

The Use of a Method for Selecting the Right Outsourcing Providers in the Logistics Strategies of Enterprises

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Abstract— This article studies the development of a method for selecting the right outsourcing providers in the logistics strategies of enterprises. One of the main problems faced by enterprises using outsourcing services is ensuring the right provider selection and taking into account technical and economic indicators in this process. The proposed “MI-MA” method involves conducting internal and external assessments. This assessment is based on 6 main criteria: experience, cost, quality, risk, carrying capacity and traceability indicators. Within the framework of the study, the evaluation coefficients are analyzed more precisely using fuzzy set theory and objective comparisons are made. The constraint conditions defined for each criterion allow evaluating the effectiveness of providers and determining their suitability. The approaches in the article are suitable for practical applications and can help enterprises develop outsourcing strategies.

Keywords— *logistics, outsourcing, transport logistics, evaluation method, logistics management, outsourcing strategy.*

I. INTRODUCTION

Outsourcing is a strategy used by enterprises in almost all sectors of the economy. [1]. During the Covid-19 pandemic, most enterprises clearly reflected the effect of this strategy in their annual final indicators. During this period, enterprises that used outsourcing were able to overcome a difficult economic period with less damage than enterprises that refused such a strategy. Considering the aforementioned factor, it has become clear that the outsourcing strategy has become more relevant in the post-pandemic period. It is clear that with the correct application of this strategy, it is possible to obtain significant advantages such as reducing costs, improving work quality, and managing risks. It should also be noted that since many enterprises also have the desire to control the providers offering outsourcing services and monitor the progress of outsourced work, the issue of abandoning the outsourcing strategy arises if their wishes are not met. Because enterprises do not trust logistics outsourcing providers, they want to be constantly informed about the outsourcing processes. It can also be concluded from published studies that the lack of mutual trust between enterprises can be considered one of the reasons that hinder the development of outsourcing [2]. Then the question may arise: what is the solution to this problem that hinders the development of logistics outsourcing? First of all, it may be more important to divide the solution to the problem into the two parts mentioned below:

- choosing the right provider;
- control of outsourcing operations.

II. THE PROBLEM STATEMENT

It is known that companies engaged in outsourcing services undertake a number of obligations, such as solving the problems of customer enterprises in the outsourced area in a short time, as well as organizing them in a better quality manner. However, customer enterprises must have certain technical and economic indicators to choose the right outsourcing service provider when making an outsourcing decision. According to these indicators, companies can determine whether to outsource an area, what risks they will face if they outsource, how it will be financially profitable, and how it will affect the quality of work, and thus select the most technically and economically suitable enterprise from among the many enterprises offering outsourcing services. For this reason, the evaluation of outsourcing services for enterprises is considered one of the most relevant issues. Thus, enterprises will identify both their weaknesses and the providers offering professional services in this area by evaluating outsourcing services [3].

As mentioned, it is important for customer enterprises to conduct certain technical and economic calculations before making a decision to use outsourcing services. These calculations are carried out in two directions: internal (the area to be outsourced within the enterprise) and external (enterprises offering outsourcing services) evaluation [4].

The criteria used in the aforementioned evaluation method are as shown in Table I.

TABLE I. Criteria for internal and external assessment methods

Internal assessment (M)	External evaluation (P)
<p>Experience factor.</p> $T_m = \frac{N_t}{N_i}$ <p>where, N_i – the number of experienced employees; N_i – the total number of employees; T_m – is the experience criterion.</p>	<p>Experience factor.</p> $T_p = \frac{N_t}{N_i}$ <p>where, N_i – the number of experienced employees; N_i – the total number of employees; T_p – is the experience criterion.</p>
<p>Cost factor.</p> $X_m = \frac{X_f}{X_u}$ <p>where, X_f – the cost incurred in the area being evaluated; X_u – the total cost incurred; and X_m – is the cost criterion.</p>	<p>Cost factor.</p> $X_p = \frac{X_f}{X_u}$ <p>where, X_f – cost incurred by providers; X_u – total cost incurred; and X_p – is the cost criterion.</p>
<p>Quality factor.</p> $K_m = \frac{N_u}{N_x}$ <p>where, N_u – the number of successful transactions; N_x – the</p>	<p>Quality factor.</p> $K_p = \frac{N_u}{N_x}$ <p>where, N_u is the number of successful operations; N_x – the total number of</p>

<i>total number of services provided; K_m – is the quality criterion.</i>	<i>services provided; K_p – is the quality criterion.</i>
Risk factor. $R_m = \frac{N_q}{N_x}$, where, N_q is the number of accidents (errors); N_x is the total number of services provided; and R_m is the risk criterion.	Risk factor. $R_p = \frac{N_q}{N_x}$, where, N_q is the number of accidents (errors); N_x is the total number of services provided; and R_p is the risk criterion.
The utilization factor of the average carrying capacity. $Q_m = \frac{\sum_{i=1}^n Q_i}{n}$, where, Q_i is the load factor of the enterprise's vehicle; n is the number of trips made by the enterprise during a certain period; and Q_m is the utilization factor of the average carrying capacity.	The utilization factor of the average carrying capacity. $Q_p = \frac{\sum_{i=1}^n Q_i}{n}$, where, Q_i is the load factor of the logistics provider's vehicle; n is the number of trips performed by the logistics provider during a certain period; Q_p is a coefficient using the average value of the carrying capacity.
A coefficient indicating the degree of traceability of cargo. $I_m = \frac{I_i}{I_n}$, where, I_i – the number of traceable vehicles in use by the enterprise; I_n – the total number of vehicles in use by the enterprise; I_m – is the cargo traceability criterion.	A coefficient indicating the degree of traceability of cargo. $I_p = \frac{I_i}{I_n}$, where, I_i – the number of traceable vehicles used by the logistics provider; I_n – the total number of vehicles used by the logistics provider; I_p – is the cargo traceability criterion.

Internal and external evaluation is carried out on 6 (six) criteria and the coefficients can be rated in the range of 0-1. Thus, through this evaluation method, enterprises can both determine the coefficients for their own internal evaluation and evaluate providers offering multiple outsourcing services [5]. However, this evaluation method may not be sufficient to solve the problem posed - choosing the right provider.

First of all, it should be noted that while it is desirable for some coefficients (for example, R_p) to be close to 0 in the evaluation of providers, it is also desirable for some coefficients (for example, I_p) to be close to 1. In this case, such an approach makes it impossible to make a joint comparison of all coefficients.

Considering this, a new method for choosing the right provider "MI-MA" has been developed by us. Thus, the "MI-MA" method first involves grouping 6 coefficients according to the desired results (Table II).

TABLE II. Desired minimum and maximum coefficients

Desired result - Minimum (MD)	Desired result - Maximum (MA)
Cost factor - X	Experience coefficient - T
Risk coefficient - R	Quality factor - K
Average carrying capacity utilization factor - Q	The coefficient indicating the degree of traceability of cargoes – I

It is known that customer enterprises always want providers to provide high-quality, accurate and highly professional services with low costs and minimal risks. Logistics providers, in turn, claim to meet such expectations of customer enterprises. In this regard, it is important to accurately compare the coefficients and correctly analyze the results obtained for the right provider selection. However, it should be noted that if the coefficients are rated in the range of 0-1 and the results in the evaluation of numerous enterprises

offering outsourcing services are close to each other, the decision on the choice of provider may not be completely correct. The question may arise: to what value can the coefficients corresponding to the desired minimums (DM) be considered acceptable if they increase? At the same time, to what value can the coefficients corresponding to the desired maximums (MA) be considered acceptable if they decrease? Taking into account the above, it is considered appropriate to apply the fuzzy set theory of the world-renowned scientist Lotfi Zadeh (Lotfi Aliasker Zadeh) for a more accurate comparison of the results, as well as for determining the limits for the "MI" and "MA" indicators [6]. Considering that the evaluation coefficients are evaluated in the range of 0-1 and that a 2-column comparison is carried out using the "MI-MA" method, it can be considered appropriate to initially determine the maximum value for the "MI" column and the minimum value for the "MA" column as 0.5. Thus, by including this common limit, the excess value range was already expanded to $0 \div 0.5 \div 1$. The inclusion of this common limit will also ensure that in cases where the limits for the "MI" and "MA" columns are exceeded when comparing multiple providers, those providers will be removed from the list of comparables.

After entering the average limit, it is necessary to determine the specified constraint conditions for the coefficients in each column. For this purpose, let's first set a specified constraint condition for the first criterion in the "MI" column - the Cost coefficient. It is known that providers receive a certain amount of payment for the services they provide. This eliminates the possibility of costs being 0. However, it is always desirable for customer enterprises to have low costs. The point to be taken into account here is that customer enterprises do not want to pay higher amounts than their own costs for logistics outsourcing service providers. Taking this factor into account, it can be considered appropriate to record the constraint on the cost coefficient for providers as the cost coefficient for the enterprise. That is,

$$0 < X_p < X_m < 0.5.$$

It should be noted here that if $X_m > 0.5$, then the constraint for X_p is considered to be 0.5.

$X_p > X_m$ according to the above constraint, then that provider will be removed from the list of comparable providers. Considering all these conditions, the refined constraint for the effective cost ratio can be defined as follows:

$$0 < X_p < 0.2 < X_m < 0.5.$$

Within this specified constraint, if the cost ratios of providers are less than 0.2, the probability of their selection by ordering enterprises increases.

The next coefficient in the "MI" column is the risk coefficient. If the first restriction condition mentioned above and $R_p > R_m$ are met, the exclusion of the provider from the list of comparable providers remains relevant for the Risk coefficient as well. That is,

$$0 < R_p < R_m < 0.5.$$

Here too, if $R_m > 0.5$, then the restriction for R_p is considered to be 0.5.

It is known that risks in the field of logistics are always high. For this reason, customer enterprises want to achieve some reduction in risks by transferring them to providers. Taking into account such factors, it may be appropriate to define a specified restriction condition as follows:

$$0 < R_p < 0.02 < R_m < 0.5.$$

In accordance with the specified restriction on the risk coefficient, providers must show a result below 0.02.

The last coefficient in the “MI” column is the average capacity utilization coefficient. You may ask why this coefficient is important? The average capacity utilization coefficient is used to determine whether the logistics provider fulfills the orders of the ordering enterprise on time and within the “fastest” condition. If logistics providers fully utilize their capacity, undesirable situations such as transportation shortages and cargo delays are inevitable.

The first constraint condition (< 0.5) that applies to the other coefficients listed above for the average carrying capacity utilization factor is not considered relevant. Because, like any other enterprise, logistics providers always try to operate at maximum capacity. This, in turn, causes the capacity utilization factor to be higher than 0.5. Taking into account the above, it can be considered appropriate to set the first constraint condition for the average capacity utilization factor to be 0.85. In addition, if $Q_p > Q_m$, the removal of the provider from the list of comparable providers remains relevant for this factor as well. That is,

$$0 < Q_p < Q_m < 0.85.$$

Here, if $Q_m > 0.85$, then the restriction for Q_p is considered to be 0.85.

It may be appropriate to set a specified constraint condition for the utilization factor of the average carrying capacity as follows:

$$0 < Q_p < 0.7 < R_m < 0.85.$$

According to the specified constraint condition, the expectation of customer enterprises from logistics providers is that the average cost of transportation capacity utilization is less than 0.7.

After determining the specified constraint conditions for the "MI" column, it is necessary to investigate the determination of specified constraint conditions for the "MA" column as well.

The first coefficient for the “MA” column is the Experience coefficient. It is known that one of the advantages of the outsourcing strategy is to achieve a more professional provision of activities by transferring existing activities of enterprises in addition to their main purpose to experienced enterprises specializing in that activity. Approaching from this point of view, it can be noted that it is desirable that the experience coefficient of logistics providers for client enterprises is 1 (maximum). Therefore, it can be considered appropriate to state the initial condition for the experience coefficient as follows. That is,

$$0.5 < T_m < T_p < 1.$$

Here, if $T_m < 0.5$, then the restriction for T_p is considered to be 0.5.

If the first restriction condition mentioned above and $T_p < T_m$ are met, then the removal of the provider from the list of comparable providers remains relevant for the experience factor. That is,

$$0.5 < T_m < 0.8 < T_p < 1.$$

According to the specified constraint condition, the expectation of customer enterprises from logistics providers is that the experience coefficient is greater than 0.8.

The second coefficient in the “MA” column is the quality coefficient. Quality is one of the important factors in the logistics sector, as in all areas of production. A high quality coefficient of logistics providers is the main guarantee that customer enterprises trust the providers. Therefore, it is appropriate for this coefficient to be close to 1. That is,

$$0.5 < K_m < K_p < 1.$$

Here, if $K_m < 0.5$, then the restriction for K_p is considered to be 0.5.

If the first restriction condition mentioned above is met and $K_p < K_m$, then the removal of the provider from the list of compared providers is also relevant for the quality factor:

$$0.5 < K_m < 0.9 < K_p < 1.$$

According to the specified constraint condition, the expectation of customer enterprises from logistics providers is that the quality coefficient is greater than 0.9.

The last coefficient in the “MA” column is the coefficient indicating the degree of traceability of cargoes. One of the most worrying issues for customer enterprises is their desire to be informed about the location of their cargoes. That is, the tracking of their cargoes. Of course, tracking cargoes is of great importance in terms of planning work and making advance preparations for cargo operations. For this reason, in modern transportation processes, the issue of tracking cargoes is at the forefront of the list of requirements for logistics providers of customer enterprises. Taking into account the above, it is desirable for customer enterprises to have a cargo traceability coefficient of 1. That is,

$$0.5 < \dot{I}_m < \dot{I}_p < 1.$$

Here, if $\dot{I}_m < 0.5$, then the restriction for \dot{I}_p is considered to be 0.5.

If the first restriction condition mentioned in other coefficients and $\dot{I}_p < \dot{I}_m$, the removal of the provider from the list of compared providers remains relevant for the coefficient of cargo traceability. That is,

$$0.5 < \dot{I}_m < 0.95 < \dot{I}_p < 1.$$

Based on the specified constraint condition, the expectation of ordering enterprises from logistics providers is that the cargo traceability rate coefficient is greater than 0.95.

The specified restriction conditions for the “MI – MA” columns create the opportunity to make the right choice by evaluating providers in a more accurate price range. Therefore, summarizing all of the above, it may be appropriate to calculate the following formulas to determine the desired minimum and maximum prices for the 6 coefficients:

$$MI = X * R * Q * 100;$$

$$MA = T * K * I * 100.$$

Based on the above formulas, it is possible to calculate the MI and MA indicators (in %) for each provider.

III. CONCLUSION

Thanks to such a methodical reporting sequence, it becomes possible to make a more accurate and complete provider selection by comparing the internal indicators of the customer enterprises with the indicators of the providers offering logistics outsourcing services. However, it should be noted that obtaining results within the framework of variable data through this method may cause certain time losses. For this reason, the electronicization of calculations will speed up the calculation processes and at the same time, by analyzing a large number of provider indicators, it will be possible to make a correct and favorable choice.

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