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The Conference Paper-Reviewer Assignment Problem*

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ABSTRACT

Conference organizers often face the following problem: Given a collection of submitted papers, select a subset to be presented at the conference. The bulk of the work often amounts to assembling a pool of reviewers and then sending each submitted paper to several reviewers. We present in this paper a technique for finding a good assignment of papers to reviewers. An important feature of the solution we find is that each paper is sent to at least one reviewer who is "as expert as possible" for that paper. A major component of the problem is modeled as a bottleneck version of a capacitated transshipment problem.

Subject Areas: Assignment Problem, Network Theory, Optimization, and Service Operations.

INTRODUCTION

Academic conferences are often organized in the following way. Several months before the conference, an announcement is disseminated in which researchers are asked to submit a written version of a paper they wish to present at the conference. Larger conferences may have several "tracks," in which case papers are earmarked for the most appropriate track. Each (track) organizer next has the job of deciding which papers to accept for presentation and which to reject. In some conferences the organizer enlists the help of reviewers for this screening process. In this case the organizer obtains a list of willing reviewers and then sends each paper to one or more of them. The reviews that are sent back become the basis for the screening process.

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In this paper we consider the following problem of the organizer: How to best assign the papers to the reviewers? Of course, the loose objective of the organizer is to send each paper to reviewers who have expertise in the subject matter of the paper. This goal can be difficult to achieve when (1) there are a large number of papers and reviewers; (2) there is a wide variety of different subject areas among the papers; and (3) there is a wide variety of types of expertise among the reviewers.

A standard method for solving this problem is to use some sort of classification scheme for the papers and reviewers. For example, each author and reviewer may be asked to classify his or her subject or expertise by selecting a few keywords from a list supplied by the organizer. The organizer can then attempt to assign papers to reviewers with common keywords. This might be done in a heuristic fashion by simply considering the papers in some order and assigning each to any underutilized reviewer with a common keyword. This can lead to two problems.

1. This heuristic does not guarantee an optimal solution, even in the sense of maximizing the number of assignments with keyword overlap. Even an optimal solution, which maximizes the total number of overlaps, may assign some papers to reviewers with no keyword overlap.
2. This heuristic does not address the following more subtle issue: The method of overlapping keywords is fairly crude. To see this, note that some pairs of keywords may be more similar to each other than other pairs. Hence, two lists of keywords with no overlap may represent a paper and reviewer that are completely dissimilar or are similar enough for a reasonable assignment to be made.

In this paper we present an optimization approach to solving the paper-reviewer assignment problem faced by a conference organizer. Our solution has two phases. In the first phase, we describe a way of quantifying the level of expertise of each reviewer for each paper. This method is more refined than counting keyword overlaps and provides a solution to Problem 2 mentioned above. This method involves solving a number of small transportation problems. The second phase produces an assignment using the levels of expertise from the first phase. It is not a conventional assignment problem (or capacitated transshipment problem). Instead we find an overall best assignment that also guarantees that every paper is assigned, for example, to at least one reviewer who is "as expert as possible" for that paper. This technique may be succinctly described as a bottleneck version of the capacitated transshipment problem. This phase addresses Problem 1 above.

The remainder of the paper is organized as follows. The next section contains a brief review of related work in the literature. The third section describes our model and solution technique. The following section describes the implementation of this method for the 1998 Decision Sciences Institute annual meeting. Then, generalizations and other possible applications of the model are discussed, followed by a conclusion.

ASSIGNMENT PROBLEMS IN THE LITERATURE

The general assignment problem involves assigning members of one group of objects (e.g., workers) to members of another group of objects (e.g., jobs). It is one of the best known and most studied special cases of the minimum cost network flow problem. The general assignment problem can also be viewed as a special case of a transportation problem in which all the supplies and demands equal 1. Ahuja, Magnanti, and Orlin (1993) provided an excellent review of solution methods and applications of the assignment problem. Among the applications they listed are the following: personnel assignment (Machol, 1970; Ewashko & Dudding, 1971); optimal depletion of inventory (Derman & Klein, 1959); scheduling on parallel machines (Horn, 1973); pairing stereo speakers (Mason & Philpott, 1988); and vehicle and crew scheduling (Carraresi & Gallo, 1984). Other applications are posting military serviceman (Klingman & Phillips, 1984; Bausch, Brown, Hundley, Rapp, & Rosenthal, 1991), airline commuting (Hansen & Wendell, 1982), and classroom assignment (Carter & Tovey, 1992), among others.

The multiperiod assignment problem adds the complexity of the time dimension to the assignment decision. Many staff-planning and workforce-scheduling applications can be solved as multiperiod assignment problems with various modeling characteristics and solution approaches (Ross & Zoltners, 1979; Krajewski, Ritzman, & McKenzie, 1980; Aronson, 1986; Mazzola & Neebe, 1986; Bechtold & Showalter, 1987; Showalter & Mabert, 1988; Gilbert & Hofstra, 1988; Franz, Baker, Leong, & Rakes, 1989; Franz & Miller, 1993). Most of the multiperiod assignment formulations tend to use integer programming models and solve them by heuristics that exploit the special structures of the models.

METHODOLOGY

We begin this section with a definition of our problem. We next describe our model for this problem and our solution technique.

The problem we study is the following. We are given a set $\{1, \ldots, r\}$ of reviewers and a set $\{1, \ldots, p\}$ of papers; we wish to assign the papers to the reviewers so as to satisfy the following conditions.

(1.1) Each reviewer should be assigned at most three papers;

(1.2) Each paper should be assigned to exactly three reviewers;

(1.3) As much as possible, each paper should be assigned to reviewers who are experts for that paper.

Of course, the number "three" in (1.1) and (1.2) is arbitrary and can be changed in general (although we assume we have enough reviewers so that a feasible solution exists). The first task in our solution method is the following.

Task 1: For each reviewer i and paper j, determine a number s_{ij} denoting the "degree of expertise" of reviewer i for paper j. The higher this number is, the better paper j falls within the expertise of reviewer i.

We can now define the "weight of an assignment" to be the sum of the numbers s_{ij} for all pairs ij in the assignment. This suggests the idea of finding an assignment by solving a maximum weight-capacitated transportation problem on the following network:

(1.4) For each reviewer there is a source node;

(1.5) For each paper there is a sink node;

(1.6) The supply at each source node is less than or equal to 3 units;

(1.7) The demand at each sink node is equal to 3 units;

(1.8) There is an arc from each source node i to each sink node j with weight s_{ij}, capacity (or upper bound) 1, and lower bound 0.

Optimal solutions to this problem that are integral always exist, hence the arcs at value 1 in such a solution define the assignment. However, a possible problem may result: A paper may be assigned to no reviewer with a "high degree" of expertise for that paper. This can occur due to the "global" nature of the optimization problem. We address this by providing procedures for the following two tasks:

Task 2: Given a threshold T, find a maximum weight assignment such that every paper is assigned to at least one reviewer whose expertise for that paper is greater than or equal to T, or show that no such assignment exists;

Task 3: Find the largest threshold T^* for which there exists a feasible assignment in Task 2. This assignment is the solution to the problem.

In other words, the two tasks above provide a solution of the following type. First, find the highest threshold so that every paper can be sent to at least one reviewer whose expertise is greater than or equal to the threshold. Then, subject to this, an optimal solution also has the property that the sum of all the degrees of expertise in the assignment is a maximum.

Let us observe that Tasks 2 and 3 are a generalization of the bottleneck assignment problem. The bottleneck assignment problem is essentially the problem obtained by replacing the "three" in conditions (1.1) and (1.2) above with "one" (see Ahuja et al., 1993).

In the remainder, we provide procedures for performing Tasks 1, 2, and 3.

Procedure for Task 1

We use a three-step procedure to accomplish Task 1. In the first step we allow each reviewer to classify himself or herself, and each author to classify his or her paper. To do this we consider a standard set of categories $\{1, \ldots, C\}$ of research areas. In particular, each reviewer is given, say, 10 points and is instructed to distribute these over the categories so as to characterize his or her areas of expertise. Likewise, each author is given 10 points to distribute over the categories so as to characterize his or her paper. So, a reviewer may assign all 10 points to one category if this is his or her sole area of expertise, or may spread them out over a number of categories. The same holds for each author. Thus for each reviewer i we obtain a reviewer classification vector:

$$\mathbf{R}_i = (R_i(1), \ldots, R_i(C)) \text{ for } i = 1, \ldots r. \tag{1}$$

And for each paper j we obtain a paper classification vector:

$$\mathbf{P}_j = (P_j(1), \ldots, P_j(C)) \text{ for } j = 1, \ldots p. \tag{2}$$

Note that

$$\sum_{k=1}^{C} R_i(k) = \sum_{k=1}^{C} P_j(k) = 10$$

$$\text{for } i = 1, \ldots r \text{ and } j = 1, \ldots p. \tag{3}$$

In the second step we estimate numbers w_{kl}, for $k = 1, \ldots, C$ and $l = 1, \ldots, C$, which denote the "degrees of similarity" between each pair of categories. A larger number indicates a higher degree of similarity. These numbers can be obtained by polling one or more experts and may represent a rounded average of their individual estimations.

In the third step, the degree of expertise numbers s_{ij} are found as solutions to the following linear programs:

$$s_{ij} = \max \sum_{k,l} w_{kl} y_{kl}, \tag{4}$$

$$\sum_{l} y_{kl} = R_i(k) \text{ for } k = 1, \ldots C, \tag{5}$$

$$\sum_{k} y_{kl} = P_j(l) \text{ for } l = 1, \ldots C, \tag{6}$$

$$y_{kl} \geq 0. \tag{7}$$

Each such linear program is a transportation problem from C sources indexed by k to C sinks indexed by l. Each source corresponds to a category, as does each sink. The first group of constraints says that the supply at each source is the number of points assigned to the corresponding category by reviewer i. The second group of constraints says that the demand at each sink is the number of points assigned to the corresponding category by the author of paper j. In practice, this transportation problem may be reduced to a transportation problem with fewer constraints and variables, where the sources are those categories given a positive value by reviewer i and the sinks are those categories given a positive value by the author of paper j. A variable y_{kl} will tend to be large in an optimal solution if the following conditions hold: the reviewer assigned a significant number of points to category k; the author assigned a significant number of points to category l; and categories k and l are similar.

The numbers s_{ij} so obtained have some nice properties. In particular, suppose $R_i(k) = P_j(k)$ for $k = 1, \ldots, C$; that is, reviewer i and paper j are described by identical classification vectors. Then, it's easy to see that s_{ij} takes on the maximum possible value. (If the degrees of similarity are drawn from $(0, \ldots, 5)$ and reviewers and authors are allotted 10 points, then this maximum value is 50.) On the other hand, if the degree of similarity between every category chosen by a reviewer and an author is 0, then $s_{ij} = 0$. All numbers between these extremes are possible; hence, we obtain a more subtle measure of the degree of expertise of a reviewer for a paper than keyword overlaps (as discussed in the Introduction).

Procedure for Tasks 2 and 3

Task 2 is performed by adding more structure to the network described in (1.4)-(1.8) and, thus, transforming a maximum weight capacitated transportation problem into a maximum weight capacitated transshipment problem. We construct the following network N with supplies and demands. Recall that T is a threshold value given in Task 2 (see Figure 1 for an example of such a network).

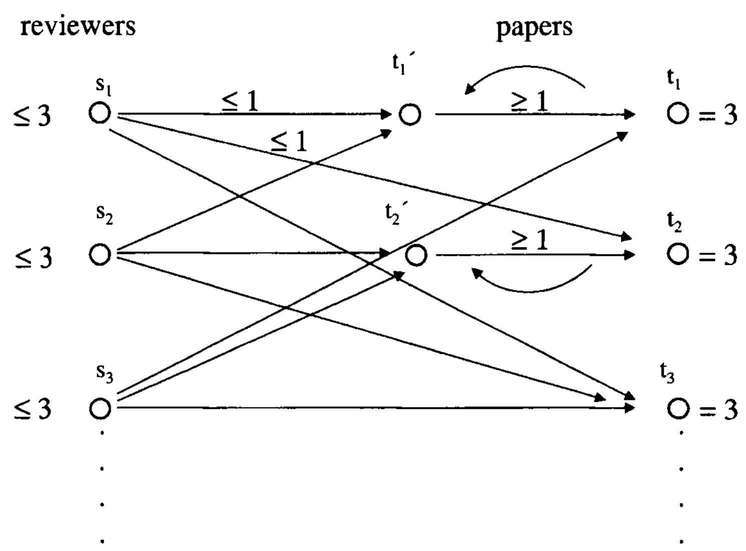
1. For each reviewer i there is a source node s_i.
2. For each paper j there are two nodes t_j and t'_j, where t_j is a sink node and t'_j is an intermediate node.
3. The supply at each source node is less than or equal to 3 units.
4. The demand at each sink node is equal to 3 units.
5. There is an arc from node s_i to t_j iff $s_{ij} < T$; such an arc has weight s_{ij} and capacity 1.
6. There is an arc from node s_i to t'_j iff $s_{ij} \geq T$; such an arc has weight s_{ij} and capacity 1.
7. For every paper j, there is an arc from t'_j to t_j with weight 0 and lower bound 1.
8. For every paper j, there is an arc from t_j to t'_j with weight $-M$, for some large positive number M.
9. Unless otherwise stated above, all arcs have a lower bound of 0 and a capacity (or upper bound) of $+\infty$.

Procedure for Task 2

Step 1: Form the network N described above.

Step 2: Find a maximum weight transshipment solution for N. If the solution is positive, then output the assignment found (as indicated by the arcs with one unit of flow); otherwise, the original problem in Task 2 has no feasible solution.

Figure 1: Network model.



For an excellent treatment of transshipment problems (also called minimum cost flow problems), both mathematical formulations and solution techniques, the reader is referred to Ahuja et al. (1993).

Procedure for Task 3

Step 1: Set T to be the smallest value s_{ij}. Apply the Procedure for Task 2.

Step 2: Set T to be the next smallest value s_{ij}. Apply the Procedure for Task 2. If a feasible assignment is found, repeat this step. If no feasible solution is found, output the assignment found in the previous iteration.

Observe that the use of intermediate nodes and the large negative weights $-M$ in the construction of N gives us the type of "bottleneck" solution that we want. Also observe that the maximum weight capacitated transshipment problem defined by the network N can be solved with any software for minimum weight capacitated transshipment problems (or minimum cost flow problems) by simply changing the signs of the weights (the resulting network has no negative weight-directed cycles). Finally, observe that Step 2 of the Procedure for Task 3 can be more efficiently implemented with a binary search (divide and conquer).

IMPLEMENTATION

In this section we describe a particular application of the methodology proposed in the previous section. This application was for the 1998 annual meeting of the Decision Sciences Institute in Las Vegas. Annual meetings for this organization typically consist of around 1,000 paper submissions that are divided into 12 functional tracks. We applied our methodology to the Production and Operations Management (POM)-Manufacturing Track, which has always been one of the largest tracks, with around 200 papers. A common practice for the track organizer is to send each paper to three reviewers and to ensure that each reviewer receives at most three papers.

The first task in applying our methodology was to construct a set of categories for the classification of papers and reviewers. We consolidated a list of 48 categories used by the *Decision Sciences* Journal for Operations and Logistics Management into a list of 30 categories for this purpose. We then constructed two survey forms, one for authors and one for reviewers. In March 1998, the POM-Manufacturing Track received feedback from 182 volunteer reviewers who filled out the survey form. The track organizers then filled out the paper survey after a quick review of each of the 174 papers submitted to the track. (Alternatively, this could have been done by the authors themselves.)

The next step was to construct a matrix that contains the "degrees of similarity" between categories, that is, the numbers w_{kl} defined in the previous section. These are contained in a 30x30 "proximity" matrix. We used a scale of 0 to 5, where 5 indicates the strongest possible similarity between two categories. This proximity matrix provides one advantage over the traditional method of assigning a paper to reviewer by keyword overlapping, as described in the Introduction. Utilizing the proximity matrix, our methodology offers the possibility of finding "almost expert" reviewers when "experts" are not available.

With 182 reviewers and 174 papers, we had to solve 31,668 transportation problems to obtain the degree of expertise for each paper-reviewer pair. We recorded the data in Microsoft Excel 97, wrote macros to organize data input and output, and solved the transportation problems via macro calls to the Solver module within Excel. We chose to use Excel due to its almost universal availability. Although the number of transportation problems is huge, these problems are completely independent of each other and, hence, can be solved in parallel. We acquired a computer lab and ran 18 Windows-based Pentium-133 personal computers at the same time. Each computer (except the 18th one) took 30 minutes to solve the transportation problems required.

We recorded all the 31,668 degrees of expertise numbers in a matrix. This matrix yielded the weights on the arcs of the networks N that were constructed during the running of the procedures for Tasks 2 and 3. We found that among the 182 reviewers, about 50 reviewers also submitted papers to the POM-Manufacturing Track. To avoid sending a paper to its own author(s), we manually assigned a big negative weight to all such combinations in the matrix. We then took this revised matrix and a starting threshold T of 25 (as dictated by binary search), and generated (with an Excel macro) the network N in a form appropriate for input to the SAS/OR software. (Again, we chose SAS/OR because of its wide availability.) Each minimum cost capacitated transshipment problem had over 40,000 arcs, but it only took the Windows version of SAS/OR about 10 seconds to solve each. Using binary search, we quickly found that the largest threshold that admitted a feasible solution was $T = 30$. This solution guaranteed that for each paper at least one of the three reviewers had an expertise level of 30 or more and that this was not possible for an expertise level of 31. The solution was also the best possible with respect to the objective function subject to the threshold constraint. Because we had more reviewers than papers, some reviewers were assigned fewer than three papers in our solution. We also considered the problem of finding the largest threshold such that every paper is assigned to two reviewers with expertise, which is at least (as large as) this value. In this case, the largest threshold that admitted a feasible solution was 24. This illustrates the trade-off between requiring one expert reviewer for each paper versus requiring two expert reviewers. The three-reviewer version of this problem also yielded a threshold of 24, although the objective function value dropped off slightly.

GENERALIZATIONS AND OTHER APPLICATIONS

The model we have presented is customized for a particular application. However, many features of the model can be generalized and other applications are possible. We first list below some of the possibilities for generalizing the model.

1. The number "three" in (1.1) and (1.2) can be any positive number and need not be the same for all reviewers and papers. This will affect items 3 and 4 in the construction of N.
2. The type of inequality or equality required in (1.1) and (1.2) is not important and need not be the same for all reviewers and papers. This will affect items 3 and 4 in the construction of N.
3. In Task 2, the requirement "at least one" can be "at least l" for some positive integer l. This will change the lower bounds on the arcs in item 7 to l in the construction of N.
4. In Task 2, the requirement "every paper" can be replaced with "all but m papers." That is, an assignment may be considered feasible if no more than m papers are assigned to reviewers who are not above the threshold T. This may allow a higher threshold to be achieved for the vast majority of the papers. This can be accomplished with the procedures as given due to the use of the large number M. To see this, observe that in Step 2 of the Procedure for Task 2, a solution is always found to the transshipment problem, which minimizes the number of papers that are assigned to reviewers whose level of expertise for that paper is less than the threshold. Thus, the Procedure for Task 3 can be run until no feasible solution is found in this generalized sense.
5. The use of 10 points in the classification vector is arbitrary.
6. The model described does not take into consideration the skill level of the reviewers. This can be a function of experience, academic rank, or reputation. However, an additive or multiplicative factor could be used to adjust the levels of expertise s_{ij} appropriately. For example, suppose we classify the reviewers into three types: student/assistant professor; associate professor; full professor. We could assign weights, say 1, 2, 3, to the respective types. Finally, we could replace each expertise level s_{ij} with $d_* s_{ij}$, where d is the weight for the type of reviewer i.

Finally, we hope this methodology can be used in other applications that require a good match between two groups. Some possible applications are given below.

Consulting

Consider the situation of a number of projects and a number of people that must be assigned to these projects. Each project requires a certain number of people and each person must be assigned to a certain number of projects. Each person's skills can be characterized by distributing points over some categories, and each project's requirements can be characterized by distributing the same number of points over the same categories. The expertise level of each person for each project can be calculated with Task 1 of our model. The assignment of people to projects can then be carried out using Task 2 of our model so that every project is assigned at least one person who is as expert as possible.

Job interviews

Consider the problem of assigning graduating students to job interviews at a university. Each company is allowed to interview a certain number of students and each student is allowed to interview with a certain number of companies. To begin, each student distributes a certain number of points over the interviewing companies according to their preferences, and each company distributes the same number of points over the students according to their preferences. A straightforward version of Task 1 of our model can be used to determine the strength of each student-company pair. Task 2 of our model can then be used to assign students to interviewers so that every student gets to interview with at least one company in which they are strongly interested (this could alternatively be done from the companies' points of view).

Class registration

Consider the situation of students requesting courses in a preregistration process at a university. To begin, each student is given some number of points to distribute over the courses offered (the more points they give to a course, the higher their preference). The objective is to assign the students to courses so that each student gets one (or two, etc.) course(s) with a point rating above a threshold that is made as large as possible. Each course can also have a student capacity. (This model uses only Task 2 of our model.)

CONCLUSIONS

In this paper we proposed a two-phase optimization approach to solving the conference paper assignment problem. We implemented the proposed approach to help organize the POM-Manufacturing Track of the 1998 annual meeting of the Decision Sciences Institute. We provided optimal solutions to the assignment of 174 papers to 182 reviewers in this track. These solutions have the following property: For each paper, a specified number (one, two, or three in our case) of reviewers possess a level of expertise that is above a threshold, which is as large as possible. [Received: May 20, 1998. Accepted: October 16, 1998.]

REFERENCES

Ahuja, R. K., Magnanti, T. L., & Orlin, J. B. (1993). *Network flows*. Upper Saddle Ridge, NJ: Prentice-Hall.

Aronson, J. E. (1986). The multiperiod assignment problem: A multicommonality network flow model and specialized branch and bound algorithm. *European Journal of Operational Research, 23*, 367-381.

Bausch, D. O., Brown, G. G., Hundley, D. R., Rapp, S. H., & Rosenthal, R. E. (1991). Mobilizing marine corps officers. *Interfaces, 21*(4), 26-38.

Bechtold, S. E., & Showalter, M. J. (1987). A methodology for labor scheduling in a service operating system. *Decision Sciences, 18*, 89-107.

Carraresi, P., & Gallo, G. (1984). Network models for vehicle and crew scheduling. *European Journal of Operational Research, 16*, 139-151.

Carter, M. W., & Tovey, C. A. (1992). When is the classroom assignment problem hard? *Operations Research, 40*(1), S28-S39.

Derman, C., & Klein, M. (1959). A note on the optimal depletion of inventory. *Management Science, 5*, 210-214.

Ewashko, T. A., & Dudding, R. C. (1971). Application of Kuhn's Hungarian assignment algorithm to posting servicemen. *Operations Research, 19*, 991.

Franz, L. S., & Miller, J. L. (1993). Scheduling medical residents to rotations: Solving the large-scale multiperiod staff assignment problem. *Operations Research, 41*(2), 269-279.

Franz, L. S., Baker, H. M., Leong, G. K., & Rakes, T. R. (1989). A mathematical model for scheduling and staffing multiclinic health regions. *European Journal of Operational Research, 41*, 277-289.

Gilbert, K. C., & Hofstra, R. B. (1988). Multidimensional assignment problems. *Decision Sciences, 19*, 306-321.

Hansen, P., & Wendell, R. E. (1982). A note on airline commuting. *Interfaces, 11* (12), 85-87.

Horn, W. A. (1973). Minimizing average flow time with parallel machines. *Operations Research, 21*, 846-847.

Klingman D., & Phillips, N. (1984). Topological and computational aspects of preemptive multicriteria military personnel assignment problems. *Management Sciences, 30*(1), 1362-1375.

Krajewski, L. J., Ritzman, L. P., & McKenzie, J. P. (1980). Shifting scheduling in banking operations: A case study application. *Interfaces, 10*, 1-6.

Machol, R. E. (1970). An application of the assignment problem. *Operations Research, 18*, 745-746.

Mason, A. J., & Philpott, A. B. (1988). Pairing stereo speakers using matching algorithms. *Asia-Pacific Journal of Operational Research, 5*, 101-116.

Mazzola, J. G., & Neebe, A. W. (1986). Resource-constrained assignment scheduling. *Operations Research, 34*, 560-572.

Ross, G. T., & Zoltners, A. A. (1979). Weighted assignment models and their application. *Management Science, 25*, 683-696.

Showalter, M. J., & Mabert, V. A. (1988). An evaluation of a full-/part-time tour scheduling methodology. *International Journal of Operations and Production Management, 8*, 54-71.

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