

A Generalized Reciprocal Service Cost Allocation Model – for Manufacturing Firms

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This study details the development of two reciprocal service cost allocation models. The first model was developed using a system of linear difference equations and the other with a system of simple linear equations. Both models were introduced for a manufacturing firm with at least one production department and more than one service department. It is assumed that

A1: at least one service department will serve one or more production departments and all other service departments can serve any department(s).

This is an extensive generalization of a paper presented earlier by the same author. Any set of allocation ratios chosen for the service departments satisfying this new assumption will lead to a matrix of the form $\begin{pmatrix} O & B \\ O & A \end{pmatrix}$, where the matrix $A = (\mu_{ij})$ represents the matrix of reciprocal allocation between service departments and μ_{ij} denotes the proportion of service department j 's overheads assigned to service department i at each allocation. This matrix A is a non-negative square matrix with at least one column sum less than one and all the other column sums less than or equal to one. For a meaningful setup in a manufacturing firm three further assumptions are made.

A2: No service department will serve only itself.

A3: No service department serves only one other service department.

A4: There is no a group of service departments that serves only that group.

To establish unique allocation of service costs to production departments with these models a few important results have been proved under the above assumptions. The first result is when each service department uses less than half of its service for itself, the second if matrix A is a positive or a non-negative irreducible matrix, and the third if A is a non-negative matrix with all entries $a_{ij} < 1$. The third result is new, and it reads 'if a non-negative matrix $A_n = (a_{ij})_{n \times n}$ has all entries less than one where one column sum of A_n is less than one and all other column sums are less than or equal to one, then for all, $n \geq 2$, $|I - A_n| > 0$ '. Two corollaries to this result has also been proved. In all these results and corollaries unique solution to the models have been established.

Keywords: irreducible matrix, non-negative matrix, reciprocal allocation.