Applied Soft Computing xxx (2015) xxx–xxx

Contents lists available at ScienceDirect

Applied Soft Computing

journal homepage: www.elsevier.com/locate/asoc

# An integrated intuitionistic fuzzy AHP and SWOT method for outsourcing reverse logistics

Madjid Tavana [a,b,*,1], Mohsen Zareinejad [c], Debora Di Caprio [d,e], Mohammad Amin Kaviani [c]

[a] Distinguished Chair of Business Systems and Analytics, La Salle University, Philadelphia, PA 19141, USA
[b] Business Information Systems, Department Faculty of Business Administration and Economics, University of Paderborn, D-33098 Paderborn, Germany
[c] Young Researchers and Elite Club, Shiraz Branch, Islamic Azad University, Shiraz, Iran
[d] Department of Mathematics and Statistics, York University, Toronto M3J 1P3, Canada
[e] Polo Tecnologico IISS G. Galilei, Via Cadorna 14, 39100 Bolzano, Italy

ARTICLE INFO

*Article history:*
Received 1 June 2015
Received in revised form 22 October 2015
Accepted 2 December 2015
Available online xxx

*Keywords:*
Reverse logistics
Decision making factors
Outsourcing
SWOT analysis
Intuitionistic fuzzy AHP

ABSTRACT

We consider the problem faced by a company that must outsource reverse logistics (RL) activities to third-party providers. Addressing RL outsourcing problems has become increasingly relevant issue in the management science and decision making literatures. The correct evaluation and ranking of the decision criteria/priorities determining the selection of the best third-party RL providers (3PRLPs) is essential for the competitive performance of the outsourcing company. The method proposed in this study allows to identify and classify these decision criteria. First, the relevant criteria and sub-criteria are identified using a SWOT analysis. Then, Intuitionistic Fuzzy AHP is used to evaluate the relative importance weights among the criteria and the corresponding sub-criteria. These relative weights are implemented in a novel extension of Mikhailov's fuzzy preference programming method to produce local weights for all criteria and sub-criteria. Finally, these local weights are used to assign a global weight to each sub-criterion and create a ranking. We discuss the results obtained by applying the proposed model to a case study of a real company. In particular, these results show that the most important priority for the company when delegating RL activities to 3PRLPs is to focus on the core business, while reducing costs constitutes one of its least important priorities.

© 2015 Published by Elsevier B.V.

## 1. Introduction

Reverse logistics (RL) is one of the key features of a company that affect customers' purchasing decisions in a competitive environment. RL can be defined as "the process of planning and implementing the efficient and cost effective control of the flow of raw materials, inventory being processed, final goods, and relevant information, from consumption point to origin point, aimed at reevaluation or proper disposal" [1]. RL is about the processing of returned goods, how to deal with these items properly and all the operations related to the reuse of goods and materials in order to improve the productivity, profitability, and efficiency of the company. Thus, RL involves all supply chain activities which occur in a reverse order: it is the process comprising the movement and transfer of goods and products that can be returned in the supply chain [2].

RL can increase the competitive advantage of the company by accepting returned goods and gaining customers' trust in purchasing decisions [3]. Immediate and effective RL can enhance customer satisfaction [4] which is highly important for maintaining and improving competitive advantages. However, as observed by Kannan et al. [5], Krumwiede and Sheu [6], and Meyer [7], RL processes can be remarkably complex.

Due to resource constraints, most companies are not able to control complicated networks and implement an effective RL plan. As a result, companies need to outsource part or all of their RL activities. Busi [8] simply defined outsourcing as the "strategic decision of an enterprise to prevent doing an activity in-house (p. 8)". In other words, outsourcing means subcontracting to a third party

* Corresponding author at: Distinguished Chair of Business Systems and Analytics, La Salle University, Philadelphia, PA 19141, USA. Tel.: +1 215 951 1129; fax: +1 267 295 2854.
*E-mail addresses:* tavana@lasalle.edu (M. Tavana), Mohsen.zareinejad@gmail.com (M. Zareinejad), dicaper@mathstat.yorku.ca, debora.dicaprio@istruzione.it (D. Di Caprio), aminkaviani1366@yahoo.com (M.A. Kaviani).
[1] http://tavana.us/.

http://dx.doi.org/10.1016/j.asoc.2015.12.005
1568-4946/© 2015 Published by Elsevier B.V.

UNCORRECTED PROOF

one or more of the operations that cannot adequately performed in-house [26]. In many cases, organizations choose other companies (or firms) to investigate RL advantages and problems, returned goods management, and customer service operations and, hence, delegate the relevant processes to them. These firms are known as "third-party RL providers" (3PRLPs). In this sense, outsourcing RL processes turn out to be particularly interesting from the strategic viewpoint [5,9].

Outsourcing, however, is not always successful [10] and it is actually profitable for the company only if it is done properly. A proper implementation of the outsourcing procedure is possible through a set of data analyses associated with the organization's strategies about risk taking, profitable outlooks, focus on core operations, strategic alignment, internal processes, external environment, human resources, etc. The correct evaluation and ranking of the decision criteria/priorities determining the selection of the best third-party RL providers (3PRLPs) is essential for the competitive performance of the outsourcing company.

Although outsourcing is being considered an important issue in several scientific fields, the number of studies concerning the analysis of outsourcing RL is very limited. Thus, despite the existence of some interesting and recent literature on outsourcing RL (see, for example [11–13]), the study of outsourcing RL decision making is still to be considered in its early stages. In particular, most of conducted studies discuss how to select 3PRLPs without proposing a detailed analysis of the strategic aspect of outsourcing RL.

### 1.1. Problem statement

We consider the problem of outsourcing RL activities faced by a company or organization that must sub-contract to a third party operations that cannot be adequately performed in-house. The company must decide which ones are the RL activities to outsource and to which third party so as to guarantee a competitive performance on the market.

In order to select the best third-party RL provider (3PRLP), the company managers need to correctly identify and evaluate the factors that play a relevant role in the outsourcing process and to rank the decision criteria (or priorities) that must be met by the available 3PRLPs. Thus, the problem becomes to design a suitable method that allows the managers to both identify and rank the factors (and the corresponding decision criteria) to refer to when taking RL outsourcing decisions. To the best of the authors' knowledge, there are no previous studies that attempt to identify the elements of success and/or failure in outsourcing RL decision making.

### 1.2. Contribution

In the current paper, we focus our attention on the identification and evaluation of the important factors affecting manages' decisions about outsourcing RL. The method we propose to rank the priorities of the outsourcing company combines Strengths-Weaknesses-Opportunities-Threats (SWOT) analysis with an Intuitionistic Fuzzy (IF) version of Analytic Hierarchy Process (AHP), where local weights of decision criteria and sub-criteria are obtained through a novel intuitionistic fuzzy extension of group preference programming.

The integrated method can be outlined as follows. First, we use a SWOT analysis to identify the criteria and sub-criteria that are considered relevant by the company when selecting a 3PRLP. Then, we use an Intuitionistic Fuzzy AHP (IF-AHP) to evaluate the relative importance weights among the criteria and the corresponding sub-criteria. The relative weights are given in terms of Tringular Intuitionistic Fuzzy Numbers (TIFNs), while the consistency rate (CR) of each comparison matrix is measured by the standard Chang's Method [14,15]. We implement the relative weights in an intuitionistic fuzzy preference programming (IFPP) model to produce local weights for all criteria and sub-criteria. Finally, as in AHP, local weights of sub-criteria are combined with those of the corresponding main criteria to produce global weights which are in turn used to rank all the sub-criteria. Fig. 1 provides a graphical representation of the phases just described.

The IFPP model that we use to derive the local priorities (local weights) from uncertain pair-wise comparison judgments (comparison matrices) expressed by TIFNs is an extension of the fuzzy preference programming (FPP) method proposed by Mikhailov [16], Mikhailov [17] to derive priority vectors from a set of crisp or interval comparisons. This novel expansion of the FPP model to an IF setting represents the main contribution of the paper from the technical point of view.

We discuss the results obtained by applying the proposed model to a case study of a real company. In particular, these results show that the most important priority for the company when delegating RL activities to 3PRLPs is to focus on the core business, while reducing costs constitutes one of the least important priorities.

The specific objectives of our research can be outlined as follows.

a) Designing an efficient methodology to determine and evaluate the main elements that play a role in successfully outsourcing RL activities.
b) Developing an effective analytic hierarchy process with intuitionistic fuzzy numbers supported by a verifiable IFPP method.
c) Synthesizing IF-AHP and SWOT so as to obtain an integrated method for analyzing strategic decision making processes.

The remainder of this paper is organized as follows. Section 2 presents a literature review on RL outsourcing, the key role it plays in attracting costumers in competitive environments and the reasons for RL outsourcing decisions. Section 3 discusses the methodology and tools that we employ to develop our method. In Section 4 we define the IFPP model that will be used for local rankings, while in Section 5 we explain how to integrate the IFPP model with AHP-SWOT. Section 6 shows the results obtained by applying the proposed method to a real case study. These results are discussed and interpreted in Section 7, while Section 8 presents our conclusion.

## 2. RL outsourcing and decision criteria: a literature review

Addressing RL outsourcing problems has become an increasingly relevant issue in the management science and decision making literatures (see, Oshri et al. [18] and Zhu [19], among the most recent work).

RL is a component of closed loop supply chains (CLSCs). CLSCs are a combination of forward supply chains and RL, usually organized and managed by the original equipment manufacturer that supports its own production line [20]. The RL component is often used to dispose of low consumption products. 3PRLPs have being showing their potential in this context especially in relation with and their involvement with the return of goods in international associations has expanded [4]. In fact, companies constantly have particular problems with accepting returned goods and recovering missing valuables. Thus, most of the existing research on the topic (Kannan et al., 2008; [5,9,21]) has focused on selecting and evaluating 3PRLPs for supply chains.

A proper implementation of RL operations increases both customers' satisfaction and competitiveness on the market [4]. This implementation depends on a correct choice of third-party providers when outsourcing RL so that the company can focus on other production activities and the efficiency of its supply chains increase.

UNCORRECTED PROOF

Please cite this article in press as: M. Tavana, et al., An integrated intuitionistic fuzzy AHP and SWOT method for outsourcing reverse logistics, Appl. Soft Comput. J. (2015), http://dx.doi.org/10.1016/j.asoc.2015.12.005

دریافت فوری ← متن کامل مقاله

ISIArticles
مرجع مقالات تخصصی ایران

✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
✓ امکان دانلود نسخه ترجمه شده مقالات
✓ پذیرش سفارش ترجمه تخصصی
✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
✓ دانلود فوری مقاله پس از پرداخت آنلاین
✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات