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MULTI CRITERIA DECISION MAKING FOR LOGISTICS INFORMATION SYSTEM SELECTION

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ABSTRACT
Information Systems (IS) play a major role in developing and sustaining competitive advantage in the global marketplace. The Logistics Information System (LIS) is part of the information system of the organization that is integrated in the supply chain and is correlated with the partner organizations. Decision making problem is the process of finding the best option from all of the feasible alternatives. This paper presents TOPSIS multi-criteria decision making method to select logistics information system for practitioners.
Keywords: Information systems, Logistics Information System, Decision making, TOPSIS.

1. INTRODUCTION
Supply chain management encompasses many activities, it is defined as follows: Supply chain management is the integration of all activities associated with the flow and transformation of goods from new materials, through to the end user, as well as associated information flows, through improved supply chain relationships to achieve a sustainable competitive advantage This definition clearly identifies the two major flow components of the supply chain:
materials and information [1].
Logistics is the collection of activities associated with acquiring, moving, storing and delivering supply chain commodities (i.e., products in all stages of manufacture, services and information).Logistics supply chains (also called logistics systems or logistics networks) arise in numerous business segments and government functions, including: manufacturing firms, retailing firms, food producers and distributors, the military, transportation carriers (such as trucking and railroad companies), service companies, postal delivery, utilities, petroleum pipelines, and public transportation, among others [2].
Logistics information system (LIS) is becoming important as it provides efficient and effective logistics management that aims to reduce cost and cycle time for its customers on the supply chain. LIS are flexible tools for collecting, aggregating and analyzing data from the operative applications (Purchasing, Sales, Logistics, Inventory Controlling, Plant Maintenance, Quality Management/Inspection Processing), which enable users to continually control target criteria and to react in time to exceptional situations [3].
Logistics Information System(LIS) is known as a critical factor in achieving logistics competitiveness. Most corporations, however, do not seem to have clear strategies in meeting the information systems requirements of this decade. This is partly due to a lack of understanding about the causal relationship between a corporation's characteristics and logistics information system priorities [4].

The activities of strategic IS planning include: 1) identify the organization's information needs; 2) find new opportunities for using information to achieve a competitive advantage; 3) define data, applications and technology for satisfying the organization's objectives. Therefore, an IS manager in an organization which exercises a high extent of strategic IS planning activities must have a better understanding of the organization's intent on future IS developments [5].

A successful information logistics system includes:

- EDI providing for direct data exchange through electronic transmission;

-Electronic Funds Transfer (EFT) allowing simplified payment procedures through data communications networks;

-activity based costing relating cost information to costs sources;

-article-numbering and bar-coding for identification and addressing of goods; and

-databases to store, manage and analyse the collected information in an efficient Manner [6]. In the following section, we use TOPSIS to solve multi-attribute problem for selection IS in SCM.

This paper propose that the logistic information technology evaluation and selection criteria for practitioners and a multi-attribute decision making methodology, TOPSIS, for the selection problem of information systems

2. TOPSIS AND GROUP DECISION MAKING

Decision making problem is the process of finding the best option from all of the feasible alternatives. In almost all such problems the multiplicity of criteria for judging the alternatives is pervasive. That is, for many such problems, the decision maker wants to solve a multiple criteria decision making (MCDM) problem. A MCDM problem can be concisely expressed in matrix format as:

$$\boldsymbol{D} = \begin{array}{c} \\ A_1 \\ A_2 \\ \vdots \\ A_m \end{array} \begin{array}{c} \begin{array}{cccc} C_1 & C_2 & \cdots & C_n \end{array} \\ \left[\begin{array}{cccc} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{array} \right] \end{array}, \qquad (1)$$

$$W = [w_1 \; w_2 \; \cdots \; w_n], \qquad (2)$$

where *A*1, *A*2,..., *Am* are possible alternatives among which decision makers have to choose, *C*1,*C*2,...,*Cm* are criteria with which alternative performance are measured, *xij* is the rating of alternative *Ai* with respect to criterion *C j* and *j w* is the weight of criterion *C j* .

A survey of the MCDM methods has been presented by Hwang and Yoon [1]. Technique for Order Performance by Similarity to Ideal Solution (TOPSIS), one of the known classical MCDM methods, also was first developed by Hwang and Yoon [7]. TOPSIS is a multiple criteria method to identify solutions from a finite set of alternatives. The basic principle is that the chosen alternative should have the shortest distance from the positive ideal solution and the farthest distance from the negative ideal solution. The procedure of TOPSIS can be expressed in a series of steps:

(1) Calculate the normalized decision matrix. The normalized value n_{ij} is calculated as

$$n_{ij} = x_{ij} \Bigg/ \sqrt{\sum_{j=1}^{m} x_{ij}^2}, \quad j = 1, \ldots, m, \; i = 1, \ldots, n. \qquad (3)$$

(2) Calculate the weighted normalized decision matrix. The weighted normalized value v_{ij} is calculated as

$$v_{ij} = w_i n_{ij}, \quad j = 1, \ldots, m, \; i = 1, \ldots, n,$$

where w_i is the weight of the ith attribute or criterion, and $\sum_{i=1}^{n} w_i = 1$.

(3) Determine the positive ideal and negative ideal solution.

$$A^+ = \{v_1^+, \ldots, v_n^+\} = \left\{ \left(\max_j v_{ij} | i \in I \right), \left(\min_j v_{ij} | i \in J \right) \right\},$$
$$A^- = \{v_1^-, \ldots, v_n^-\} = \left\{ \left(\min_j v_{ij} | i \in I \right), \left(\max_j v_{ij} | i \in J \right) \right\}, \qquad (4)$$

where *I* is associated with benefit criteria, and *J* is associated with cost criteria.

(4) Calculate the separation measures, using the n-dimensional Euclidean distance. The separation of each alternative from the ideal solution is given as

$$d_j^+ = \left\{ \sum_{i=1}^{n} (v_{ij} - v_i^+)^2 \right\}^{\frac{1}{2}}, \quad j = 1, \ldots, m. \qquad (5)$$

Similarly, the separation from the negative ideal solution is given as

$$d_j^- = \left\{ \sum_{i=1}^{n} (v_{ij} - v_i^-)^2 \right\}^{\frac{1}{2}}, \quad j = 1, \ldots, m. \qquad (6)$$

(5) Calculate the relative closeness to the ideal solution. The relative closeness of the alternative A_j with respect to A^+ is defined as

$R_j = d_j^- / (d_j^+ + d_j^-), \quad j = 1, \ldots, m.$ Since $d_j^- \geqslant 0$ and $d_j^+ \geqslant 0$, then, clearly, $R_j \in [0, 1]$ (6).

Rank the preference order. The basic principle of the TOPSIS method is that the chosen alternative should have the "shortest distance" from the positive ideal solution and the "farthest distance" from the negative ideal solution. The TOPSIS method introduces two "reference" points, but it does not consider the relative importance of the distances from these points [8].

3. CASE STUDY

The number of studies on LIS s is increasing on the last decade, there is still a lack of attention on how to evaluate and select among these technologies in supply chain practices. This multi-dimensional evaluation problem should be solved taking several criteria into consideration. In this study we define five criteria to select the most proper IS for logistic. Four different Logistics Information Systems will be evaluated using TOPSIS. We set five criteria to evaluate four IS alternatives, below as Table 1:

Table 1. There are qualitative indices and quantitative indices in bidding, we need to standardize them.

Evaluation indices	Cost(C)	Customer Satisfaction(CS)	Multiple Use of Information(MUI)	Quality of Information(QI)	Completion Time(CT)days
LIS 1	100	Very satisfy	Advanced	Pass	50
LIS 2	85	Normal	Normal	Pass	45
LIS 3	100	Very satisfy	Advanced	Not pass	55
LIS 4	110	Very satisfy	Normal	Pass	50

All the evaluation indices are categorized in five classes, there are five indices that is worse, bad, normal, good, very good. We can score the indices according to the range of value of the evaluation indices, which is given in table 2 [9].

Table 2. The range of value of the evaluation indices

Worse	bad	normal	good	Very good
0-20	20-40	40-60	60-80	80-100

We normalize the original data and build normalized matrix, which is given as table 3.

Table 3. The normalized original data

Evaluation indices	Cost(C)	Customer Satisfaction(CS)	Multiple Use of Information(MUI)	Quality of Information(QI)	Completion Time(CT)days
LIS 1	100	100	90	80	50
LIS 2	85	85	70	80	45
LIS 3	100	100	90	50	55
LIS 4	110	95	70	80	50

At last we build ideal solution A^* and non-ideal solution A^- , the result is as follows.
A^* =0.11094, 0.15756, 0.08371, 0.1086, 0.08229
A^-=0.08572, 0.13392, 0.06511, 0.07884, 0.07330

At the end we calculate the indicate distances and relative closeness separately according to weighted normalized matrix ideal and non-ideal solutions, and rank alternatives according to the relative closeness in descending order, the result is given in table 5.

Table 5. The indicate distance, relative closeness and its order

Bidding LIS	d_j^+	d_j^-	R_j	Order
LIS 1	0.03976	0.14217	0.70814	2
LIS 2	0.12734	0.09411	0.42496	4
LIS 3	0.99381	0.11019	0.99811	1
LIS 4	0.68140	0.13311	0.66142	3

The result shows that: the best alternative is LIS 3 project having a greater closeness coefficient.

4. CONCLUSION

Information technologies contribute to organizations' basis and champion functions as marketing, logistic, selling, offering service, buying, human resource, management. It also rendered possible that producing the more qualified goods and services, decreasing the costs, increasing the performance and productivity and supplying the advantages of racing. It is clear that the selection of a LIS is a difficult and sensitive issue which has quantitative and qualitative aspects, complexity and imprecision.
In this paper, we have presented a framework to rank and select the most viable Logistic information technology provider. The TOPSIS method is used to compare alternatives and evaluation criteria of LIS systems.

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