

While reference to recent papers will indicate methods used for differentiation currently used, the least that an investigator in the detergency field can do is to be sure that a sufficient number of replications has been made, then indicate the mean value, the number of test replicates used to attain that mean, and the standard deviation and standard error (22).

An attempt has been made to review the various types of detergency evaluation, to indicate cooperative and association effort in this field, and to suggest methods, wash test equipment, soiled fabrics, and evaluation of data as available from the literature so that a detergency laboratory might be more readily established.

#### Acknowledgment

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## Some Aspects of Inventory Control in the Soap Industry

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**S**KILL in controlling inventories is one of the hardest tests of business management. Government reports show that this is one of the most common causes of business failures. Both big and small companies are vulnerable.

Inventory control has a special importance to soap companies as a large portion of the cost of soap is dependent on the price of fats and oils. Note in Figure 1 that in one year (1947) the price of fancy

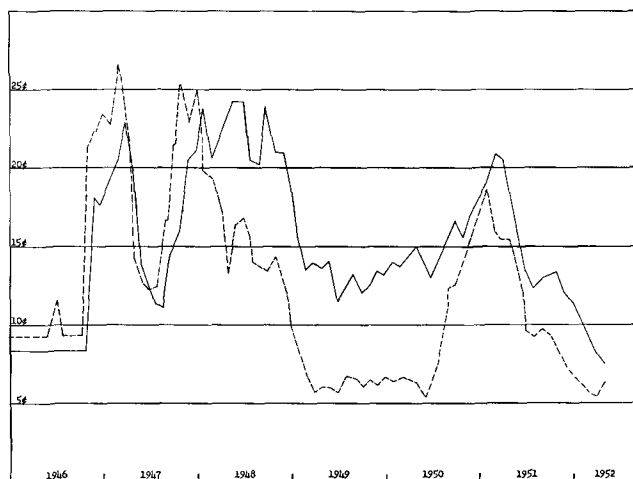


FIG. 1. Price range for tallow (broken line) and coconut oil (solid line).

tallow started out at around 23c, went down to 12½c, and then went up again in the last portion of the year to 25c. Now if your company is to buy fat at 20c a pound and you are competing with a company that bought theirs at 12c, you can readily see your disadvantage. This fats and oils inventory problem is so important in the soap industry that it is usually handled as a separate inventory item with top executives making the decisions of how much to carry.

However whether the business is making soap, autos, or safety pins, inventory control means dollars saved. It is not hard to visualize how high inventories tie up capital with heavy carrying cost and expensive warehousing. Also you run the risk of possible obsolescence due to changes in method or products, deterioration due to age, and of price reductions. On the other hand, if inventories are too low, costs are raised through uneconomical buying on a rush order basis, inefficient production scheduling, and possibly even a loss of business due to not being able to deliver goods on time.

#### Finished Goods Control

In considering how to control inventories, problems peculiar to the business concerned must be analyzed. Finished goods inventories depend on six main factors.

1. *Methods of Sales.* Companies such as mail order houses which sell directly to a retailer or to the consumer must have large stocks of finished goods ready for immediate delivery upon receipt of order. Companies, such as machine tool manufacturers, which work on a contract or job-lot basis, on the other hand, need not carry such a heavy inventory of finished goods.

The large soap companies sell directly to the retail stores. They have their salesmen going to thousands of grocery stores throughout the nation taking orders. When these orders are sent in to the plant or branch warehouses, there must be sufficient soap on hand to fill the order. This order probably consists of at least four or five different types of soap. If any of these soaps are not on hand when the order arrives, it means the order must be held or shipped short. As an average branch warehouse handles several hundred orders a day, it is very important that there be an uninterrupted flow. The billing systems are designed for shipment and not for revisions. It has been estimated that revisions cost anywhere from 50 to 75c for

each order revised. Thus if you are out of stock of a particular soap for four or five days and it was included on the several hundred orders each day, the cost of revising the billing would be considerable, to say nothing of the loss of business and customer good will.

2. *Cost of Manufacturing Compared to the Original Cost of the Raw and Packaging Materials.* If your manufacturing costs are high in relation to your material cost, it means that greater emphasis should be put on reducing the finished goods inventory than when the materials' cost is the greatest proportion of the total cost. For soap the greatest cost is for the oils and fats. Packaging and the manufacturing costs run only 5 to 10%. Therefore it makes little difference whether you convert the materials into finished goods or store them as raw materials, providing other factors are equal.

3. *Manufacturing in Economical Lots.* When sales of an item are small, it is often best to manufacture several months' supply rather than to make separate runs for each month. The smaller the quantity of production, the greater the weight that should be put to carrying higher inventories.

4. *Consideration of Even Labor.* It is easy to see where you might desire to have steady work for a certain number of employees throughout the year rather than to have peak periods of employment and then heavy lay-offs a few months later.

In the soap industry sales vary considerably month by month even though the consumer's probable usage of soap is fairly constant. Obviously, it is desirable to have level production throughout the year in order to hold the labor force at an even number. This is very difficult because of sales fluctuations and the great physical volume of soap that is moved. When you build up a two-month inventory of finished goods, you are not only tying up a large quantity of money but also are involved in a tremendous warehousing problem.

5. *Price Variation.* As previously mentioned, price variation of raw materials can have drastic effect on profits.

6. *Obsolescence.* When you build up too large an inventory on a slow-moving item, you are running the risk of being stuck if sales plans should be revised and this item dropped or the product changed.

### Raw and Packing Materials Control

When you consider the factors that affect decisions on raw materials, you see that they are quite similar to those which affect finished goods inventories. These factors are:

1. *Market Conditions.* There are several purchasing conditions that affect the quantity of inventories that should be carried.

First is the length of time necessary to obtain deliveries. Unless the usage is constant, it usually is a good idea to carry inventories that are large enough to bridge the gap between the time an order is placed and delivery is made.

Second, the quantity to be carried is affected by economical purchasing lots. Buying in large quantities usually means cheaper unit prices. However offsetting this saving, you have to calculate the costs of storage and extra handling that may be required.

Third, a number of items are seasonal. This means that when the production season is on you must make

your material commitments for the year or else pay premium prices to obtain materials out of season.

2. *Storage Capacity.* Obviously, you cannot store more goods than you have storage capacity for unless you can develop outside storage facilities. This storage capacity problem is not quite as simple as it first may seem, especially on items such as packing materials, where materials for many different products share the same warehouse space. The floor area must be apportioned between the various types of materials that are stored, and then intelligent coordination of purchase orders and production scheduling is needed to keep the space utilized to the best advantage. Packing materials for any one product must not hog all the available space.

3. *Handling Problems.* It is also important to consider the storage capacity in areas that are convenient to the point of use. Thus it is often best to buy in smaller lot quantities and have the goods delivered directly to the point of use rather than in large quantities if a portion of these have to be stored in distant area.

4. *Deterioration of Materials Due to Age.* When supplies are kept for a length of time, you run the risk of losing quality due to aging.

5. *Obsolescence.* We have the same problem of obsolescence with raw and packing materials as we have with the finished goods. When changes are made in the sales plans, you are likely to be left holding supplies which are no longer required.

6. *Meeting Sales Demands.* This is the most important consideration of all. The purpose of carrying inventories is so that you will be able to supply production at a rate to meet sales. Nothing is worse than to lose sales on account of a lack of supplies. Each time sales jump up or down, the inventory control group must jump with them. Good inventory control means good balance. You must never be caught off balance and must be ready to go in any way that sales require.

The weight that should apply to each of the above factors constantly changes. You cannot establish a definite set of rules, but for each purchase made all the factors have to be considered in the light of the moment. The heart of control lies with the men requisitioning materials. They must review all the factors and place their requisitions using judgment backed up by experience and prayers.

### Development of the Budget

Having now attempted to clarify the aims, how are you to best bring these about? Not having a crystal ball handy, you have to do some guesstimating. Of primary importance in inventory control is the sales forecast. A good sales forecast eliminates 90% of the inventory control headaches. In order to prepare a good sales forecast, work must be done in coordinating sales hopes and advertising plans, fitting those in with anticipated profits, financial considerations, production capacity, and purchasing ability. In most companies, at least four to six months before the start of the year, an annual budget is prepared. This states the sales expectations for the coming year, based on all the factors that can be anticipated. Usually this annual budget is prepared by a separate budget department, which sits in on and coordinates the consultations between sales, advertising, market research, etc. The annual budget is the basis for monthly sales

and production budgets. Colgate is using a three-month revolving budget which has given good results. This budget is made out each month with a projected budget for the following two months, thus forcing during each month a review of the next three months. The three-month budget is first prepared in terms of dollar sales and is later converted to units of dozen or gross. It is checked with the annual budget for any variances which would throw the profit pictures of the annual budget out of line.

Having decided what is to be sold, the next question comes up as to how much finished goods inventories can be carried. This is a problem for the top executives. Once it has been decided to carry, say, a one-month finished goods inventory on one type of item, three weeks on another, two weeks on a third, etc., it then remains for the inventory control groups to handle the details, product by product. They compare the expected sales figures with quantities on hand and the desired inventory to be carried. The difference is the amount that must be made. This is the production budget. If more than one plant is involved, it must be decided what and how much each plant will produce. This normally is a problem for the home office manufacturing, who consider the economics of transportation costs to the sale area, plant capacity, etc. The budget is then passed to the individual plants and they, in turn, make a rebuttal in detail based on available labor and economical runs on the machines. Next the rebutted budget is broken down into the various raw and packing material component parts. This gives the requirement figures on which the material coordinator bases his purchase requisitions. The purchasing department places orders according to the requisitions or asks for a review if the requisition violates good purchasing policy. Finally the materials arrive, production is effected, and the product shipped to the customer.

### Responsibility and Organizational Set-Up

The fixing of responsibility for these various steps in the development of the budget is a vital question. The sales department certainly is in the best position to furnish sales forecasts and should be held responsible for its accuracy.

It is also important to fix responsibility for the purchase of items needed to meet the budget. Without control the purchasing department tends to buy all the materials needed in large quantities so as not to be bothered with reordering and to take advantage of volume price reductions. To counteract this tendency, responsibility for quantity should be vested in an independent group. This might well be the plant material control department. This department is the one faced with the storage and handling problems as well as the responsibility of seeing that there is no shut-down due to lack of materials. As such, this is the logical place for controlling all materials except fats and oils. Fats and oils, as previously pointed out, are in a different category.

Knowing who would be responsible first for sales forecasts and second for material controls, you now approach the problem of setting up the detailed organization to carry out these responsibilities.

1. *A Budget Department.* This central control group prepares the annual budget based on the information supplied by the sales, advertising, and financial departments. It is their duty to check the detail budgets

monthly to see that sales and estimated sales are in line with the original annual budget. Should there be any serious deviations, it brings this to the attention of top management for action. This budget department might well report to the comptroller of the company as its work is very closely allied with his responsibilities.

2. *Home Office Planning.* In firms with more than one plant it is necessary to have a home office planning group with the responsibility of deciding in which plant production should be carried out. They are usually called on to prepare the production budget, using the sales budget and the inventory levels as predetermined by the budget department.

3. *Plant Planning Group.* In this group you have your real controls over raw and packaging material inventories. They rebut the monthly production budgets, levelling out labor and seeing to it that generally the plant is run without sharp volume variations. Having the duty of setting up daily machine schedules for the month, they are best acquainted with the production capacity and storage and material problems. Theirs is the responsibility for the breakdown of the budgets into the various raw material and packaging material component parts. From this they prepare purchase requisitions based on their knowledge of production rates, finished goods inventory, storage capacity, and production schedules. These purchase requisitions should be coordinated with the purchasing department problems of purchasing in economical lots and with the lead time necessary to obtain materials.

4. *Purchasing Department.* The purchasing department decides who is to be the supplier and what the price should be. They make all outside contact with the suppliers, and any complaints as to quality, delivery, etc., should be put through this department. In the case of inventory control for fats and oils, where the cost of storage and handling are relatively insignificant, the important point is buying at low prices. This responsibility should then be directly that of the purchasing department.

### Methods

Having considered problems and the fixing of the responsibilities and organizational set-up, you can get down to actual operating practice. A problem of no small magnitude is the keeping of accurate inventory records. The problem of inventory control is largely a problem of obtaining and acting on figures. Colgate finds it necessary to take an actual physical inventory of finished goods at least once a month. Many companies have perfected their book inventory methods so that they are accurate enough for figuring inventory control. However periodic physical inventories are advisable to uncover pilferage, etc. In order to ease the problem of recording you should try to standardize. Instead of counting production by the case, it can be counted by pallet or skid loads. This will reduce the quantities to be considered.

Colgate has devised a system which has proved successful in keeping records. When a pallet load is produced, a transfer slip is made out by the producing department, transferring this to the shipping department. There are four copies of this transfer. One goes immediately to the accounting department, the second is sent to the shipping department for their records, the third stays with the producing depart-

ment for their records, and the fourth is attached to the load itself with colored Scotch tape. The load is then transferred to the shipping department, where if it is loaded directly in the cars, the transfers are immediately taken off by the checker, giving him an account of the number of cases going into the car, or if it goes into the warehouse, the transfer stays on until it is brought down from the warehouse to the actual shipping floor at which time it is removed and sent back to the accounting department. The accounting department then has a record of the original transfer to the warehouse and a record of shipment out of the warehouse. From this it is possible to have a daily book inventory of finished goods. These transfers can also be used to check against the quantity of cases invoiced by the billing department. The Scotch tape used to attach the transfer to the load is made of various colors. A different color is used for each month. This is to aid the shipping department in readily identifying the date of production so that the oldest stock can be shipped first.

In keeping raw and packing material inventories it is not necessary to take such a frequent physical inventory. However, in actual practice, due to spoilage and waste it has been found that at least a three-month physical inventory is necessary. More weight is then put on the book figure. To prepare your book records it is necessary to have the following:

1. An inventory of what is on hand.
2. A copy of the purchase order to see what is coming.
3. A copy of the receiving ticket to see what is actually delivered.
3. Usage figures for past production and projected usage figures for future production.

The first three of these are relatively simple to obtain. However figuring the usage is complicated by the fact that many items are used in making soap. At the Jersey City plant of the Colgate-Palmolive-Peet Company the materials control department has to control more than 6,000 different items. There are all types of chemicals, boxes, cartons, labels, banners, bottles, caps, etc. These have to be ordered anywhere from one week to six months in advance. Not only must you know the requirements for the coming month, but for several months in advance. Colgate's revolving three-month budget is of particular value in determining future needs.

Originally, the production budget was broken down by hand and the requirement figures posted in the purchasing department books. This was a full week's job for six people. A mechanized system has been installed utilizing International Business Machines. With this the work of these six people has been completely eliminated, and the whole breakdown only takes a few hours. This system can be applied to a number of companies that use I.B.M. machines for payroll and accounting purposes. It can also be used by small companies without I.B.M. equipment through the use of I.B.M. branch offices which have the machines and are willing to run them for a very small fee. Here is how it works:

A list of materials is made out for each product. This shows, for example, on Super Suds, that for every large size case produced, there are 24 cartons, Symbol No. 2-1569, one corrugated case, Symbol No. 2-1533, and 35 plus, pounds of Super Suds, Base No. 20-650. Another list of materials specifies all raw materials and chemicals used in preparation of this

soap, Base No. 20-650. An I.B.M. card is made out for each of these packing and raw material items. Each card shows its own symbol number and the stock number or formula base number for which it is used. Also punched in each card is the quantity needed for one case or one pound of base. When there is a budget of, say, 125,000 cases of Super Suds, Stock No. 72734, this is sent to the tabulating department, which multiplies each of the cards under No. 72734 by 125,000 times the factor marked on the card. This multiplication is all done automatically on an I.B.M. machine and punched on each card. The base cards for the various sizes are totalled separately, and the pound totals are used to multiply against all the components making up the base. All cards are then accumulated and put through a tabulating machine which prints on sheets of paper the quantities indicated by the punched holes on the cards. The original copy is given to the production planning department. The second copy of this printed sheet is sent to the purchasing department so that they can use this to check against the purchase requisitions issued by the production planning department. Thus, in spite of the great number of items, the complete budget for the following month and projected budget for the next two months can all be broken down into all the component parts within the course of several hours.

### Requisitioning

The heart of inventory control should be in the requisitioning of materials. To requisition intelligently you must have accurate records as to where you stand today and projections of future requirements.

Not being able to predict the future exactly, requisitions must be planned with the assumption that they may be increased, decreased, or cancelled entirely. The materials controller making the requisitions must always keep this fact in mind and not let himself or the purchasing department go overboard in ordering items even though they seem to be a sure thing at the time.

To assist in activating the records, Colgate has developed a Kardex file system. This Kardex has visible margins, used for signalling the items needing attention. The advantage of the Kardex over a book record or a straight card record is that the general volume of cards or pages hides the items needing immediate attention. By using the Kardex visible margin to signal the status of the items, a glance at a whole drawer full will tell you which items need attention now. The rest of the items can be disregarded. In this signal margin, as shown in Figure 2, there is one signal which shows the length of time the inventory on hand will last, and another signal showing the time when a new purchase requisition should be issued to cover future requirements. Note that the lead time is automatically handled by the difference between the top and bottom months. The Kardex is

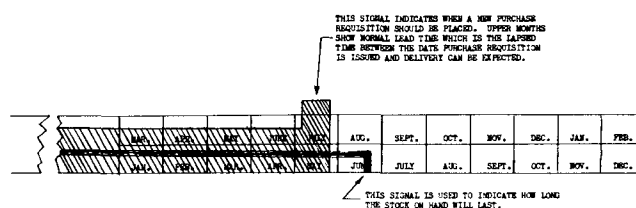


FIG. 2.

