access to CDCS data for all Centers during the development of the project.

3.3 PRICE INDICATOR

Figure 3-2 displays the results of the Centers' Pricing performance for fourth quarter FY92. This figure shows that the Agency's prices dropped an average of .6 points. This is a .56 percent decrease in prices when compared to the third quarter. This value is based on a 50/50 weighting of average contract unit price and average standard unit price. The main contributor to this favorable position is Center Three, which had a 3.6 point decrease in its Price Rate over last quarter's performance. Center Three's performance can be explained by a 5.3 percent decrease in its Basket's average standard unit price (Figure 3-3). Figure 3-2 also shows that Center Five had a moderate decrease (.3 percent decrease in prices) in its Price Rate value. In Center Five's case, the improvement is attributed to a .53 percent decrease in its average unit procurement cost (Figure 3-4). Center Six had the highest change (.16 percent increase in prices over third quarter) in Prices, as compared with other Centers (Figure 3-2).

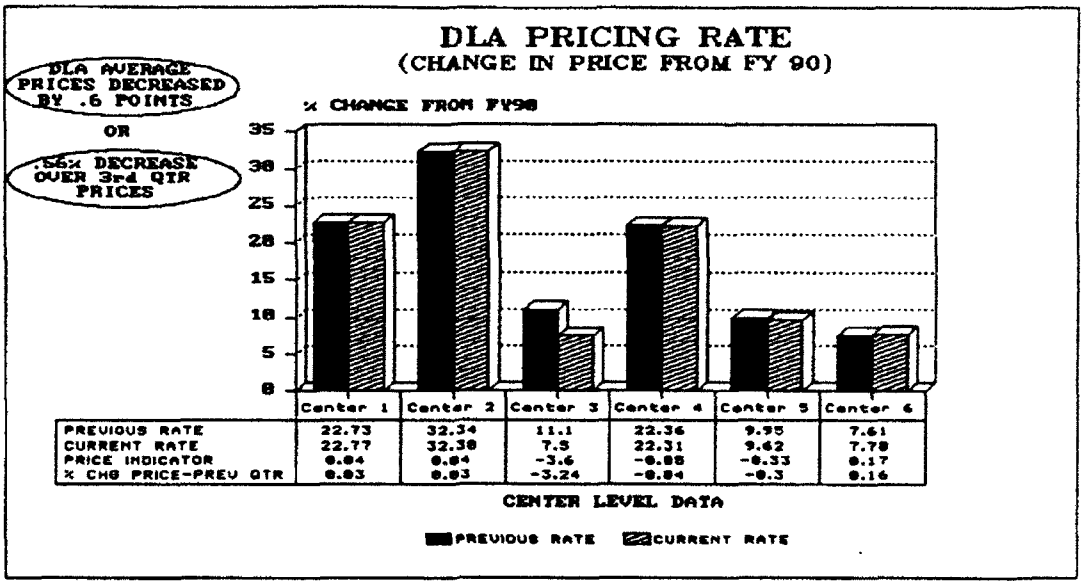

Figure 3-2 4th Qtr FY92 Price Rates

As mentioned in Section 2.3.2, Center Price Rate values indicate the rate of change in the two pricing factors since the 4th Qtr FY90 (the benchmark year). From this view, Center Two has had the largest increase (32.34 percent) in average pricing since FY90. Center Two's performance is attributed to a 61 percent increase in its average standard unit price since FY90 (Figure 3-3). The large increase in Center Two's average standard unit price can be attributed to a 3.6 percent increase in average contract unit prices (the highest increase among the Centers) since FY90 (Figure 3-4).

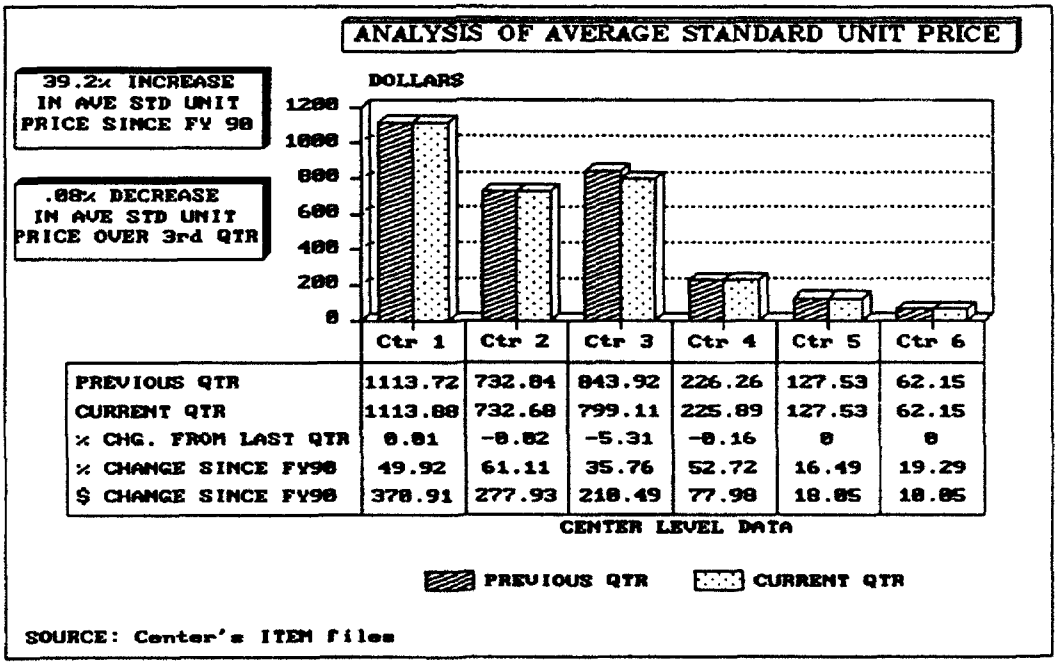

Figure 3-3 4th Qtr FY92 Average Standard Unit Prices

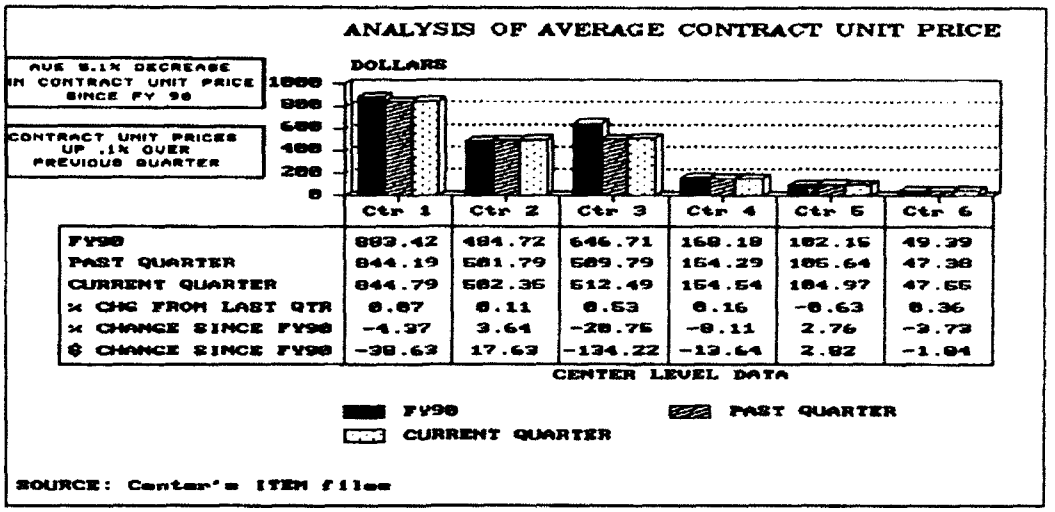

Figure 3-4 4th Qtr FY92 Average Contract Unit Prices

Figure 3-2 also shows Centers Three, Five and Six were the best performers in holding down the prices since FY90. These centers had less than a 10 percent increase (Center Three 7.5 percent, Center Five 9.62 percent, Center Six 7.78 percent) in overall pricing factors. Center Three's success is attributed to an average contract unit price decrease of $134.22 since FY90 (Figure 3-4).

The Market Basket Model also has the capability to provide the user the flexibility to conduct detailed statistical analysis of the most recent price factors. This is possible because of the model's ability to generate a data set containing price factors for each basket item. Similar data sets are generated for the other performance indicators. However, they are not presented in this report. This data set can be downloaded to a user's personal computer (PC), where the user can use various software applications, such as Dbase IV, to conduct further data analysis and screening. Table 3-2 provides an example of a PC-based database of a center's Price data.

Basket Reference No.	Average Contract Volume	FY90 STD Unit Price	FY90 Ave Contract Unit Price	4th Qtr FY92 STD Unit Price	4th Qtr FY92 Ave. Contract Unit Price
5,000,003	2	440.80	382.00	792.00	531.20
4,000,007	5	211.20	183	413.60	277.40
4,000,016	3	2,405.11	2,091.43	3,789.44	2,520.34
4,000,021	3	13.60	12.20	13.90	11.70
6,000,004	9	17.20	24.40	22.20	32.30
6,000,007	26	41.70	32.50	58.20	40.80

Table 3-2 Price Rate Database Example

3.4 SUSTAINABILITY INDICATOR

The Agency's fourth quarter FY92 Sustainability Indicator results are provided as Figure 3-5. The weighting scheme for this indicator is: Average Inventory Position 55 percent, Acquisition Processing Time 25 percent, Percent of Basket NSNs with Long Term Contracts 5 percent, and Vendor Base Goal Rate 15 percent. Figure 3-5 shows the Agency's Sustainability

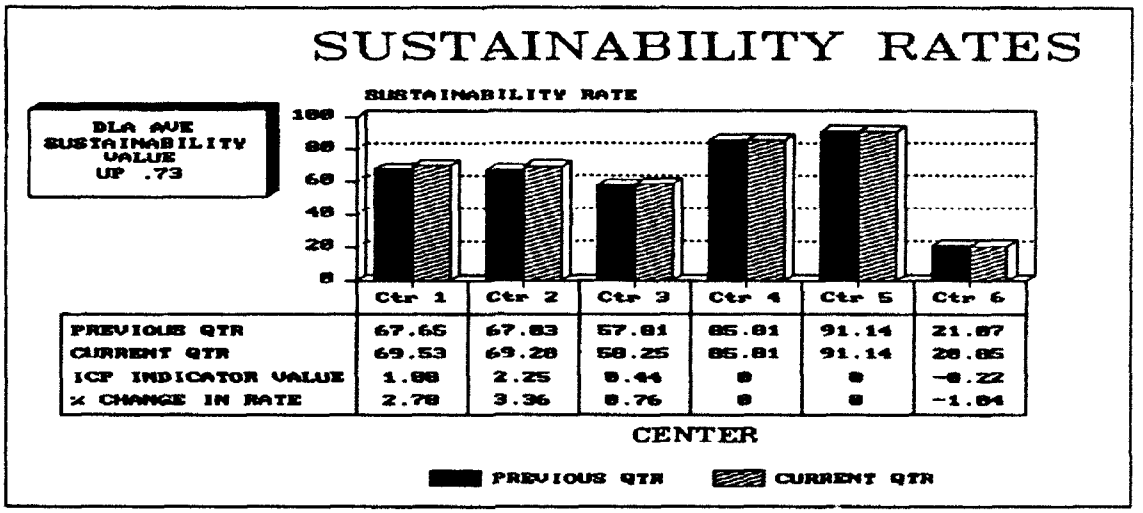

Figure 3-5 4th Qtr FY92 Sustainability Indicator Results

performance improved by .73 points or .97 percent over the past quarter's rating. Majority of this improvement is attributed to the performance at both Center One and Center Two. However, an improvement in this rate does not necessarily mean desirable supply performance. This fact is pointed out in Figure 3-6 where the average inventory position of the Centers' Basket items is over five times what is needed to meet the next 6 months of

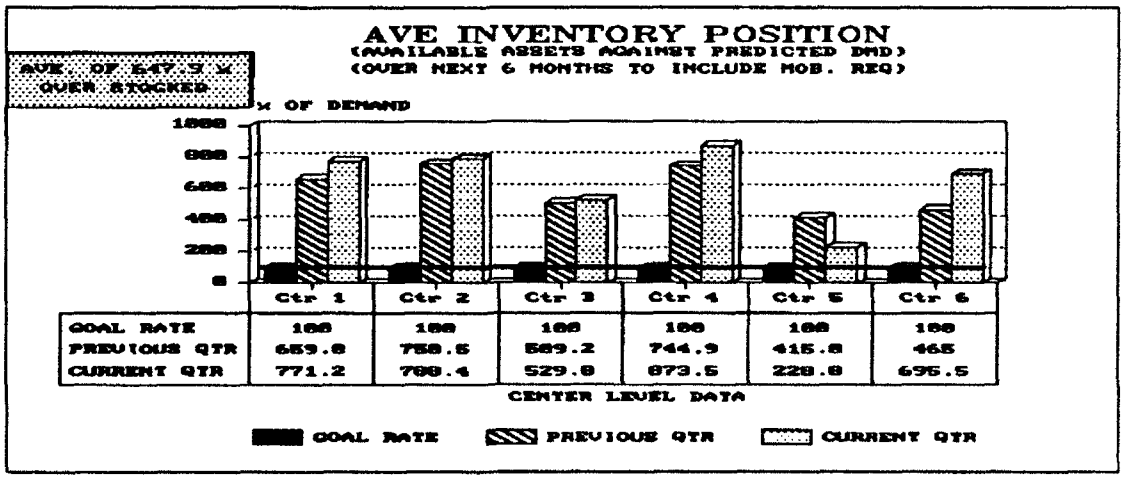

Figure 3-6 DLA Basket Average Inventory Position

normal demand and the Services' mobilization requirements. This can be translated to mean that the Agency has, on average, enough inventory to meet 3 years worth of Services supply requirements. These high inventory levels translate into higher than needed inventory storage costs. Figure 3-6 also indicates that, except for Center Five, these inventory levels have increased since last quarter. The solid black line and bars indicate the 6 month demand requirement.

Another component of the Sustainability Indicator value is the Center's performance in acquisition processing time. This component describes the time it takes, on average, for a center to complete processing of the procurement action. The clock starts on an action at the time when a recommendation is made to start a procurement action and ends at the time the contract order is received at the stockage location or by the customer. Fourth quarter FY92 results are shown in Figure 3-7. Figure 3-7 shows that, on average, it takes 247 days to complete an acquisition action. This is a 2.4 day improvement over the previous quarter. The solid black bar indicates the Center's goal processing rate of 20 percent below the total average acquisition processing time for FY90. The 20 percent goal was arbitrarily set to demonstrate the model's capabilities. It is assumed that DLA management would set these goals, if the model is implemented. This figure shows that only Centers Four and Five have met their goals. At Center Six, processing times have increased significantly since FY90.

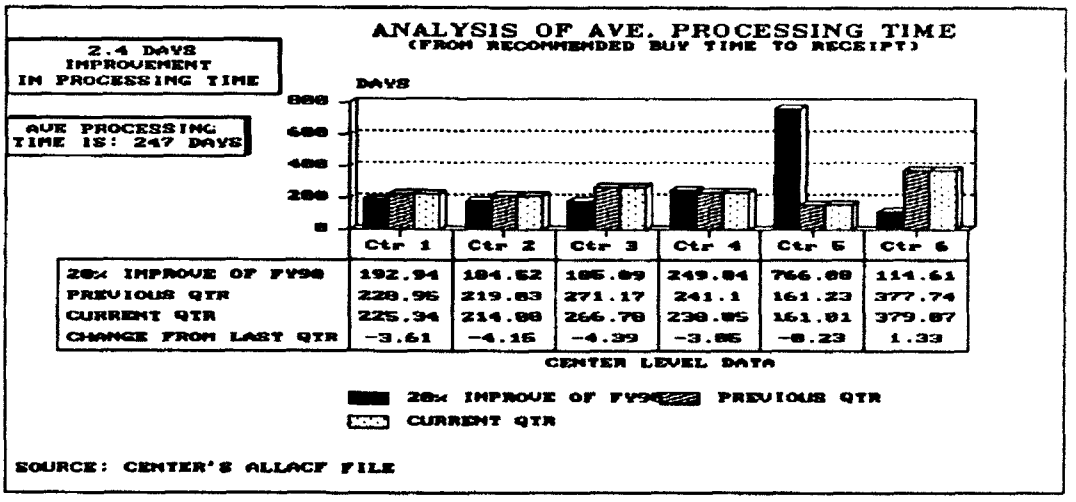

Figure 3-7 4th Qtr FY92 Average Acquisition Processing Time

Results of the Percent of Basket NSNs on Long Term Contract component are displayed as Table 3-3. As this table shows, there was no significant change in the Centers' performance in this area.

	Center One	Center Two	Center Three	Center Four	Center Five	Center Six
4th Qtr FY92 percent NSNs on Long Term Contract	8.5	5.2	13.8	5.4	40.9	13.3
3rd Qtr FY92 percent NSNs on Long Term Contract	8.5	5.2	14.0	5.4	40.9	13.3
Percent Change	0.0	0.0	0.2	0.0	0.0	0.0

Table 3-3 Market Basket Long Term Contract Performance

The last component of the Sustainability Indicator is the Average Vendor Base Goal Rate. In the prototype run, the goal rate was set at two vendors per Basket NSN. In all cases, the centers met or exceeded this goal rate, thus, obtaining a component rate of 1.0.

3.5 AVAILABILITY INDICATOR

Results of the Agency's fourth quarter FY92 Availability Indicator is presented as Figure 3-8. The component weighting scheme used for this Indicator is shown in Table 3-4. Figure 3-8 shows the Agency's Availability Indicator value improved 3.7 points or 13.9 percent over third quarter figures. Though the fourth quarter figures show improvement, the results are misleading. Four of the six centers showed a decrease in their Availability performance over third quarter figures. Center Two showed only a slight improvement, while Center Six had a significant improvement over its third quarter performance. Center Six's third quarter performance can be explained in Figure 3-10. Figure 3-8 also shows that Center Two had the best Availability performance, with a 91.14 rate, during the fourth quarter. This was a .35 percent increase over third quarter figures. Center Four had the largest decrease (19.37

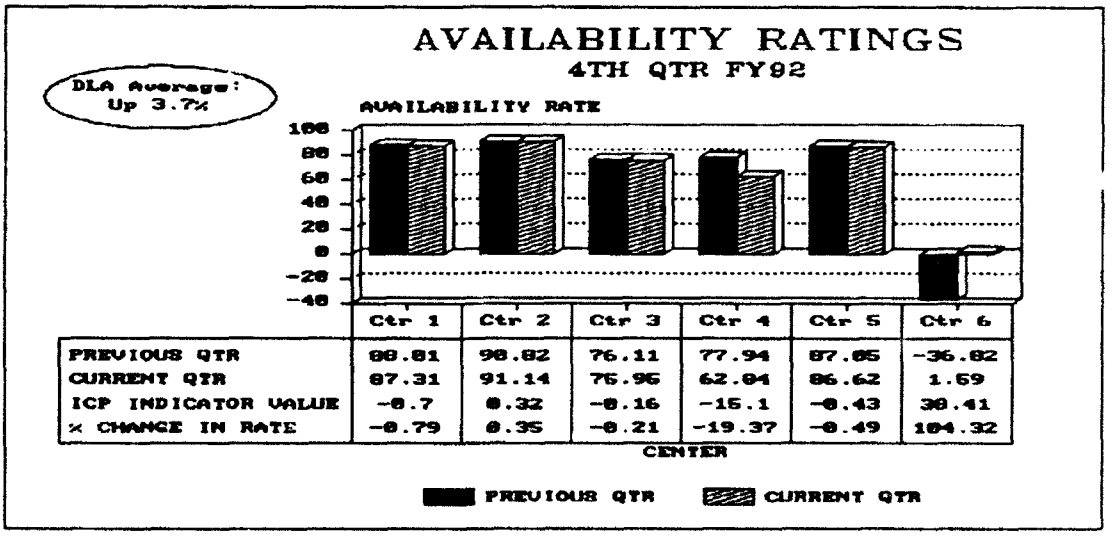

Figure 3-8 4th Qtr FY92 Market Basket Availability Indicator Results

percent Non-filled Requisitions	Ave percent Back Order to Annual Demand	Percent of Basket on Back Order	Ave. Age of Back Orders	Ave. Requisition Process Time	Ave Fill-Kill Cancellation Rate
0.10	0.20	0.15	0.25	0.20	0.10

Table 3-4 Weighting Scheme For Availability Indicator

percent) in its fourth quarter Availability Performance Rate. Figure 3-9 highlights a cause for Center Four's performance. This chart shows that Center Four had almost a 10 percent increase in the number of non-filled customer requisitions over last quarter.

Figure 3-9 shows that the Agency's overall performance in filling requisitions improved by .39 percent. This improvement can be accredited to Center Three's 11.68 percent decrease in its non-fill rate. However, Center Three still leads the other centers with the highest non-fill rate of 48.9 percent. Center Five had the lowest non-fill rate (6.57 percent).

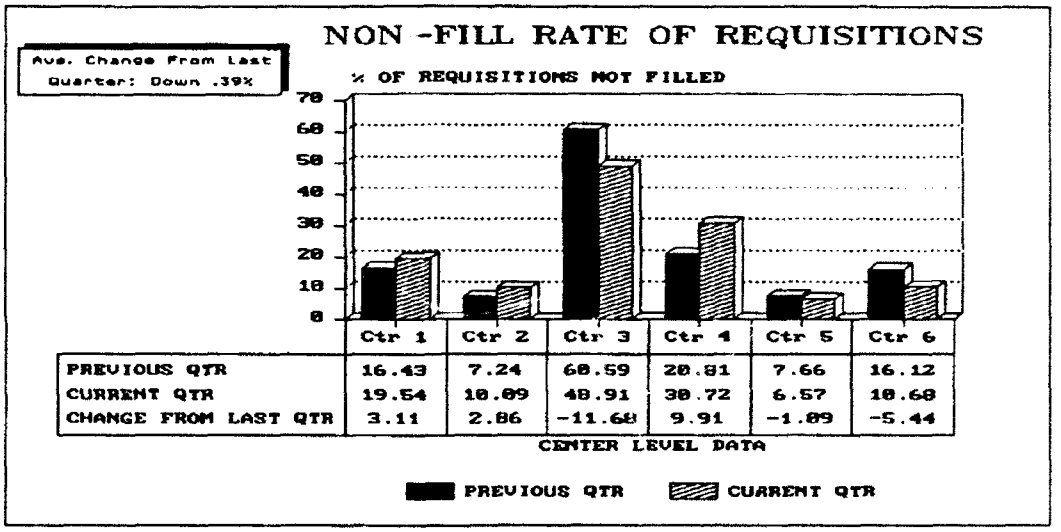

Figure 3-9 4th Qtr FY92 Non-Filled Requisitions Rate

Figure 3-10 shows that, on average, the Centers' average Basket item back order quantity is 102.39 percent of the item's average annual demand requirement. The fourth quarter figures are a 17 percent improvement over the third quarter results. Center Six is the major contributor to the high back order figure. Center Six has over four times the item quantity amounts on back order than are normally demanded on an annual basis. An investigation of Center Six's data revealed that the high back order to annual demand rate is caused by one NSN which has an extremely high back order situation. Center Four's average back order quantities are also slightly higher (26 percent) than average annual demand quantities. Both Centers One and Two show outstanding performance with very low NSN back order quantities when compared to average annual demand requirements.

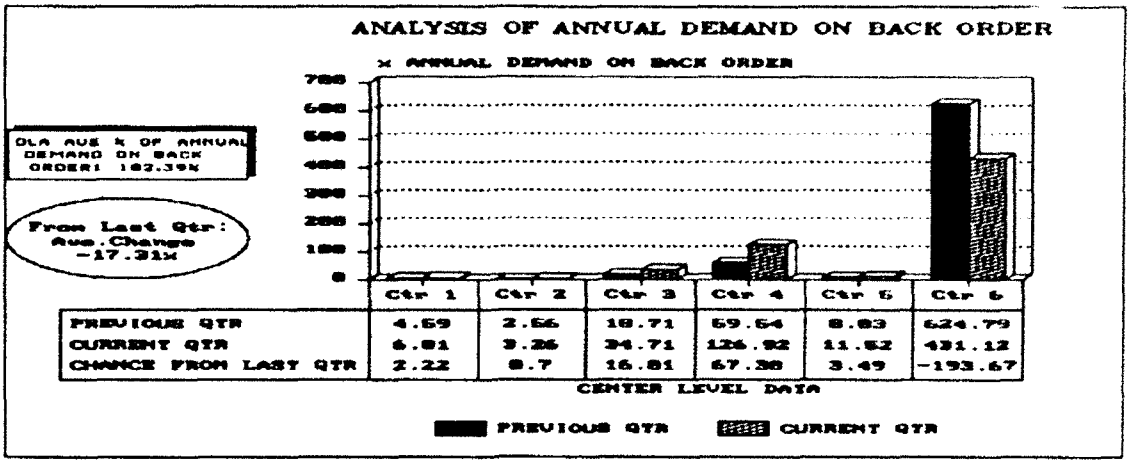

Figure 3-10 4th Qtr FY92 Average Annual Demand To Back Order Quantities

Figure 3-11 shows the Centers' performance results for Average Back Order Age. On average, it takes the Agency 18 days to fill a back ordered customer requisition. This is a .9 percent improvement over the third quarter figures.

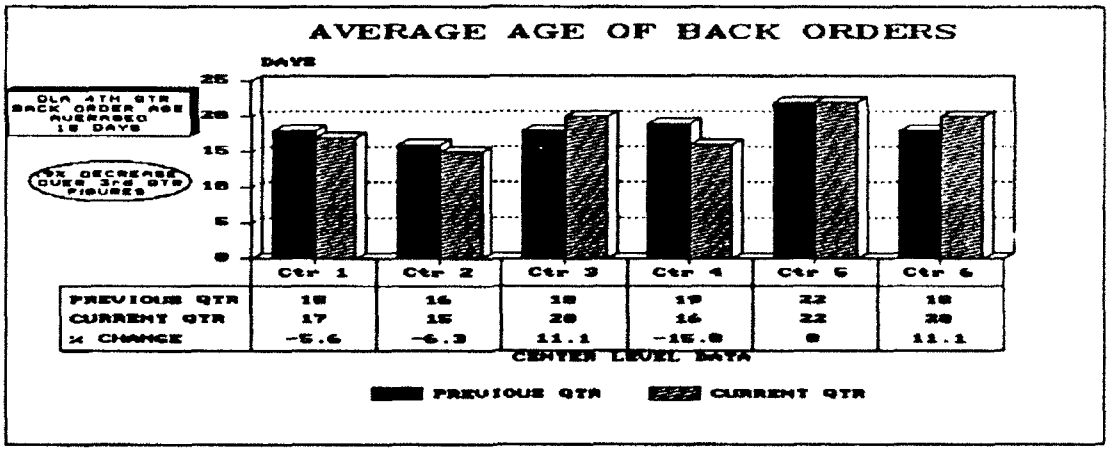

Figure 3-11 4th Qtr FY92 Average Back Order Age

Figure 3-12 highlights the Centers' performance on timeliness of processing customer requisitions. Though timeliness standards currently exist within the Agency for various requisition priority levels, the intent of this component is to only capture the general time it take to process a requisition. On average, it takes the Agency 9 days to process a customer requisition. At the Agency level, there was no change in average processing time. Figure 3-12 show that only Centers One and Two had any change in their average processing rate.

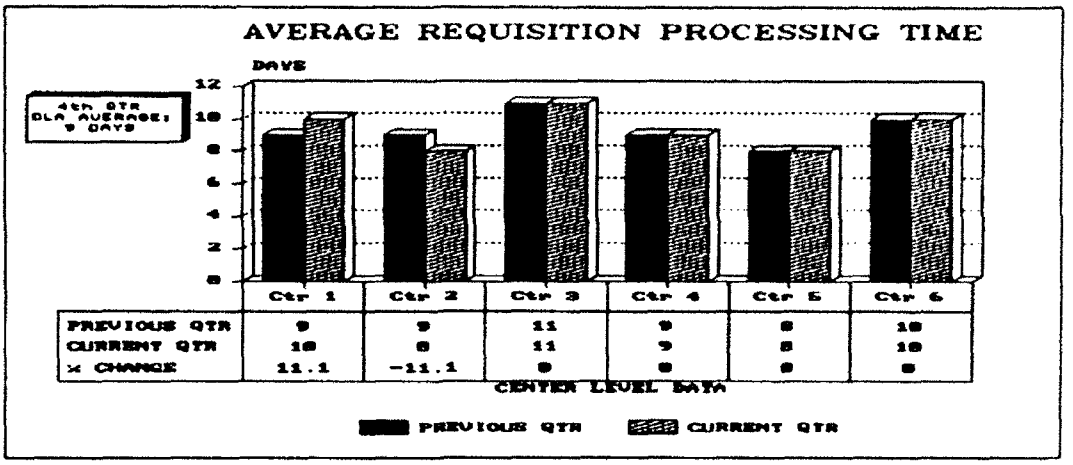

Figure 3-12 4th Qtr FY92 Average Requisition Processing Time

The Fill-Kill Cancellation Rate is the remaining Availability component to be discussed. Across the Agency fill-kill cancellations occurred at a very low frequency. It was so low that none of the Basket NSNs had any fill-kill cancellations during the fourth quarter.

3.6 QUALITY INDICATOR

Performance results for the Quality Indicator are limited to only one center at the time of publishing this report. This is due to the fact that DORO has access to CDCS data and completed ABVM files for only one center. As a center's CDCS files are transferred to IPC-R and ABVM data sets generated, DORO will be able to calculate Quality values. Transfer of CDCS files are planned to be accomplished by June 1993.

A center's Quality Indicator value is provided as an example in Table 3-5. This table shows that the center's Quality performance decreased by .38 percent over the previous quarter's performance. This situation is due to a higher number of packaging and product complaints as compared to its contract volume. The average laboratory test score (a measure of conformance to specifications of items tested) was unchanged.

	Quality Rate	Ave. Product Rate	Ave. Packaging Rate	Ave. Lab Test Score
3rd Qtr FY92	97.3	96.2	96	100
4th Qtr FY92	96.9	95.2	95.6	100
Indicator	Down .4			
% Change In Indicator	Down .38			

Table 3-5 4th Qtr FY92 Quality Indicator

SECTION 4
CONCLUSIONS

An automated process was developed, using stratified sampling techniques, to construct a representative collection of DLA managed goods. This collection was defined as the DLA Market Basket. Baskets were developed for each of the Agency's supply centers, except DFSC, since these organizations perform most of the supply management function. The average center Basket size was only 3.4 percent of the centers' eligible population or 850 NSNs. These relatively small study samples facilitate easy isolation and identification of areas for improvement as well as the flexibility to conduct varying degrees of sensitivity analysis. The Market Basket Model generates NSN level databases for each performance area. These databases were designed for use in conducting such analysis.

The performance indicators that were desired by the Study Sponsor were developed and meaningful values obtained. This report shows that these indicators can provide information about the Agency's and Supply Centers' performance of providing quality customer supply support in the areas of Price, Sustainability, Availability, and Quality Assurance. These indicators describe the rate of change in a respective performance rate between consecutive calendar quarters. As part of this study effort, performance rates were developed using a set of performance related data elements. This report shows that an analysis of the data elements provide management utility in isolating improvement areas. The final decision on the usefulness of these indicators, however rests with top management.

Computer programs used to calculate the Market Basket indicator values were completed as a prototype model. This model was designed in a modular fashion and written in a computer language which is transferrable to a central design activity. The modular design allows each performance indicator to be updated separately as well as separates the process of constructing updated Baskets from Indicator updates. With minimal programming and documentation effort, the Market Basket model could be transformed into a regularly scheduled production system. PC-based management support models can also be developed with a minimal amount of effort.

The composition and size of the Centers' Market Baskets should not to be modified. Such tampering would result in inconsistent indicator values and an inaccurate assessment of true performance of a center's Basket. However, an internal evaluation should be conducted annually to assess whether Basket NSNs have been deleted from center management or if the population of items managed by a center has undergone a major change.

SECTION 5
RECOMMENDATIONS

It is recommended that an inquiry be made to both the Agency's and Centers' top leadership on the usefulness of the Market Basket model as a management tool. In the process of obtaining top management approval, the Market Basket approach should be further validated. This effort will require an in-depth review by Agency and Center functional experts of the indicator attributes and component weighting schemes as well as a sanity check of the output data. It is then recommended that the Agency's management, in conjunction with Center management input, establish performance goals for each indicator. In a concurrent effort, an implementation plan should be developed to transfer the prototype Market Basket model into a production tool which is centrally administered at Headquarters DLA.

It is recommended that the Market Basket sponsor, DLA-P&PI request a follow-on project if top management approves the concept of using the Market Basket approach in measuring the Agency's supply support performance. This effort would involve having management and functional experts provide a further validation and approval of the indicators methodology and data. This project would also include development of an implementation plan.

APPENDIX A
SUSTAINABILITY RATE COMPONENT METHODOLOGY

TABLE OF CONTENTS
APPENDIX A

APPENDIX A
SUSTAINABILITY RATE COMPONENT METHODOLOGY

A-1 AVERAGE INVENTORY POSITION DETERMINATION

The average inventory position compares a center's average inventory asset posture against an average 6 month demand requirement. A value for the average inventory position is obtained by using the following equation:

$$\text{Average Inventory Position} = \frac{\text{Average Inventory Asset Posture}}{\text{Ave 6 Month Demand Requirement}}$$

As the below equation shows, a Basket item's inventory asset posture is defined as the NSN's on-hand inventory (total quantity of items available for issue within DLA depots) plus the quantity of material that is on contract for delivery to a DLA depot. Source of this data is the DLA's Item files[1]. The average inventory asset posture is obtained by the following equation:

$$\text{Average Inventory Asset Posture} = \frac{\Sigma(\text{Item's Inventory Asset Position})}{\text{No. Items in the Basket}}$$

where:

$$\text{Item's Inventory Asset Posture} = \text{On-hand Qty} + \text{Due-In Qty}$$

The average 6 month forecasted demand requirement is obtained by averaging each Basket item's 6 month demand requirement. The average 6 month demand requirement is obtained by the following equation:

$$\text{Ave. 6 Month Demand Req} = \frac{\Sigma(\text{Item's 6 Month Dmd Requirement})}{\text{No. Items in the Basket}}$$

A Basket item's 6 month demand rate is obtained by accumulating an NSN's 6 months of normal demand plus 6 months of the Services' total mobilization requirements plus the total quantity of material that is on back order to the customer. This is shown by the following equation:

$$\text{Item's 6 Month Demand Requirement} = (\text{Back Order Qty} + \text{6 Month Forecasted Demand} + \text{6 Month Mobilization Requirement.})$$

[1] Stanley Naimon, Defense Logistics Agency Integrated Data bank (DIDB) Dictionary, Cameron Station, Alexandria, VA, DLA's Operations Research and Economic Analysis Office, 1991.

A 6 month normal demand requirement is determined by doubling a NSN's quarterly forecasted demand quantity which is obtained from the latest update of the DIDB's Item file. The item's back order quantity is also obtained from the Item file.

The 6 month mobilization requirement is obtained from DLA's Service War Reserve Material Requirements data files. These files contain the Services' monthly war reserve material requirements during a full mobilization. This file provides data for both the prepositioned requirements (normally defined as the first 60 days of stocks that are to be located within or near the operational theater), prepositioned requirements - protectable (the portion of the preposition requirement that has been acquired or funding obtained), and the additional six monthly requirement quantities which are determined to be DLA's responsibility to fill. An item's 6 month mobilization demand rate is determined by calculating the preposition shortfall (preposition material requirement quantity - preposition material requirement protectable quantity) plus the first 4 months of DLA's responsible requirements.

A-2 AVERAGE ACQUISITION PROCESSING TIME GOAL RATE

The second component, average acquisition processing time goal rate assesses the time it takes the Agency to complete an acquisition action. This period is defined by the following equation:

Process Time = Contract Receipt Date - Contract Recommended Buy Date.

The selected approach is to obtain an average acquisition processing time for all the basket items over the most recent two year periods. The source for this information is DIDB's ALLACF files[2]. Since an NSN could have multiple contracts (or contract lines), an average process time value is determined for each NSN. The average NSN processing rate for all basket NSNs are averaged together to form the basket's average acquisition processing time. This process is shown by the following equation:

$$\text{Current Ave. Basket Acq. Process Time} = \frac{\Sigma(\text{Ave NSN Acquisition Process Time})}{\text{No. NSNs in Basket}}$$

This value is then compared against a calculated average acquisition processing time performance goal. This performance goal is a percentage reduction of the average acquisition processing time for all of a center's contracts during FY90. An average acquisition process time goal rate is then determined by using the following scoring process:

1. If the current average basket acquisition process time meets or exceeds the performance goal, the goal rate value is 1.0.

[2] See footnote 1

2. If the current average basket acquisition process time is between the performance goal and the FY90 average processing rate, the goal rate is determined by the following equation:

Goal Rate = (Current Ave. Basket Process Time / Performance Goal)

3. If the current average basket acquisition processing time is above the FY90 average processing rate, the goal rate is determined by the following equation:

Goal Rate = (1 - (Current Ave. Process Time / FY90 Ave. Process Rate)

In this case, a negative goal rate will occur. This situation results in an negative impact on the overall Sustainability Rate value.

A-3 PERCENT OF BASKET ITEMS WITH LONG TERM CONTRACTS

Percent of Basket items with long term contracts (LTCs) is determined by the following equation:

Percent Basket With LTCs = (No. Bskt Items on LTC / No. Items in Basket)

Determination if an NSN is on LTC is based on whether an NSN has any open contracts that are designated as Indefinite Delivery Term (IDT) contracts. This information is obtained from the DIDB ALLACF files. These contracts are coded with a "D" in the ninth position of the item contract number.

A-4 VENDOR BASE GOAL RATE DETERMINATION

This Sustainability Rate component makes an assessment of whether an adequate number of proven vendors exist for the basket NSNs. The number of vendors for a given NSN is determined by the count of unique CAGE codes for all closed contracts within a five year period for a given NSN. The source for this information is the DIDB ALLACF files[3]. This assessment compares the average numbers of proven vendors per Basket NSNs over the past two years against an established goal. If the goal is met or exceeded , the goal rate is 1.0. If the average number of proven vendors is below the goal then the goal rate is the ratio of the average number of vender over the goal value.

[3] See footnote 1

APPENDIX B
AVAILABILITY RATE COMPONENT METHODOLOGY

TABLE OF CONTENTS
APPENDIX B

APPENDIX B
AVAILABILITY RATE COMPONENT METHODOLOGY

B-1 AVERAGE NSN NON-FILL RATE

This component measures the Centers' performance in filling customer requisitions. Values for this component are determined by the following equations:

Average Non-fill Rate = (Σ Basket NSN Non-fill Rate / No. of Basket NSNs)

The Basket NSN non-fill rate is determined by the following equation:

Basket NSN Non-fill Rate = (No. Requisitions on Back Order / No. Requisition Received)

Data for this calculation is obtained from the DIDB quarterly Item files. The number of requisitions received for a NSN is obtained by adding the most recent quarter's Non-Recurring and Recurring Demand Frequency data fields together. The number of requisitions for an NSN that are on back order is obtained from the Item file's Back Order Lines data field.

B-2 PERCENT OF BASKET NSNs ON BACK ORDER

This component assesses the percentage of the Basket that is in a back order status. This information can be used to assess a center's performance in responding to customer requisitions. Values for this variable are determined by the following equation:

Percent of Basket NSNs on Back Order = (No. Bskt NSNs with Back Orders / No. of Basket NSNs)

The source of data for the above equation is also the DIDB Item files. The number of Basket NSNs on back order is determined by counting the number of Basket NSNs which have a value greater than zero in the Back Order Quantity field.

B-3 AVERAGE PERCENT OF BACK ORDER QUANTITY AGAINST ANNUAL DEMAND QUANTITY

This component assesses the magnitude of a NSN's back order (BO) quantity against its annual demand quantity. Information from this variable can be used to assess the magnitude of the average NSN back order quantity in relative terms to its annual demand requirements. Rate values for this component are determined by the following equations:

Ave. percent Back Order Qty Against Annual. Dmd Qty = (Σ NSN BO Rate / No. Basket NSN with BO)

where:

NSN BO Rate = (BO Quantity / Annual Demand Quantity)

Both an NSN's Back Order Quantity and Annual Demand Quantity are obtained from theDIDB quarterly Items Files.

B-4 AVERAGE BACK ORDER (BO) AGE

The average BO age component is included in the Availability Rate equation to assess the average age of a center's BO situation. BO age is defined as the number of days that a back order coded requisition has been on back order. Information from this variable can provide some insight into a center's ability to respond to a back order situation in a timely manner. This average is based on the most recent four quarters of requisition history. Equations used in calculating the value for this component are:

Ave BO Age = (Σ Ave NSN BO Age / No. Basket NSNs on BO)

where

Ave NSN BO Age = (Σ Requisition BO Age / No. Requisitions on BO)

and

Requisition Back Order Age = (Current Run Date - Requisition Birth Date)

or

Requisition Back Order Age = (Ship Date - Requisition Birth Date)

An NSN's requisition birth and ship dates are obtained from the DIDB quarterly commodity Material Readiness System Requisition (GOR.MAR.RQN) files[1]. The current run date value is the Julian date when the Availability program is run. This date is also referred to as the computer's system date.

B-5 AVERAGE REQUISITION PROCESS AGE

An important aspect of supply availability is timeliness of filling material demand requirements. As with the BO age variable, this component's unit of measure is the total number of days to process a requisition. The average requisition processing time is based on the most recent four quarters of requisition history. Both valid open and closed requisitions are included in this calculation. Requisitions which have been cancelled are not included. Values are obtained for this component by the following equations:

[1] See footnote 1, Appendix A, Naimon

Ave. Requisition Processing Age = (Σ Ave NSN Process Age / No. NSNs in Basket)

where:

Ave NSN Process Age = (Σ Requisition Processing Age / No. of Requisition for NSN)

and:

Requisition Processing Age = (Depot Ship Date - Requisition Birth Date)

or

Requisition Processing Age = (Current Run date - Requisition Birth Date)

As with the back order age equations, source data for the requisition processing age equations are obtained from the DIDB GOR.MAR.RQN files.

B-6 AVERAGE FILL-KILL CANCELLATION RATE

The final component of the Availability Rate equation is the fill-kill cancellation quantity rate. This variable is included in the Availability equation because availability performance information can be inferred by large quantities of fill-kill cancellations. Fill-kill cancellation can occur when there is inadequate stock to fill a requisition and customer agrees to killing the requisition. This rate is based on the most recent four quarters of requisition history which is obtained from the DIDB GOR.MAR.RQN files. The equations for this variable are:

Average Fill-Kill Cancellation Quantity Rate = (Σ Ave NSN Fill-Kill Qty / No. NSNs in Basket)

where:

Ave NSN Fill-Kill Qty = (Σ Requisition Qty of fill-kill can / No. Fill-kill Can. Requisitions)

APPENDIX C
QUALITY RATE COMPONENT METHODOLOGY

TABLE OF CONTENTS
APPENDIX C

APPENDIX C
QUALITY COMPONENT METHODOLOGY

C-1 AVERAGE PRODUCT QUALITY RATE

The Average Product Quality Rate assesses the average volume of customer product quality complaints over the past year as compared to the number of contract lines over the past year. Product quality complaints identified from DLA's Automated Best Value Model (ABVM) quality transactional file[1]. Contract volume is obtained from the center's Contract History file. Equations used to calculate the rate value are:

NSN Product Quality Rate = 1 - (No. of CDCS Product Quality Complaints / NSN Contract Volume)

Ave. Product Quality Rate = (Σ NSN Product Quality Rate / No. Basket NSNs)

C-2 AVERAGE PACKAGING QUALITY RATE

The Average Packaging Quality Rate assesses the average NSN volume of customer/depot complaints of packaging discrepancies over the past year. This quantity is compared to the average NSN contract volume during the same year. Source of complaint information is DLA's ABVM quality transactional file. Equations used to calculate the rate value are:

NSN Packaging Quality Rate = 1 - (No. of CDCS Packaging Complaints / NSN Contract Volume)

Ave. Packaging Quality Rate = (Σ NSN Packaging Quality Rate / No. Basket NSNs)

C-3 AVERAGE LABORATORY TEST RATE

This rate is included in the Quality Indicator rate equation to assess the conformance level of material when being compared to an item's design specification. These conformance checked are conducted as part of the DLA's Laboratory Testing Program. Testing results are archived in the SALT database and fed to the ABVM transactional file. The transactional file data is used in calculating the laboratory test rate. In analyzing these results, focus is placed on assessing the number of parts which failed as compared to the total number of parts tested. In this assessment there are three failure categories. They are Critical, Major, and Minor. Determination on the type of failure is based on severity of the non-compliance. Results of a NSN's laboratory test are assessed by using the following scoring method.

---

[1] See footnote 4, Section 2, Grover

$$\text{NSN Lab Test Score} = 1 - ((W1 * \text{NSN Critical Fail Rate}) + (W2 * \text{NSN Major Fail Rate}) + (W3 * \text{NSN Minor Fail Rate}))$$

where:

$$\text{NSN Critical Fail Rate} = (\Sigma \text{ Critical Failed Parts} / \Sigma \text{ Parts Tested})$$
$$\text{NSN Major Fail Rate} = (\Sigma \text{ Major Failed Parts} / \Sigma \text{ Parts Tested})$$
$$\text{NSN Minor Fail Rate} = (\Sigma \text{ No. Minor Failed Parts} / \Sigma \text{ Parts Tested})$$

and:

$$W1 + W2 + W3 = 1$$

A score of 1.0 is given to a NSN when no laboratory tests have not been conducted. The NSN laboratory test scores for all Basket NSNs are averaged together to form the center's Average Laboratory Test Rate. The equation is:

$$\text{Average Laboratory Test Rate} = (\Sigma \text{ NSN Lab Test Score} / \text{No. of Basket NSNs.})$$

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13. ABSTRACT *(Maximum 200 words)*

The DLA Market Basket model is an analytic approach for measuring DLA's performance of providing wholesale supply support to its customers. This approach closely follows that used by the U.S. Department of Labor, Bureau of Labor Statistics in developing the Consumer Price Index. The Market Basket is a representative sample of the population of items managed by DLA developed using stratified sampling techniques. From this sample of items, data are collected and four performance indicator values are computed. The indicators measure the rate of change in the Basket's four performance measurement areas over time. The four measurement areas are: Price, Sustainability, Availability, and Quality. Each performance area is measured by a mathematical rate equation. These equations are composed of several related data elements. DLA management can use these indicators to measure and track supply support performance over time. Analysis of the supporting data, also generated by the model, can be used to explain the indicator values and to isolate areas where business improvements may be needed.

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