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Part II**



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MANAGEMENT SCIENCE UPDATE COLUMN

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MULTICOMMODITY DISTRIBUTION SYSTEM DESIGN BY BENDERS DECOMPOSITION

A. M. GEOFFERION AND G. W. GRAVES — PART II

Last time we saw a case study of the Geoffrion-Graves system in action, with the Department of Defense as the patient. This second case comes from the private sector. We won't spend time rehashing information from the last *Update* column. Let's jump right into the story, which is shortened and paraphrased from a case-study description prepared by Insight, a consulting firm that handles applications of the G-G approach.

A \$200MM Midwestern manufacturer of replacement parts furnishes approximately 150,000 line items to about 5,000 outlets through about 20 field distribution centers (DC's) via common carrier, private fleet, and package services. Among the concerns which led to the initiation of a distribution system planning project were extensive overlaps in the DC service areas in the East and Midwest, excessive DC inventories, and rapidly rising DC labor costs along with a lack of productivity improvement.

The project mandate was to determine the number, location and size of DC's throughout the U.S. and the best deployment of inventory, so as to minimize total system cost without any significant reduction of customer service. Specifically consider the possible introduction of one or more fully automated "super-DC's."

Some constraints of the analysis included these: Primary analysis was to be for a base year (the most recent 12-month period for which adequate historical data were available), with secondary analysis for 1985. The analysis was to exclude wholesale demand (which is supplied by an essentially independent and relatively small distribution system of its own), export demand (which is small and relatively easy to manage) and vendor direct shipments to outlets. All DC's had to be private. Labor contracts made employee terminations undesirable.

Goods flow from company plants and vendors to consolidation centers to three national depots to field DC's to retail outlets. All national depots are situated within a few miles of company headquarters, and the field DC's are the primary focus of the project.

A methodology was worked out for aggregating the company's 150,000 SKU's into fewer than 100 product groups based on functional end-use category, bulk vs. nonbulk, level of annual demand, and whether ordered for stock or to meet current demand.

Criteria were developed for adding new candidate locations to the list of current field DC locations. The criteria included geographic areas not covered by current locations, location of major demand concentrations, location of competitors' facilities, and availability of suitable transportation systems.

It was determined that not all field DC's would be full-line. Several types of product bundles and three types of DC's were defined so that certain types of DC's would stock only certain types of product bundles.

A methodology was worked out for aggregating customers (outlets) into customer zones based on three-digit zip codes. All possible inbound transportation links from national depot sources to field DC's were included, with commodity truckload rates assumed.

Results showed that a substantial improvement in customer service — namely, a 100-mile reduction in the maximum service radius of all field DC's from the current 500 miles (East and Central) or 700 miles (West) — turned out to require a total distribution cost increase of about 7%.

In broad terms, the results showed that the current field DC system could be improved very substantially whether or not fully automated super-DC's were introduced. One of the principal activities of the study group was to develop two practical distribution system redesign alternatives — one without and one with super-DC's. This meant purging the “optimal” solutions of all differences from the current system that were not economically justifiable when the need for organizational change was considered. For example, when the least cost system moved the Atlanta field DC to Orlando for the sake of nominal savings, this move was countermanded. The result of this purging process was two alternatives. The first alternative would involve no super-DC's, cut the number of field DC's from 19 to 12 (all at existing sites) and cut total operating costs by 10%. The second alternative would involve one super-DC, cut the number of field DC's from 19 to 10 (all at existing sites) and cut total operating costs by 14%.

The fact that nearly all possible savings could be achieved without using new field DC locations was itself interesting, as it was not at all apparent at the outset that new locations would be of only marginal added value.

An interesting secondary finding was that only somewhat less than 1% of the current total operating cost can be saved through better customer zone assignments. Additional savings require closing some of the field DC's.

Although the second alternative showed a bigger cut in operating costs, the first alternative showed shorter pay-out period, less severe employee impact, smaller customer disruption and smaller risk. Reconfiguration costs were almost three times as high for the second alternative, and the number of employees relocated or terminated was over 60% higher. In view of those factors, the first alternative was tentatively recommended. However, certain steps common to both alternatives were recommended for immediate action as an interim measure highly attractive from all viewpoints. Namely, close five of the field DC's closed in both alternatives and realign the service areas of the remaining DC's. The decision on the two alternatives could then be deferred for a year or so pending the formation and closer scrutiny of an Implementation Committee.

This column marks the start of a second year of *Update*. We depend on *your* stories, and as you can see you don't need to take much time or use much space to hit the highlights. If you know of an article from the last 20 years or so of *Management Science* that led to real-world applications or other important developments, send your story to the *Update* editor today!