WAREHOUSE SPACE ALLOCATION

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Discusses computer application for use in the warehouse.

Computer application for use in the warehouse has been given too little attention by management, operations and data processing personnel. The application is computerized space allocation.

The application has simple goals: (1) maximum use of available warehouse cube; (2) proper placement of merchandise in slots which match its size requirement in terms of movement and/or average quantities on hand; (3) an increase in warehouse productivity by reducing the number of times that a product has to be moved; (4) considerable reduction in slot let downs and a corresponding reduction in warehouse scratches; (5) a method to constantly monitor slot size/product movement relationships; and, (6) a tool to accurately project the space requirements of unavoidable expansion. With all of these benefits it is hard to comprehend why so few wholesalers have turned the power of the computer to this area.

One can only guess why a specific company has neglected this area but some of the more popular reasons include:

1. Lack of Manpower
By and large industrial engineers are foreign to the wholesale food distribution industry. This leaves the task of installing the application to the warehouse manager who is usually too busy running the shop.

2. Priorities
Most companies have had to postpone certain applications, warehouse space allocation included, because of conversions, refinements to bread and butter applications, and the well known crash program.

3. Complexity
The application is, in itself, extremely simple. The difficulty lies in developing the data base. Any sound space allocation system requires complete, accurate cube information about each item in inventory, each varying slot in the warehouse and the warehouse as a whole. It also requires accurate information regarding product movement and quantities on hand. All of these elements are simple to accumulate with the exception of case cube. It is difficult to originally collect and more difficult to maintain.

(A) Original Cubes
Original cube information was collected in both instances using a combination approach. Buyers were instructed to quiz the manufacturer's representatives about the cube of their product, and temporary employees (college students) were used to physically measure each case. As one employee put it, "All it takes is a ruler, a conversion table, a master item list, an input form and perseverance."

(B) Cube Maintenance

This proved to be more sticky, new items and pack changes soon made the initial measurements obsolete. One Company solved this problem with a special projects foreman, the other by refusing to add a new item to the file unless cube information was available.

4. Unstable Inventory

Perhaps the main reason that space allocation has been put on the back burner is because of the widespread belief that it will not work. The doubters point to the unstable nature of the inventory caused by: a) 1,000 new items a year; b) item movement fluctuations from 20 cases a week to 200 cases a week; c) 800 to 1,000 promotions coming on, in process or going off each and every week; d) advertised specials; e) new item competition which reduces movement on the "me toos"; f) seasonal adjustments; g) lack of product availability - this last problem area has really been raging uncontrolled during the past several months.

5. The Buy-In

A final reason given for the impracticality of space allocation centers around the time honored practice known as the buy-in. The buyer often, and always unannounced, purchases a quantity of an item far out of proportion to his replenishment needs to generate extra profits.

An allocation system geared to movement and/or average quantities on hand cannot cope with this popular practice.

Now let us consider some other relevant facts:

1. Inventory amounts to 45% of the total assets employed by a wholesale food distributor. It is too big a segment of the total investment to be left to its own devices.

2. Warehouse costs, exclusive of building and turnover expenses, amount to 30% of the total cost of doing business for the average wholesaler.

3. 60% of all warehouse expenses consist of wages paid to production employees.

4. The average wholesaler has found it necessary to expand his warehouse every seven years.

5. Construction costs (exclusive of land and equipment) amounts to between $8.00 and $9.00 per square foot.

6. The average wholesaler uses only 30% of his warehouse for product storage. The remaining 70% is taken up by:

1. Aisles
2. Truck and rail receiving areas
3. Shipping docks
4. Unusable overhead space
5. Pallet space
6. Wasted space

7. It has been proven by companies using allocation systems that the usage can be increased from 30 to 45% while not reducing, but in fact, increasing warehouse productivity.

8. Production is at its peak when a product moves directly from the receiving dock to the working slot. The more interim moves the lower the productivity and the higher the costs.

A space allocation system is designed to eliminate the interim moves.

If these eight facts are not sufficient to generate some enthusiasm towards space allocation consider this: The hottest item in food distribution today is shelf allocation at retail -- Eliminate the back room -- Buy to turn -- Coordinate shelf space with -- profit contribution -- Decrease inventory investment --

These are just a few of the warcrys being bantered around the industry. Perhaps it is time that the preachers heed the sermon. Two companies have -- and with spectacular results.

COMPANY A

This Company devised a space allocation system for use in designing a slot system for a new warehouse addition. It proved to be so valuable in its initial use that they have used it extensively to maintain and update the initial slotting requirements.

The original application was designed to answer two specific questions:

1. The number of specific types of slots which would be needed to house product efficiently based on either historical movement or average quantity on hand.

2. The type of slot needed for each item based on historical movement or average quantity on hand.

The first step was to determine the type of slots which would be used and the cube capacity of each slot. They settled on the following configuration:

Type of Slot	Usable Cube Capacity
1. Small rack - 3 tier	14.85
2. Small rack - 2 tier	28.98
3. Large rack	42.42
4. Floor slot - 3 deep	590.31
5. Floor slot - 4 deep	847.08
6. Drive in	675.67

Note that the preceding table refers to usable cube. The usable cube is calculated by taking the gross cube and subtracting; cube of pallet, entry and exist space, and fire protection drop. Once the slot cubes were identified the next step was to calculate the number of each needed to house the individual items. This second step was accomplished using two separate approaches.

The Movement Approach

In its simpliest context this measurement category ascertained the daily movement of the product in cases, contested this movement to cube movement and multiplied the cube by an assigned number of days.

As an example:

Product A--movement - 5 cases per day
cube - 5 cubic feet per case

5 x 5 = 25 cubic feet per day.

slot to hold x days supply.

X times = 25 cubic feet.

The program was designed so that the number of days supply could be tied to the vendor shipment cycle (lead time) or the replenishment cycle (order frequency).

Using this approach the computer was able to calculate the cube requirements of each item based on a given number of days supply and then compare the cubes to the slot parameters initially established. The ultimate printout then married up the specific items with the specific slot requirements.

The Inventory Approach

The inventory of a given product does not always correspond to its movement times a given number of days supply. Because of this the Company developed a second parameter. Each day the amount of inventory on hand was stored in an accumulator. After a period of time the total amount in the accumulator was divided by the number of storage days to arrive at the average quantity on hand.

This average quantity on hand was converted to its cube equivalent and this cube compared the slot parameters initially established. Again, the ultimate printout married the specific items to specific size slots.

Using these two approaches the Company was able to ascertain the required number of slots of each size, assign numbers to these slots and finally assign product to each slot.

One added initial benefit---the Company had decided to use a family grouping concept and as a result the reports were broken down by commodity classification and each segment of the report gave slot requirements for each product in a given commodity classification.

The original report proved to be so useful and so accurate that with a few additions it became a monitoring agent used to keep the slots in balance.

The addition was simply to print the type of slot that the product was currently assigned to and to compare this slot to the movement and average inventory projections. Any mismatches were flagged as misslotted items to be reviewed.

COMPANY B

This Company did not develop their space allocation system to slot a new addition but to insure that they were getting the maximum use out of their present warehouse. They had six specific aims in mind when developing their system:

1. Determine the number of types of slots needed, in total and by commodity group.

2. Assign the product to the slot based on current activity.

3. Determine the maximum usable cubic feet of storage in the warehouse.

4. Compare the maximum usable cubic feet of storage to the cubic feet of inventory presently stored.

5. Compare productivity achievements to the ratio of actual inventory cube to maximum inventory cube.

6. Predict needed expansion based on facts.

Their allocation system has currently achieved all of their aims.

The first step in development of this system revolved around a definition of sales and for purposes of space allocation it was determined that three separate sales figures had to be considered:

a. Regular sales -- Defined as sales to customer for shelf stock replenishment.

b. Deal (allowance) Sales -- Defined as sales subject to a price reduction.

c. Advertising Sales -- Defined as sales due to newspaper and radio advertising. This particular company required that ad item sales be ordered off of a separate order sheet so the information was available.

Two interesting facts came out of this sales analysis:

a. There was little difference between the regular sales of an item and deal sales.

b. There were significant differences between the regular sales and advertising sales.

Because of this the programs were all designed to isolate ad sales from regular sales.

Once the sales were defined the Company set about to capture the information necessary to determine inventory cubes. This was done by expanding the master item library to include:

(a) Case sales regular
(b) Case sales advertising
(c) Length of time product on file
(d) Average inventory on hand. This particular element of information was captured by using a random selection technique.
(e) Case cube by item

With these additions to the file the computer had the capability to calculate:

(1) Cube movement of each item, daily, weekly
(2) Cube movement of each commodity group, daily, weekly
(3) Cube movement of total inventory, daily, weekly

Armed with this information it was decided to establish certain inventory parameters or measuring devices. The three arrived at were:

Minimum Inventory - Inventory based on the vendor shipment cycle. If the product was ordered on Tuesday and arrived Friday the "vendor" cycle = 4 days.

Maximum Inventory - Inventory based on buyer replenishment cycle. If the buyer ordered the product every other Tuesday the "purchase" cycle was 10 days.

Actual Inventory - Inventory based on a random selection of quantities on hand of each item in the inventory.

All three of these measurements or parameters are used in each report generated.

Certain formulas were then applied to the expanded information in the master item library and the three measurement categories:

I

Regular Sales ÷ (Weeks on Hand x 5) = Daily Sales
a) cases — Cases
b) dollars — Dollars
c) cube — Cubes

II

Daily Sales x Vendor Cycle = Minimum Inventory
a) cases — Cases
b) dollars — Dollars
c) cube — Cube

III

Daily Sales x Purchase Cycle = Maximum Inventory
a) cases — Cases
b) dollars — Dollars
c) cube — Cube

IV

Average Quantity on Hand x $ Per Case Cube Per Case = Actual Inventory
a) cases
b) dollars
c) cube

NOTE: a) Sales include just regular sales
b) Average inventory includes all inventory

The cubes arrived at above were then applied to a preset grid of varying slot sizes:

0 - 23 Cubic Feet	Less than 1/2 pallet
24 - 44 Cubic Feet	1/2 to 1 pallet
45 - 99 Cubic Feet	Full rack
100 -258 Cubic Feet	2 deep floor slot
259 -420 Cubic Feet	3 deep floor slot
421 -606 Cubic Feet	4 deep floor slot
Over 606 Cubic Feet	5 deep or double floor slot

A report was then generated which then stated the slot requirements for each item based on vendor cycle, purchase cycle and average inventory. As an example:

Based on the formula Item A --

1. Should be in a full rack if the vendor cycle is used.

2. Should be in a 3 deep floor slot if purchase cycle is used.

3. Should be in a 2 deep floor slot if inventory cycle is used.

Each report was run in item number sequence and then summarized by commodity class and in total.

These procedures answered the questions regarding the number of types of slots required and the type of slot needed by each item. The next step attempted to analyze the total usage of the warehouse.

The first step in this system was to determine the available, usable storage cube. This was accomplished by actual measurement of the storage area and then deducting a non-use factor -- as an example:

1. Total overhead storage cube less 10% = usable overhead storage

2. Total working slot (rack) cube less 50% = usable working slot storage

3. Total floor slot storage cube less 100% = usable floor slot storage.

Usable overhead storage + Usable working slot storage + Usable floor slot storage = Total storage capacity

This total storage capacity was then compared to the cube calculated using the minimum inventory (vendor cycle), maximum inventory (purchase cycle) and actual inventory and a ratio of available cube to used cube was established. This ratio was further compared to warehouse production i.e. case and tons thruput per production manhour worked.

The Company discovered that there was a very distinct relationship between productivity and inventory levels. Production was at its peak when the actual inventory cube equalled 75% of the usable cube. When the inventory level fell below this level production rose, above it production was curtailed.

This then answered the final question -- when inventory on hand consistently exceeded the optimum 75% of capacity the price tag of new construction could then be compared with the price tag of lost production.