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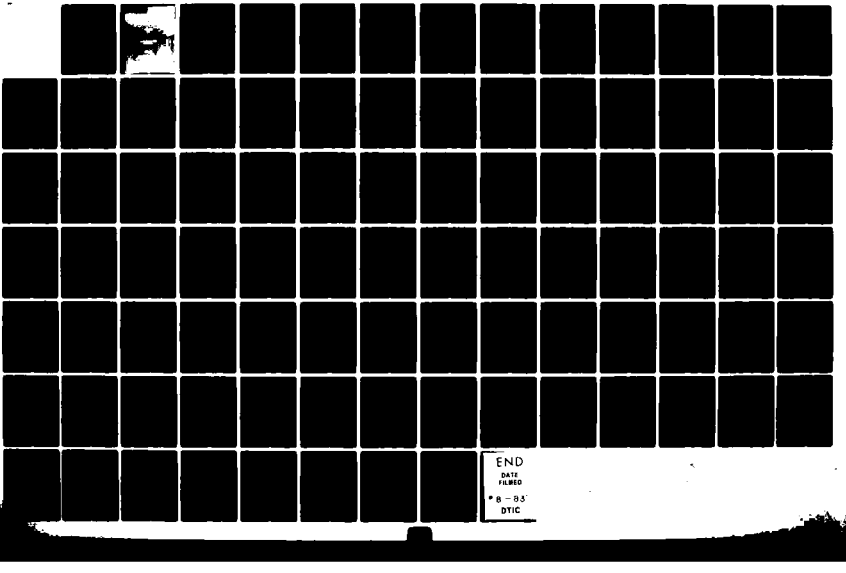

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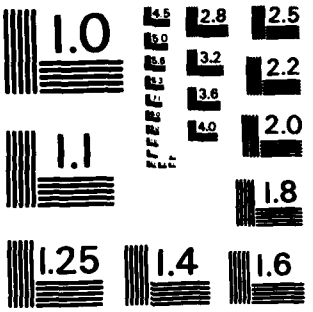

APRO 82-12

F I N A L

CENTRAL PROCUREMENT SYSTEM

MANPOWER MODEL

by

Charles A. Correia

Charles M. Lowe

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The pronouns "he," "his," and "him," when used in this publication represent both the masculine and feminine genders unless otherwise specifically stated.

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EXECUTIVE SUMMARY

A. BACKGROUND. DARCOM has developed a forecasting model providing credible results in procurement workload projections. These workload forecasts have assisted DARCOM in substantiating additional manpower spaces for allocation to Central Procurement (Army Management Structure Code PE 721113) at the Major Subordinate Commands (MSC's). However, Commanders at the MSC's have seen the need to distribute a share of those spaces designated for the PE 721113 code to other program elements supporting Central Procurement. This diversion of procurement spaces to other support functions thwarts the intent of alleviating the manpower shortage in Central Procurement. To see how the support functions are affected by the changes in Central Procurement and determine equitable distribution or augmentation of personnel resources, it is necessary to describe and model the procurement system.

B. OBJECTIVES.

1. Describe the central procurement workload interrelationships among the various elements of the procurement system such as Supply Management Operations, Quality Assurance, Base Operations, Logistics Support Activities and Total Maintenance Support Activities.

2. Develop a conceptual model of the Central Procurement System, along with an analysis of manpower distribution in the system.

C. STUDY APPROACH. The Central Procurement System is described through the use of cross-interaction matrices to illustrate how the different functional areas interact to support it. A flow chart describing how an item is procured along with the support function's role in the procurement is diagramed for better understanding of the system. Also, manpower data obtained from the Manpower Utilization and Requirements Report (RCS CCFOR 78) and Cost and Performance Plan and Report (RCS DRCSU 207) is used for the analysis of the manpower distributions as found at the MSC's over the last five years.

D. SUMMARY AND RECOMMENDATIONS. In its basic structure the Central Procurement System is dependent upon Supply Management and Maintenance Operations for procurement direction in the form of requirements. To act upon these requirements in a timely and efficient manner Central Procurement must have adequate support in all phases of the Central Procurement System process. The allocation of manpower should be done on a total system rather than an individual element basis, with proper distribution to the various elements based on work measurement and workload projections. The conceptual model developed in the report should be used as an aid in the procurement process. All on-going and future work measurement efforts for the Central Procurement System elements should be coordinated with other support activities within the system.

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CHAPTER I

INTRODUCTION

A. BACKGROUND OF PROBLEM.

DARCOM has developed a forecasting model providing credible results in Central Procurement workload projections. These workload forecasts have assisted DARCOM in justifying additional manpower spaces for allocation to Central Procurement (Army Management Structure Code PE 721113) at the Major Subordinate Commands (MSC's). However, Commanders at the MSC's have seen the need to distribute a share of those spaces designated for the PE 721113 code to other program elements supporting Central Procurement. This diversion of procurement spaces to other support functions thwarts the intent of alleviating the manpower shortage in Central Procurement.

What must be illuminated is that the increase in Central Procurement workload does, in fact, increase the requirements for personnel supporting Central Procurement, as well as for spaces allocated to the PE 721113 Central Procurement code. The Central Procurement System is not the Central Procurement function alone, but a system including other direct/indirect support functions. To see how the support functions are affected by the changes in Central Procurement and determine equitable distribution of personnel resources, it is necessary to describe and model the procurement system.

A well-defined description of the procurement system will result in the identification of the system's parts, the degree to which the parts interface and the relationship between the parts and the whole. Once the system is properly described, then a conceptual model can be developed. In addition, if a reliable data base exists it is often possible to mathematically describe

the relationships among the various parts of the system and hence to develop a mathematical model of the system.

B. STUDY OBJECTIVES.

Initially the objectives of the study were as follows:

- Describe the Central Procurement workload interrelationships among the various elements of the procurement system such as Supply Management Operations, Quality Assurance, Base Operations, Logistics Support Activities and Total Maintenance Support Activities.

- Develop a manpower allocation model for the Central Procurement System.

Unfortunately, the lack of a reliable workload data base prevented the accomplishment of the second objective. Instead the study will address the development of a conceptual model of the Central Procurement System along with an analysis of manpower distribution in the system.

C. STUDY APPROACH.

A system can be defined as a set of elements so interconnected as to aid in arriving at a defined goal. The field of systems engineering has developed useful graphical tools to describe, clarify and communicate the interrelations of elements of a system. Since the problem addressed in this report deals with the Central Procurement System, two such graphical tools are used to develop a conceptual model. The purpose of the construction of this conceptual model is to learn how the Central Procurement System operates.

To help in understanding how the functions outside Central Procurement contribute to the procurement process, the flow of a procurement action from requirement to contract award and through contract administration has been

depicted using a DELTA chart technique [16:418-29]. The DELTA chart incorporates events and activities in the workflow through time as well as decision and logic functions. The acronym DELTA stands for Decision, Event, Logic, Time, Activity. Additionally, the functional elements responsible for the activities and decisions are specified for each action. While DELTA charts are normally used for project planning, they were selected for this effort due to their effectiveness in communicating iterative situations and the interaction of the players.

A graphical technique often used to illustrate the interactions between elements of a system and their goals is an array formed from two types of interaction matrices [7:65-81, 16:149-161]. The first type is the self-interaction matrix which derives from the fact that the same set of elements appears along both axes of the matrix: for example, all the elements of Central Procurement. The second type is the cross-interaction matrix which portrays the interaction between different types of elements: for example, the support functions and Central Procurement.

The overall relationships between Central Procurement and the support functions as they both self-interact and cross-interact in the Central Procurement System process is portrayed by linking them together in a matrix array. The measure of the relationships is the workload influence between and among the elements of the system and the Central Procurement System process. Three workload influence measures are used: strong, moderate and none to little. The degree of interaction was arrived at through the expert judgement of analysts knowledgeable in the Central Procurement System process. The technique is illustrated by figure 4 in Chapter II and explained further in Appendix E. The various functional areas which make up the Central Procurement System are identified by the Army Management Structure codes (AMSC) set forth in AR 37-100-XX.

Finally, an analysis of the manpower comparisons as found at the MSC's over the last five years is made using manpower data obtained from the Manpower Utilization and Requirements Report (RCS CSFOR-78) and Cost and Performance Plan and Report (RCS DRCSU 207).

CHAPTER II

CENTRAL PROCUREMENT SYSTEM INTERFACES

A. INTRODUCTION.

The difficulties inherent in the proper assignment and costing of manpower according to program and function is illustrated by the dichotomous findings of the 1981 USAAA Audit, Survey of Procurement Support Function [7]. According to the AAA, DARCOM uses excessive numbers of personnel allocated to AMSC 721113 outside of Central Procurement. At the same time, the Central Procurement activities are allegedly misassigning procurement personnel to perform indirect support type functions. Without discussing the merits of AAA's assertions, the survey findings bear out the axioms that the procurement function is not independent of other activities nor can Central Procurement be described by solicitations and contracts alone.

The Central Procurement System process requires many players with diverse skills from a variety of functional elements. The involvement of any one of the players may range from the most direct, e.g., preparing a contractual document, to the very indirect, e.g., inprocessing a newly hired employee. The roles played by the functional elements are shown in this chapter using a flowchart depiction of typical Central Procurement System activities. The degree of interface between the elements is also graphically displayed using an interaction matrix. Supplementing these representations of the process is a description of the activities involved in the system. These three complementary sections provide an understanding of the mutual dependence of each element on the others for accomplishing the acquisition objective of procuring the required goods and services in a timely manner.

B. FUNCTIONAL ELEMENTS OF CENTRAL PROCUREMENT SYSTEM.

The Central Procurement System process entails the conversion of a requirement from description to actuality. The process necessitates the involvement and interaction of a set of functional elements in direct and indirect roles on a continuous or intermittent basis. Who is involved and the function they fulfill will be discussed in this section.

Since the title of a particular element may vary from command to command, the identification of elements involved was done through the use of the Army Management Structure Codes (AMSC). A review of the AMSC account descriptions and recent MSC's redistribution of spaces allocated for Central Procurement to other accounts shows certain AMSC's to be commonly and logically associated with the Central Procurement System process. For other AMSC's the connection is less obvious. Figure 1 depicts these relationships and their general contribution to the process.

While each of the AMSC's shown in Figure 1 have functions in the acquisition cycle beyond those shown, these are the major activities that are necessary for accomplishing the Central Procurement mission as depicted in the following flowcharts. Certain functions have no direct relationship to the number of current procurement actions, as is the case with adequate CPO support, without which the process would soon be stymied. That the indirect functions are an essential part of the process is illustrated by the fact that several of the Base Operations functions have counterpart or complementary staffing under the subactivity 721113.100002, Overall Management, to facilitate actions directly identified to Central Procurement.

DIRECT	MAJOR ACTIVITIES
721112 Supply Management Operations	Requirements Computation to Initiate/ Modify Procurement Direction, Inventory Control
738017 Total Maintenance Support Activities	Maintenance Engineering and Technical Services
728012 Logistic Support Activities	Attendant Central Supply Services; Production Engineering
721113 Central Procurement	Contract Execution and Administration; Quality Assurance Actions
INDIRECT	
722896.Z Base Operations	Provides Administrative Services to include CPO, F&A, and General DMIS Operations
728011 Industrial Preparedness Operations	Maintenance of Production Technical Data; Process Materiels Priorities and Allocations Requests

NOTES: 1. For those commands under Army Industrial Fund (AIF) the corresponding account would apply.

2. AMSC 728011, despite its role in the process, will not be discussed in the report due to the relatively insignificant number of personnel assigned to this function.

3. AMSC 722898, Management Headquarters, was not included in this analysis. The legal staff formerly included under this account is now found in 721113.

4. A detailed listing of accounts at the activity level that are involved or impacted by the Acquisition Process is provided at Appendix A. The full description of each activity can be found in the referenced sections of AR 37-100-XX.

AMSC FUNCTIONAL ELEMENTS IN CENTRAL PROCUREMENT SYSTEM

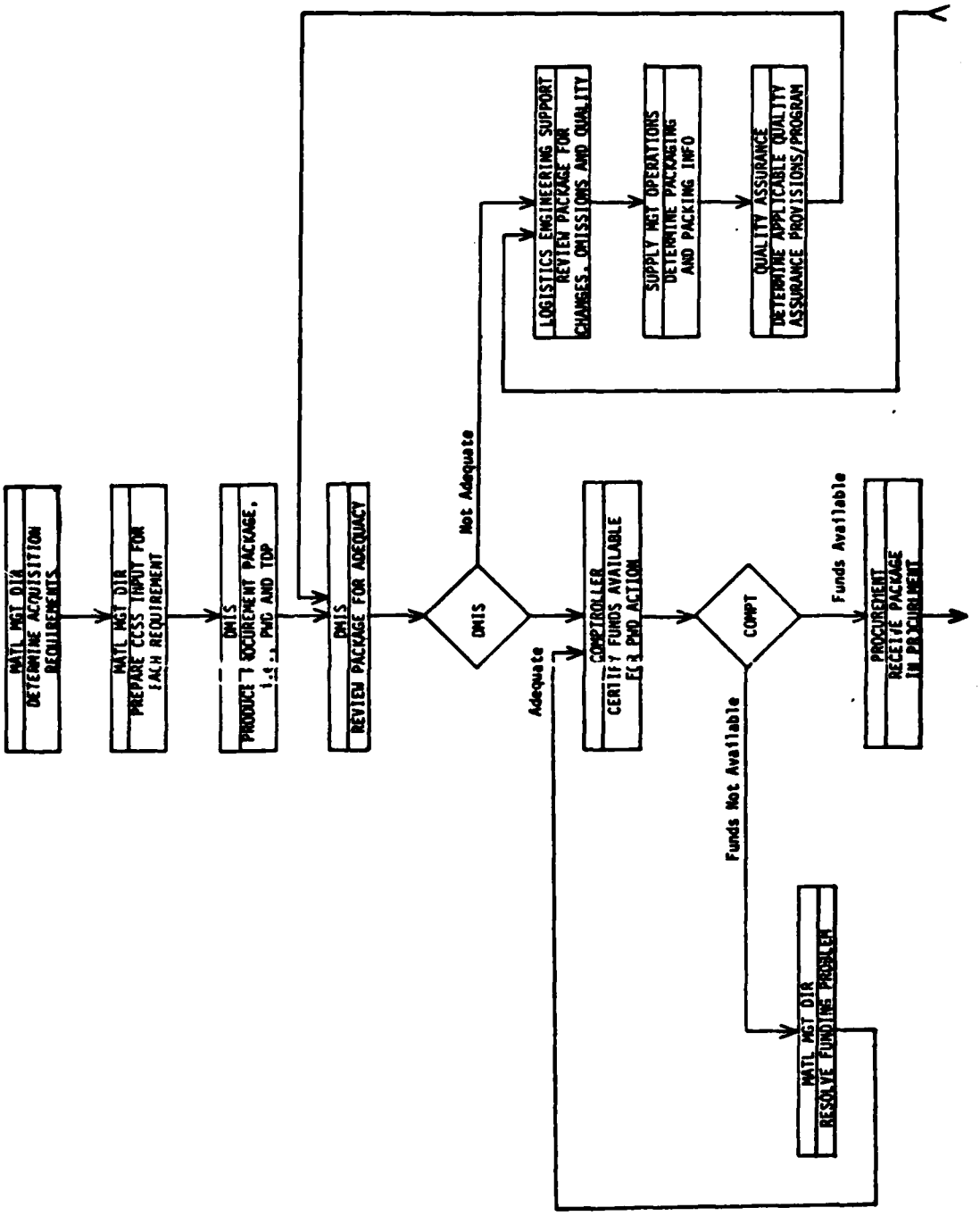
FIGURE 1

C. CENTRAL PROCUREMENT SYSTEM PROCESS WORKFLOW.

The DELTA chart is a form of flowchart, first developed to improve the method for depicting a planned flow of activities in research and development projects. They have been designed to incorporate events, activities, decision and logic functions that allow the flexibility of planning for alternative approaches and for feedback paths. Those responsible for each activity and decisions are specified on the DELTA charts so as to be clearly understood by a variety of potential users.

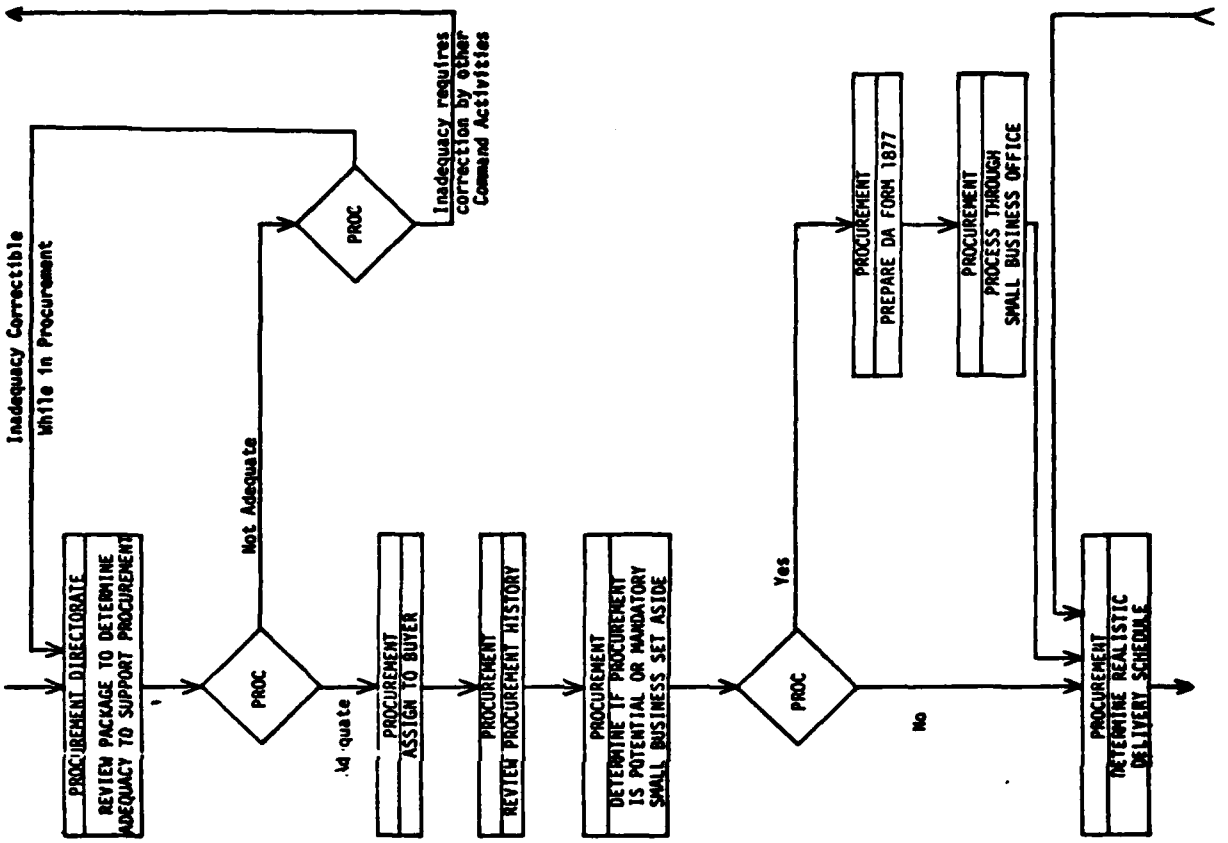
When several organizations are expected to be involved in a planned program, the DELTA chart is especially useful because it furnishes a means through which these organizations can explore how they must function synergically in order to achieve overall goals. This plan of cooperation by the various elements involved in the procurement process is what is being depicted in the use of the DELTA chart of the Conceptual Model of the Central Procurement System.

The DELTA charts for Contract Execution (Figure 2) and Contract Adminisitration (Figure 3) are designed to show those actions that may be required for any procurement action. Obviously many of the decisions and their consequent actions are predicated upon the characteristics of the individual requirement. Factors such as dollar value, priority and technical and/or contract complexity will vary the occurence or requirement for the activities as shown. Similarly, to some degree, the time phasing and placement of responsibility in the DELTA chart flow is dependent upon the individual command organization. The purpose of the charts is to visualize a general workflow for accomplishing the Central Procurement function and not to suggest how each action must be processed.



DELTA CHART OF CENTRAL PROCUREMENT SYSTEM PROCESS - CONTRACT EXECUTION

FIGURE 2



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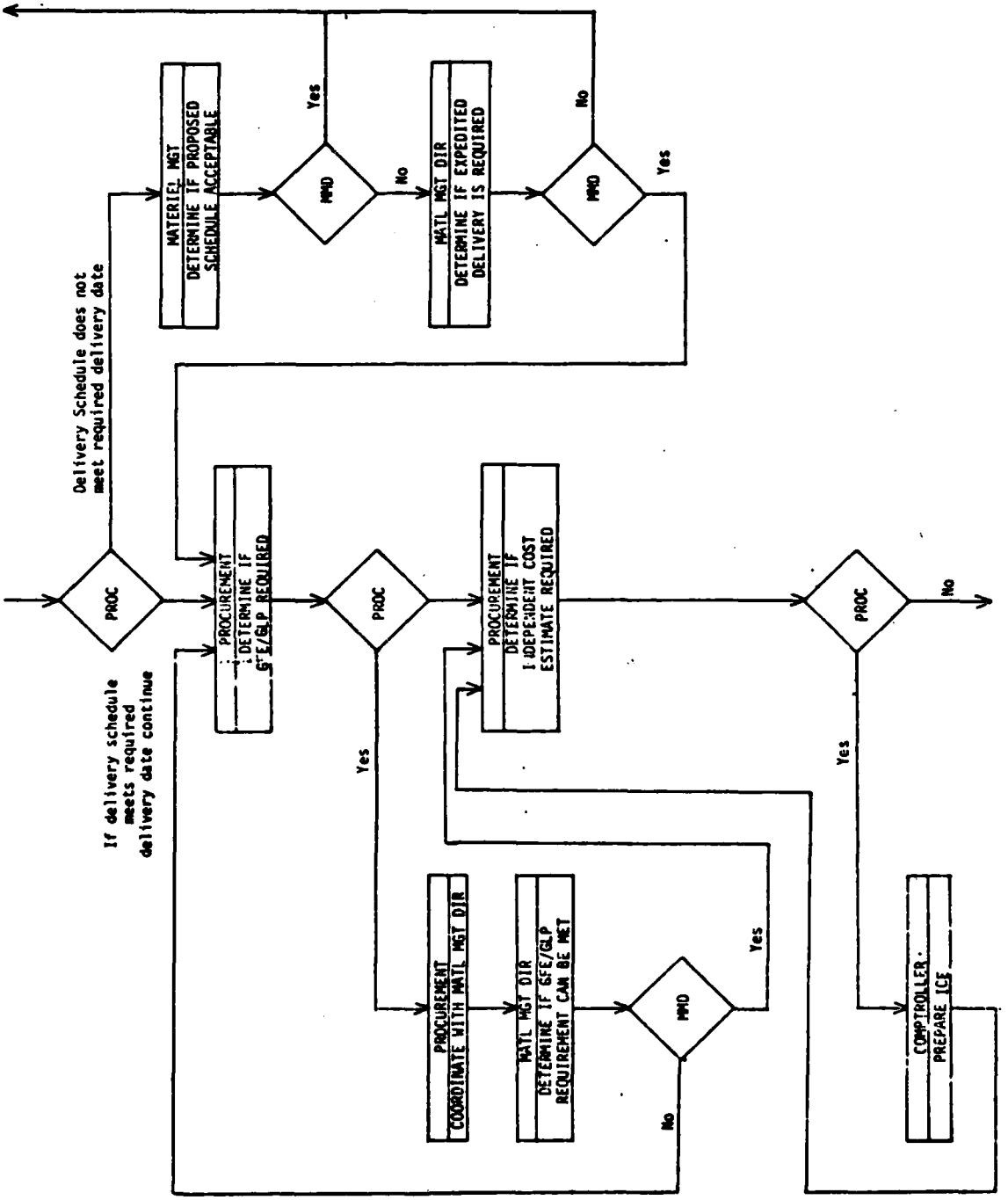

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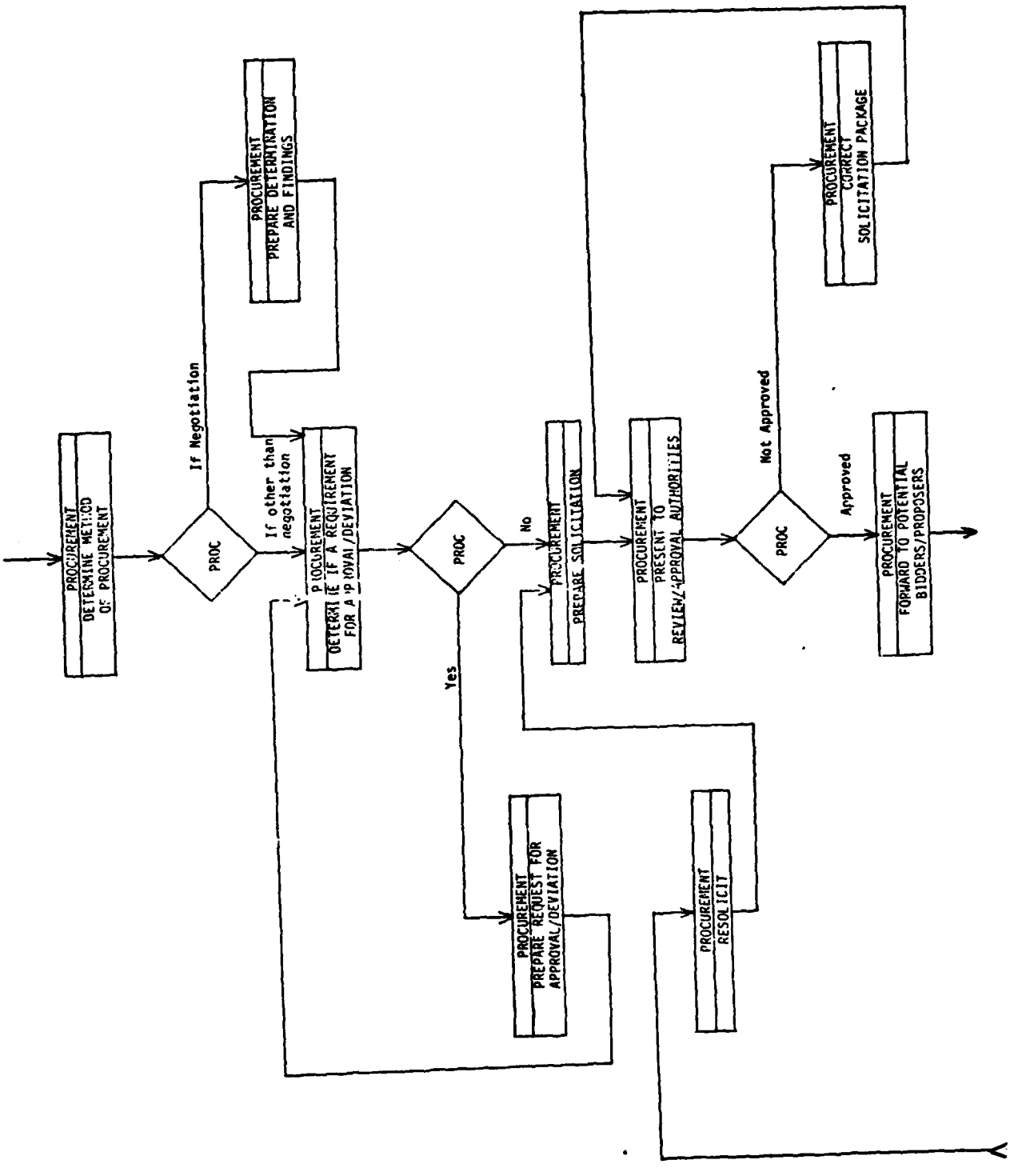

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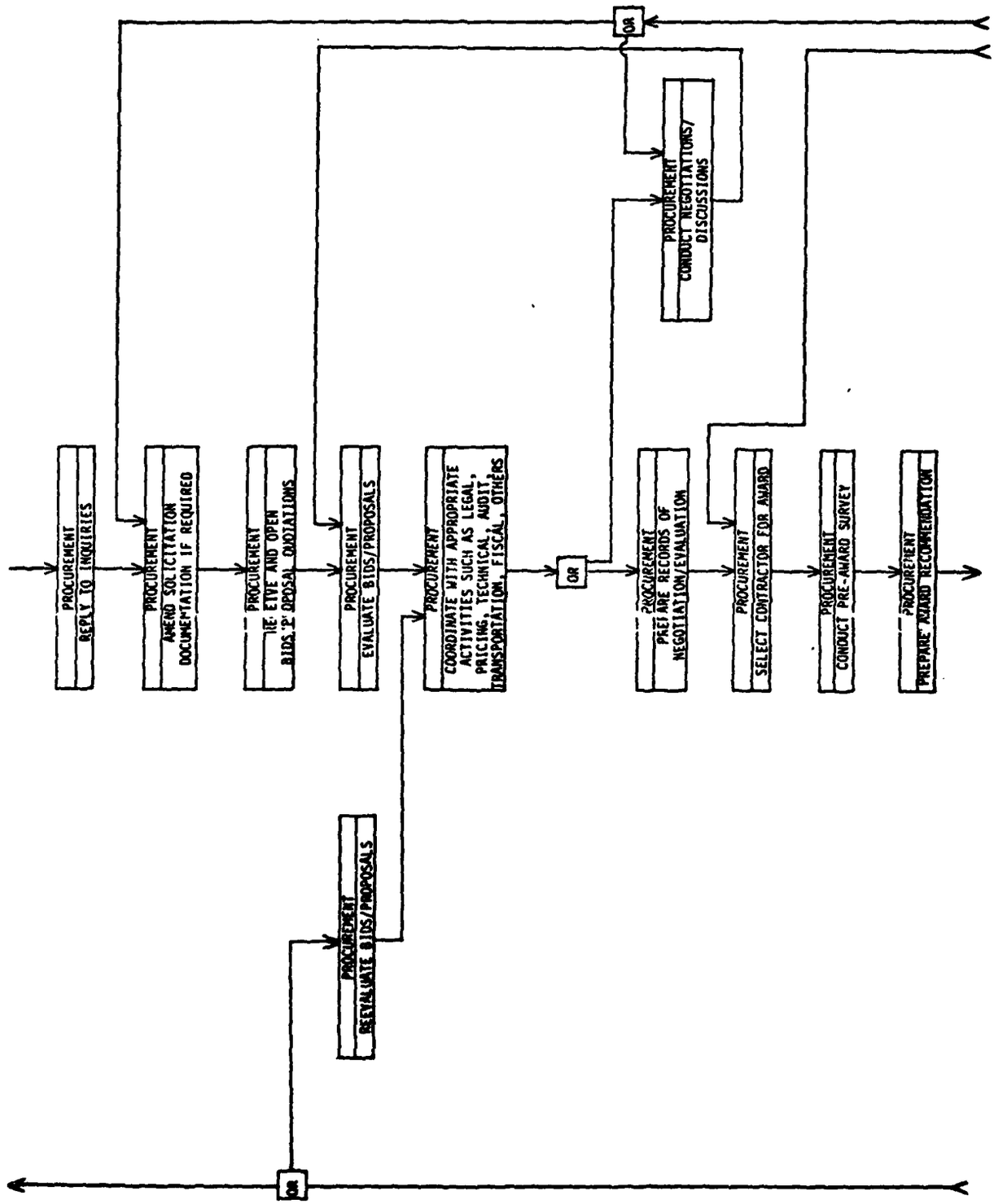

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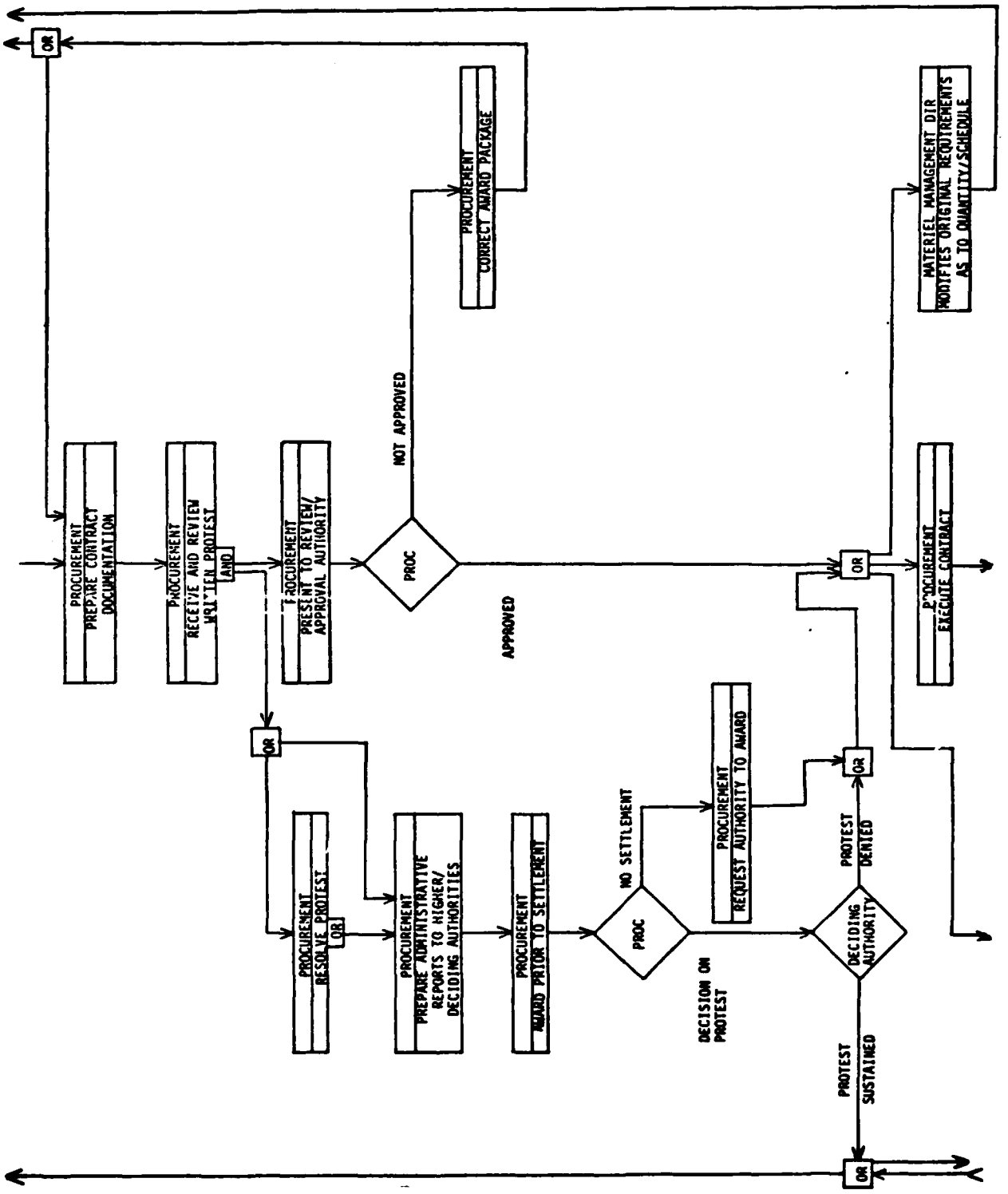

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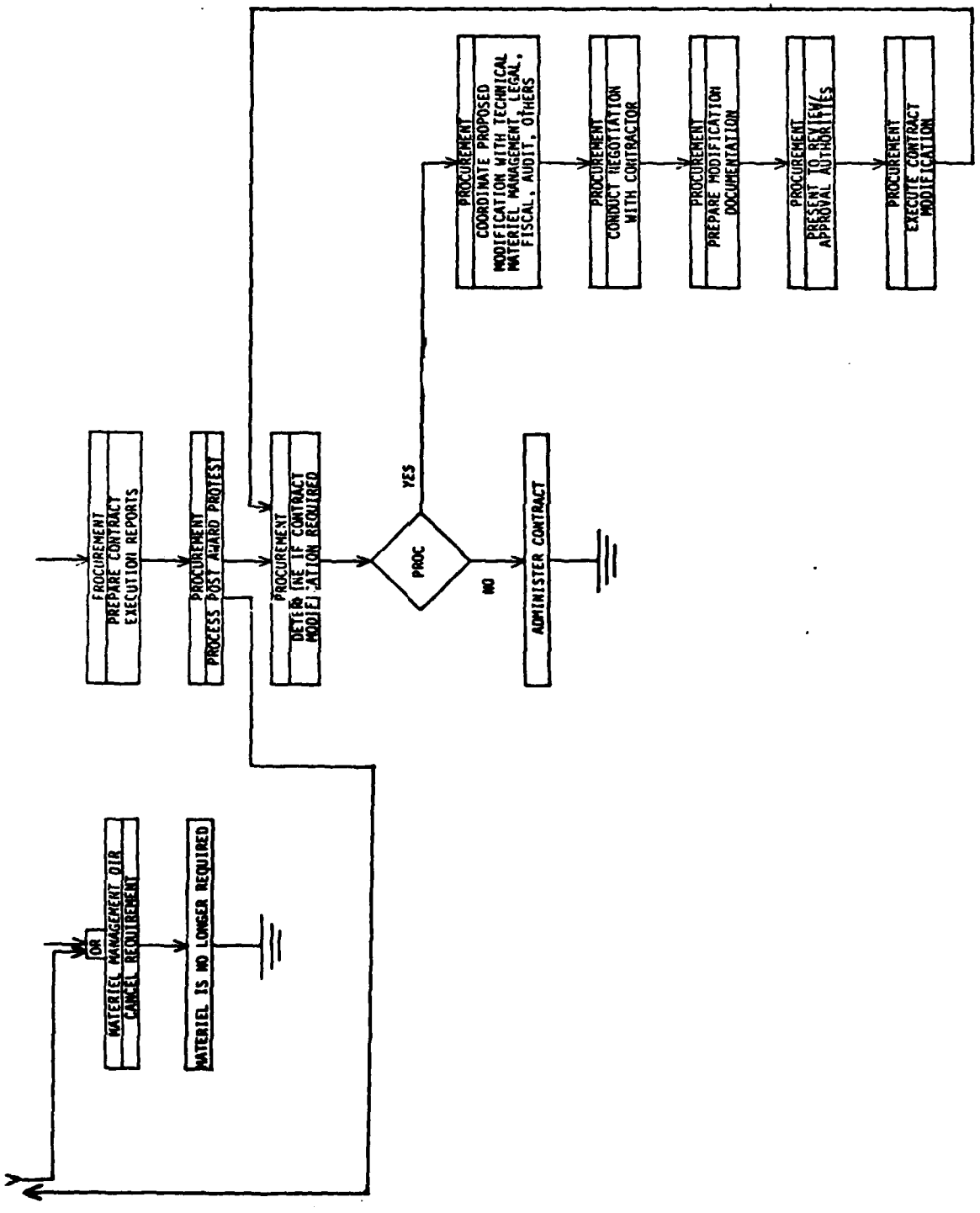

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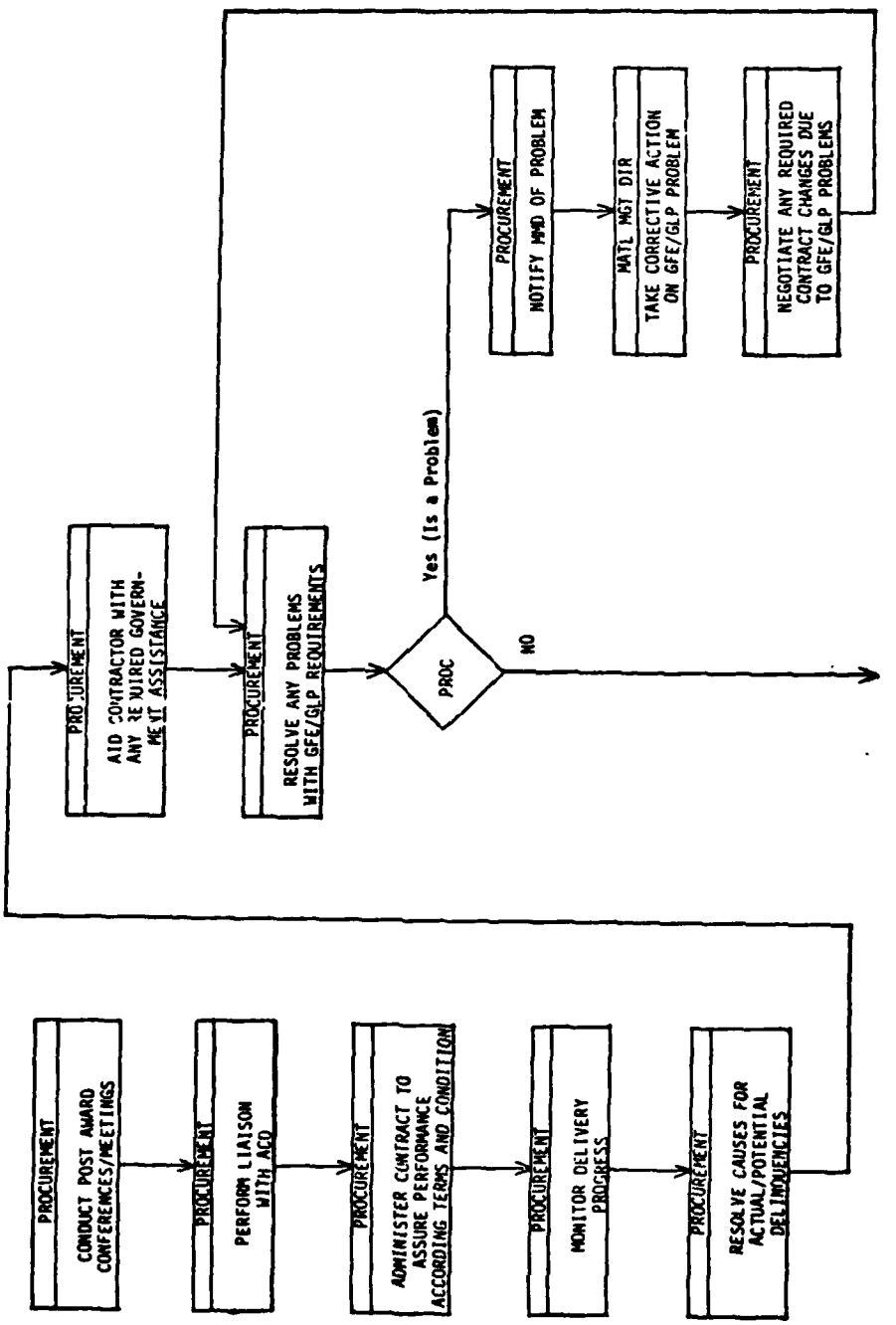


DELTA CHART OF CENTRAL PROCUREMENT SYSTEM PROCESS - CONTRACT ADMINISTRATION

FIGURE 3

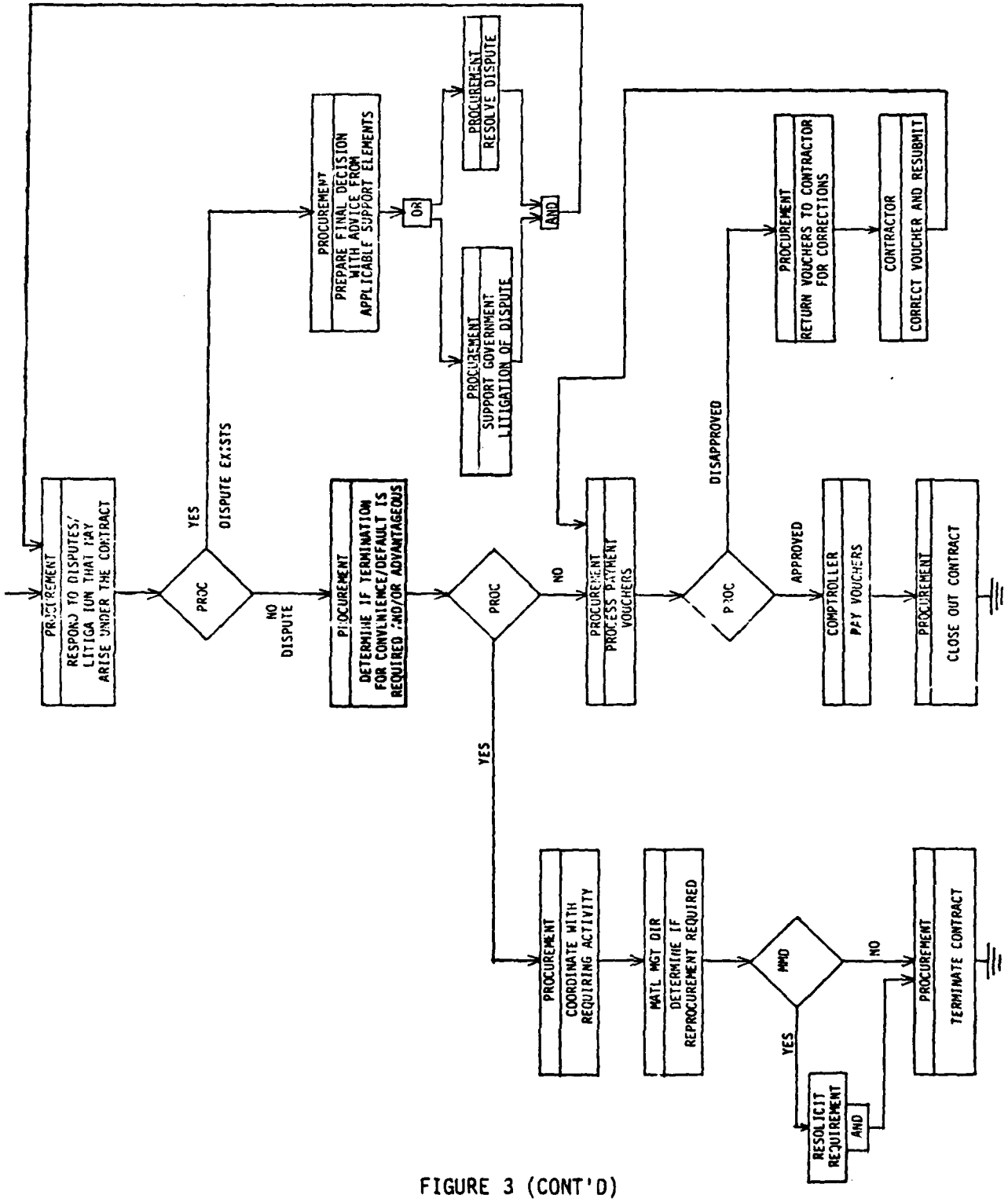


FIGURE 3 (CONT'D)

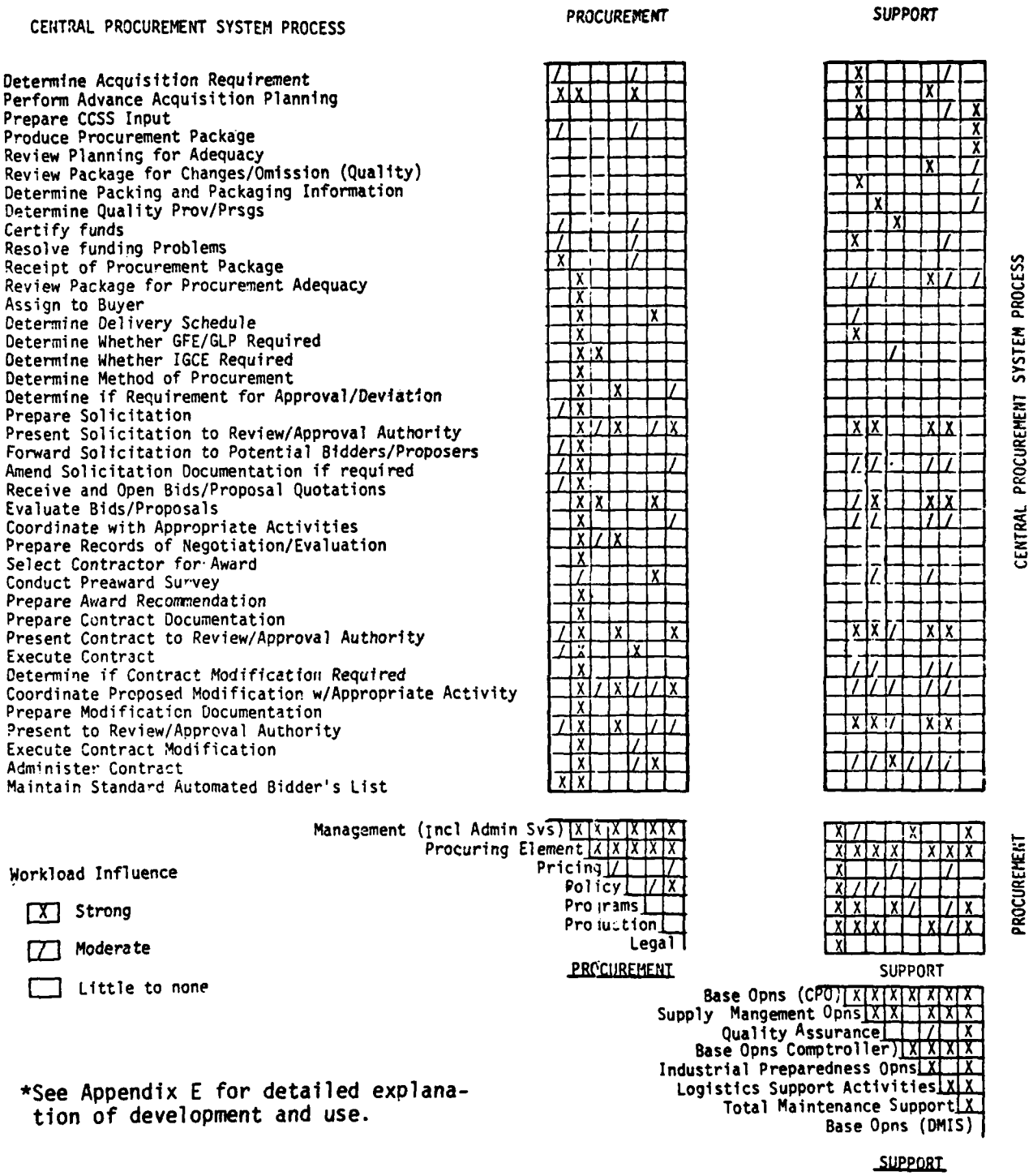
D. INTERFACE OF CENTRAL PROCUREMENT SYSTEM.

To describe how the various functional activities of the Central Procurement System interact with each other, a scheme of matrices is used (Figure 4). Figure 4 provides a structure for graphically portraying the linkage of the Central Procurement System to the Central Procurement System process through the workload of the various activities. This technique is explained in more detail in Appendix E.

The two self-interaction matrices show the workload influence among the support activities and procurement activities but not between the two groups. The workload between the two groups is related through the cross interactions matrix to the right of procurement activities and directly above the support activities. For example, Base Operations (DMIS) workload is strongly influenced by all other activities of the support group but by only four procurement activities. Legal, Policy and Pricing have little to no effect on DMIS workload.

To see how the workload of the procurement and support activities directly relate to the process, similar cross-interaction matrices were developed. Also in the DMIS example one sees strong workload influence in three areas of the process, moderate in four and little to none in the rest. Legal in procurement is strongly influenced in three areas, moderately influenced in four and little to none in the rest.

To illustrate the concept look at the support function, Supply Management Opns. It has a strong workload relation with all elements of the support functions except Industrial Preparedness Opns, and a strong workload relation with three procurement elements and moderate with two others. In addition, Supply Management interacts with 17 of the 39 steps in the Central Procurement



*See Appendix E for detailed explanation of development and use.

LINKAGES WITHIN CENTRAL PROCUREMENT SYSTEM

FIGURE 4

System process. It can be observed from the Delta chart in Figure 2 that backlogs would occur in the process due to inadequate support from Supply Management Opns. Therefore, a manager by studying Figures 2, 3 and 4 will obtain some concept of the requirement for equitable allocation of manpower.

This linkage of the procurement and support groups to the Central Procurement System Process provides a conceptual model by which allocation of resources can be made throughout the Central Procurement System. If workload data existed then a cross check could be made between the conceptual model and an empirically derived model. Unfortunately, this is not possible. However, this conceptual model along with the DELTA charts provides a decision maker with a means of observing where a lack of personnel may cause dysfunction within the system.

CHAPTER III

MANPOWER ALLOCATION IN CENTRAL PROCUREMENT SYSTEM

A. INTRODUCTION.

It was initially thought it would be feasible to mathematically describe the relationship among the various activities involved in the overall procurement process. Since the process is made up of elements interconnected for achieving a defined goal, the manpower allocation issue in Central Procurement was treated as a total systems problem. In order to develop a mathematical model of the system the following requirements must be met:

- an identification of the system's parts.
- an identification as to the degree the system's parts interface.
- the identification of the functional relation between the parts and the whole.
- a data base which describes the functional relation.
- the development of a model based on the functional relations.

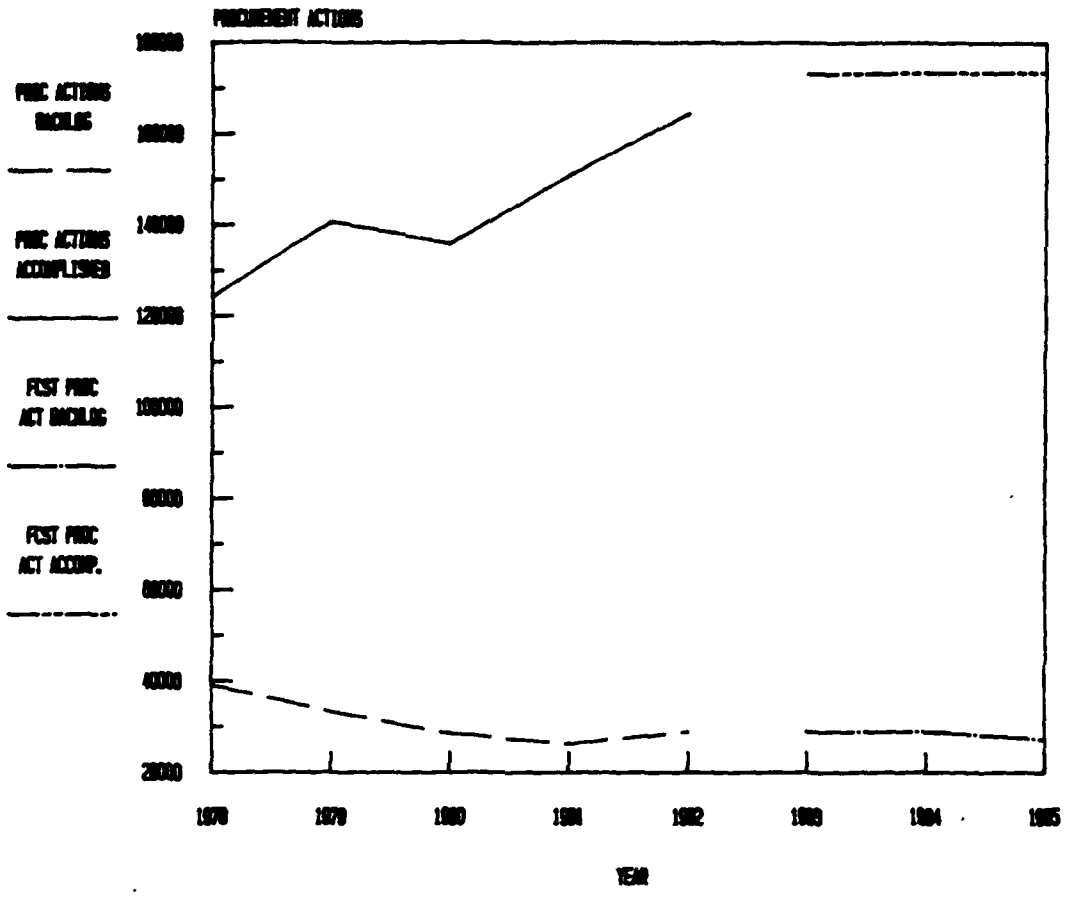
Since the study attempts to examine the allocation of manpower to various elements of the system the data base has to include the identification of resources utilized (manpower), which is obtained from the DARCOM Manpower Utilization and Requirements Report (CSFOR 78). Since manpower allocation is a function of an activity's workload (performance factors), then the data base should include workload data. Unfortunately, either performance factors related to the procurement process for the support activity do not exist or have not been recorded with any consistency for most of the system's elements. For example, DARCOM Supplement to AR 37-100-82 specifies actual workload performance factors for most of the procurement process elements at the

subactivity account level. However, the historical data has only been reported at the higher subprogram or, activity account level and is in terms of manpower only. The required performance factors at the actual reported levels for the support elements of the Central Procurement System are man-hours worked, which are not sufficient for workload analysis. The lack of available and reliable data bases prevents description of mathematical relationships among various elements of the system at this time.

B. MANPOWER DISTRIBUTION.

Central Procurement has received additional manpower spaces based on an ability to show an increase in workload either as to quantity or complexity or both. In addition, forecasts of future workload substantiated the need for additional manpower. Figure 5 shows DARCOM's Central Procurement workload expressed in terms of its performance factor, procurement actions accomplished, its calculated backlog and future projections of both. This tracking of workload by Central Procurement helps justify resource requirements.

To illustrate how the additional spaces allocated to Central Procurement have affected the manpower relationships in the Central Procurement System a comparison is made between the actual manpower strength of Central Procurement, 721113.1 & 2, to the actual strength of each of the support activities in the System. The comparison is made by taking a ratio of the manpower strength of each activity to the total manpower expended in the system. Appendix D shows actual manyears expended for the elements of the Central Procurement System from FY'78 through FY'82. The data in Appendix D is used to develop the ratios in Table 1 and the ratios for the tables of each MRC in Appendix B are developed from supporting manpower reports. The ratios are then illustrated by the graphs in Figures 6 through 10 and the Figures in Appendix C.



DARCOM CENTRAL PROCUREMENT WORKLOAD

FIGURE 5

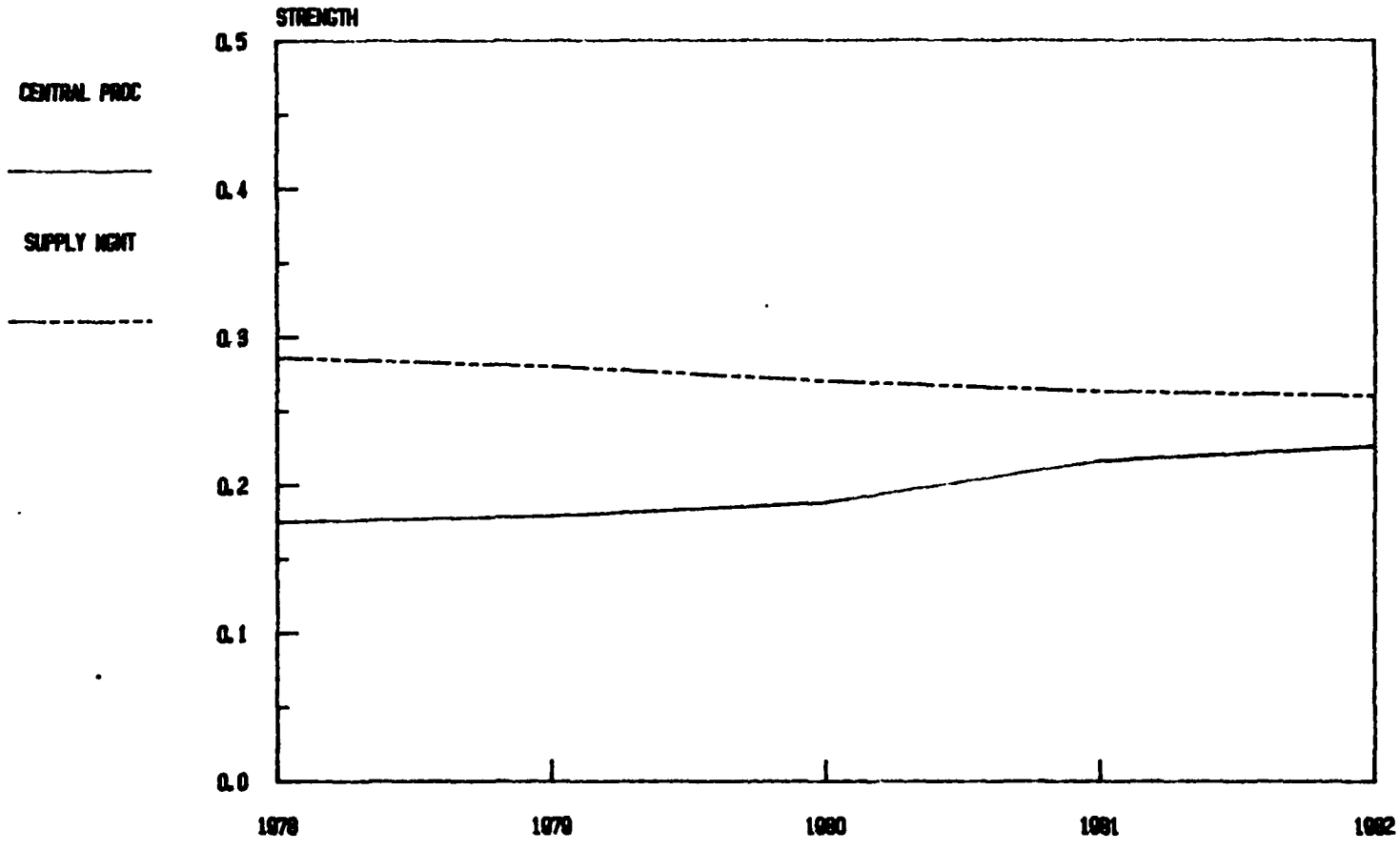
TABLE 1

DARCOM MRC's

Actual Strength as a Function of Central Procurement System Process Manpower

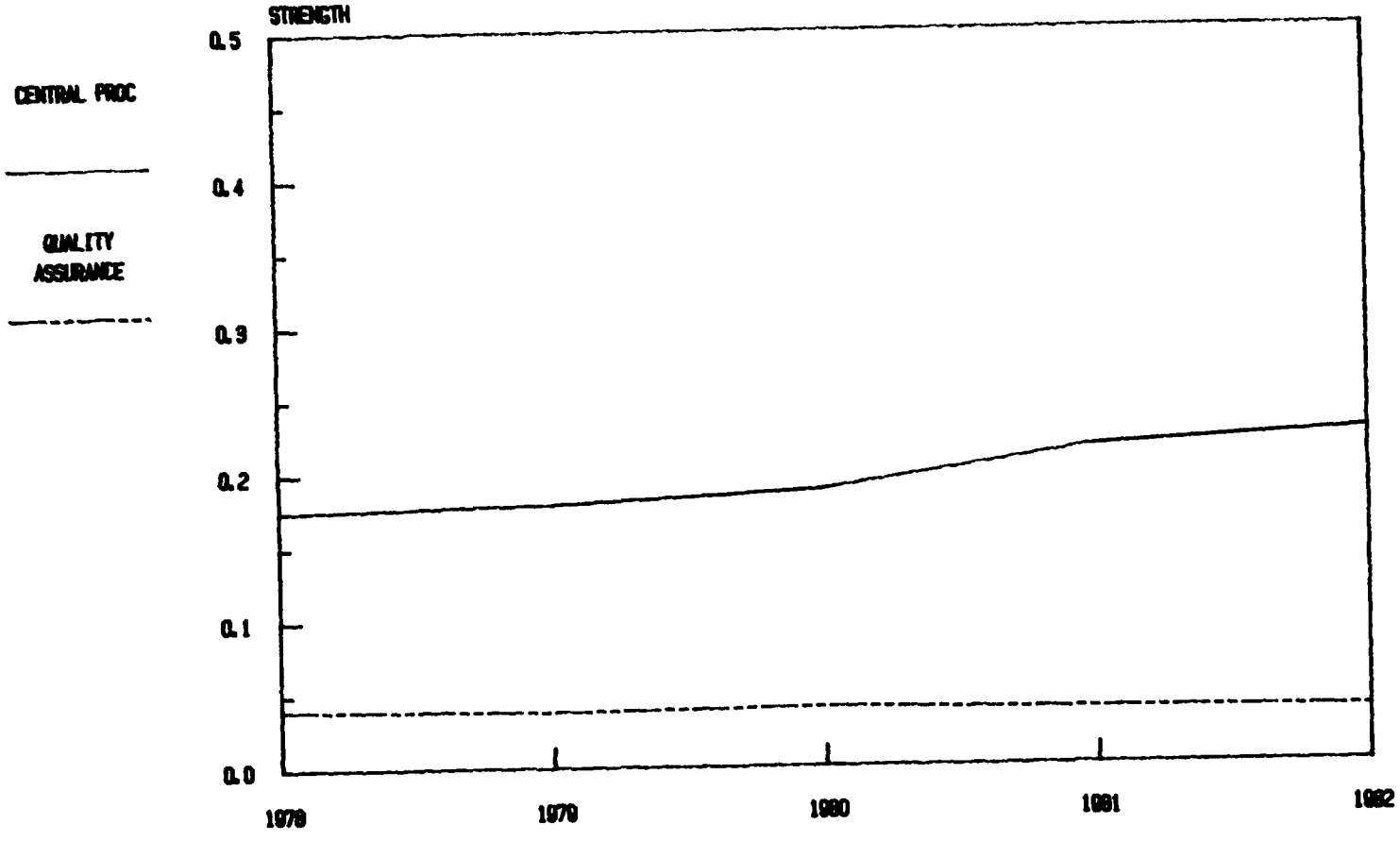
	30 Sep '78	30 Sep '79	30 Sep '80	30 Sep '81	30 Sep '82
Supply Mgmt (721112.0)	.286	.280	.270	.263	.260
Procurement (721113.1&2)	.175	.179	.188	.216	.226
Quality Assurance (721113.3)	.040	.038	.040	.038	.037
Administration (CPO & FA) (722896.No)	.133	.128	.134	.124	.115
Automation Activity (722896.PO)	.033	.031	.029	.028	.026
Industrial Preparedness (728011.0)	.021	.015	.013	.016	.025
Logistics Support (728012.0)	.066	.068	.064	.056	.057
Total Maintenance Support (738017.0)	.241	.256	.259	.255	.248

Source: Derived from Table D.
*Traffic Management omitted since only 0.006 of total.



DARCOM
COMPARISON OF SUPPLY MANAGEMENT OPERATIONS
TO CENTRAL PROCUREMENT

FIGURE 6



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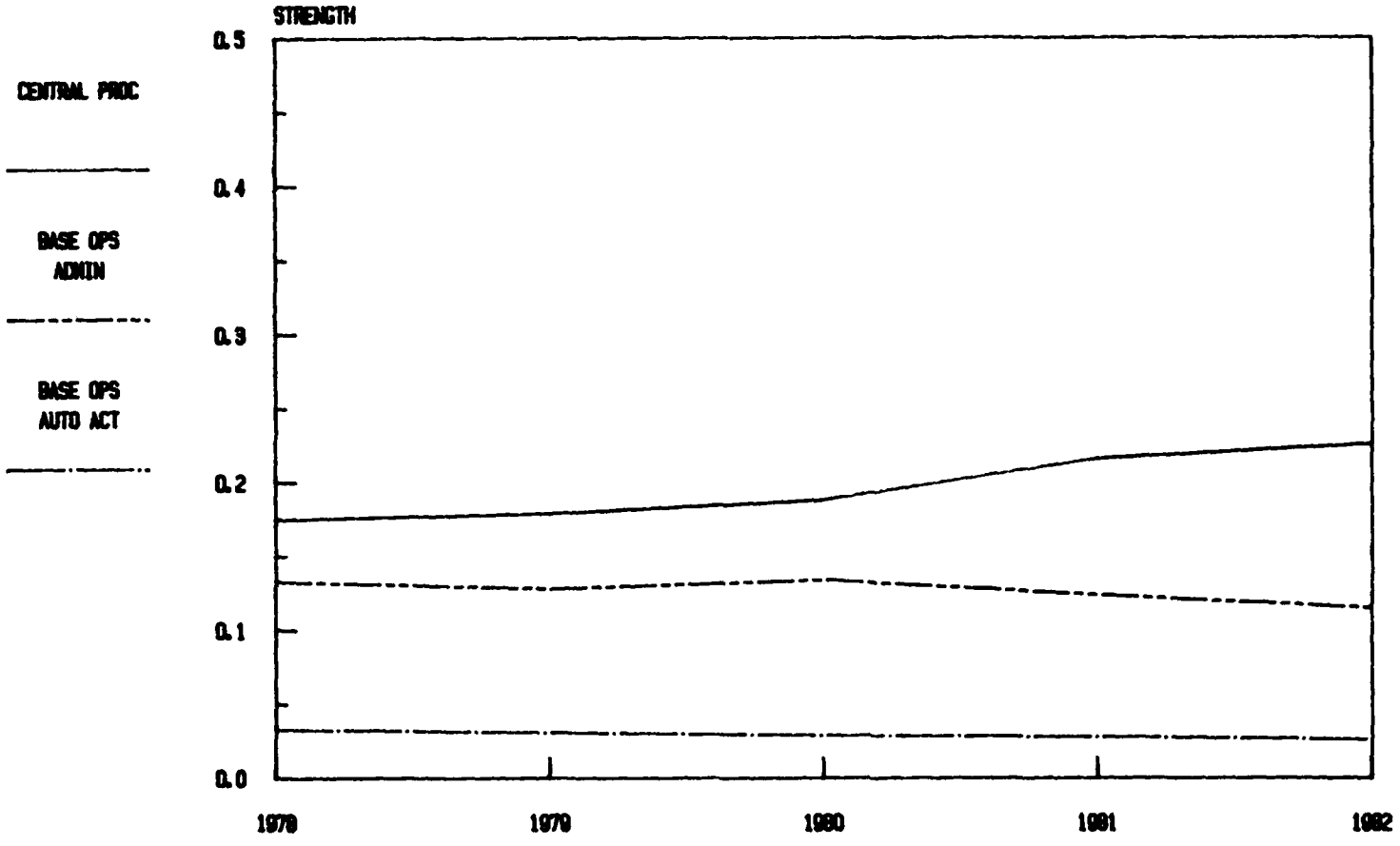
COMPARISON OF QUALITY ASSURANCE
TO CENTRAL PROCUREMENT

FIGURE 7



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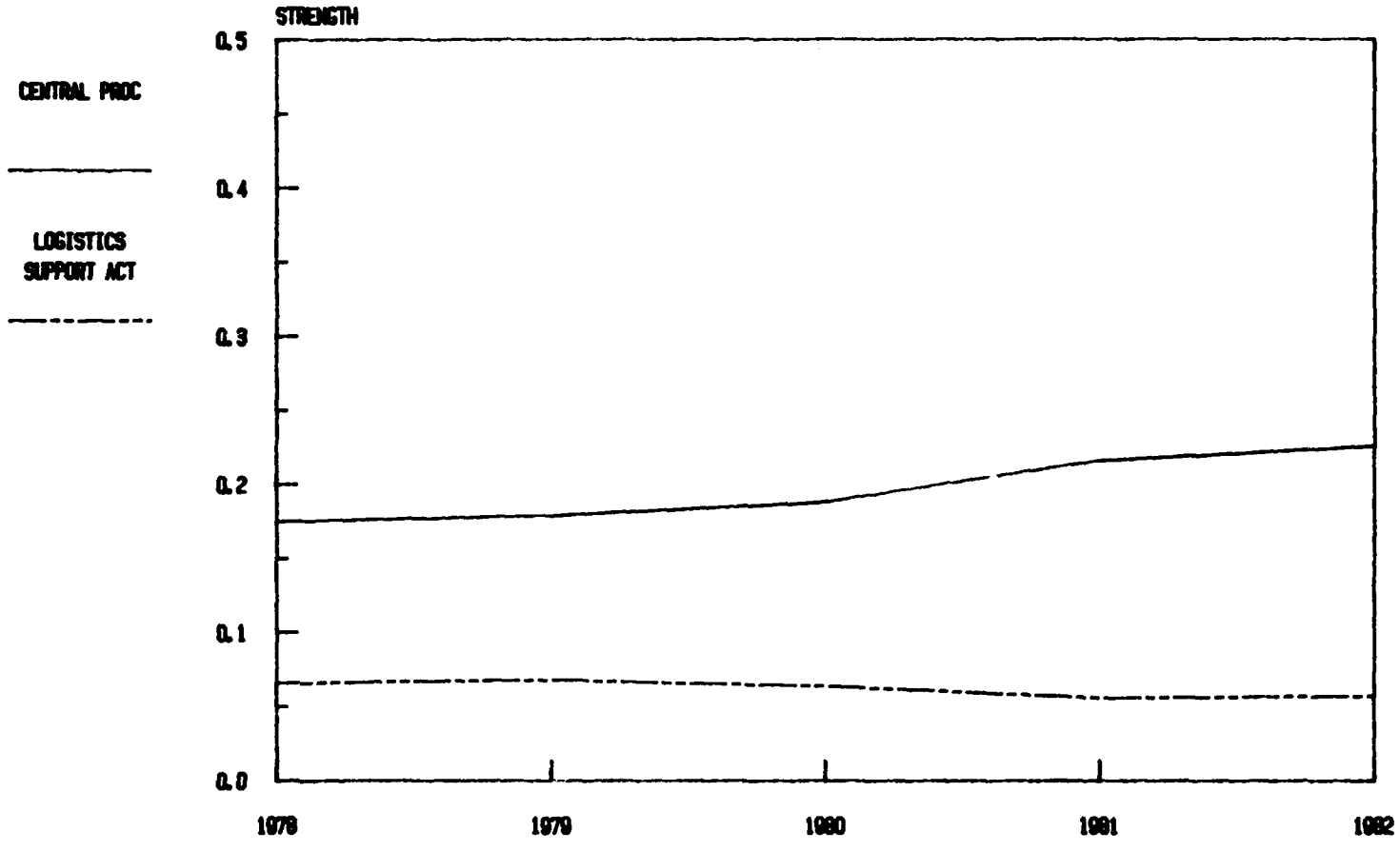
COMPARISON OF BASE OPERATIONS
TO CENTRAL PROCUREMENT

FIGURE 8



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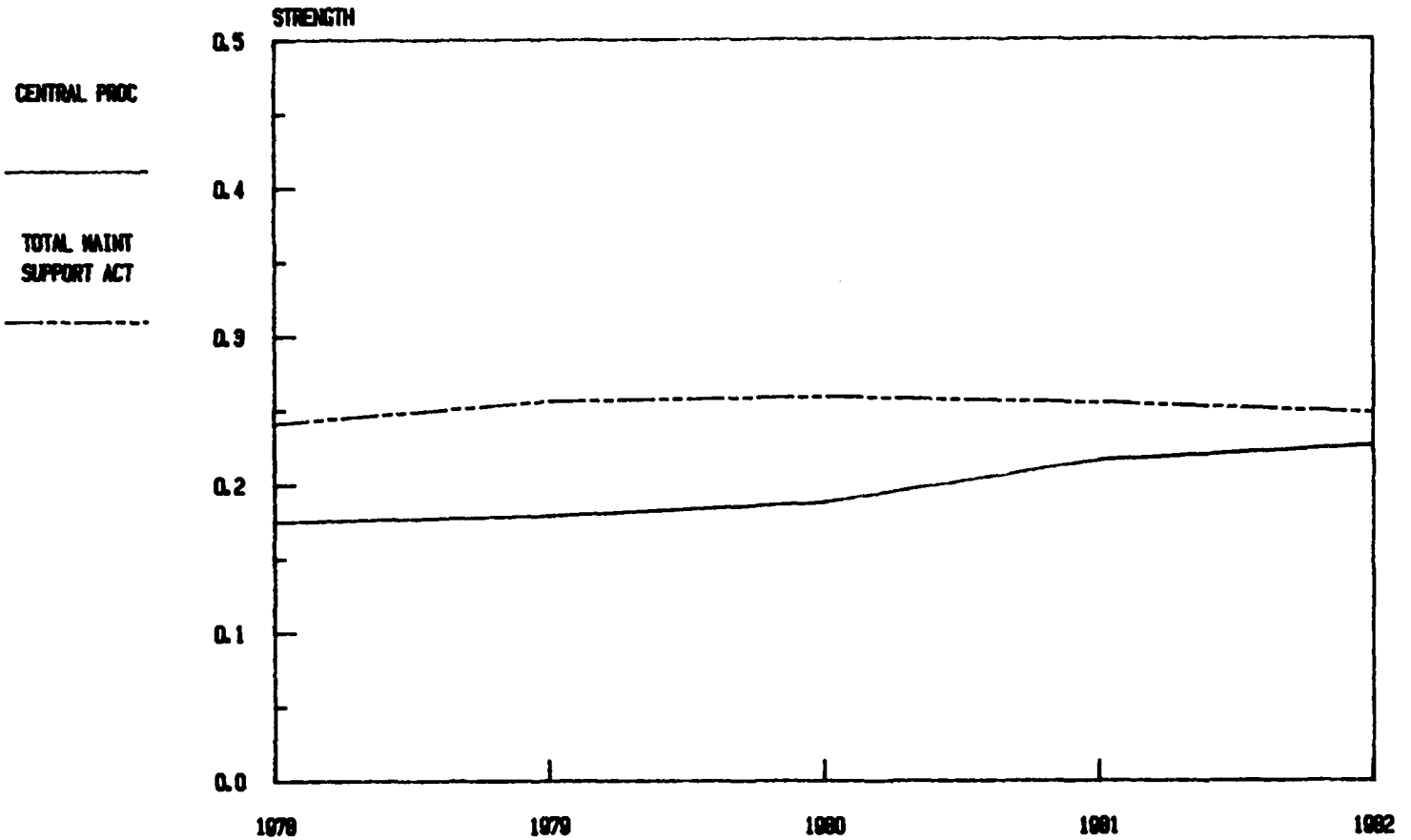
COMPARISON OF LOGISTICS SUPPORT ACTIVITIES
TO CENTRAL PROCUREMENT

FIGURE 9



COMPARISON OF TOTAL MAINTENANCE SUPPORT ACTIVITY TO CENTRAL PROCUREMENT

FIGURE 10

Figures 6 through 10 show that the manpower of the support activities has remained virtually the same or has decreased with respect to the Central Procurement System process at the Major Readiness Commands. Note that the difference in the state of the system takes effect after FY'80, the year Central Procurement began to received additional spaces, while the support element's manpower remained relatively the same. This change in the system's state is the same at all the individual Major Readiness Commands except the Communications Electronics Command (CECOM), where the change begins after FY'79.

C. AID TO MANPOWER ALLOCATION.

Although it is not feasible to describe the relationships among the various elements of the Central Procurement System as a system of mathematical equations relating workload to manpower, it is possible to use direct ratios as a guide to determining manpower.

For example, using data from Table 2 at Command A the manpower for Supply Management was 806 manyears versus 552 for Central Procurement in FY'78. In fiscal year 1982 the manyears for Central Procurement rose to 722 as a result of DARCOM's justification for additional Central Procurement manpower through the use of workload forecasting models. What should be the corresponding manyears for Supply Management? If it is assumed the work environment is the same now as in FY'78 and that there was no "fat" or inefficiency in the system, then the equivalent number of manyears required in FY'82 is 1,054, that is

$$\frac{806}{552} = \frac{x}{722}$$

$$x = 1,054$$

If the assumption of constant proportion of support workload is valid, it would be a simple matter to determine the correct manpower necessary to accomplish the work. Suppose the workload performance factors were available and Supply Management accomplished 1,904,302 and 1,235,928 pieces of work in FY'78 and FY'82, respectively, while Central Procurement accomplished 15,123 and 23,425 pieces of work, then employing similar ratios, such as

$$\frac{\frac{15,123}{552}}{\frac{1,904,302}{806}} = \frac{\frac{23,425}{722}}{\frac{1,235,928}{x}}$$

the number of manyears now required to accomplish the work is only 442.

This example is cited to caution the user about employing this simple ratio technique without first examining the year used as the base year. Table 2 illustrates the fiscal year 1982 manyear requirements for Supply Management. For instance, if FY'78 is used at Command A as the base year then the calculated manyear requirement for FY'82 is 1,054. Similarly, if FY'79 is used then 1,097 manyears are needed for FY'82 and, respectively, 1,135 manyears based on FY'80 and 903 manyears based on FY'81. With the only data presently available to use in performing estimates being manpower data, it is important to choose a base year which is truly representative of the standard work environment. In addition, note should also be made of workload backlog where possible.

D. MODEL DEVELOPMENT.

The conceptual model of the Central Procurement System developed in Chapter 2 will allow for the proper perspective in determining which elements of the system interact and where in the procurement process this interaction occurs. Essentially, the model is a description and linkage of the system

TABLE 2

ILLUSTRATION OF FY 82 MANPOWER REQUIREMENTS
BASED ON DIRECT RATIOS BY INDIVIDUAL BASE YEAR

	Base Yr FY'78	Base Yr FY'79	Base Yr FY'80	Base Yr FY'81	FY'82
Command A					
Manpower					
Procurement	552	533	486	658	722
Supply Mgmt	806	810	764	823	829
Calculated MY Rqmt by Base Yr for FY'82	1,054	1,097	1,135	903	
Workload					
Procurement	15,123	15,104	14,064	17,594	23,425
Supply Mgmt	1,904,302	1,209,214	1,117,788	1,294,388	1,235,928
Calculated MY Rqmt by Base Yr for FY'82	442	723	753	648	

Source: Supply Management data abstracted from FY' 78-82 Cost and Performance Plan and Report (RCS DRCMM 207). Supply Management Manpower data is for manpower utilized to accomplish the related workload units.

elements. The model is not classified as quantitative since there are no mathematical equations accepting data as input, processing the data, and then providing a solution as output. The model is qualitative based on deductions arrived at by assumptions and judgments about the problem under consideration.

Given that procurement workload has increased since FY'78, it seems reasonable to assume the workload of the various support elements have also increased, but not necessarily in the same ratio. Without reliable workload performance factors, an accurate mathematical estimate of manpower requirements by function cannot be made. However, a decision maker, using the

conceptual model and the knowledge of how his command operates, may judgmatically arrive at an estimate.

When relevant performance factors for the support functions are reliably reported, the qualitative model can be developed into a quantitative system model. The requirement for relevancy is fulfilled by reporting workload performance factors that are workload drivers for other Central Procurement System elements and/or reflect the reported elements' contribution to the process. However, the data must also be reported in a consistent manner by the individual commands, be verified for accuracy and be maintained as a statistical data base to be useable for a model. These were the conditions met by Central Procurement in developing the earlier workload forecast models and in the design of the Procurement Automated Manpower Utilization and Projection System (PAMUPS). As of yet the other functional elements' data bases have not achieved similar credibility.

CHAPTER IV

CONCLUSIONS AND RECOMMENDATIONS

A. GENERAL.

DARCOM Central Procurement has developed several different models to measure procurement productivity [3] and to forecast procurement workload [1]. In addition, a new system, the Procurement Automated Manpower Utilization and Projection System (PAMUPS), is being developed and scheduled for implementation in the near future. PAMUPS will document procurement workload by type of instrument (i.e., contract, BOA, Purchase Order) and complexity (Firm Fixed Price Contract, Service Contract, etc.) along with time standards showing the necessary manhours to accomplish various tasks and a forecast of future workload [2].

Other support elements of the Central Procurement System are also initiating work measurement systems similar to PAMUPS. These efforts are the Standard Financial System (STANFINS) within Base Operations and the Maintenance Data Management System for Maintenance Operations.

B. CONCLUSIONS.

1. A Central Procurement System does exist and Central Procurement does affect and is affected by the workload of elements of the system.

2. In its basic form the system is dependent upon elements such as Supply Management and Maintenance Operations for procurement direction in the form of requirements.

3. Central Procurement to act upon these requirements in a timely and efficient manner must have adequate support in all phases of the acquisition process.

4. Allocation of manpower should be done on a total system rather than an individual element basis.

5. The Central Procurement System conceptual model developed in this report aids the manager to visualize the interrelationships of the functional elements within the system, and in identifying the issues associated with the allocation of manpower within the Central Procurement System.

6. The simple direct ratio technique illustrated in this report to calculate required manpower is inadequate and should be used with caution if at all.

7. Proper distribution of allocated manpower to various elements of the system should be based on work measurement and workload projections.

8. Without reliable and valid performance factors to measure the workload of each of the elements of the Central Procurement System no mathematical manpower allocation model is feasible.

C. RECOMMENDATIONS.

1. Recommend the distribution of report to Major Subordinate Commands.

a. Suggest the use of the conceptual model in the procurement process.

b. Consider the application of the technique of interaction matrices and DELTA flow charting to other uses.

2. Recommend lessons learned with respect to PAMUPS should be coordinated with other support activities within the Central Procurement System.

a. Those support elements that do not have workload reporting systems should initiate them.

b. The selection and reporting of functional element performance (workload) factors should consider system requirements as well as those of the individual elements.

3. Recommend this report be made available as a resource in executing the new Manpower Staffing Standards System (MSSS) for DARCOM and also sent to the Integrated Methods and Standards Activity (IMSA) for their use as appropriate in methods and standards work.

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APPENDIX A

SELECTED ARMY MANAGEMENT STRUCTURE CODES

(Extracted from AR 37-100-82, Section VIII, Program 7 - Central Supply and Maintenance and Section XII, Base Operations/RPMA-Z Accounts)

CODE	ACTIVITY
721112.00000	SUPPLY MANAGEMENT OPERATIONS
721112.10000	Inventory Control
721112.11000	Commodity Management
721112.12000	Requirement Computations--All Principal and Secondary Items
721112.13000	Other Inventory Control and Logistics Support Functions
721112.40000	Stock Control
721112.41000	Requisitions Processing
721112.42000	Inventory Accounting and Stock Control Records
721113.00000	CENTRAL PROCUREMENT ACTIVITIES
721113.10000	Procurement Operations
721113.20000	Contract Administration Operations
721113.30000	Quality Assurance for Central Procurement Activities
728011.00000	INDUSTRIAL PREPAREDNESS OPERATIONS
728011.30000	Industrial Base Management
728011.33000	Planning with Government--owned Reserve Industrial Plants and Equipment
728011.34000	Maintenance of Production Data
728011.36000	Materials Priorities and Allocations

CODE	ACTIVITY
728012.00000	LOGISTIC SUPPORT ACTIVITIES
728012.10000	Other Logistic Services
728012.11000	Attendant Central Supply Services (by Activity)
728012.12000	Production Engineering for Stock Fund Items (excluding Food, Food Services, Organizational Clothing & Equipment)
728012.13000	Standardization Programs
722896.Z0000	BASE OPERATIONS
722896.N0000	Administration
722896.N9000	Other Administration
722896.P0000	Automation Activities
722896.P1000	Automation Support
722896.P2000	Automation Security
738017.00000	TOTAL MAINTENANCE SUPPORT ACTIVITIES
738017.000P0	Maintenance Programming and Planning Support
738017.000P3	Organic Maintenance Engineering Services (Pre-Issue)

APPENDIX B

Ratio of Functional Element Manpower to

Central Procurement System Process Manpower at

Materiel Readiness Commands

These ratios are calculated from the respective Tables in Appendix D

TABLE B-1

ARRCOM

Actual Strength as a Function of Central Procurement System Process Manpower

	30 Sep '78	30 Sep '79	30 Sep '80	30 Sep '81	30 Sep '82
Supply Mgmt (721112.0)	.205	.204	.222	.208	.196
Procurement (721113.1&2)	.288	.307	.307	.328	.309
Quality Assurance (721113.3)	.115	.109	.100	.088	.084
Administration (CPO & FA) (722896.No)	.048	.047	.050	.046	.049
Automation Activity (722896.PO)	.030	.026	.031	.030	.028
Industrial Preparedness (728011.0)	.039	.043	.041	.052	.086
Logistics Support (728012.0)	.077	.068	.066	.049	.045
Total Maintenance Support (738017.0)	.186	.189	.191	.190	.186

TABLE B-2

CECOM

Actual Strength as a Function of Central Procurement System Process Manpower

	30 Sep '78	30 Sep '79	30 Sep '80	30 Sep '81	30 Sep '82
Supply Mgmt (721112.0)	.331	.334	.333	.301	.299
Procurement (721113.1&2)	.130	.131	.177	.210	.224
Quality Assurance (721113.3)	.009	.013	.015	.016	.017
Administration (CPO & FA) (722896.No)	.174	.157	.190	.159	.157
Automation Activity (722896.PO)	.028	.021	.020	.013	.016
Industrial Preparedness (728011.0)	.007	.005	.005	.008	.006
Logistics Support (728012.0)	.114	.126	.122	.100	.098
Total Maintenance Support (738017.0)	.207	.213	.213	.193	.189

TABLE B-3

MICOM

Actual Strength as a Function of Central Procurement System Process Manpower

	30 Sep '78	30 Sep '79	30 Sep '80	30 Sep '81	30 Sep '82
Supply Mgmt (721112.0)	.174	.191	.185	.172	.186
Procurement (721113.1&2)	.137	.136	.144	.167	.187
Quality Assurance (721113.3)	.009	.007	.014	.015	.018
Administration (CPO & FA) (722896.No)	.170	.159	.155	.149	.152
Automation Activity (722896.PO)	.068	.071	.066	.062	.053
Industrial Preparedness (728011.0)	.005	.005	.003	.003	.003
Logistics Support (728012.0)	.023	.026	.020	.019	.019
Total Maintenance Support (738017.0)	.413	.404	.412	.412	.395

TABLE B-4

TACOM

Actual Strength as a Function of Central Procurement System Process Manpower

	30 Sep '78	30 Sep '79	30 Sep '80	30 Sep '81	30 Sep '82
Supply Mgmt (721112.0)	.289	.295	.284	.277	.262
Procurement (721113.1&2)	.160	.175	.183	.197	.215
Quality Assurance (721113.3)	.044	.039	.046	.048	.039
Administration (CPO & FA) (722896.No)	.144	.143	.139	.135	.116
Automation Activity (722896.PO)	.027	.025	.022	.024	.028
Industrial Preparedness (728011.0)	.050	.017	.012	.012	.011
Logistics Support (728012.0)	.114	.125	.118	.109	.123
Total Maintenance Support (738017.0)	.172	.182	.195	.197	.206

TABLE B-5

TSARCOM

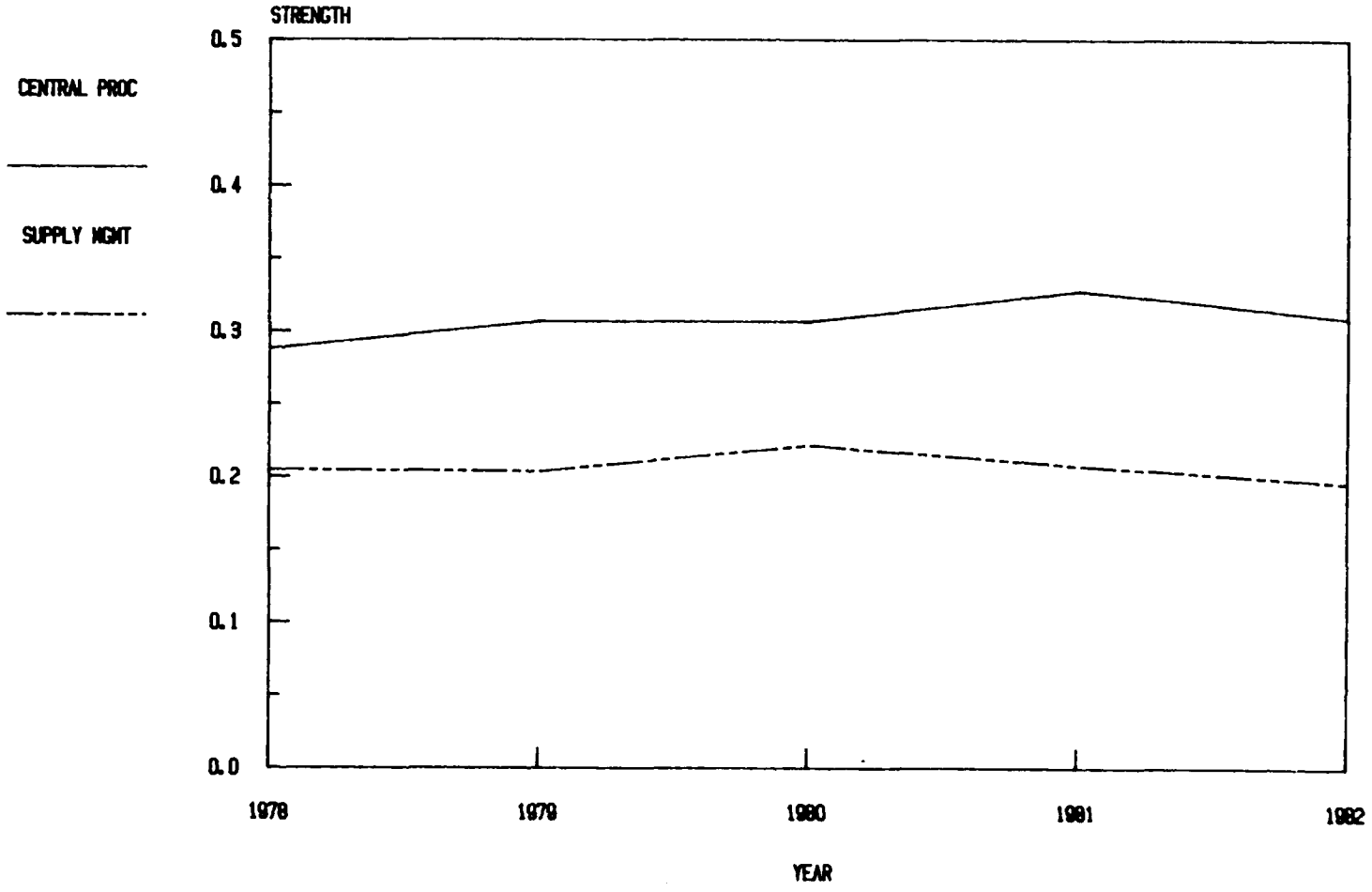
Actual Strength as a Function of Central Procurement System Process Manpower

	30 Sep '78	30 Sep '79	30 Sep '80	30 Sep '81	30 Sep '82
Supply Mgmt (721112.0)	.407	.392	.368	.368	.371
Procurement (721113.1&2)	.131	.132	.124	.164	.174
Quality Assurance (721113.3)	.013	.017	.016	.017	.018
Administration (CPO & FA) (722896.No)	.132	.145	.161	.141	.131
Automation Activity (722896.PO)	.010	.009	.006	.006	.008
Industrial Preparedness (728011.0)	.002	.002	.002	.003	.002
Logistics Support (728012.0)	.011	.009	.010	.008	.005
Total Maintenance Support (738017.0)	.283	.283	.301	.283	.277

APPENDIX C

Comparison of Support Activities to Central Procurement

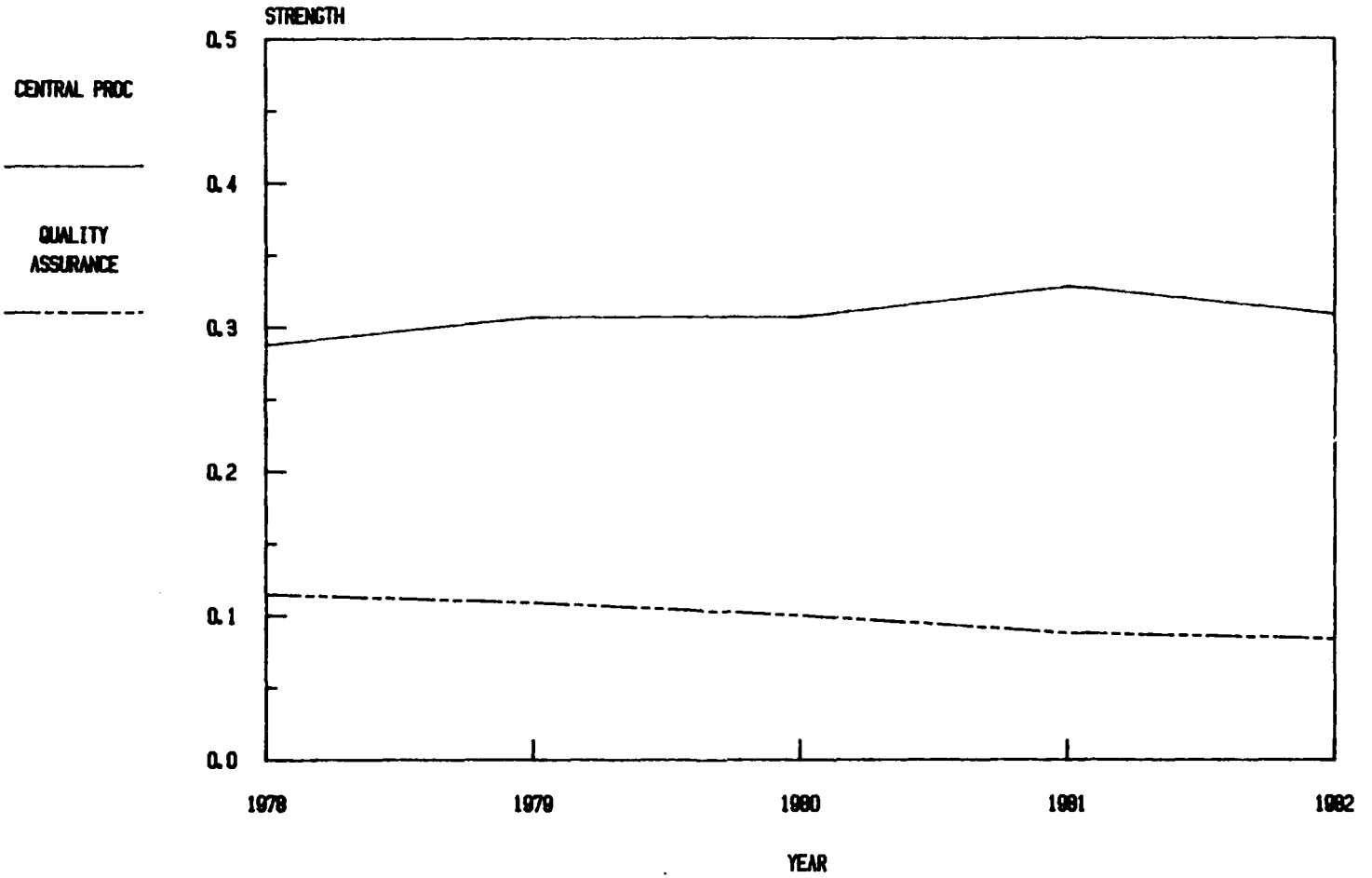
This appendix is a comparison of manpower utilization between functional elements and Central Procurement as a function of total Central Procurement System process manpower for Materiel Readiness Commands.



ARRCOM

SUPPLY MANAGEMENT OPERATIONS
TO CENTRAL PROCUREMENT

FIGURE C-1

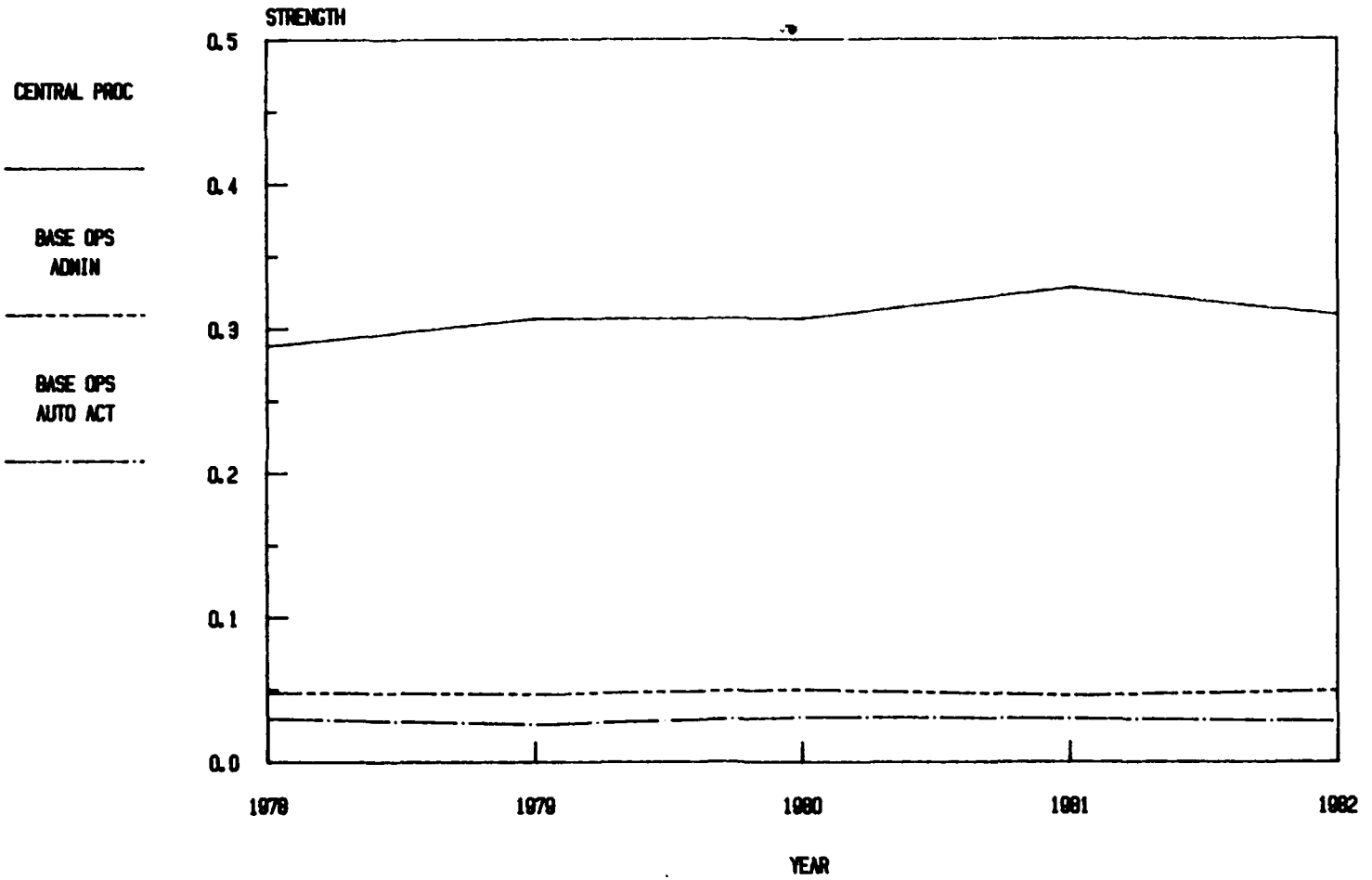


ARRCOM

QUALITY ASSURANCE

TO CENTRAL PROCUREMENT

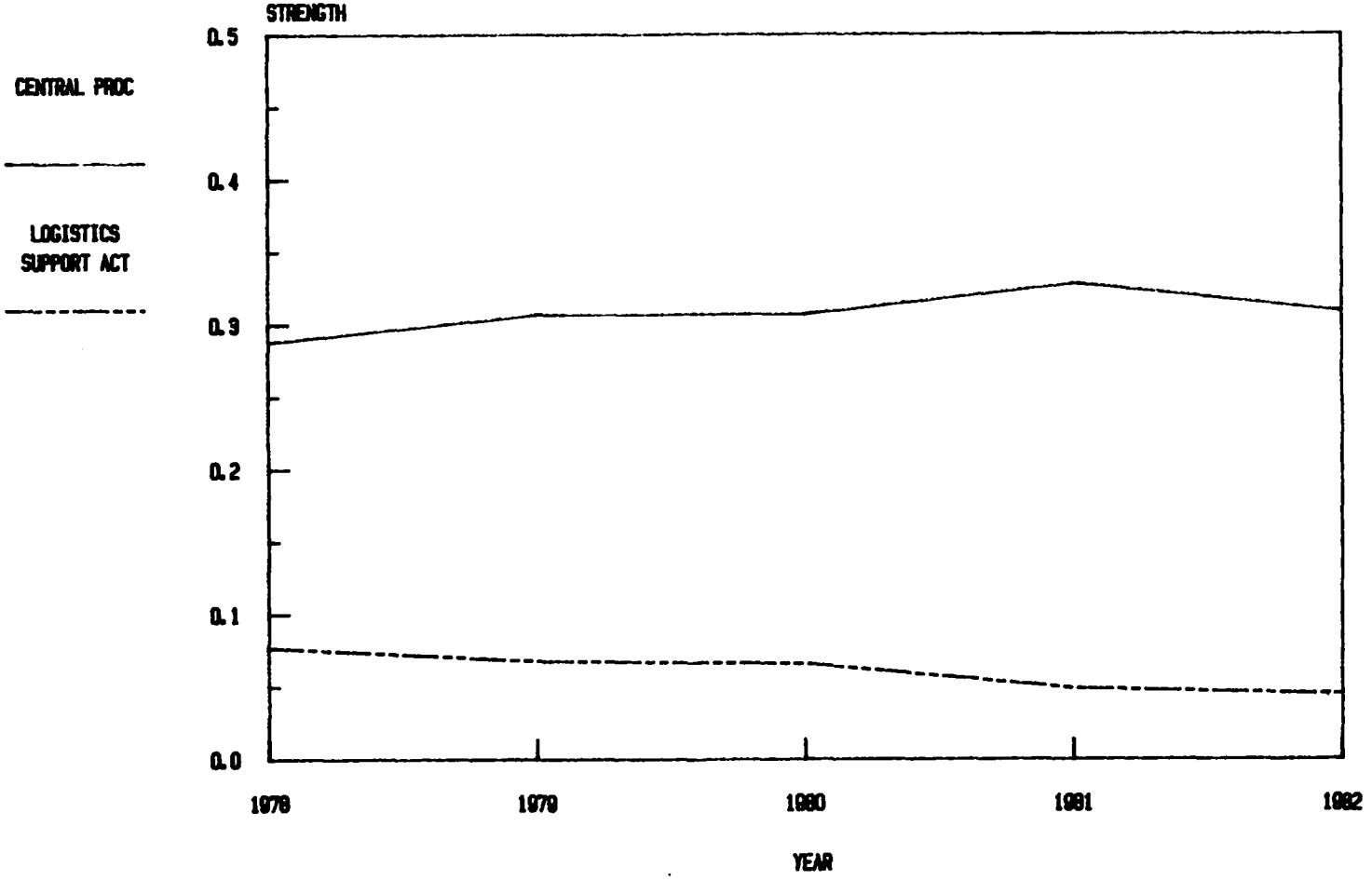
FIGURE C-2



ARRCOM

BASE OPERATIONS
TO CENTRAL PROCUREMENT

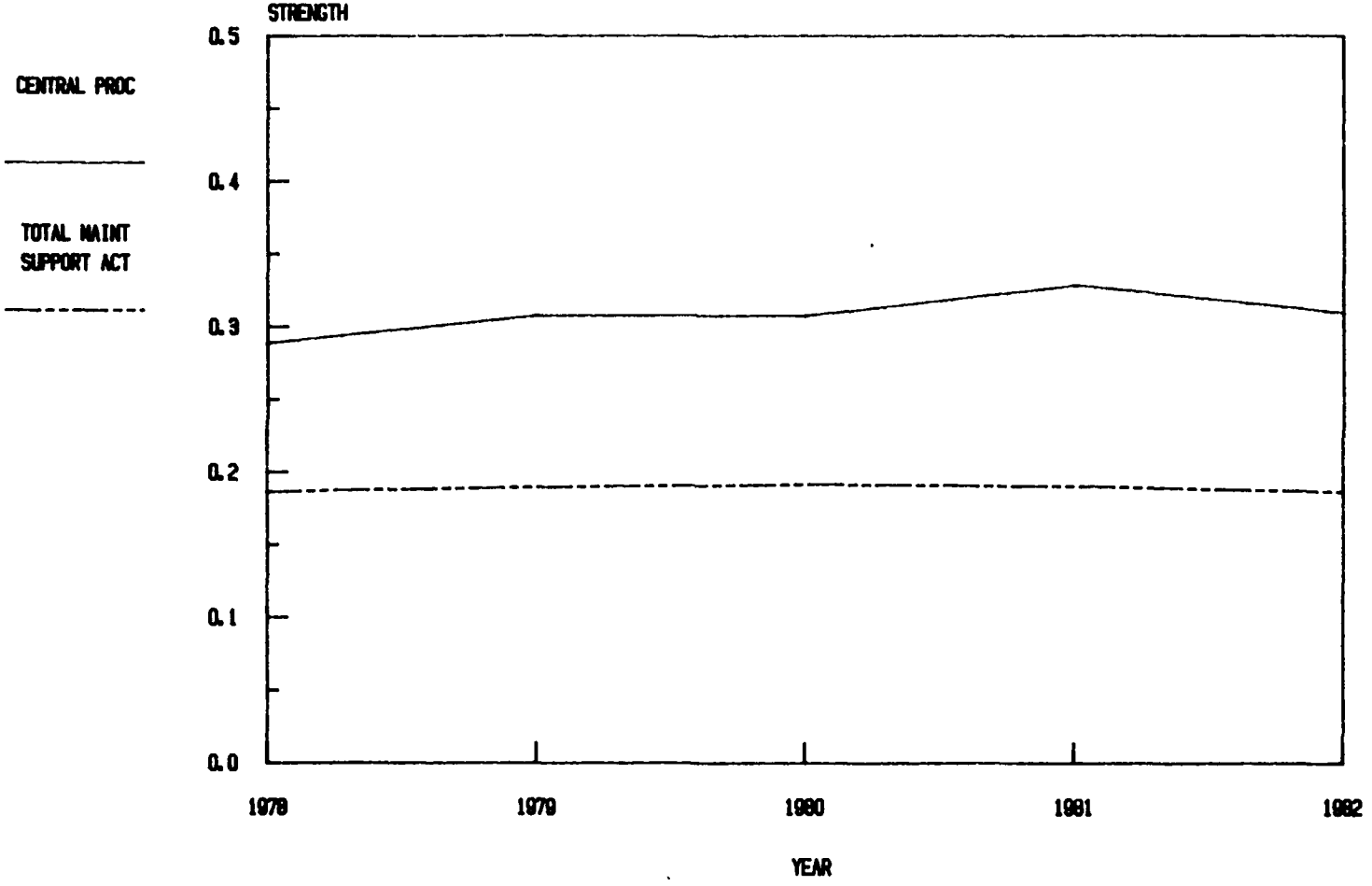
FIGURE C-3



ARRCOM

LOGISTICS SUPPORT ACTIVITY
TO CENTRAL PROCUREMENT

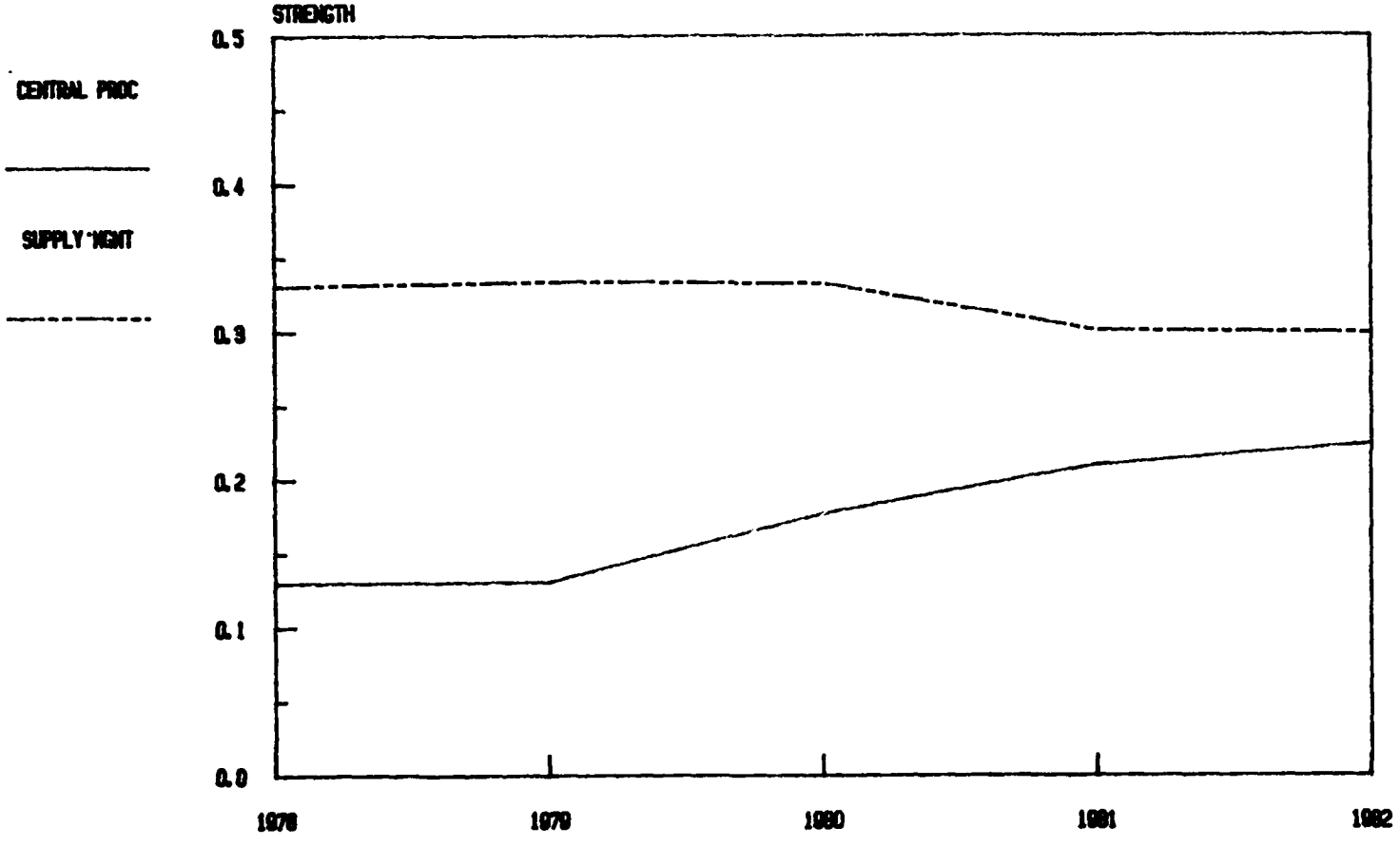
FIGURE C-4



ARRCOM

TOTAL MAINTENANCE SUPPORT ACTIVITY
TO CENTRAL PROCUREMENT

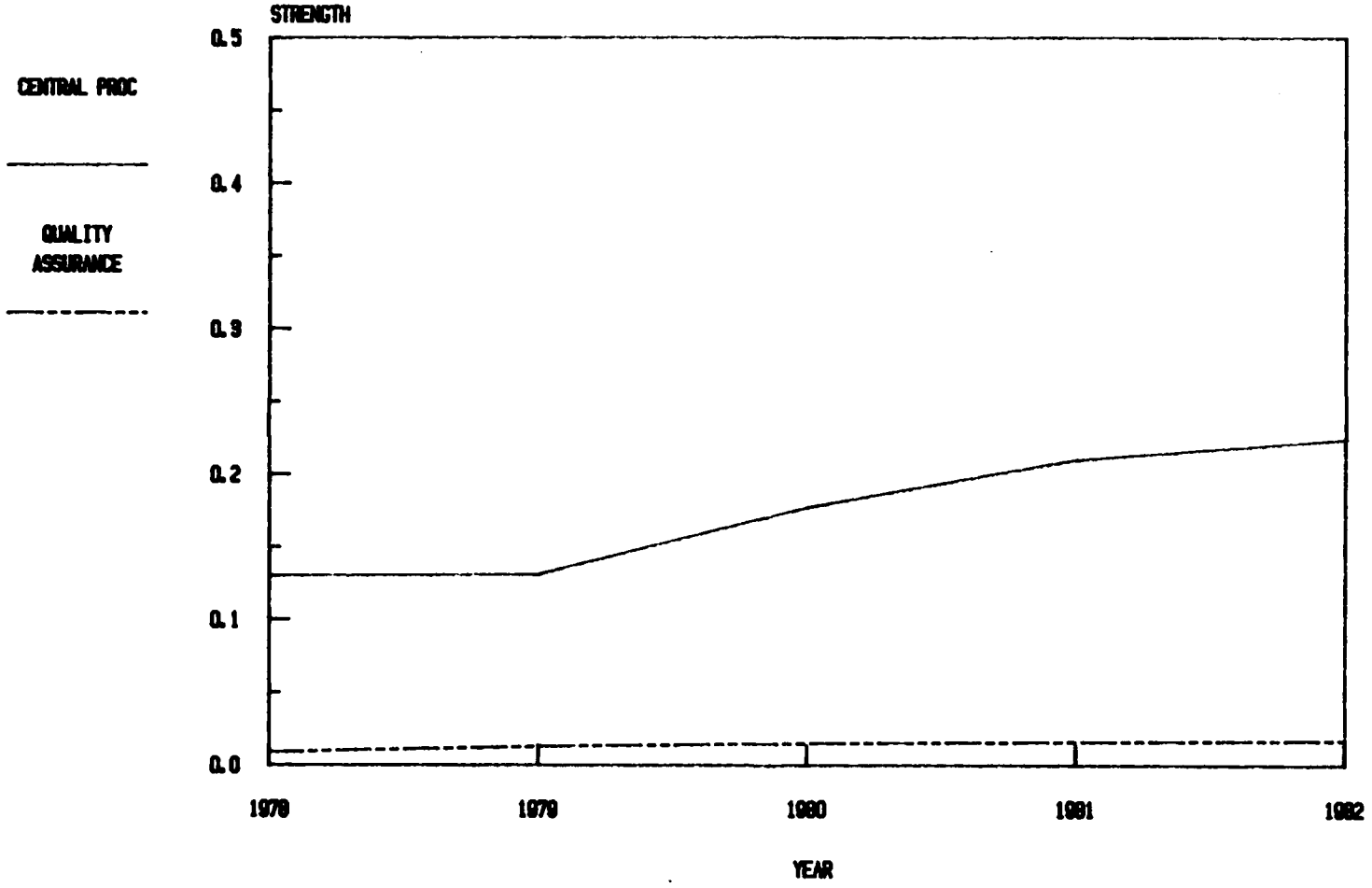
FIGURE C-5



CECOM

SUPPLY MANAGEMENT OPERATIONS
TO CENTRAL PROCUREMENT

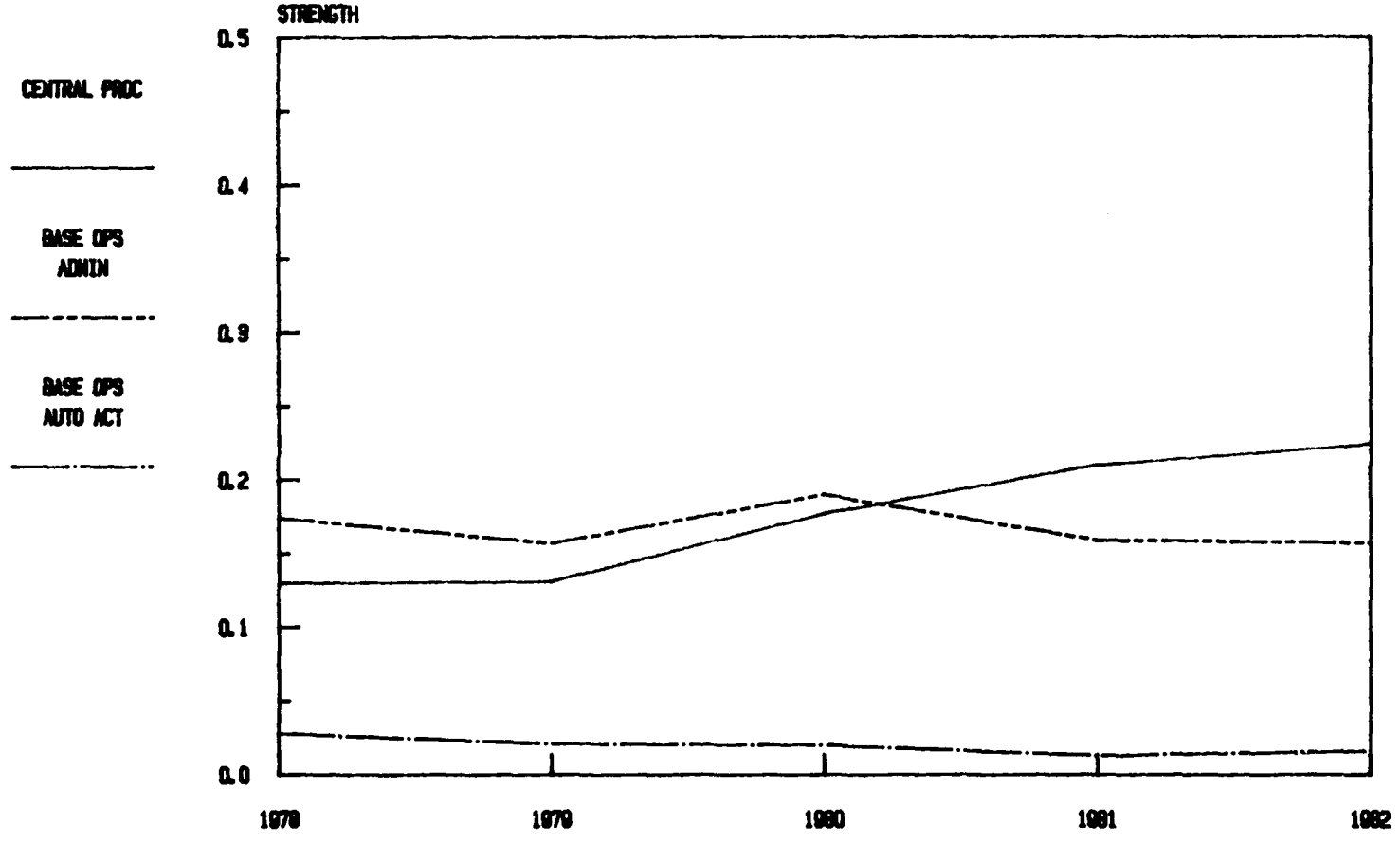
FIGURE C-6



CECOM

QUALITY ASSURANCE
TO CENTRAL PROCUREMENT

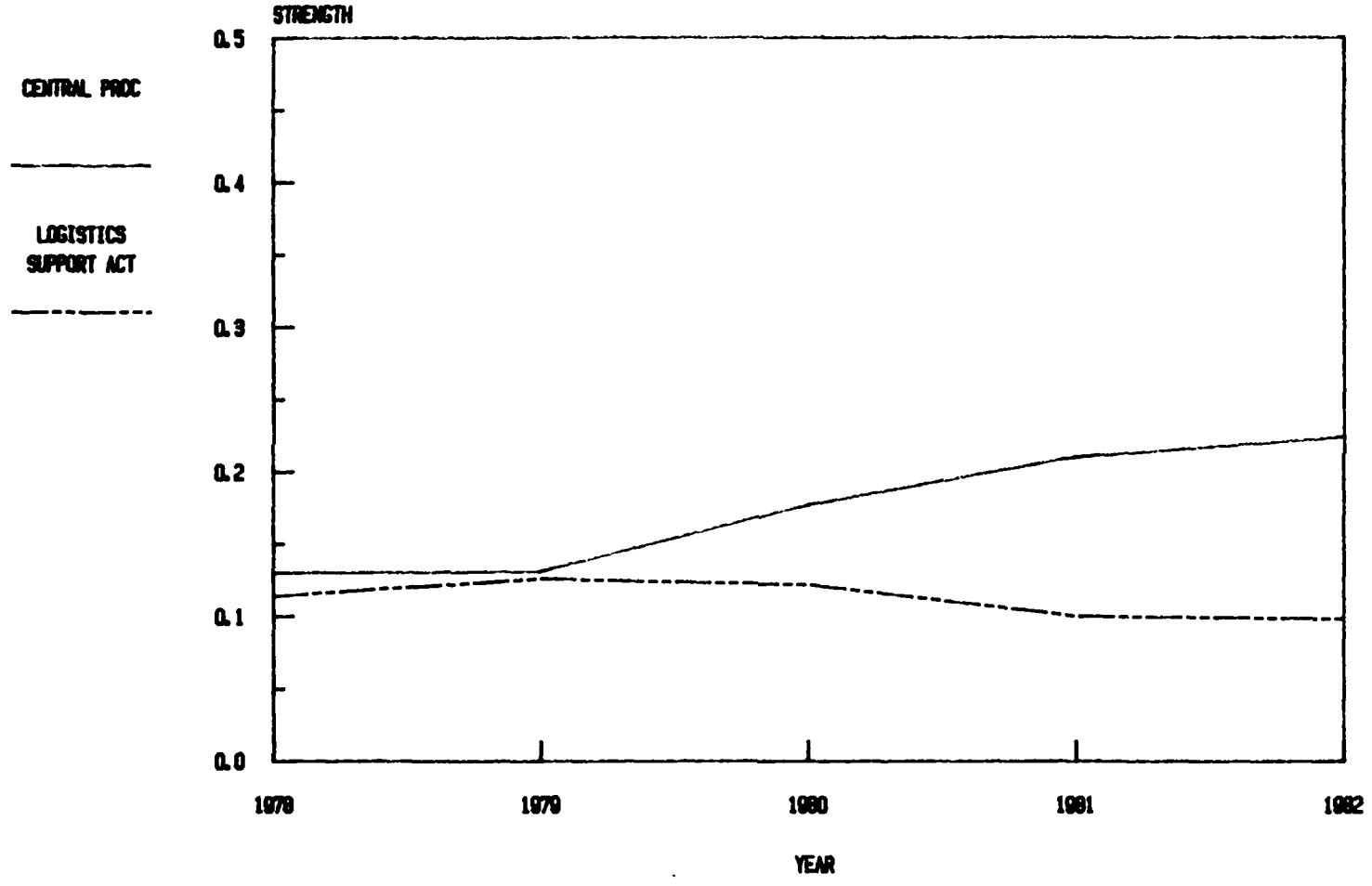
FIGURE C-7



CECOM

BASE OPERATIONS
TO CENTRAL PROCUREMENT

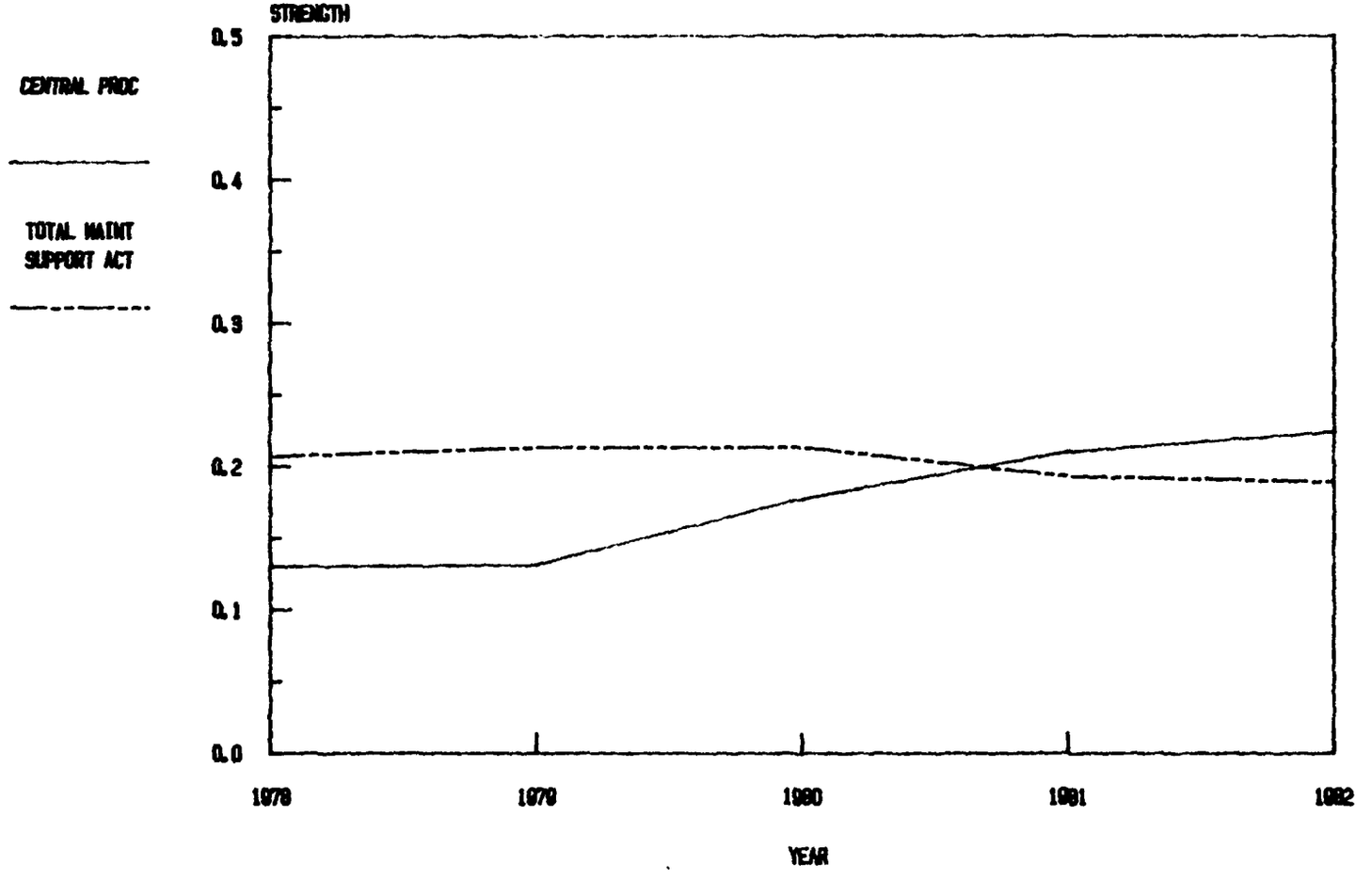
FIGURE C-8



CECOM

LOGISTICS SUPPORT ACTIVITY
TO CENTRAL PROCUREMENT

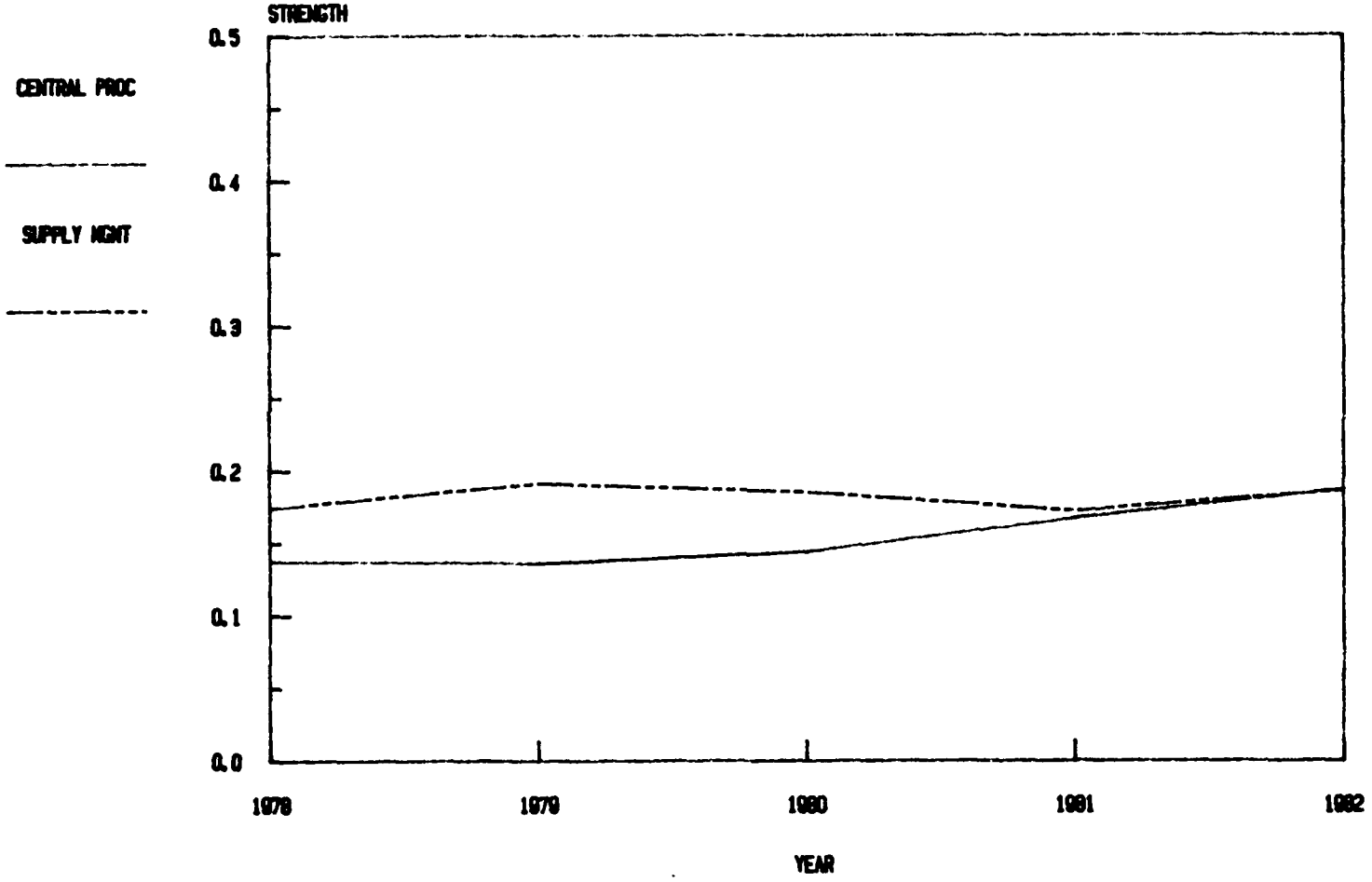
FIGURE C-9



CECOM

TOTAL MAINTENANCE SUPPORT ACTIVITY
TO CENTRAL PROCUREMENT

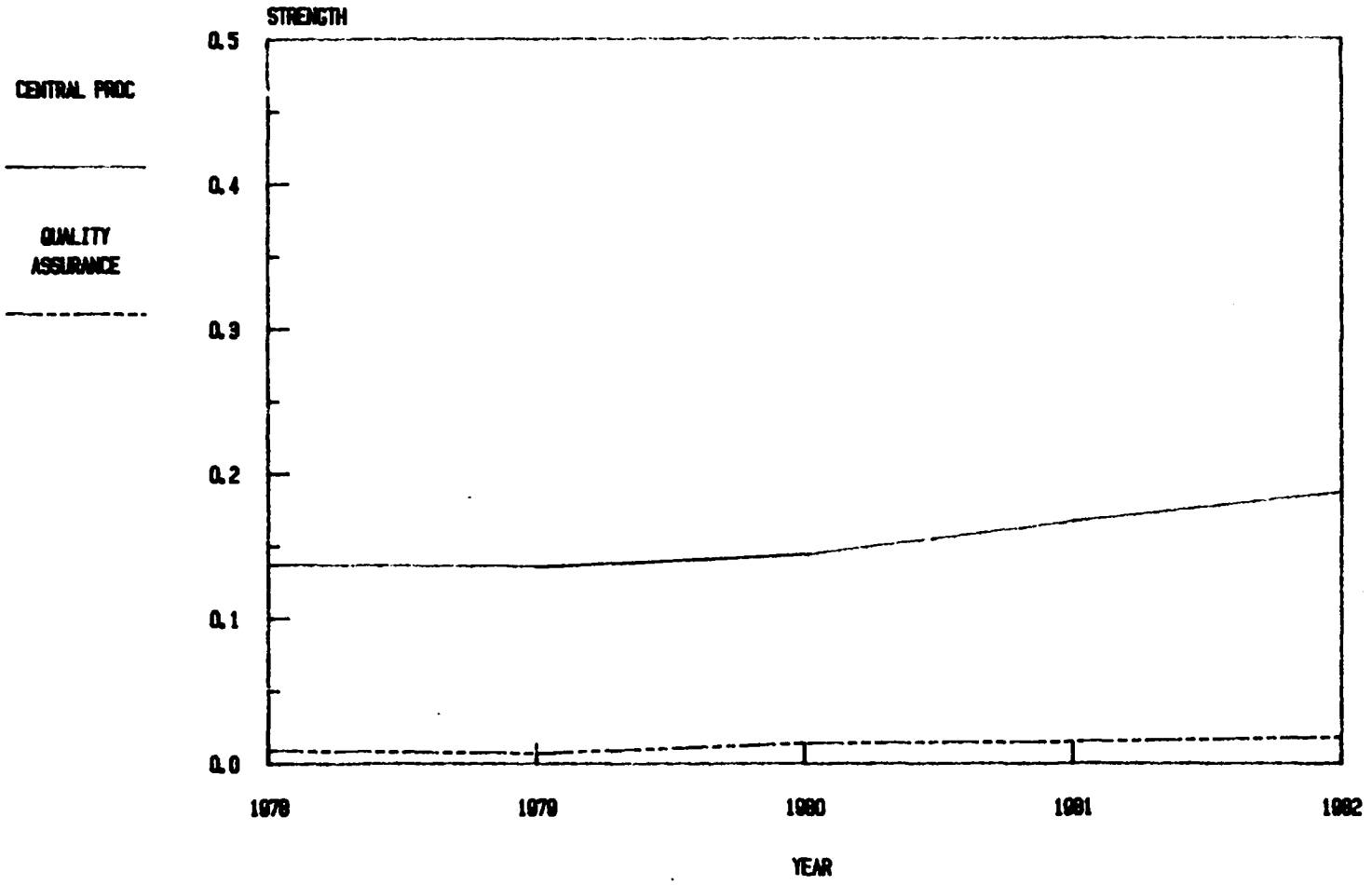
FIGURE C-10



MICOM

SUPPLY MANAGEMENT OPERATIONS
TO CENTRAL PROCUREMENT

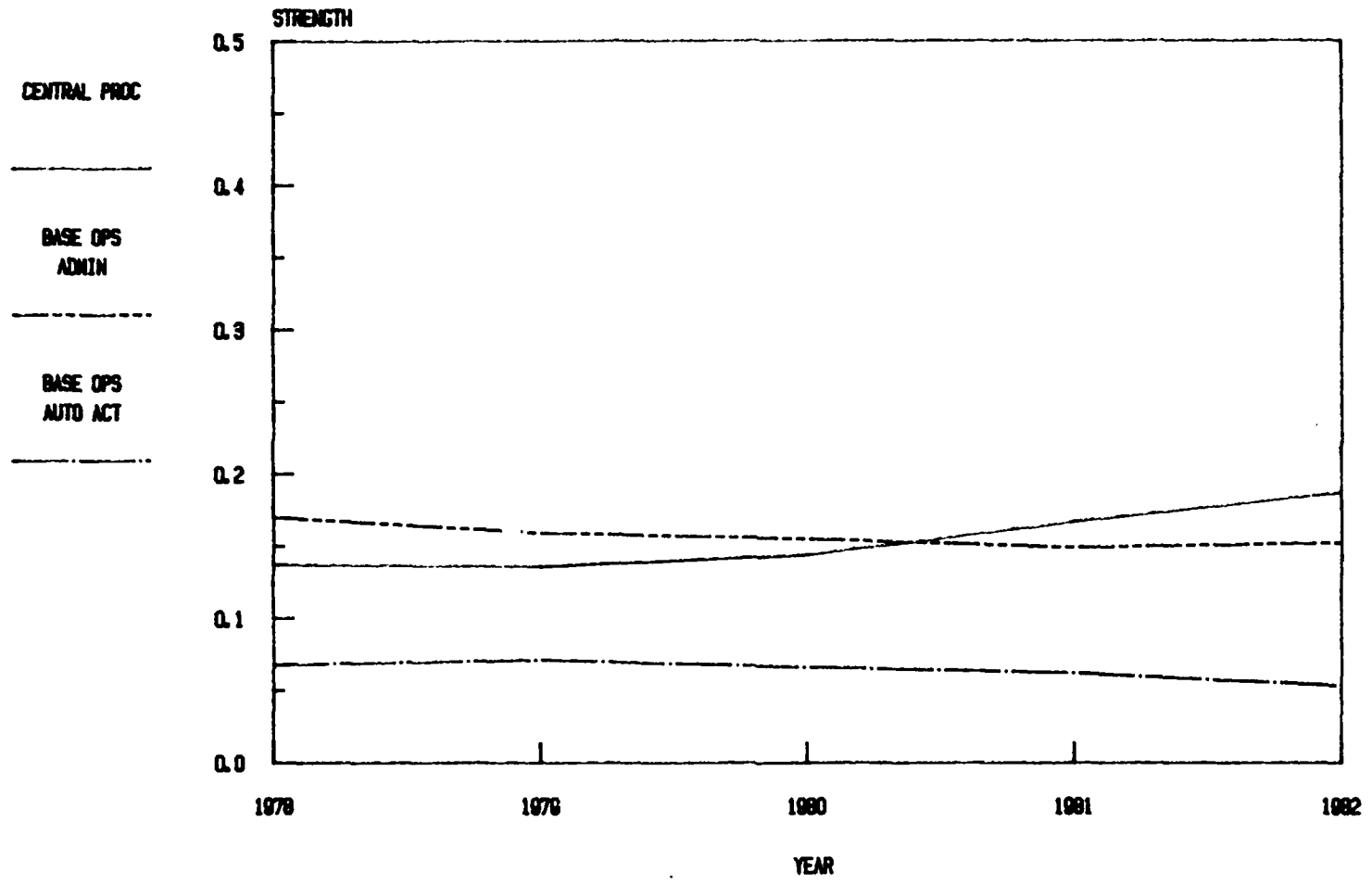
FIGURE C-11



MICOM

QUALITY ASSURANCE
TO CENTRAL PROCUREMENT

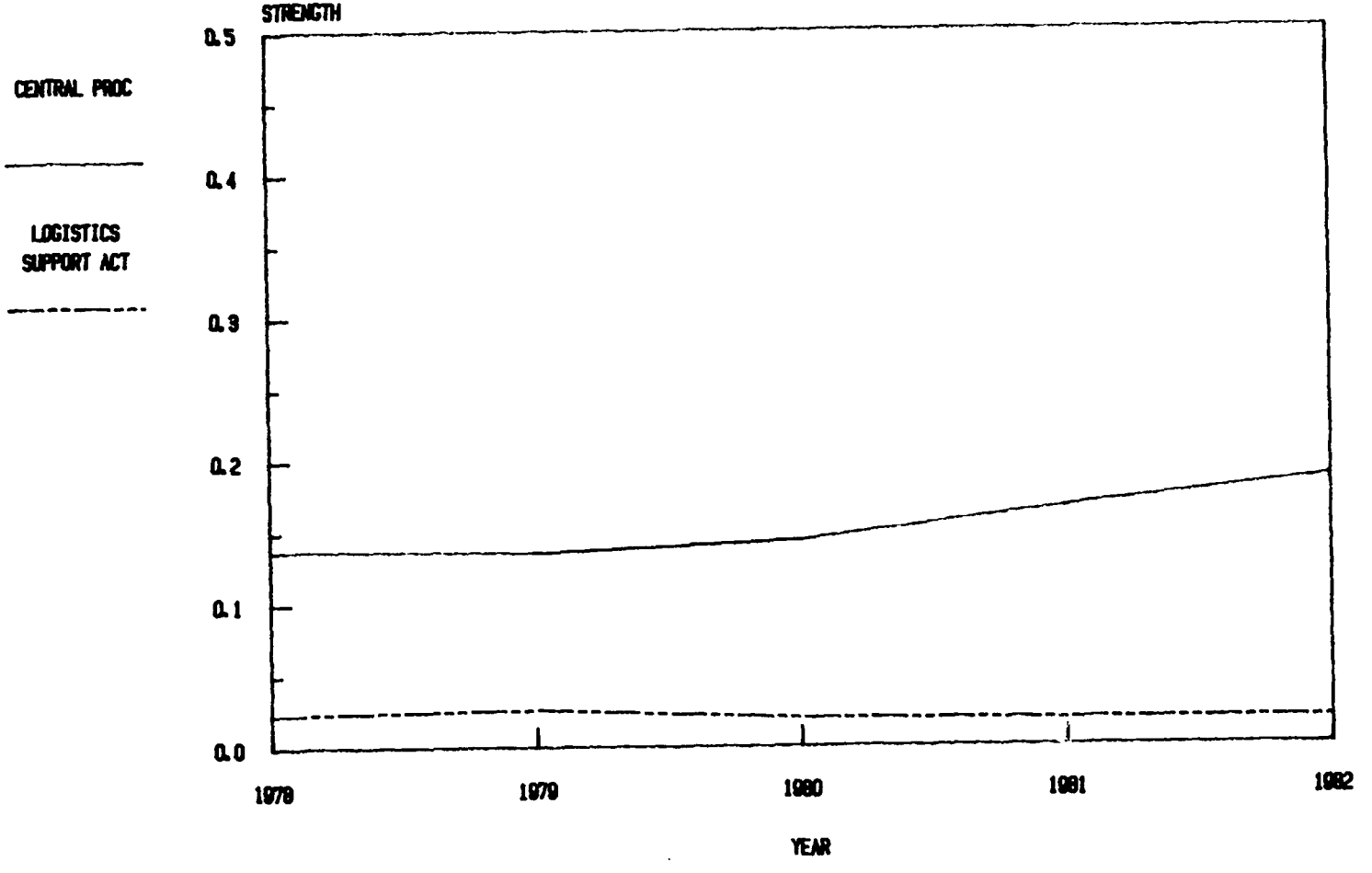
FIGURE C-12



MICOM

BASE OPERATIONS
TO CENTRAL PROCUREMENT

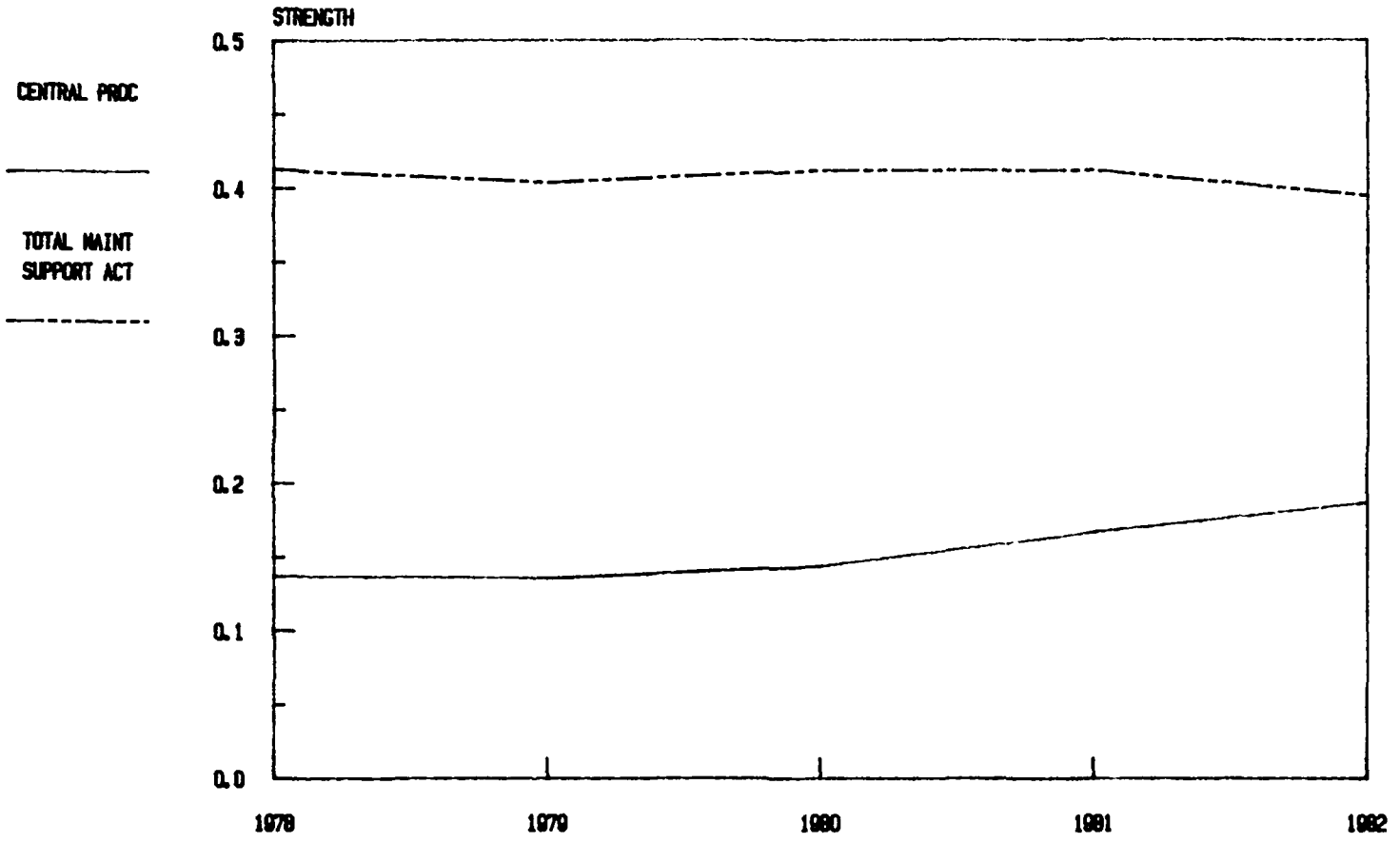
FIGURE C-13



MICOM

LOGISTICS SUPPORT ACTIVITIES
TO CENTRAL PROCUREMENT

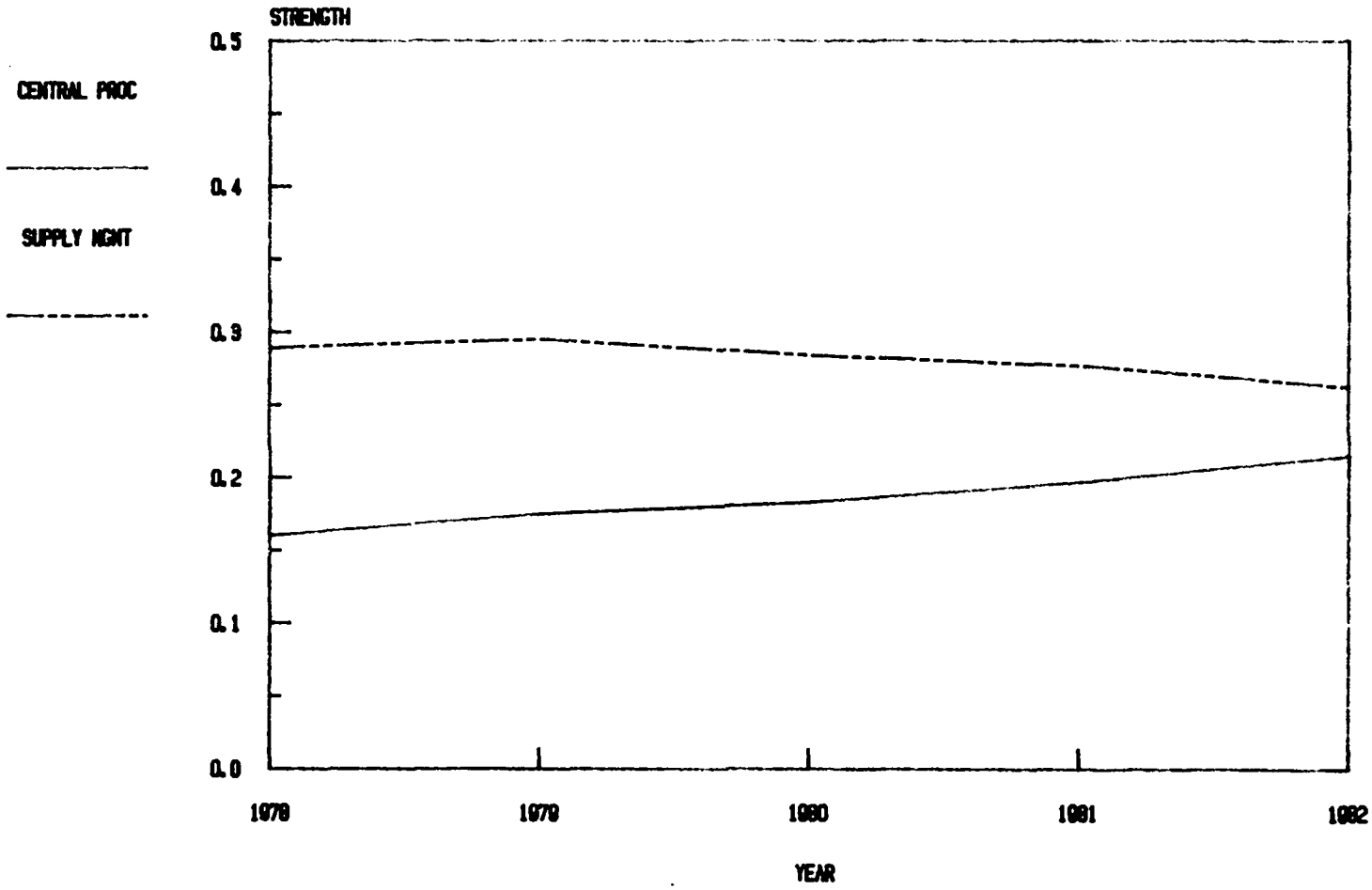
FIGURE C-14



MICOM

TOTAL MAINTENANCE SUPPORT ACTIVITY
TO CENTRAL PROCUREMENT

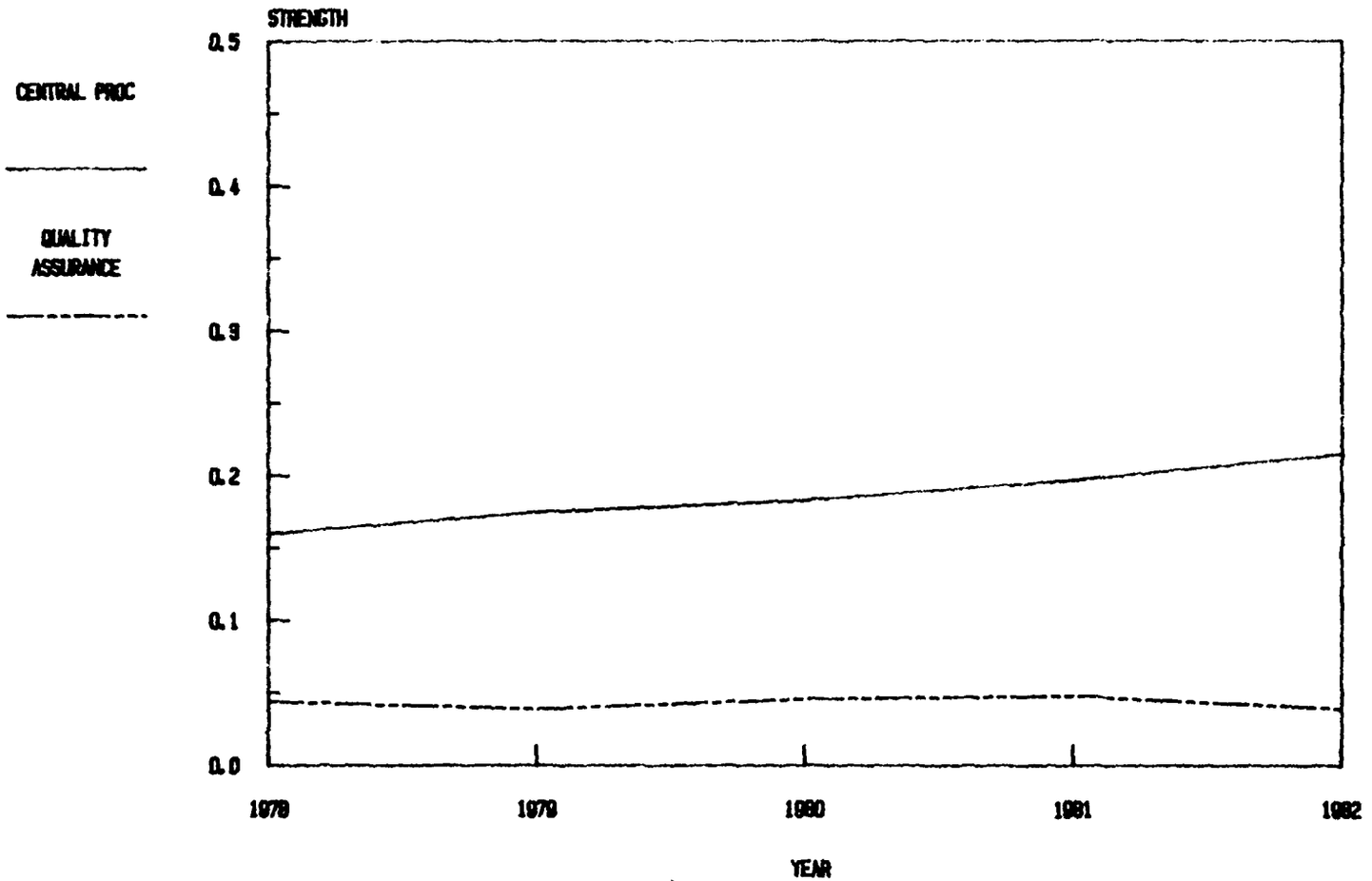
FIGURE C-15



TACOM

SUPPLY MANAGEMENT OPERATIONS
TO CENTRAL PROCUREMENT

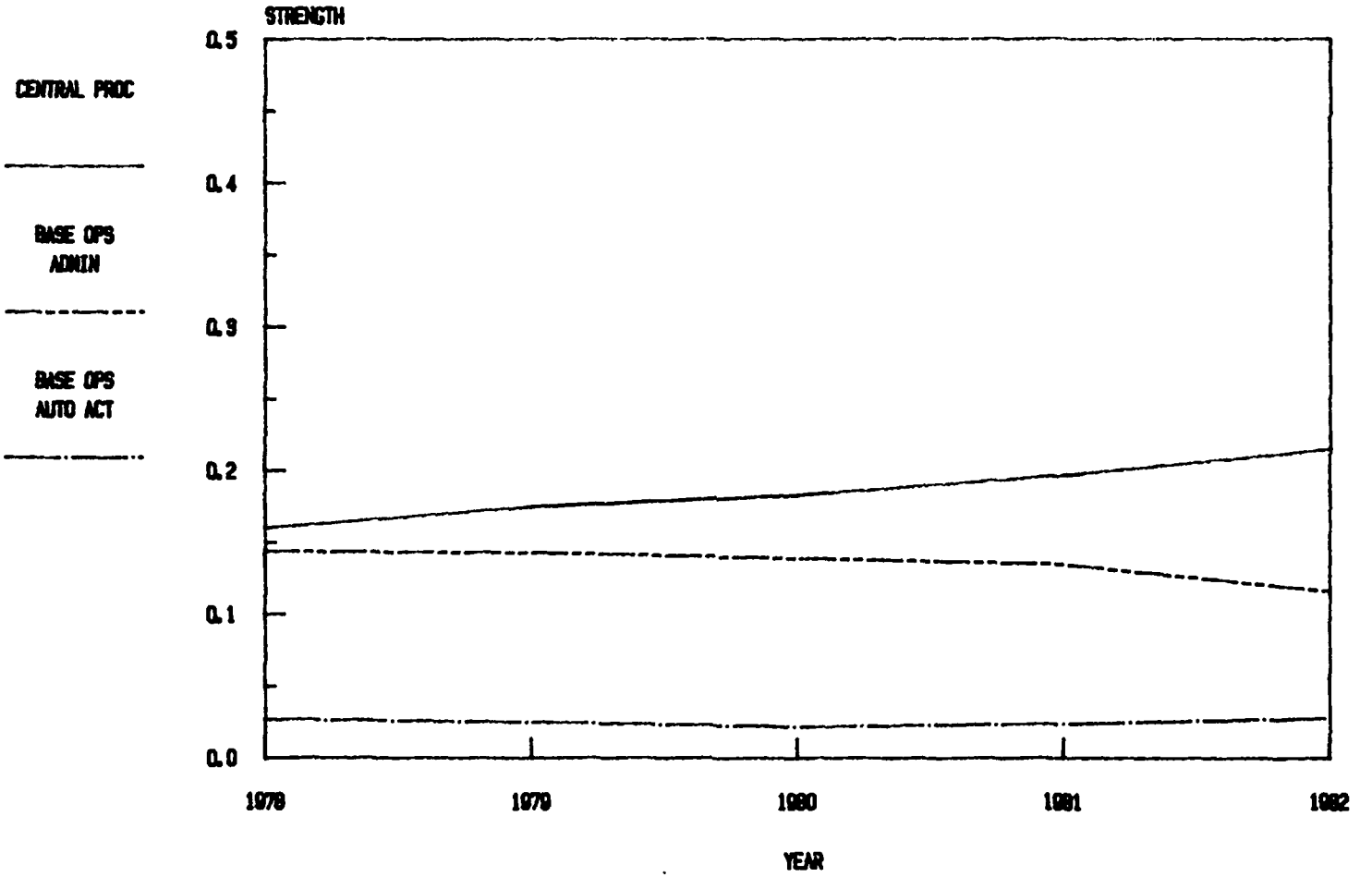
FIGURE C-16



TACOM

QUALITY ASSURANCE
TO CENTRAL PROCUREMENT

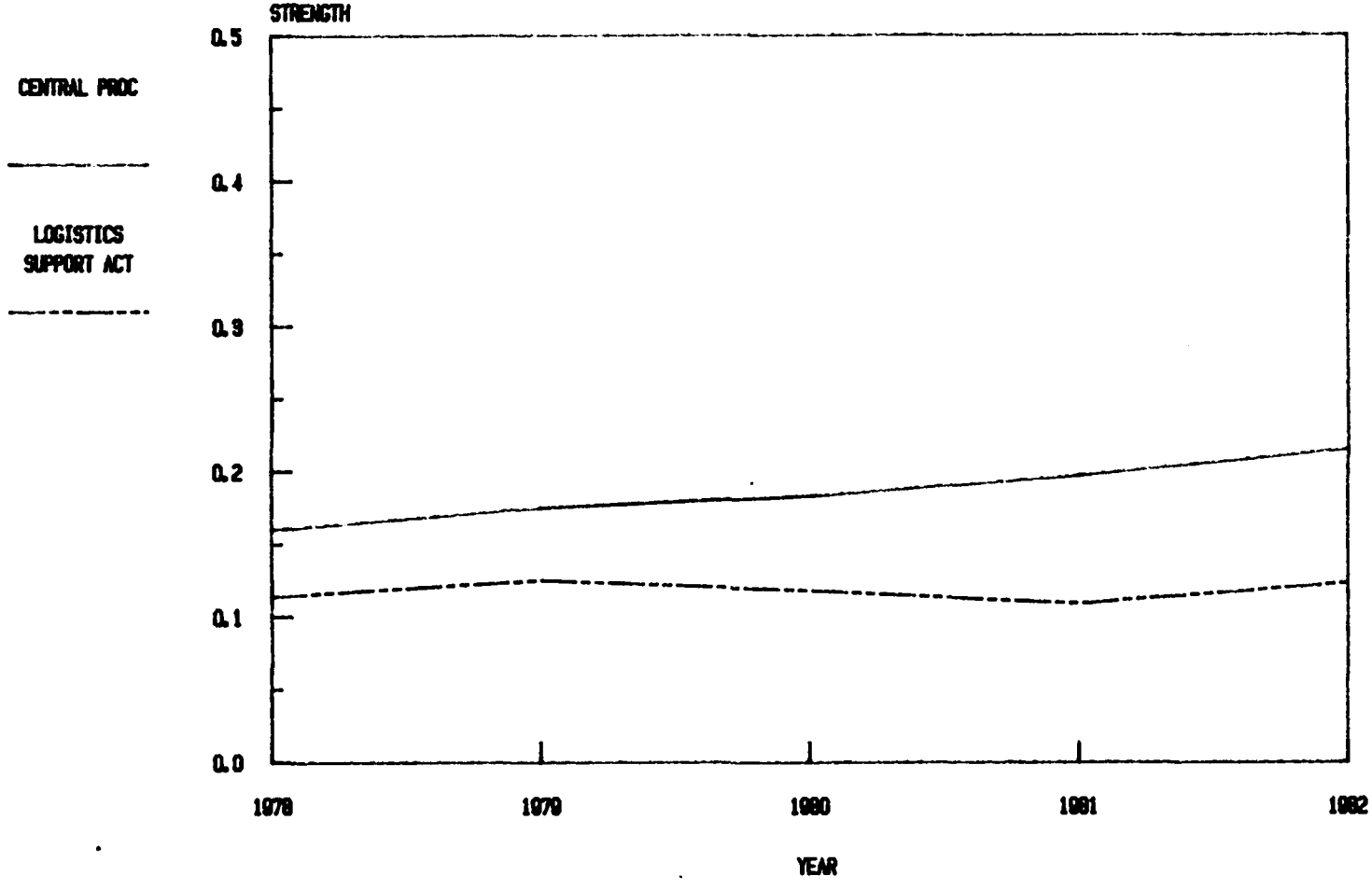
FIGURE C-17



TACOM

BASE OPERATIONS
TO CENTRAL PROCUREMENT

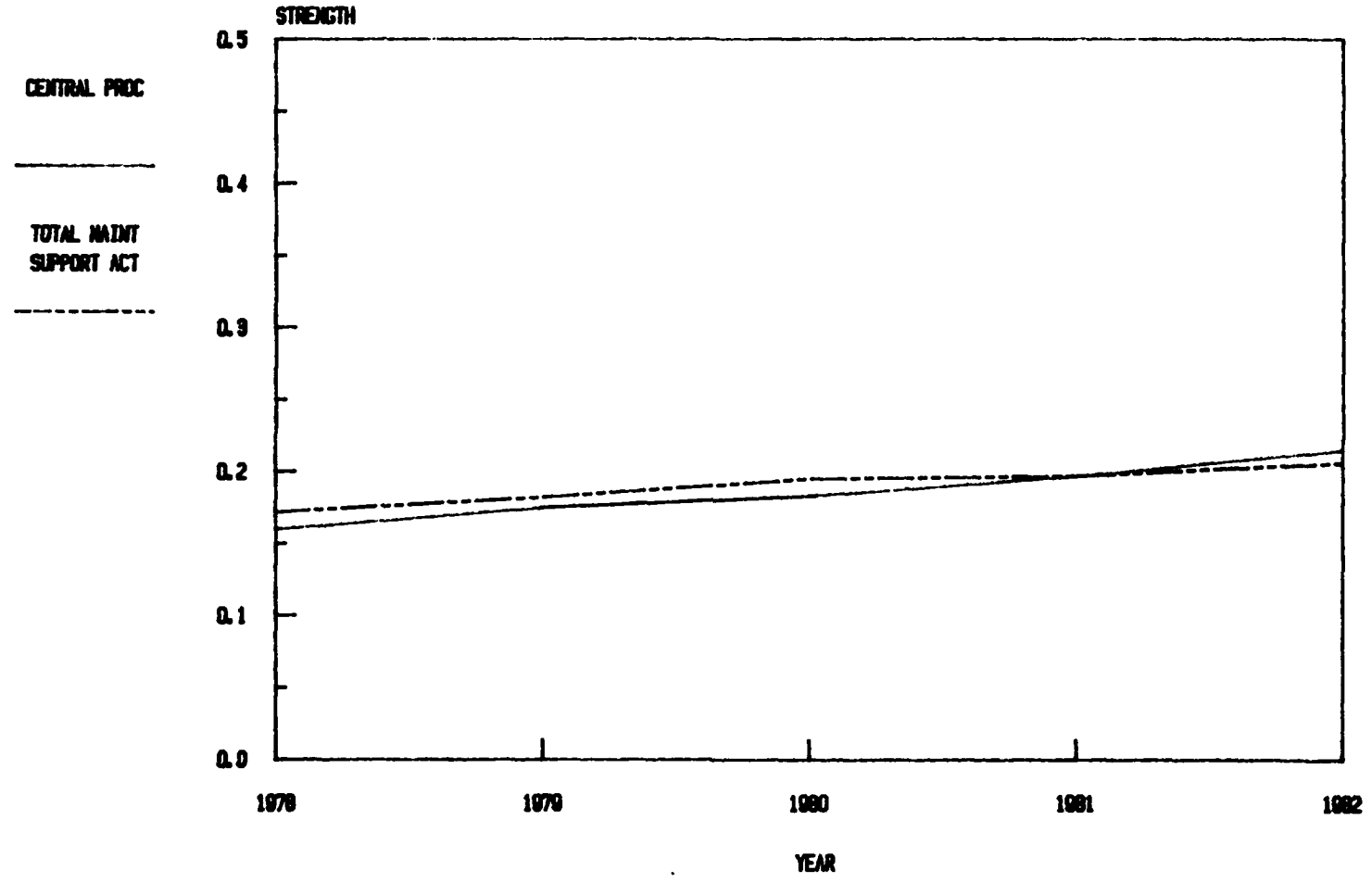
FIGURE C-18



TACOM

LOGISTICS SUPPORT ACTIVITIES
TO CENTRAL PROCUREMENT

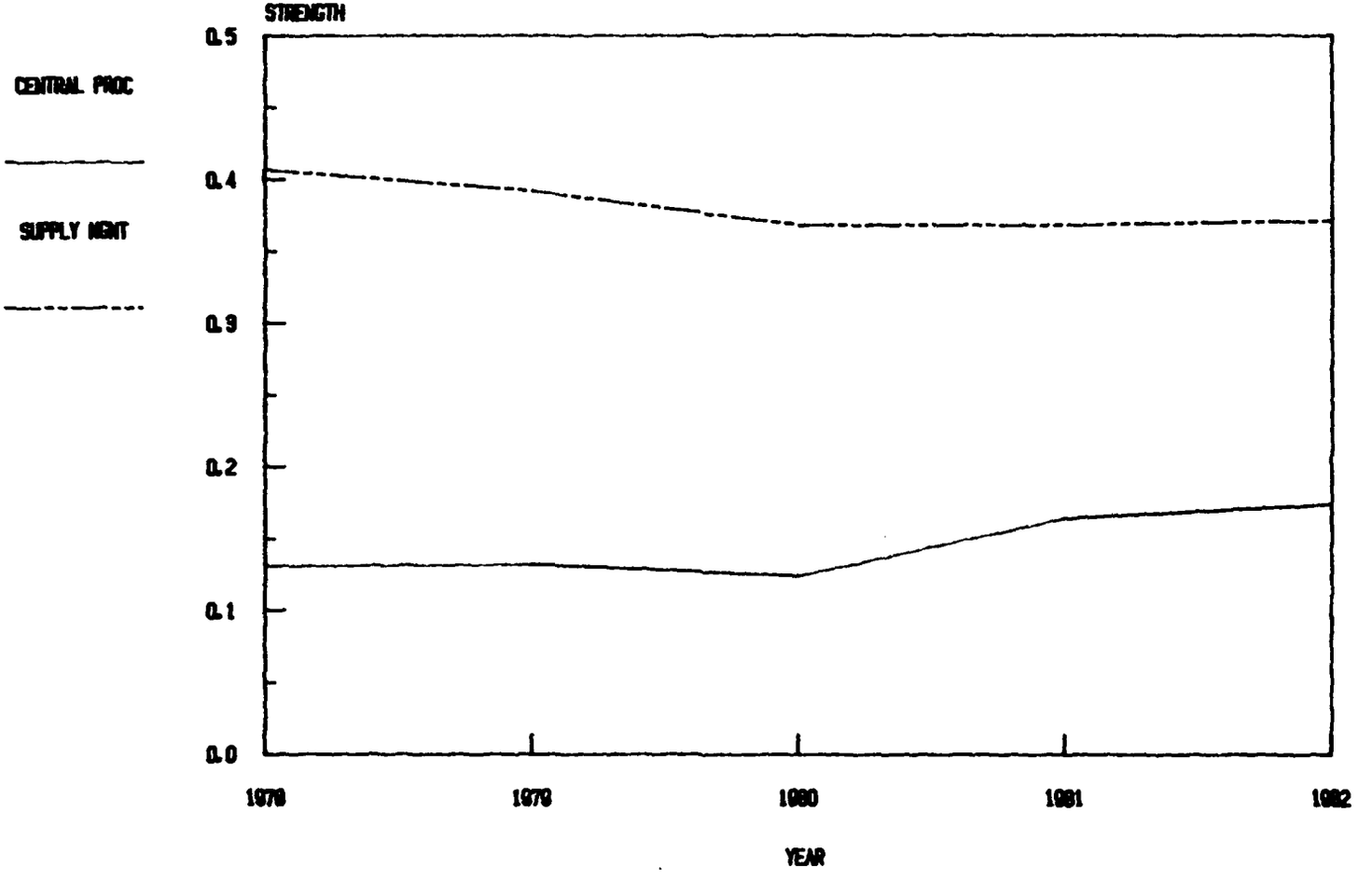
FIGURE C-19



TACOM

TOTAL MAINTENANCE SUPPORT ACTIVITY
TO CENTRAL PROCUREMENT

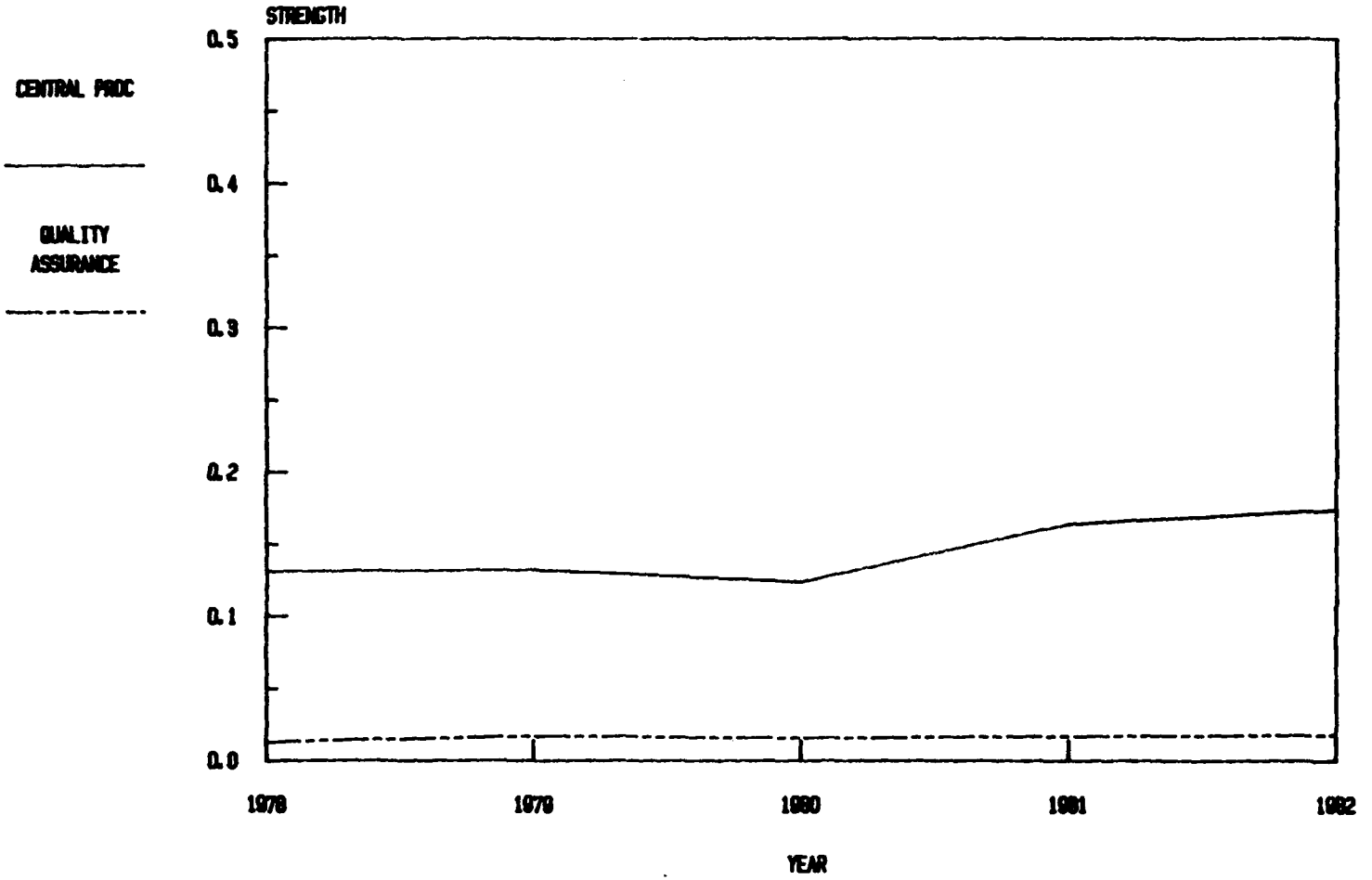
FIGURE C-20



TSARCOM

SUPPLY MANAGEMENT OPERATIONS
TO CENTRAL PROCUREMENT

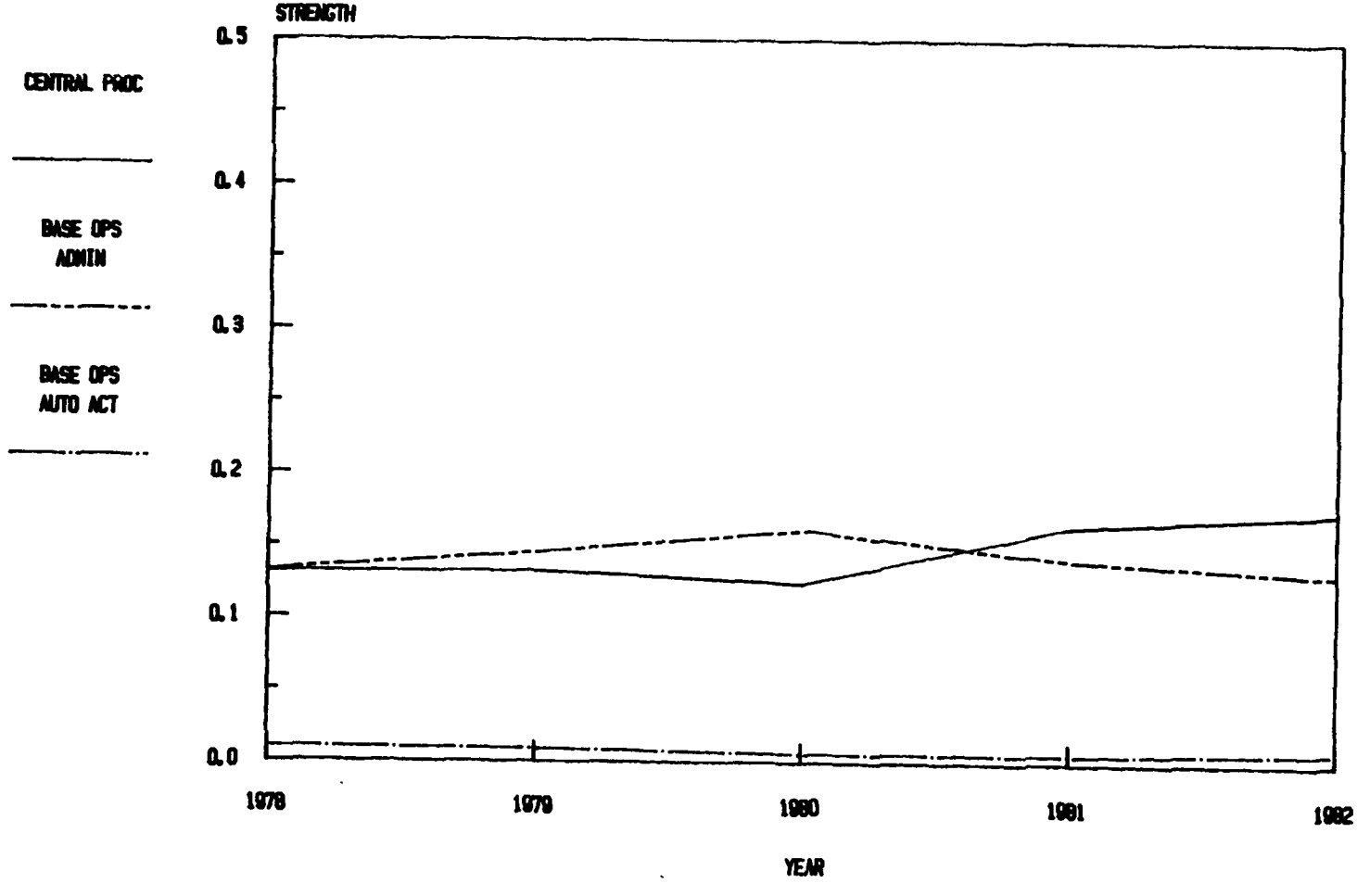
FIGURE C-21



TSARCOM

QUALITY ASSURANCE
TO CENTRAL PROCUREMENT

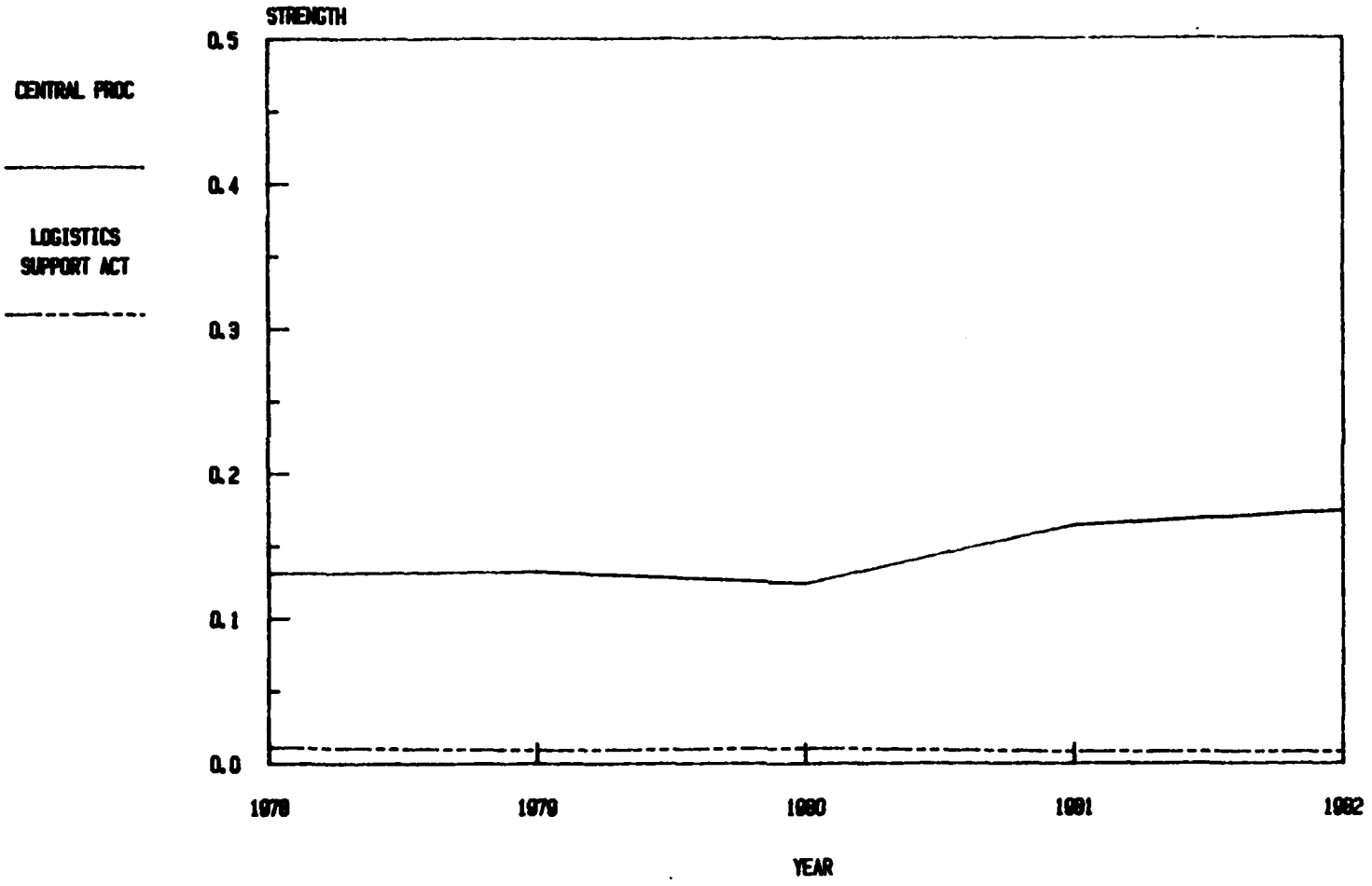
FIGURE C-22



TSARCOM

BASE OPERATIONS
TO CENTRAL PROCUREMENT

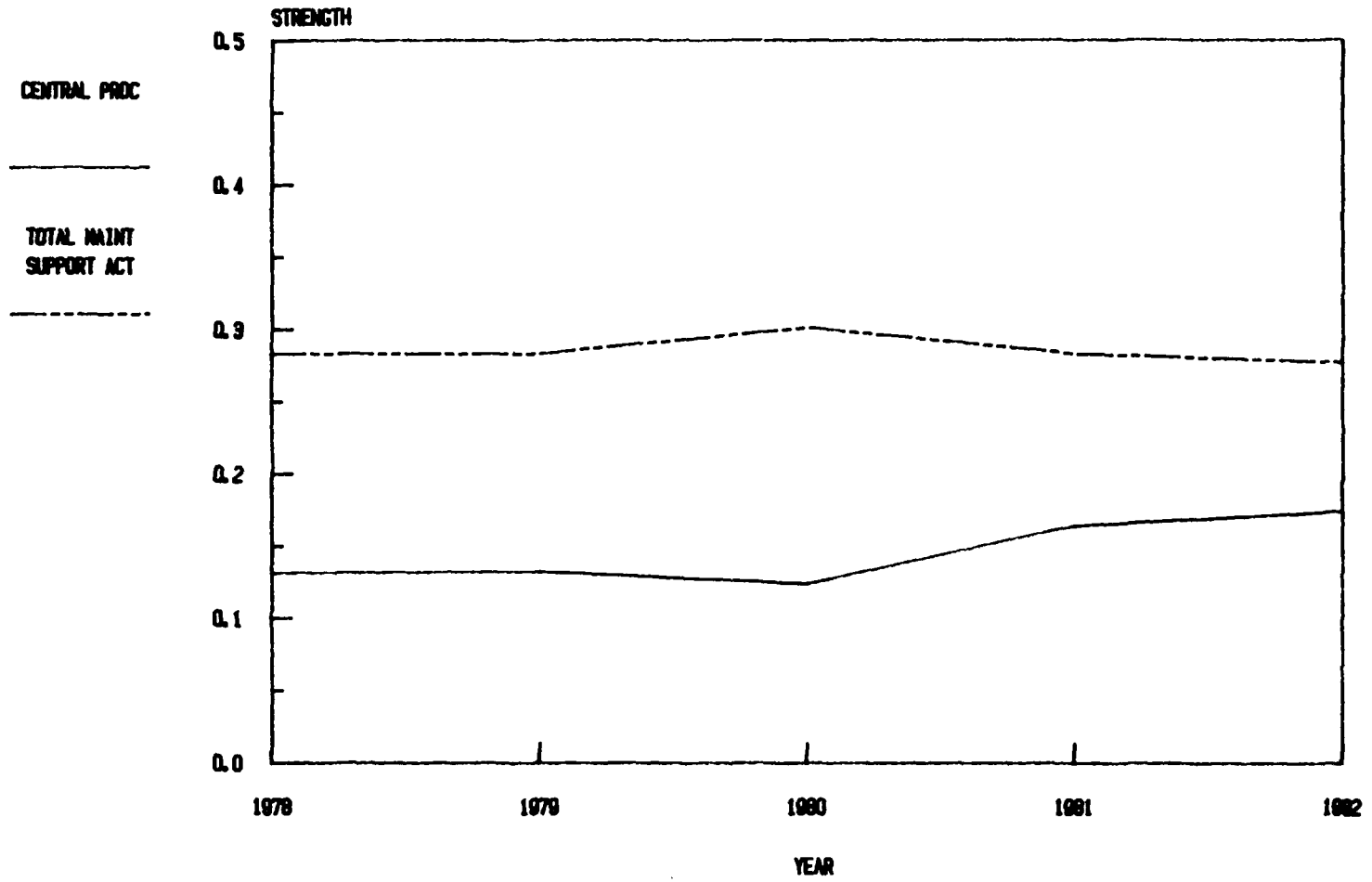
FIGURE C-23



TSARCOM

LOGISTICS SUPPORT ACTIVITIES
TO CENTRAL PROCUREMENT

FIGURE C-24



TSARCOM

TOTAL MAINTENANCE SUPPORT ACTIVITY
TO CENTRAL PROCUREMENT

FIGURE C-25

APPENDIX D

Manpower by Functional Element and Army Management

Structure Code for the Central Procurement System

[Extracted from Manpower Utilization and Requirements

Report (RCS-CCFOR 78)]

TABLE D

CENTRAL PROCUREMENT SYSTEM PROCESS MANPOWER

DARCOM

	30 Sep '78	30 Sep '79	30 Sep '80	30 Sep '81	30 Sep '82
Supply Management (721112.0)	5546	5514	5381	5506	5562
Procurement (721113.1&2)	3399	3525	3741	4534	4829
Quality Assurance (721113.3)	770	755	788	793	796
Administration (CPO & FA) (722896.NO)	2587	2519	2667	2594	2470
Automation Activity (722896.PO)	636	610	581	577	566
Industrial Preparedness (728011.0)	404	298	267	346	529
Logistics Support (728012.0)	1285	1346	1277	1180	1222
Total Maintenance Support (728017.0)	4666	5025	5156	5333	5305
Total System Process	19,293	19,592	19,858	20,863	21,279
Total Command	34,574	36,711	37,583	38,317	37,664

APPENDIX E

EXPLANATION AND USE OF INTERACTION MATRIX

A. INTRODUCTION.

The linkage technique used to display the interaction between Central Procurement activities, support activities and the Central Procurement System process is a graphics tool used in Systems Engineering to illustrate the interrelations between various goals, elements and activities of a systems problem. The array of matrices provides a way of displaying the overall relationships between all the major elements of a systems problem by linking them together simultaneously.

B. SELF-INTERACTION MATRIX.

The self-interaction matrix is used to illustrate the interactions between pairs of elements of the same class. Note how figures E-1 and E-2 show how the Central Procurement activities and the support activities, respectively, provide a means of relating how workload influences the other members of their own respective classes. For example, in Figure E-1, Legal has a strong workload relationship with Policy, the Procuring Element and Management but only a moderate one with Pricing and little to none with Programs and Production.

Figure E-2 shows that Base Opns Comptroller has a strong workload relationship with everyone except Quality Assurance, while Supply Management Opns has a strong workload relation with all other support activities except Industrial Preparedness Opns.

Management (Incl Admin Sys)	X	X	X	X	X	X
Procuring Element	X	X	X	X	X	X
Pricing	/					/
Policy				/	X	
Programs						
Production						
Legal						

Workload Influence

[X] Strong

[/] Moderate

[ ] Little to None

SELF-INTERACTION MATRIX OF PROCUREMENT ACTIVITIES

FIGURE E-1

Base Opns (CPO)	X	X	X	X	X	X	X
Supply Management Opns	X	X		X	X	X	
Quality Assurance				/		X	
Base Opns (Comptroller)	X	X	X	X		X	
Industrial Preparedess Opns	X					X	
Logistics Support Activities	X	X					
Total Maintenance Support	X						
Base Opns (DMIS)							

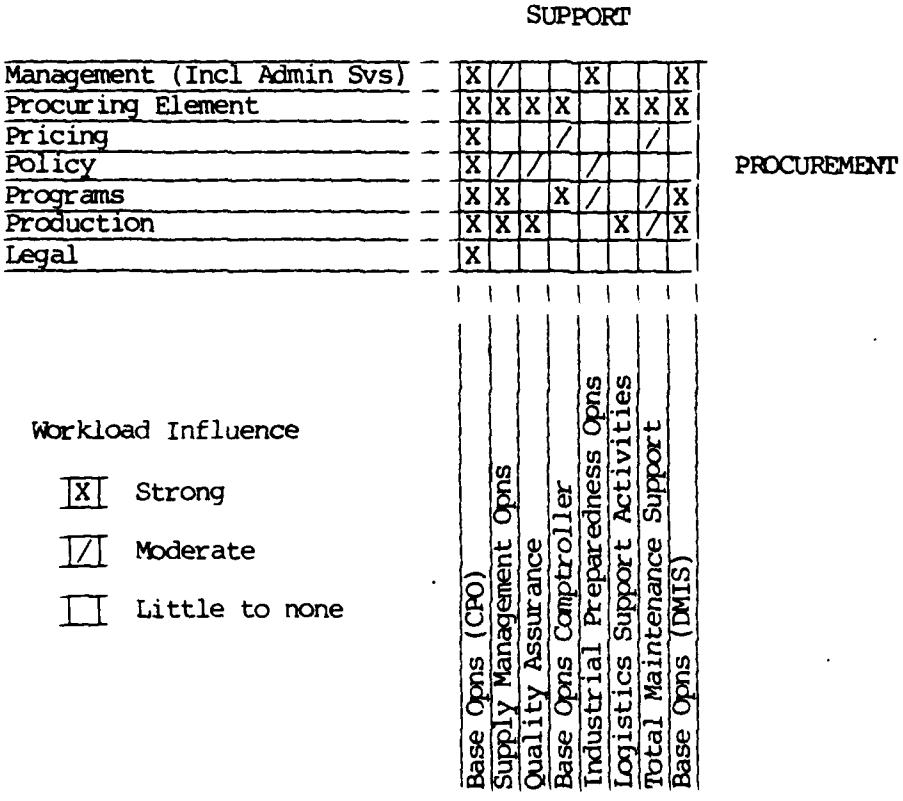
SELF-INTERACTION MATRIX OF SUPPORT ACTIVITIES

FIGURE E-2

C. CROSS INTERACTION MATRIX.

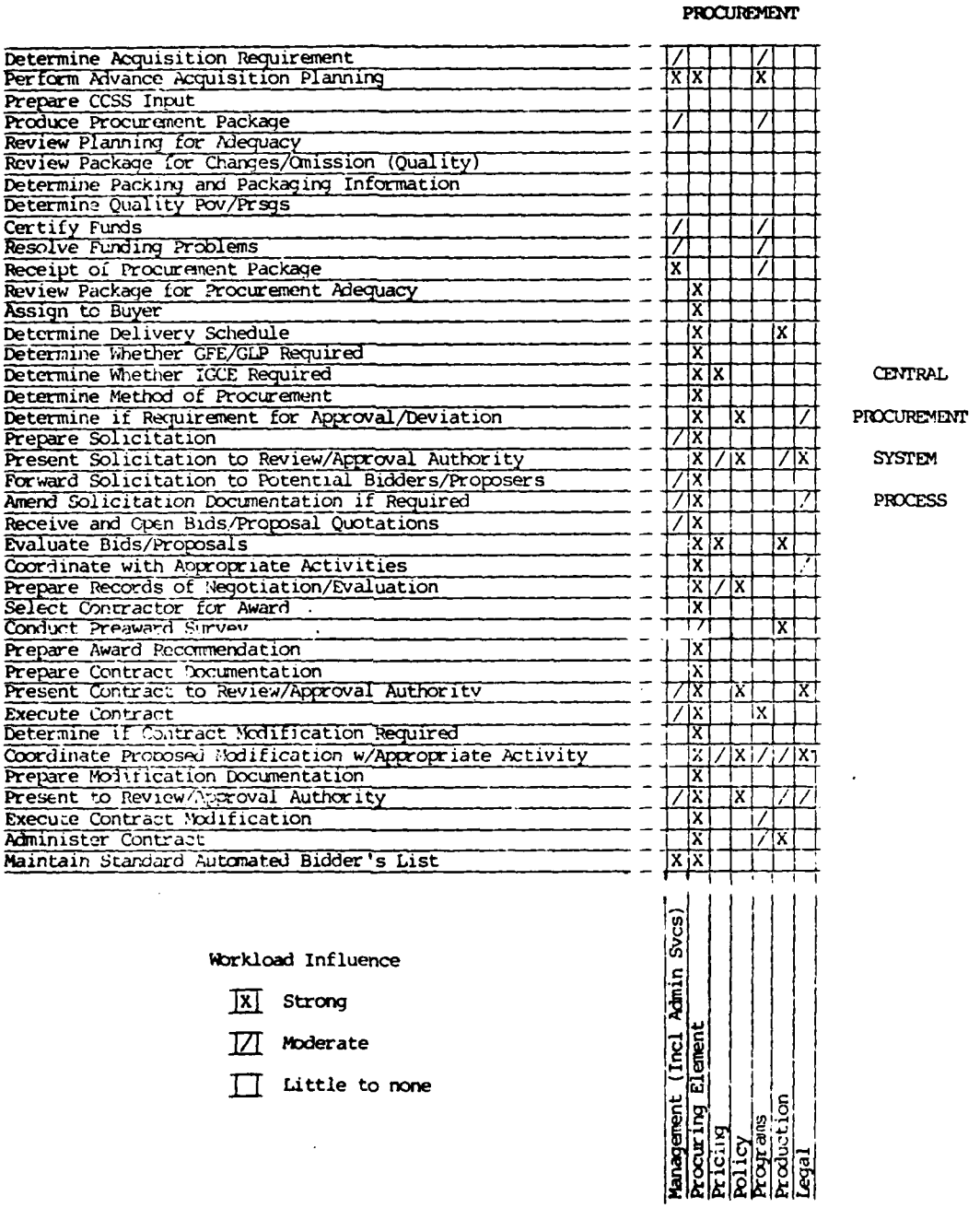
The cross interaction matrix relates the interactions between pairs of elements of two different classes. Figure E-3 shows the interaction, pair-by-pair, of the elements of the Central Procurement Activities to Support Activities. For example, Base Opns (CPO) has a strong workload relationship between itself and every element of Central Procurement. Procurement Policy has a strong workload relationship to CPO but only a moderate influence to Supply Management Opns, Quality Assurance and Industrial Preparedness Opns and little to none with all others. The cross interaction matrix showing the workload relationship between the Central Procurement Activities and the Central Procurement System Process is illustrated in Figure E-4 while Figure E-5 shows the cross interaction between the support activities and the Central Procurement System Process.

Figure 4, Linkages within Central Procurement System, in the text of the report illustrates all the interrelations between the elements of the Central Procurement System and the Central Procurement System Process in one graphic display to allow the viewer to visualize simultaneously the interactions within the total system.



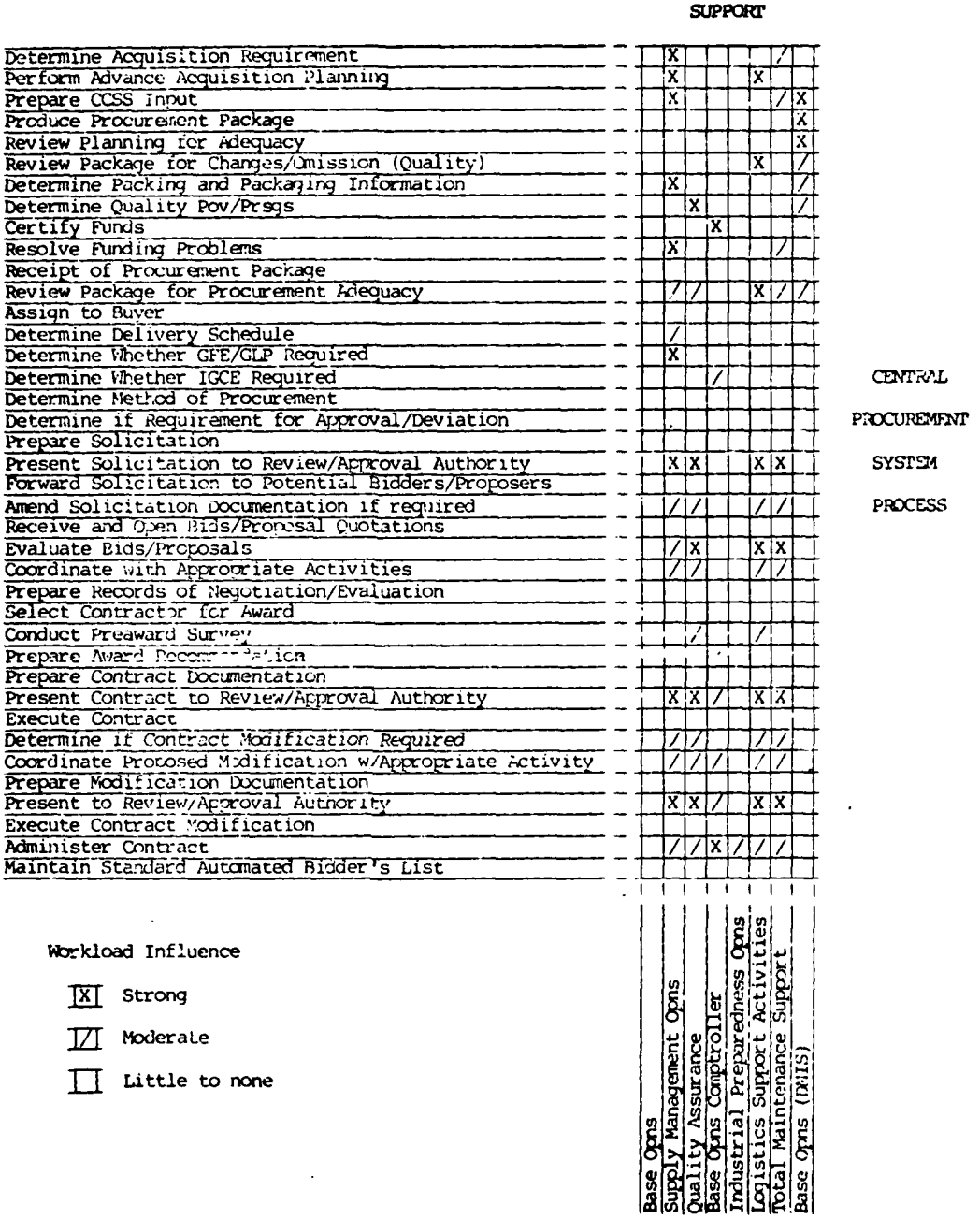
CROSS INTERACTION MATRIX BETWEEN CENTRAL PROCUREMENT ACTIVITIES AND SUPPORT ACTIVITIES

FIGURE E-3



CROSS INTERACTION MATRIX BETWEEN CENTRAL PROCUREMENT ACTIVITIES AND CENTRAL PROCUREMENT SYSTEM PROCESS

FIGURE E-4



CROSS INTERACTION MATRIX BETWEEN SUPPORT ACTIVITIES AND CENTRAL PROCUREMENT SYSTEM PROCESS

FIGURE E-5

STUDY TEAM COMPOSITION

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This study describes the Central Procurement System through the use of cross interaction matrices to illustrate how the different functional areas interact to support it. A flowchart describing how an item is procured along with the support function's role in the procurement is diagrammed for better understanding of the system. Also, data obtained from the Manpower Utilization and Requirements Report (RCS CCFOR 78) and Cost and Performance Plan and Report (RCS DRCSU 207) is used for the analysis of the manpower distributions as found at the MSC's over the last five years.

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