SIMOS PROCEDUE

Conventionally, our collaboration experts introduce some specific ways for weighting criteria. In this study, we leverage Simos procedure to weight criteria because that Simos is a method commonly used in the field of logistics. It also considers the criteria order of importance which can be determined by the experts. In Simos, every criteria is matched with a gaming card. In other words, for a decision making problem with n criteria, n card is picked. The detailed process of this method is as follows [FR02]: • We arrange the criteria order from the least to the most importance. If some criteria share the same importance based on the decision-maker’s view, a subset of these criteria is established. • We consider the importance of two consecutive criteria, which may be closer or less close. In other words, when determining weightings, the difference between two consecutive criteria can be very small or very big. To deal with this situation, we put white cards between two consecutive criteria, and a bigger difference between criteria weighting means more white cards. Based on the Simos procedure, the weighting of unit price (UP), stock holding capacity (SHC), average distance to shops (DS), average distance to main suppliers (DMS), the number of nearby main suppliers (NMS), and the number of nearby freeway entrance (NFE) criteria can be calculated as follows:

按照惯例，我们的协作专家会介绍一些加权标准的特定方法。在本研究中，我们将Simos程序用于权衡标准，因为Simos是物流领域中常用的一种方法。它还考虑了可以由专家确定的重要性标准顺序。在Simos中，每个条件都与游戏卡匹配。换句话说，对于具有n个标准的决策问题，选择n张卡。此方法的详细过程如下[FR02]：•我们按从最小到最大的顺序排列标准顺序。如果基于决策者的观点某些标准具有相同的重要性，则将建立这些标准的子集。 •我们考虑两个连续标准的重要性，这两个标准可能相近或相近。换句话说，在确定权重时，两个连续标准之间的差异可能很小或很大。为了应对这种情况，我们将白卡放在两个连续的标准之间，并且标准权重之间的较大差异意味着会有更多白卡。根据Simos程序，加权单价（UP），库存量（SHC），到商店的平均距离（DS），到主要供应商的平均距离（DMS），附近主要供应商的数量（NMS）和可以按以下方式计算附近高速公路入口（NFE）标准的数量：

build criteria set F = {UP,SHC,DS,DMS,NMS,NFE}. Regarding the potential null values in the original data, we fulfill DS, DMS, NMS, and NFE by calculating the POI features of the corresponding warehouse, and UP and SHC through manual work such as using the average unit price and default values. • The experts determine the increasing order of importance among the above criteria as NFS, DS, DMS, NMS, UP, and SHC. • The experts further evaluate the average distance to main suppliers (DMS) and average distance to shops (DS) as equally important and the difference of importance between unit price (UP) and NMS is determined to be in a high level according to the difference between other two consecutive criteria.

We summarize the calculation steps of weighting criteria using Simos procedure in Table. 1. To be specific, criteria subset are first formed with same important criteria and in the parallel of this relation order and counting number for each criterion are appointed. Second, we calculate the average weighting value for each criteria subset. Finally, the classification value for criteria is proportioned to the sum of consecutive numbers and weighting values are calculated. Through these steps, we obtain the importance weights of criteria as follows: {WNFE,WDMS,WDS,WNMS,WUP,WSHC} = {0.04,0.22,0.17,0.26,0.31}.

构建标准集F = {UP，SHC，DS，DMS，NMS，NFE}。关于原始数据中可能存在的空值，我们通过计算相应仓库的POI功能来完成DS，DMS，NMS和NFE，并通过使用平均单价和默认值等人工工作来计算UP和SHC。 •专家确定上述标准（如NFS，DS，DMS，NMS，UP和SHC）中重要性的递增顺序。 •专家们进一步评估到主要供应商的平均距离（DMS）和到商店的平均距离（DS）同等重要，并根据差异确定单价（UP）和NMS之间的重要性差异处于较高水平在其他两个连续条件之间。

我们在表中使用Simos程序总结了加权标准的计算步骤。 1.具体来说，首先使用相同的重要条件形成条件子集，并与此关系顺序并行，并指定每个条件的计数编号。其次，我们计算每个标准子集的平均加权值。最后，将标准的分类值与连续数字的总和成比例，然后计算权重值。通过这些步骤，我们获得了如下标准的重要性权重：{WNFE，WDMS，WDS，WNMS，WUP，WSHC} = {0.04,0.22,0.17,0.26,0.31}。

An important and challenging step in the solution of a decision making problem is the elicitation of weights. In the examples presented in the previous Chapters, the weights of the criteria were inputs to the problem. However, one of the most important steps that the decision maker performs during the solution of a decision making problem with an MCDA method is the assessment of the criteria weights. Various methods have been proposed for this task. These methods can be mainly categorized in two major classes, the direct assessment ones and the indirect ones. The indirect assessment methods have been used in most applications of MCDA methods due to their simplicity and realism. One of the most widely-used methods is the one proposed by Simos [2, 3]. This method is a typical indirect assessment method that has been widely-used in decision making problems since it is relatively easy for decision makers to express their preferences. The elicitation of the criteria weights is performed by asking decision makers to express the relative importance of the criteria, through the arrangement of criteria cards, from the least to the most important one. The method was later extended by Figuera and Roy [1] in order to address certain robustness issues of the original method. The revised Simos method is widely-used in decision making problems for estimating the criteria weights.

The decision maker is given a set of cards. The name of each criterion is written on a card. The decision maker uses the cards in order to rank the criteria from the least important to the most important. The first criterion in the ranking is the least important and the last criterion is the most important. If some criteria have the same importance for the decision maker, he/she can place them together in the same position. Therefore, a complete pre-order of the whole n criteria is obtained. The number of ranks is n, where 1 ≤ n ≤ n (since some of the cards can be placed in the same rank).

The decision maker has also a set of white cards. The importance of two successive criteria (or two successive subsets of ex aequo criteria in case two or more cards have been placed together) in the ranking can be more or less close. In order to depict this smaller or larger difference of the importance of successive criteria, the decision maker introduces white cards between two successive cards. The more the number of white cards between two successive criteria, the greater the difference between their importance. If no white card is placed between two successive ranks, then the difference between the weights of the criteria in these two successive ranks can be chosen as the unit, u, for measuring the intervals between weights. Hence, if one white card is placed between two successive ranks, then there is a difference of 2u between the weights of the criteria in these two successive ranks. Finally, the decision maker should state how many times the last criterion is more important than the first one. This ratio is denoted by the parameter z.

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决策者会得到一组卡片。 每个条件的名称都写在卡上。 决策者使用这些卡片以便从最不重要到最重要的顺序对标准进行排名。 排名中的第一个条件是最不重要的，而最后一个条件是最重要的。 如果某些标准对决策者具有相同的重要性，则他/她可以将它们放在同一位置。 因此，获得了全部n个标准的完整预订购。 等级数为n，其中1≤n≤n（因为某些卡可以放置在同一等级中）。

决策者也有一套白卡。在排名中，两个连续标准（或如果两个或多个卡放置在一起的情况下，exequo标准的两个连续子集）的重要性或多或少接近。为了描述连续性标准重要性的较小或较大差异，决策者在两个连续性卡之间引入白卡。两个连续标准之间的白卡数量越多，其重要性之间的差异就越大。如果没有在两个连续等级之间放置白卡，则可以选择这两个连续等级中标准权重之间的差异作为单位u，以测量权重之间的间隔。因此，如果一张白卡放置在两个连续等级之间，则在这两个连续等级中的标准权重之间存在2u的差异。最后，决策者应说明最后一个标准比第一个更为重要的次数。该比率由参数z表示。