OUTSOURCING OR INSOURCING LOGISTICS ACTIVITIES: A BRAZILIAN CASE STUDY

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Studies point out that logistics outsourcing is a way to reduce costs, increase performance, increase quality of service and consequently improve consumer satisfaction. On the other hand, logistics insourcing has emerged as a counter-point of analysis since financial gains from centralized management may turn a company more competitive. Moreover, the decision between outsourcing and insourcing is a high complexity logistics procedure due to several criteria involved in the selection of the best alternative. This decision is also not easy to tackle when we consider the activities of a distribution center, where the governance structure in Brazil regarding logistics operations must consider a high use of workforce. On the other hand, over the past 15 years, outsourcing has shown a significant growth in industries around the world. This paper evaluates the logistics outsourcing of a Brazilian company. We apply methods based on multicriteria decision analysis (MCDA) as a methodological structure to provide a recommendation to the decision-maker on whether to insource or outsource the logistics operations within a distribution center. Although there are few
differences between the insourcing and outsourcing of logistics operations, benefits based on flexibility, working conditions, risks, reputation, innovation and responsiveness, encompassing much more than only costs, were crucial for the decision-making of sustaining insourcing of logistics activities.

Palavras-chave: outsourcing, insourcing, decision, logistics operation
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1. Introduction

According to Razzaque and Sheng (1998), the logistics activities that are most commonly outsourced include transportation, distribution, warehousing, inventory management, order processing and product handling. Hsiao et al. (2010) provide a classification in four levels of logistical activities that can be outsourced: the first level refers to basic activities such as transportation and storage; the second level refers to value addition activities, such as packaging; the third level refers to planning and control activities, such as inventory and transportation management; and the fourth level refers to the projection of a distribution network, which is at a strategic decision level, such as the location of a warehouse. Regardless of the level, the study of logistics outsourcing has been focused on reduction of costs, increasing of performance, increasing of service quality and consequent consumer satisfaction (ANDERSSON; NORRMAN, 2002; HWANG; CHEN; LIN, 2016; MURPHY; DALEY, 1997; QURESHI; KUMAR; KUMAR, 2007; YANG, 2014). On the other hand, logistics insourcing has emerged as a counter-point of analysis (GHOSE; MURPHY, 2012), since financial gains obtained from centralizing management may turn a company more competitive (HARTMAN; OGDEN; HAZEN, 2017), especially for large companies (REZAEISARAY; EBRAHIMNEJAD; KHALILI-DAMGHANI, 2016).

This paper is based on an empirical study that evaluates logistics outsourcing within the scope of a Distribution Center at a company located in the state of São Paulo, Brazil. A literature review is performed on the topic, evaluating the criteria for logistics outsourcing and applications through decision models. In this empirical study, an interview with high level managers of the organization is carried out. The application is performed using SMART (Simple Multi-Attention Rating Technique) according to the steps proposed by Goodwin and Wright, (2004), and weight elicitation is used according to the ROD (Rank Other Distribution) method proposed by Roberts and Goodwin (2002). At the end, to obtain a comparative analysis, the SMARTER method was applied following the recommendations from Edwards and Barron (1994), and sensitivity analyses are performed.
2. Literature review

2.1. Outsourcing logistics

In logistics, specifically, the decision to outsource or not an activity ends up considering the possibility of giving a greater added value to the company's activities, since with better logistics performance, the value perceived by customers increases (CHRISTOPHER, 1998). In this vein, the concept of Third Party Logistics (3PL) arises, that is, organizations specialized in a particular logistic activity to its customers, which typically is on contract basis (YANG, 2014). By outsourcing logistics activities to 3PL, a company can derive a number of benefits, such as cost reduction, performance improvement, focus on their core business, etc. (AGUEZZOUL, 2014). However, for the decision-maker to actually decide whether or not an activity should be outsourced, several criteria must be taken into account, and the decision-making criterion might not necessarily be reduction of cost (DAVID, 2009).

Qualitative and quantitative criteria can be considered in the 3PL selection process. Although there are several criteria presented in literature, and each criterion tends to be shaped according to cultural and regional characteristics (AGUEZZOUL, 2014; BOLUMOLE; FRANKEL; NASLUND, 2007; DAMME; AMSTEL, 1996), there are, however, overlap of some criteria that are too often cited by 3 or more authors, namely: minimum cost, reputation, delivery performance, financial stability, and quality of service.

In total, 42 different criteria were identified in the literature review, having been performed a qualitative analysis extraction, classifying them in the proposed study model. Thus, for this study, a combination of the selection criteria was used, dividing them into 5 categories. For criteria that did not fit any dimension, it was classified as "intangible". A summary of the criteria cited by each author can be followed in Table 1.
Table 1 - Criteria for 3PLs
<table>
<thead>
<tr>
<th>Criteria</th>
<th>Costs</th>
<th>Intangible</th>
<th>Performance</th>
<th>Quality Assurance</th>
<th>Service</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Continuous cost reduction</td>
<td>x</td>
<td>Cultural Compatibility</td>
<td>Capability</td>
<td>Commitment Matching</td>
</tr>
<tr>
<td></td>
<td>Minimum Cost</td>
<td>x</td>
<td>Flexibility in operation and</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>Operating and Pricing</td>
<td>x</td>
<td>Information sharing and trust</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>Price</td>
<td>x</td>
<td>Innovation</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>Operating and Pricing</td>
<td>x</td>
<td>Long-term relationship</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>Profitability</td>
<td>x</td>
<td>Past Experience</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Professionalism</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Reliability</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Reputation</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Responsiveness</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Word of mouth</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Capabilities</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Operational Performance</td>
<td>x</td>
<td>x</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Delivery Performance</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Performance Operation</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Document accuracy</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Experience</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Financial Stability</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Geographic spread and range</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>IT Capability</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Key performance indicators</td>
<td>x</td>
<td>x</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Problem solving capability</td>
<td>x</td>
<td>x</td>
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<td></td>
<td></td>
<td></td>
<td>Shipment error data</td>
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<td>x</td>
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<td></td>
<td></td>
<td></td>
<td>Size and Quality of Fixed</td>
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<td>x</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Transportation safety</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Track &amp; Trace</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Value add service</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

Citations:
- Hwang, Chen & Lin (2007)
- Andersson & Norrman, 2002
- Bhatnagar, Sohal, & Millen, 1999
- X. Yang, 2014
- Murphy, Dalev, 1997
- Qureshi, Kumar, & Kumar, 2007
- Qureshi, Kumar, & Kumar, 2008
2.2. Outsourcing or insourcing: decision models

The decision between outsourcing and insourcing is a highly complex logistics procedure. It is characterized by multiple objectives whose trade-offs must be evaluated regarding their main reasons (cost, quality, focus on the main activity, flexibility and innovation), which are commonly conflicting and result from the fact that a company is not able to achieve them all if one of its activities is outsourced (DABHILKAR, 2011). The criteria can be quantitative and qualitative. Hence, to decide between outsourcing and insourcing an activity implies an approach based on decision analysis techniques, such as a Multi-Criteria Decision Analysis (MCDA) problem, which considers quantitative and qualitative factors as well as simultaneous assessment criteria (Attari et al., 2012). MCDA is a methodological structure that aims to provide a recommendation for decision-makers with a finite range of alternatives (actions, objects, solutions or candidates), being evaluated from multiple points of view, called criteria (attributes, resources or objectives) (AGUEZZOUL, 2014; CHAI; LIU; NGAI, 2013).

Approaches based on MCDA have been widely applied to suppliers selection, the main used methods being: analytic hierarchy process (AHP), analytic network process (ANP), case-based reasoning (CBR), data envelopment analysis (DEA), fuzzy set theory, genetic algorithm (GA), mathematical programming, simple multi-attribute rating technique (SMART), and their hybrids (AGUEZZOUL, 2014; CHAI; LIU; NGAI, 2013; HO; XU; DEY, 2010). SMART is a prominent methodology because its analysis incorporates a wide variety of quantitative and qualitative criteria (CHOU; CHANG, 2008), and Aguezzoul (2014) recommends its use in subjects related to outsourcing decisions, since, in this case, its occurrence is reduced when compared to methodologies like AHP or DEA.

According to Goodwin & Wright (2004), SMART was created in 1971 and, due to its simplicity, it guarantees a transparent analysis to improve understanding of the problems faced by decision-makers. However, a key point in developing a multi-criteria decision model...
to select the recommended alternative is the weight attainment criteria (BARRON; BARRETT, 1996a, 1996b). To avoid MCDA weight attribution difficulties, the use of rank-based weight substitution, like ROC (Rank Order Centroid), RS (Rank Sum), RR (Rank Reciprocal) and ROD (Rank Order Distribution) has been used, leading to a satisfactory result approximation of the standard method (for example: point allocation) (BARRON; BARRETT, 1996a, 1996b; EDWARDS; BARRON, 1994; ROBERTS; GOODWIN, 2002). According to Roberts and Goodwin (2002), ROD performs better, mainly when there is an increased number of alternatives and criteria under analysis. The criteria weight for the ROD method, as a function of their quantity, can be observed in Roberts and Goodwin (2002).

The combination of SMART with simpler weight attribution methodologies was proposed by Edwards and Barron (1994), when combining SMARTS (using swing weight) and ROC, which was called SMARTER (SMART Exploiting Ranks). However, SMARTER not only differs in characteristics because of the use of ROC, but also because of the use of linear value functions to evaluate the given alternatives for the criteria (GOODWIN; WRIGHT, 2004). Hence, SMARTER is a simpler use of SMART, but the combination of SMART and ROD can be equally simple, and its application on real decision cases can aid the DM’s in complex situations as outsource or insource their logistics operations.

3. Methodology approach

This work uses a single study case with a descriptive approach to comprehend the criteria adopted by a company in the decision process of insourcing or keeping part of its distribution logistics operation outsourced. This method is appropriate when the focus is the study of contemporary phenomena like the outsourcing decision, through detailed reporting of the processes of the company that could result in new and creative perceptions about the phenomenon and achieve high enforceability with professionals (FLYNN et al., 1990; VOSS; TSIKRIKTIS; FROHLICH, 2002; YIN, 2001).

The W company is located in the countryside of the state of São Paulo, Brazil. It is a chemical industry with average annual income around US$ 350,000,000.00 disclosing 300 SKUs into the market, with distribution based on six outsourced subsidiaries spread over the country. In this context, it recently faced the issue of outsourcing or insourcing part of its distribution
operations. Thus, the objective of this study is to evaluate logistics outsourcing by checking and prioritizing the criteria with which the W company (through a single case study) considers in the decision process between insourcing or outsourcing its distribution logistics operations. The research respected the eight steps showed on the flow diagram of Figure 1.

During **Step 1**, it was performed a bibliographic survey, leading to better familiarity with the subject, as well as the gathering of the most common criteria adopted in the decision process of outsourcing a certain logistics activity. During **Steps 2 and 3**, the study case data were acquired from documents and from interviews and questionnaires taken from three participants of the decision process (see Tables A1, A2 - Appendix), in order to get higher accuracy of the information obtained and to collect facts that are not contained on the analyzed documents and, in this way, guarantee some validity and reliability through triangulation (VOSS; TSIKRIKTSIS; FROHLICH, 2002; YIN, 2001). It was interviewed: the operations general manager, the logistics manager and the logistics supervisor. At **Step 4**, the criteria surveyed in Step 1 and the criteria identified in Steps 2 and 3 were compared. At **step 5**, the decision model tree was structured with the criteria and sub-criteria selected in the last step. The chosen method was the SMARTS (Simple Multi-Attribute Rating Technique using Swing weight) and its structuring was built with recommendations from Goodwin & Wright (2004). Model evaluation was performed in **Step 6** by interviewing the decision makers about tree structure, criteria and sub-criteria. In sequence, Decision Maker 1 (DM1) was asked to evaluate the criteria and sub-criteria in respect to his order of preference. Afterwards, according to the ROD (Rank Other Distribution) weight table (ROBERTS; GOODWIN, 2002) the criteria and sub-criteria received their weights. At **Step 7**, also through interviews at
a later stage from step 6, it was demanded of DM1 to evaluate the alternatives (insourcing or outsourcing) within the sub-criteria listed on the model. At Step 8, it was done a sensitivity analysis to verify step 7 decision robustness as described by Goodwin and Wright (2004). To increase the reliability in ours results, it was performed a comparison between the model applied with two others methods: SMARTER following recommendations from Edwards and Barron (1994). To perform steps 5 to 8, it was used VISA (Visual Interactive Sensitivity Analysis) software to SMART+ROD and SMARTER.

3.1. Criteria evaluation

According to Aguezzoul (2014), the criteria often used to select suppliers are, in this order: cost, relationship/cooperation, services, quality, information system/equipment, flexibility and delivery capability. The authors also mention others: professionalism, financial statement, hedge and reputation. Ho et al. (2010) also report that, for logistics suppliers/operator selection, the most common criteria are, in this order: quality, delivery capability, price/cost, production capability, services, management, technology, research and development, finances, flexibility, reputation, relationship, risks, safety and environment.

For this study, after the literature review and the decision maker’s considerations, including weights related to criteria, four main criteria were identified and branched in 22 sub-criteria (see Figure 2).

Figure 2 – Decision tree model
To evaluate this criterion, it was considered the financial report drew up by the company controllership department in comparison with the costs informed by an outsourced logistics operator. Therefore, it was done an income statement in order to compare all the intrinsic to the insourcing or outsourcing process. In possession of the global results, an average index was obtained by the ratio between the cost of each option and the relative weight of the cargo to be shipped and stocked in each case, all information was provided by the company Business Intelligence system, and this was defined as price. Such criterion is widely used in logistics cost analysis (Turkensteen, 2011).

In relation to the minimum cost and profitability sub-criteria, it was considered, respectively, the fixed cost necessary to handle each offer and the monetary difference that can be achieved when changing to the lower cost system (insourcing).
For the return sub-criterion, it was weighted a five grade qualitative scale, being: very bad (very low or almost zero return), bad (low return), regular (expected return), good (over expected return) and very good (really over expected return).

- **Benefits**

For this criterion, six sub-criteria were evaluated, within a qualitative scale based on the decision-maker’s opinions. Their weights were also attributed respecting the opinion of the most experienced professional. Among the evaluated sub-criteria are: Flexibility, Working Conditions, Risks, Reputation, Innovation, and Responsiveness. The scales adopted for such criteria are: very bad, bad, regular, good and very good.

For the Flexibility criterion, it was evaluated how much flexibility there is in the insourcing and outsourcing operation. In the working conditions criterion, it was compared the number of labor lawsuits related to working conditions, which was divided by the number of employees of each logistic operator and the company. Risks were measured in two ways: firstly the legal risks inherent to each operation and, secondly, work risks, comparing each alternative according to its characteristics. Reputation was applied by the decision makers using the reputation perceived by the client, through use of satisfaction surveys previously performed by the company. Finally, the innovation and responsiveness criteria were based on the perception of the respondents (decision-makers) who judged the performance according to the current characteristics of the hired logistic operator in comparison with the performance of the organization.

- **Performance**

For this criterion, 3 sub-criteria directly related to the logistics operation performance of a distribution center were considered, namely: operational performance, delivery performance and capability. To measure operational performance, it was considered the number of pallets received and shipped at the expected time, according to the information provided by the current company logistics operator. For the potential scenario of insourcing the distribution
center, it was considered the plant average reception and dispatch, also considering the potential risks inherent to management inexperience.

- **Service**
  For the service criterion, which evaluates the service level of an operation, 5 sub-criteria were considered, branched in additional 4 evaluation sub-criteria, which are: quality; stock accuracy; service effectiveness; lead time, surge capacity, deadline, deadline offered, expansion and opening of new DC’s. The scales considered for such sub-criteria were: very bad, bad, regular, good and very good, respecting their weight in the global analysis within the most experienced decision maker’s decision.

4. Results and discussion

4.1. Company current scenario

Currently, the company concentrates its production in 8 production plants, all located at the same site in the city of Sorocaba. All feedstock reception, stocking and supplying is local. Finished products are firstly stocked in an internal DC, and then distributed to the subsidiaries located in the states of Paraná (PR), Rio Grande do Sul (RS), Santa Catarina (SC), Mato Grosso (MT), Bahia (BA), São Paulo (SP) and Goiás (GO), and then delivered to the costumers through outsourced transportation (see Figure 2). In the industrial complex, there is enough room to build more DCs.

Figure 3 - Macro operating flow of the studied company
4.2 – Results and Sensitivity Analysis
The weight of each criterion and sub-criterion was obtained through Steps 7 and 8, respecting DM1’s opinions (Figure 4). The benefits and costs criteria displayed high weight, being succeeded by performance and service.

It was observed that the insourcing alternative was the recommendation to be implemented, with a general score of 60 points (Table 2). The insourcing alternative had a better
performance in the costs (9 points) and benefits (25 points) criteria, but tied with outsourcing in the performance (17 points) and service (9 points) criteria, suggesting the well-known conflictive trade-off pointed out by Dabhilkar (2011), costs against benefits in outsourcing decisions. However, it is important to note that the application of the proposed model for this analysis is influenced by market trends and the experiences and knowledge of the decision maker, and other contour conditions, such as a group of decision makers, which can change the result as pointed out by (GOODWIN; WRIGHT, 2004).

<table>
<thead>
<tr>
<th>Method</th>
<th>Alternative</th>
<th>Costs</th>
<th>Benefits</th>
<th>Performance</th>
<th>Service</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMART+ROD</td>
<td>Insourcing</td>
<td>9</td>
<td>25</td>
<td>17</td>
<td>9</td>
<td>60</td>
</tr>
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<td></td>
<td>Outsourcing</td>
<td>3</td>
<td>21</td>
<td>17</td>
<td>9</td>
<td>49</td>
</tr>
<tr>
<td>SMARTER</td>
<td>Insourcing</td>
<td>8</td>
<td>26</td>
<td>13</td>
<td>6</td>
<td>53</td>
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<td>2</td>
<td>28</td>
<td>13</td>
<td>6</td>
<td>49</td>
</tr>
</tbody>
</table>

Source: elaborated by the authors

(GOODWIN; WRIGHT, 2004) describe that sensitivity analysis is used to examine how robust the choice of an alternative is to changes, in the figures used in the analysis. Therefore, sensitivity analysis was performed between the sub-criterion Risks (the second most weighted) and the criterion Benefits (the most weighted). Thus, the Risks weights ranged from 0 to 100, and the results can be seen in Figure 5a. To obtain a change in the alternative chosen for the Benefit criteria, it is necessary that the Risks weight get higher than 0.38 points. However, in order for outsourcing alternative to become more attractive than insourcing, it is necessary that the Risks weight overcomes the 0.51 units as it can be seen in figure 5b, that is, a jump of 0.21 units from the current weight (0.29).

Figure 5 – Sensibility analysis
To verify alternative performances and increase reliability of the model proposed (SMART + ROD), the SMARTER model was applied, considering the same criteria and sub-criteria, respecting DM1’s preferences. Figure 5 demonstrates that the ROC method of elicitation produces a higher value of the Risks criterion, given the higher importance attributed to this criterion over other ones. Even though the insource alternative was superior than outsourcing, considering the sum of all criteria, the difference was of 53 against 49 points. In the SMART+ROD method, the Performance and Service criteria remained tied in the SMARTER method, thus confirming the trade-off pointed out by Dabhikar (2011). Despite differences in the final weights in both methods, Roberts and Goodwin (2002) state that ROD overcomes ROC because it offers a better approximation to the original weights when determined without any initial restrictions, as occurs in the direct rating method, being then normalized, which is the common procedure in SMARiTS analysis.

5. Conclusions
To assist in the decision-making of company W between outsourcing their DC activities or not, a decision structure with 4 criteria and 22 sub-criteria (qualitative and quantitative) was created, taking the literature and considerations of company W employees related decision-making into account. Evaluation of the criteria showed that costs are not always the most relevant criteria, in agreement with the studies by Ho et al. (2010) and Rezaeisaray et al. (2016). A SMARTS decision model was applied with the ROD elicitation weight method due to its ease of application in relation to swing weight, commonly applied in SMARTS. The
comparison with SMARTER showed that the applied model is viable and provides a robust choice.

This way, the W company decided to build and maintain a distribution center, insourcing all of its operation. Based on financial analysis and CSCF, this kind of investment would generate return in 5.7 years. In practice, however, the investment in the distribution center generated return in 2.4 years, also achieving flexibility and quality improvements of the delivered material. Nevertheless, the score difference between insourcing and outsourcing an operation is not so significant (11 points), and their benefits are characterized as the key point for decision-making. We suggest careful evaluation of its impacts and gains throughout the whole operation.

For future research, the adoption of grouping weights allied to SMARTS is welcome, if this decision is strategic, and if the opinion of more managers are considered in order to avoid some bias from one decision maker. Mathematical aggregation seems to be the best way to do this (GOODWIN; WRIGHT, 2004). Still, the model can be improved by using direct rating together with the value functions for criteria such as service level and risks, in order to better assess the alternatives according to the decision makers’ preferences.
REFERENCES


GOODWIN, P.; WRIGHT, G. Decision Analysis for Management Judgment. [s.l: s.n.]. v. 49


**ATTACHMENTS:**

Table A1 – Characterization of the interviewees

<table>
<thead>
<tr>
<th>Decision Makers</th>
<th>DM1</th>
<th>DM2</th>
<th>DM3</th>
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<tbody>
<tr>
<td>Age (years)</td>
<td>51</td>
<td>46</td>
<td>41</td>
</tr>
<tr>
<td>Experience (years)</td>
<td>29</td>
<td>23</td>
<td>17</td>
</tr>
<tr>
<td>Current Position/Time (years)</td>
<td>General Manager of Logistics Operation /3</td>
<td>Logistics Manager/2</td>
<td>Logistics Supervisor/3</td>
</tr>
<tr>
<td>Main Function</td>
<td>Warehouse Management Planning Management Cost Reduction Projects</td>
<td>Production Planning Inventory Management Freight Management</td>
<td>Warehouse Management Inventory Management Production Planning</td>
</tr>
<tr>
<td>Previous Experience/Time (years)</td>
<td>Finance Manager/2 Operations Manager/8 Road and Rail Project Manager/3</td>
<td>Business Analyst/8 Logistics Supervisor/4</td>
<td>Logistics Analyst/5 Cost Analyst/3</td>
</tr>
<tr>
<td>Interview Duration</td>
<td>5 h</td>
<td>3 h</td>
<td>3 h</td>
</tr>
</tbody>
</table>

Source: elaborated by the authors
Table A2 - Questionnaire applied to DM’s

**SURVEY – Step 3**
1 – Could you give us a short brief of your curriculum, as well as the position that you currently assume in the company?
2 – How are the current processes in the company logistics department?
3 – Are these processes outsourced or is the company responsible for their effectiveness?
4 – Considering a potential outsourcing of the company distribution center, which criteria would be evaluated for this decision?
5 – Which external factors would you consider relevant for further studies to outsource the distribution department?

**SURVEY – Step 6**
1 – Within this criteria tree (previously drawn up, based on the existing literature and on specialists’ opinions), do you agree or disagree with the criteria selected for evaluating a potential outsourcing of the distribution center?
2 – If you disagree, what are the reasons?
3 – Would you add any other criterion in this analysis? If yes, which one and why?

**SURVEY – Step 7**
1 - In your opinion, and based on your previous experience, how do you evaluate the criteria and sub-criteria mentioned below, considering the following alternatives: outsourcing or insourcing?
2 - According to the chosen alternative (outsourcing or insourcing) and based on the criteria tree in annex, what would be your final decision, considering the company you are currently working for?
   – Would you add any other criterion in this analysis? If yes, which one and why?

Source: elaborated by the authors