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UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

PROCUREMENT AND SYSTEMS
ACQUISITION DIVISION

NOV 16 1979

B-178214

The Honorable H. D. Harvell
Acting Commissioner
Federal Supply Service
General Services Administration D4G03333

Dear Mr. Harvell:

Subject: Review of GSA's Method of Supply Model (PSAD-80-7)

On January 3, 1978, Mr. Robert P. Graham, who was then Commissioner, asked our Office to evaluate a model containing a series of mathematical equations that your Office of Programs and Requirements had developed. The model is to be used to help determine the most cost-effective way to provide commonly used items, such as furniture, office supplies, and tools, to Federal agencies.

BACKGROUND

Federal agencies and executive offices fill their requirements for furniture, office supplies, tools, and other commonly used items in four ways. They receive the goods directly from warehouses of the Federal Supply Service (FSS) of the General Services Administration (GSA), arrange for FSS to purchase the goods for direct delivery from the supplier to the agency, buy directly from suppliers at prices and terms negotiated by FSS, or perform the entire procurement activity themselves. These four methods are referred to as stock, nonstock, schedules, and agency local purchase.

Methods of supply

For both the stock and nonstock methods of supply, FSS provides centralized contracting. FSS thus maintains records on orders, deliveries, and disbursements. The customer agencies requisition items from and pay FSS. For the schedules method, FSS negotiates contracts for items which customer agencies then order when needed directly from the contractor.

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FSS does not control the quantities of items purchased and does not maintain records of the amounts the agencies spend. Under the agency local purchase method, customer agencies procure the items themselves. FSS keeps no records on what goods were purchased, at what price goods were purchased, or what totals were expended.

SCOPE OF REVIEW

The objectives of this review were, as requested by FSS, to determine the validity and effectiveness of the model in selecting the most cost-effective method of supplying specific items requested by customer agencies.

In our effort to validate and measure the effectiveness of the models, we surveyed literature on inventory policy and interviewed appropriate FSS officials in inventory management. We reviewed each of the equations to determine if they considered all costs that would be incurred under each method and if the methods of computing those costs were reasonable. We also compared the stock method, as depicted in the stock equations, with how stock is actually managed by your Inventory Management Division. We conducted a theoretical analysis of the model and performed a variety of empirical tests using a random sample of 87 items selected from three product groups--tools, office furniture, and paper products. The inventory value of these three products represents about one-half of the total GSA inventory. In numbers, these three groups represent about 40 percent of all items managed by GSA.

Our review of the model accepts certain elements as valid assumptions. However, we did not make a detailed review of GSA records to determine if the actual costs were supported by such records. Specifically, we did not consider whether

--items meet the needs of customer agencies;

--items should be Government-unique, as opposed to commercially available; or

--the costs included in the mathematical equations (for example, the costs of letting a contract or issuing an item) were correct and supported by GSA records.

FINDINGS

We found that stock savings factors were used improperly in the equations, the safety level stock was not computed the way the Inventory Management Division--which actually manages stock items--computed it, and there were several minor errors or inconsistencies.

We also found that one of the stock savings factors used for furniture items may be wrong. In the equations, the unit purchase price is the same under the stock method as under the schedule method. We believe that the schedules method unit price should be higher because of price discounts from buying larger quantities of goods in the stock program. Correcting the stock savings factor for furniture will have a significant impact on the model's decisions. (See enc. I.)

DISCUSSION WITH THE OFFICE OF FEDERAL PROCUREMENT POLICY AND FSS

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Both your Office and the Office of Federal Procurement Policy (OFPP) were given a copy of a draft enclosure to this letter. We did not ask for written comments, but did discuss it with both Offices.

OFPP officials believe the model is of little value and are concerned that it will be used contrary to their policy of requiring the Government to purchase commercial off-the-shelf products and use commercial distribution channels where appropriate and economical. This 1976 policy represents a shift from the prior Government policy of buying, storing, and distributing items which were based on detailed specifications. The practice of using detailed specifications excluded commercial products from consideration and resulted in made-to-order products for the Government.

FSS officials stated that the model would be only one part of the overall supply decision and that market research, rather than the model, would be used to determine agency needs and possible commercial alternatives. FSS officials generally recognized the model's shortcomings.

CONCLUSIONS AND RECOMMENDATIONS

In our opinion, the equations in the model should be changed before the model is used. FSS is conducting a study

to determine what the correct stock savings factors should be. Therefore, we recommend that you use this study to update this factor in the model equations. Adopting the recommendations contained in our report entitled, "Ineffective Management of GSA's Multiple Award Schedule Program--A Costly, Serious, and Longstanding Problem," PSAD-79-71, May 2, 1979, will also have a significant impact on the factors to be considered. We also recommend that FSS make other changes relating to inventory carrying costs, space costs, stock safety-level factors, and regular use of the model. While failure to implement these changes would be less serious than failure to change the stock savings factors, these other changes can be made with little effort. Finally, we recommend that the model be used in a manner consistent with OFPP policy.

If you have any further questions, please feel free to contact our staff.

Sincerely yours,

for J. H. Stolarow
Director

Enclosure

ENCLOSURE I

GSA'S METHOD OF SUPPLY MODEL

In fiscal year 1978, the Federal Supply Service (FSS) procurement totaled almost $3.5 billion. Of that total, the stock program represented $0.9 billion; nonstock, $0.5 billion; and schedules, over $2.0 billion. The amount spent through decentralized agency procurement is unknown, but is thought to be about one-half as large as FSS' centralized procurement.

FSS has constructed a set of mathematical equations (model) to help select the most cost-effective method of supplying items to Government agencies. The equations have been programed to run on a computer. The model computes the cost for each method, compares the costs, and selects the least costly one. The model can review only goods that are now supplied through the stock and nonstock methods because FSS lacks the cost data needed to apply the model to items that are currently supplied through the schedules and agency local purchase methods.

While there are four basic methods of supplying items, the number of alternatives evaluated by the method of supply model is actually 11 because of the different ways of purchasing an item. These are established source contracts, which enable FSS to place any number of orders for any number of units per order on specified terms during the contract period, usually 6 months or a year and definite quantity contracts, which call for delivery of a fixed number of units under specified conditions and require a separate contract for each order. Under the definite quantity contract option, the procedure for awarding the contract varies with the contract amount. For purchases over $10,000, formal advertising for bids is required. For those less than $10,000 but more than $500, less formal practices are followed. For those under $500, a separate set of small purchase regulations apply.

Under the stock method of supply, the model provided for three different types of purchase--established source and the two higher cost (over $10,000 and $500 to $10,000) definite quantity contract types. Under the nonstock method, all four types of contracts are provided for, and under the local purchase method all three of the definite quantity type of contracts are included. The schedules method uses only the established source type of contract.

Thus, the model actually computes the cost of 11 different alternatives--3, under the stock method; 4, under the

nonstock method 1; under the schedules method; and 3, agency local purchase method.

The mathematical equations for the 11 alternatives were to contain all applicable costs for that alternative. Costs common to all methods include costs of preparing a requisition and letting a contract, shipping costs, inspection costs, and acquisition cost (unit price times the quantity). The stock method is the only one of the four basic methods in which the General Services Administration (GSA) would incur warehousing costs, including the cost of capital for the material in stock. The stock method also is the only one of the four methods in which there are two shipping costs--from the seller to the GSA warehouse and then from the warehouse to the requesting agency. These additional costs, however, are sometimes more than offset by the lower purchase prices that are realized under the stock method. Unit prices should be lower under the stock method because of large quantity discounts. The differences between the unit price incurred under the stock method and that paid in each of the other methods are known as the stock savings factors.

The different contracting methods incur different costs. For example, it is more expensive to go through the formal bid procedure than to follow the procedure required for contracts under $10,000. For this reason, it is necessary for the model to evaluate all 11 alternatives.

FSS' Office of Programs and Requirements plans to use the model to test 15,000 stock items over the next 12 months. This review is scheduled without any substantial change in the model's format. However, the data inputs to the model are to include a revised set of stock savings factors. Adoption of the recommendations contained in our report entitled, "Ineffective Management of GSA's Multiple Award Schedule Program--A Costly, Serious, and Longstanding Problem," PSAD-79-71, May 2, 1979, will have a significant impact on revising the stock savings factors.

The Office of Federal Procurement Policy's (OFPP's) Acquisition and Distribution of Commercial Products policy requires Federal agencies to use commercial off-the-shelf products and commercial distribution channels where appropriate and economical. It is important to distinguish the model's function from market research functions. The model has not been designed to determine customer agencies' needs or to determine whether requirements should be met by commercial off-the-shelf or Government-unique items. Such questions can best be answered through competent market research by buyers knowledgeable of their products.

ENCLOSURE I

THEORETICAL ANALYSIS OF THE MODEL

We studied the equations of the model in order to judge its validity. The major conclusions of our theoretical analysis are that the stock savings factors are miscalculated and misapplied; inconsistencies exist between the model and inventory practices elsewhere in FSS, particularly regarding safety stock and carrying costs; and no provision has been made for common procurement of related items.

Using erroneous stock savings factors

An item's unit cost to FSS should reflect the supplier's discounts, based on the volume purchased. The concept of the stock savings factor is implicit in the assumption that the central purchase of goods for stock results in higher volume purchases and lower unit prices. In the model's equations, the set of stock savings factors measures the percentages by which unit costs of schedules, nonstock, and local purchase programs exceed unit costs of stock procurements. The following paragraphs detail several areas in which the application of the stock savings factors is deficient.

The stock savings factors in the model equations are based on the Price Economies Study done by FSS. The study provides percentage factors that measure how much lower the unit purchase costs in the stock, nonstock, and schedules methods are in comparison to the local purchase methods.

In applying this data to the model equations, FSS applied the percentages to the wrong base in the case of the local purchase option compared to the stock method, and used a method which gives only approximations to the correct factors for the comparison of schedules and nonstock unit purchase costs to stock unit costs. Both practices create a bias against recommending goods for the stock program. The stock savings factor as computed by FSS on tools, office furniture, and paper products and (as they would be) if these errors were corrected are shown in the following table.

Computed Stock Savings Factors

Product category	Program: Schedules FSS	Schedules GAO	Nonstock FSS	Nonstock GAO	Local purchase FSS	Local purchase GAO
Tools	.137	.220	.337	.541	.377	.605
Office furniture	0	0	.056	.070	.196	.244
Paper products	.087	.116	.187	.248	.247	.328

In addition to the errors described above, the calculations have another flaw. The group-wide stock savings factors represent averages of many individual items tested in the Price Economies Study. The individual values vary widely about the average. For example, the FSS group-wide average for furniture is 19.6 (stock versus local purchase), but we observed values ranging from 0 to 63 percent. Presuming the stock savings factors for individual items are accurate, there can be considerable error if the group-wide average value were used.

The stock savings factors calculations imply that each of the subprograms within a given procurement program will generate the same price economies. There are three local purchase subprograms; which one is selected depends upon the average order quantity. There is no reason to assume that orders exceeding $10,000 will generate the same increase in unit cost as will those under $500. Yet, both subprograms are assigned the same stock savings factor. The same problem applies to the four subprograms within the nonstock method and the three subprograms in the stock method.

Finally, the accuracy of the Price Economies Study, the source of the stock savings factor calculations, is questionable. During our review, an FSS official was not satisfied with the accuracy of the stock savings factor calculations. Currently, FSS is reestimating them. We did not attempt to ascertain the validity of the methodology and assumptions of the Price Economies Study. However, the empirical tests discussed on page 9 indicate how sensitive the optimal method of purchase is to changes in the stock savings factors for furniture items.

Inconsistencies between model and inventory practices for safety stock

In any inventory systems where demand is variable, the supplier runs some risk of running out of stock. A shortage results in various explicit and implicit costs which, if known, should be included in the total cost equations. The explicit costs of shortages are the expenses of additional manpower requirements and special administrative action on backorders (overtime, memos, calls, personal intervention, special forms). The implicit shortage costs in the public sector might also include costs of disrupting agency services and products and the reduced value of delayed agency services and products due to backorders. These implicit costs are largely subjective in nature and therefore difficult to quantify. The Inventory Management Division does not measure shortage costs nor do they include them in the inventory management process.

ENCLOSURE I

If total shortage and carrying costs are known, selecting the optimal level of safety stock balances the expected cost of carrying an incremental unit in inventory against the expected cost of not carrying that unit. Conversely, using a service level (when shortage costs are not known) implicitly values the shortage cost. The 90-percent service-level goal, which FSS has set, implicitly values the cost of maintaining one unit on backorder at nine times the cost of carrying one unit in inventory for the same length of time.

Safety stock in the model is not calculated to meet FSS' 90-percent service level. Rather it is a function of the economic order quantity (EOQ), varying with the number of replenishments. Column six of the following table illustrates for four goods that the safety stocks calculated by the model do not achieve FSS' service-level objective.

Service Level Implied
by Model's Safety Stock Rules

Item	EOQ	No. of replenishment	Safety stock	Demand variability in leadtime	Implied service factor	Implied service level
Flattop desk	211	65	633	825	0.77	78%
Picture frame	786	16	1,572	331	4.75	100
Executive desk	31	39	92	98	0.94	83
Step stool	633	14	950	177	5.35	100

A method of providing service levels which, in our opinion, would improve the model is similar to that used by the Inventory Management Division. Using this approach, safety stock is based on variation of demand during leadtime and a factor for the chosen service level.

The safety stock for the above furniture items using a method similar to that of the Inventory Management Division and a 90-percent service level compares to the model's safety stock as follows:

	Safety stock	
	Model	GAO
Flattop desk	633	1,064
Picture frame	1,572	427
Executive desk	92	126
Step stool	950	228

In each of these four cases, there is a large difference in the computation of safety stock.

In addition to the failure to use a formula similar to that used by the Inventory Management Division, the model is unrealistic in that the number of replenishments is not constrained. In actual practice, the Inventory Management Division buys stock a maximum of 24 times a year. If actual practice concerning the number of replenishments was incorporated in the model, but left unchanged in the method for calculating safety stock, the safety stock computed by the model would still be significantly different for two of the four items listed above.

Inconsistencies caused by using two different carrying costs

Inventory carrying costs are a legitimate part of the total costs incurred in the stock method, and including such costs in the stock equations in the model is appropriate. The Office of Programs and Requirements developed one method for computing such costs, while the Inventory Management Division developed a second method. While the methods agree on how the interest cost of the material in stock (capital cost) is computed, they differ in the manner that warehouse storage and handling costs are computed.

However, both methods are used in the stock equations in the model. The Inventory Management method is used indirectly in that it is used to compute the EOQ, which in turn is used to compute the number of annual replenishments. Replenishment cost (the number of replenishments multiplied by the cost of one replenishment) is also part of the stock equations. As mentioned earlier, the EOQ also impacts on the safety level. Since the safety-level stock is included in inventory stock, carrying costs are affected. The Office of Programs and Requirements method is used directly in the computation of annual carrying costs in the stock equations.

Failure of model to recognize families of items

The model tests each item separately, even though not all items are independent of one another. FSS recognizes that items belonging to the same family should generally be procured the same way. Joint ordering of items incurs replenishment costs different from those ordered independently. Properly charging for items jointly ordered involves determining the fixed cost of preparing an order regardless of the number of items on the form and the extra cost of each

line item to be ordered. GSA's work measurement system does not measure these factors separately. The model reflects the cost of preparing an order with only one line item per order.

Failure to incorporate joint ordering procedures leads to using incorrect replenishment costs and, in turn, to incorrect order quantities and total costs. We did not attempt to measure their impact.

Minor defects in calculating space costs

We noted a minor defect in calculating space cost. Although its impact on the decision should be small, we feel that this problem can be corrected at little expense.

The basic charge for warehouse space is $0.11 per cubic foot per year. While many items are received as individual units, others are received in a variety of bulk packs.

The space code determines a storage cost based on cubic footage per bulk pack and on stacking height limitations. For example, the space code for a carton of paper (10 reams) results in a cost of $0.165 per bulk pack (per year). However, this cost is assigned to each ream in computing the holding costs. This practice overstates holding costs for all bulk pack items and creates a bias against selecting stock programs. In our computations, we divided the space cost by the number of units per bulk pack to properly measure storage costs per unit.

EMPIRICAL ANALYSIS OF THE MODEL

We used our random sample of 87 items to compare the current model's recommendations to what recommendations would be made if the model were changed to correct many of the deficiencies we previously discussed. We refer to the results from the current model as the base case and those from the corrected model as alternative solutions. Because we do not know what the stock savings factor for furniture under the schedules method should be, we ran the corrected model several times and changed the factor each time. The results from the current model and the corrected model are discussed below.

Base case results

The model results show that only 12 of the 87 items appear to be managed correctly. If those recommendations were implemented by FSS, most of the tool items would be shifted

from stock, established source to stock, informal definite quantity. Most furniture items would be shifted from stock to schedules. The completed results are presented in the table below. The potential changes in the method of supply are due exclusively to implementing the recommendations of the current FSS model. Most stock items have not been tested by any supply model.

Comparison of Current Method of Supplying Items with Those Recommended in Base Case

Item class	Current method	Recommended method: Stock, established source	Stock, formal definite quantity	Stock, informal definite quantity	Non-stock under $500	Schedule	Agency purchase under $500
		(note a)					
Tools	b/20	1	0	18	0	1	0
	c/3	0	0	3	0	0	0
	d/4	0	0	3	0	0	1
Total	27	1	0	24	0	1	1
Furniture	b/34	1	0	0	1	32	0
	c/1	0	0	0	0	1	0
	d/0	0	0	0	0	0	0
Total	35	1	0	0	1	33	0
Paper products	b/19	7	0	8	0	3	1
	c/6	2	0	0	0	4	0
	d/0	0	0	0	0	0	0
Total	25	9	0	8	0	7	1
All items	b/73	9	0	26	1	36	1
	c/10	2	0	3	0	5	0
	d/4	0	0	3	0	0	1
Total	87	11	0	32	1	41	2

a/Only 5 of the 11 possible supply methods were recommended in the base case.

b/Stock, established source.

c/Stock, formal definite quantity.

d/Stock, informal definite quantity.

Alternative solutions

On the basis of our analysis, we modified FSS' model to correct several of the deficiencies we had noted. In particular, our modifications properly account for space costs, base safety stock on demand variability, 90-percent service level, the actual number of depots per item, and follow the Inventory Management Division's procedure of constraining the number of replenishments to the range of .5 to 24. We also corrected the algebraic errors in the stock savings factors. This change resulted in all stock savings being changed except the factor for furniture items being purchased from schedules. See the table on page 3 for a comparison of the factors in the current model to the factors as we corrected them.

Correcting for algebraic errors left the stock savings factor for furniture items purchased from schedules at zero as it was in the base case. We do not believe this factor should be zero. That is, we think it is unrealistic to assume that acquisition costs of furniture items purchased from schedules is the same as furniture items procured from stock. Buying from schedules increases unit cost through reduced quantity discounts. These larger unit costs would occur because the average number of items ordered by an agency from schedules would likely be much smaller than the number ordered by FSS when it refilled its warehouse stock. As we mentioned on page 4, FSS is conducting a study to determine what the correct stock savings factors should be. However, since we do not know what it should be, we ran the corrected model four times, changing only this factor. In our first run, it was left at zero, and in the subsequent runs, it was set at 4, 8, and 12 percent. When a stock savings factor of zero percent is used for furniture items purchased from schedules, the results from our revised model are very similar to that of the base case. Thus, the other deficiencies we noted do not affect the results very much. However, when a factor of 4 percent is used (that is, the unit price of furniture items purchased from schedules is 4 percent higher than when the items are purchased in larger quantities for stock), we begin to see significant changes in the recommended method for supplying furniture items. In this case, 11 of the 35 furniture items would remain as stock items, in contrast to the 0-percent case when only 1 furniture item would remain in stock. When a 12-percent factor is used, 30 of the 35 furniture items would remain in stock.

These results for furniture items are summarized in the table below.

Method of Supply Recommendations for Furniture Items

	Base case model	Corrected model			
Furniture:					
Stock savings factors for schedules	0	0	.04	.08	.12
No. of items:					
Stock (3 classes)	1	1	11	27	30
Nonstock	1	1	1	1	4
Schedules	33	33	23	7	1
Total	35	35	35	35	35

The dollar effect of stock savings factors is also significant. If, for example, zero is the correct stock savings factor for furniture items purchased from schedules (which we do not think it could be), then implementing the model's recommendations would save about $9 million. 1/ On the other hand, if this stock savings factor is really 12 percent, then implementing the results from the model using a zero factor would result in increased costs of about $8 million, primarily by incorrectly moving furniture items from stock to schedules. These results show the importance of reliable stock savings factors and the sensitivity of recommended supply decisions to them.

Other tests

The following paragraphs describe other tests we made to determine if the recommended method of supply was sensitive to changes in inputs other than the stock savings factors.

Unit prices and replenishment costs

In the first test, all unit prices were doubled; otherwise, inputs used the base data. Eight decisions were changed, but no pattern to these changes was noted.

In the second test, stock replenishment costs were increased by $200 (current replenishment costs range from $40 to $240). Given the large change in this cost, the number of affected decisions was relatively small at 12. Further, the costs associated with maintaining the 12 incorrect decisions were small. These changes were generally from stock to schedules or from stock, established source to stock, small definite quantity. These results were predictable since higher stock costs drive goods into programs other than the stock program. Goods that remained in stock moved to the definite quantity program where the $200 increase was a smaller percentage change than in stock, established source.

These two tests suggest that the model's decisions are reasonably insensitive to changes in price, replenishment costs, and (by extension) carrying cost.

Costs and demands

We made a forecast of next year's costs and demands to simulate the impact of the model to future inputs. This

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1/This figure is based on projected sample results to group-wide totals for furniture, tools, and paper products.

forecast assumed a 10-percent increase in all unit costs, a 5-percent increase in unit demands and calls, and a general reduction in acquisition leadtime. Testing the 87 items with this revised data base changed no supply decisions from the base case results. This suggests that, except in cases of rapid and extreme variations in costs and demands, using current data should not invalidate the model's recommendations over the next year.

Modifying the model

Many of the errors we discussed earlier can be corrected easily before the model is implemented. We believe they will incur little or no extra cost and little or no additional delay in completing the test of the 15,000 stock items. For example, the additional data needed to calculate a multiple depot safety stock can be obtained from the Inventory Management Division, which supplies some of the model's inputs. Recoding a few lines of the program completes the correction. We believe other changes can also be easily made.

However, correcting the errors we noted does not improve the efficiency with which the model operates. The model is now programed to review the items one at a time. A person at a computer terminal calls the program into the central processing unit of a time-shared computer system and enters the data, such as demand and unit cost, for the first item. The program then computes the cost of supplying this item under each method, selects the least costly method, and prints out the results at the terminal. The person at the terminal then enters the data for the second item, the program computes as before, and the results for the second item are printed out. This process is repeated until all items are reviewed.

We believe the process would be more efficient if it were modified so that it did not require the input data to be entered one at a time. Instead, the data for many items could be stored in one file. The computer program could be modified so that it could take the data one item at a time from the file without the need for a person to enter the data at a computer terminal. After selecting the data for one item, the program would, as before, compute costs for that item under each method of supply and select the least costly method. The program would repeat the process for the remaining items and print the results using a high-speed printer.

AGENCY COMMENTS

FSS and OFPP officials reviewed a draft of our report.

OFPP officials feel the model is of little value and are concerned that it would be used in a manner contrary to their policy requiring the Government to purchase commercial off-the-shelf products and use commercial distribution channels where appropriate and economical. This 1976 policy represents a shift from Government buying, storing, and distributing items which were based on detailed specifications. The practice of using detailed specifications excluded commercial products from consideration, and resulted in made-to-order products for the Government.

FSS officials stated that the model would be only one part of the overall supply decision and that market research, rather than the model, would be used to determine agency needs and possible commercial alternatives. Market research would be the first step in the process. The commodity managers would consider the results of the market research along with the model's recommendations in coming to the supply decision for each individual item.

FSS officials generally recognized the model's shortcomings which we presented in some detail in the draft they reviewed. In their opinion, our recommendations would require some effort, but could be made.

CONCLUSIONS

In its present form, the model's several flaws may prevent it from developing reliable estimates of the costs of supplying specific items in various ways.

The stock savings factors for furniture items purchased from schedules may be wrong. Our analysis shows that the model's decisions were more sensitive to the set of stock savings factors than anything else. In our opinion, the equations in the model should be changed before it is used. FSS is conducting a study to determine what the correct stock savings should be. The study should be used to update the factors in the model equations.

While not as important as the stock savings factors, the following shortcomings of the current model were also noted:

--The stock savings factors contain two algebraic errors, which create a bias against selecting the stock programs. Even if properly calculated, they give only approximate costs of programs other than stock, since the group-wide average stock savings factors are not typical of many items within the group.

--The calculations of safety stock are not consistent with practices in the Inventory Management Division. The multidepot stocking practices of most items stocked by FSS is not modeled. This flaw understates safety stock and, in turn, understates carrying cost and the total cost of the stock program.

--The model uses two different measures of holding cost. Only a single holding cost can be justified.

--All items are treated as independent of each other, while many items are actually members of loosely defined families and should be analyzed by joint ordering practices. Failure to use joint ordering increases stock program costs.

--Space costs are miscalculated by the model, leading to overstated holding costs on items received in bulk packs.

--The model makes no provision for evaluating goods not now in the stock program.

RECOMMENDATIONS

FSS should not implement the model without making the following changes toward improving the reliability of the model and implementing its recommendations. In our opinion, most of these changes can be made with little extra time and resources and can be done together with current FSS revision and implementation efforts. FSS should:

--Obtain more accurate stock savings factors, especially for the schedules programs. Finer detail than group- or class-wide averages is desirable. These more accurate values should be applied properly in the equations.

--Agree upon a uniform set of carrying costs, using separate charges for the cost of capital and warehouse space, for use in all areas of FSS' inventory management.

--Recode the program to correct space costs and safety stock factors to agree with practices of the Inventory Management Division which constrain replenishments, use multiple depots, and base safety stock on variable demand.

--Construct a work plan to operate the model regularly, more efficiently, with a long-range goal of reviewing each item at a specified interval such as once every 2 years.

--Use the model consistently with OFPP policy.