

COWLES FOUNDATION DISCUSSION PAPER NO. 2

Note: Cowles Foundation Discussion Papers are preliminary materials circulated privately to stimulate private discussion and critical comment. References in publications to Discussion Papers (other than mere acknowledgment by a writer that he has access to such unpublished material) should be cleared with the author to protect the tentative character of these papers.

Comments on Organizational Aspects of the Inventory

Control Problem

Richard F. Muth

September 20, 1955

Comments on Organizational Aspects of  
the Inventory Control Problem\*

It is the purpose of this note to outline some organizational aspects of the inventory control problem. For concreteness the discussion will be framed in terms of a container-making company with whom the author has worked. Suppose that there is one parts-making factory and many parts-using plants, that the organization incurs a penalty if a shortage occurs in one of the latter; and that production costs consist of a fixed cost per order or set-up cost and a proportional cost per part. All complications arising from the interrelationship between the various parts and between inventory control and other related activities of the organization, such as production scheduling and raw material procurement, are neglected.

The non-durable case shall not be considered here since, when the usage distribution of the various plants are independent of each other and stationary and independent in the sense of Dvoretzky et al, [1] no problem of communication arises. Each plant manager will apply a certain decision rule at the beginning of each period, the same for all periods, and not involving any transmission of information. On the other hand, in the durable good case the rule might, for example, require communication of stocks on hand, back-orders, etc., from each of the parts-using plants to the factory or central warehouse.

There are two organizational aspects that might be considered, structure and communication. The first relates to the number and kinds of operating units, here central warehouses and local warehouses or plant stockrooms, to be established. The second refers to the timing and kinds of information to be exchanged between these units.

---

\*Richard F. Muth. Research under Contract Nonr-358 (NR 047-006) with the Office of Naval Research.

---

With regard to structure one might first consider local warehouses or stockrooms. Their function would seem to be twofold. First, they reduce the time between part breakdown and replacement on the average, since a new part need not be shipped from the plant or even especially produced each time a breakdown occurs. This would both reduce the shortage penalty in the aggregate and the cost of production since parts would be produced in bigger lots, but it leads to storage costs. Secondly, there may be economies in large scale transportation so that plant stockrooms would reduce transport costs by bringing about larger and less frequent shipments.

If a central warehouse were to be established at the part-making factory as well, still larger and less frequent orders on the factory would be placed. Secondly, the central warehouse would reduce the average delivery lag at the part-using plants since production time would not be included, except if the central warehouse itself were to run short. Thus the aggregate shortage penalty would be reduced and aggregate inventories might even be reduced.

With regard to communication, one can denote two extremes, complete decentralization and complete centralization. With the former the only information exchanged would be orders from the part-users to the central warehouse or factory. Under complete centralization shipments to each user would be determined by the central warehouse, say, on the basis of information on stocks, back-orders, etc., supplied by each user. At present there is little further that I can say about this problem.

Reference

- [1] Dvoretzky, Kiefer and Wolfowitz, "The Inventory Problem I: Case of Known Distributions of Demand," Econometrica, 20 (April 1952), pp. 187-222.