

Strategic Global Sourcing 2022

Assignment report

**SOURCING STRATEGY EVALUATION:
THE DISTRILIMPIEZA ANDRINA SA CASE STUDY**

Liliana-Alice Canter

Francesca Romeo

Sara Safari

Abstract

Successful supplier relationships require a lot of effort, information and incentives on both sides. To reach such goals companies need to define some strategies they can adopt to improve the management of their suppliers throughout the duration of their contract.

The objective of this paper is to investigate the sourcing strategy and the supplier evaluation and selection process within the company *Marketer Distrilimpieza Andina SA*. Subsequently, some improvements that could be implemented were proposed.

To conduct this study a quantitative approach was adopted, using a real database containing information about orders, products and suppliers.

After informing the reader about the main theoretical concepts, the study presents a section entitled *discussion* where the results of the analysis can be found.

Finally, there is a general commentary including limitations and future opportunities.

Keywords: Supplier selection, Krajlic Model, AHP, Circular Procurement

Introduction

In today's modern companies, the procurement of materials, processes, and services plays an increasingly decisive role in the creation of the product offered to the end customer, establishing a strong dependence of the company's performance on that of its suppliers. In fact, a company's ability to supply products and services with high-quality content is strongly influenced by the ability of suppliers to contribute to these results. The rising complexity of technological and market variables has made simple price bargaining inconvenient, leading to the need for management in terms of time, service, total cost, and quality as well. Increased attention is being paid to supplier management strategies in the definition of company policies, and procurement is no longer considered simply as a "purchasing" function, but it is often managed in strategic terms and with the support of top management. Supplier selection initially consists of defining the qualification criteria according to which the supplier will be selected, for instance costs, delivery lead time, post-sale assistance or quality standard. Therefore, suppliers' management and selection represent both an element of risk and opportunity for the company.

The objective of this paper is to determine the sourcing strategy for the company "**Marketer Distrilimpieza Andina SA**" and to perform its supplier evaluation and selection.

To this end, the document has been organised as follows. The first section consists in the analysis of the results of the literature review process, performed using Scopus and Google Scholar as databases. This is followed by the definition of the framework adopted for the study and the presentation of the research methodology. The next section consists of a presentation of the results of the group analysis, with the help of the numerical available data. Finally, a general discussion including limitations and future opportunities is presented to the reader.

Research Question

How can “Marketer Distrilimpieza Andina SA” select their suppliers and improve the sourcing process?

Literature review

Through the literature review, the main theoretical concepts relevant for the writing of this paper have been analysed. Each topic has its own dedicated section as follows.

MCDM

Decision-making is a daily practice, where one will choose from many alternatives the best one. The concept is being explained since Benjamin Franklin and suffered different modification throughout the years, constantly being improved (S. Dhiman and Deb 2020). The purchasing, production and distribution of raw materials and finished goods is called supply chain (SC). In supply chain management (SCM) the planning, controlling and implementing all the SC systems take place. Usually, all the systems are very complex and all the processes involved need decision-making methods (Lu, Liao et al. 2021). The MCDM methods, besides solving financial problems, are commonly used in supplier selection. Also, there are different methods available based on different algorithms that can maybe find a precise solution or sometimes can find almost precise solutions (Borissova 2021). Beside the benefits, there can be downfalls as well. A common issue is that when there are too many criteria, might be difficult to identify quantitative data needed (Liu and Ren 2021). When using a decision-making method some terminology must be known. There are alternatives, which can be intangible or tangible, and can be translated as the choices a company has, like suppliers and materials. The decision criteria are some parameters based on which the analysis takes place, like quality or lead time. Finally, there is the criteria weight, which is the actual numerical value given to all criteria (S. Dhiman and Deb 2020).

The Analytic Hierarchical Process (AHP) is a MCDM method were a problem and its possible solutions are defined. Afterwards, some criteria are selected based on which the possible solutions will be compared (Saaty and Zoffer 2012). It consists of several steps. As mentioned before, the first step would be to set a goal that needs to be solved. After that, all alternatives to solve this goal have to be considered. Then, the criteria important for the analysis should be identified. The alternatives will be prioritized in relation with each other, for each criteria chosen. It is important to consider a sensitivity analysis at the end of the AHP process because the weights each criteria receives are influencing the results very much. It would be good to see how different the results are when other weights are given (S. Dhiman and Deb 2020) (Mu 2018).

Circular procurement

Literature has produced significant insights into supplier involvement in the circular economy. The upstream supply chain is important for moving to circularity. It is not anymore enough to look only at cost, buy one need to include also the social and environment aspects into it when

looking into procurement. (Pouikli 2020) In this regard, Kannan, Mina et al. (2020) proposed a framework of circular supplier selection based on social, economic, environmental, and circular criteria (Nag, Sharma et al. 2021). Although many countries focus more on circular procurement, it is important to understand, what are the main drivers for doing so. This happens because of the environmental concern or cost effectiveness (Sharma and Foropon 2019). The increase of resources used led among other things to the global warming problems that we face nowadays. When it comes to practices regarding circular procurement not so many were found concerning the supply chains. According to Van Weele (2002), procurement is a complex function that includes a series of activities following the product throughout all its cycle from the supplier up to the customer. Such activities also include the management of internal processes, for instance, quality control, inbound inspections or stock management. Within the procurement department, the supplier selection is a key function.

Supplier selection

The goal of supplier selection function is to choose the suppliers that can better fit the company's supply needs at a reasonable cost. Consequently, the supplier selection process consists in reviewing, evaluating, and choosing the right suppliers to make them part of the company's supply chain. However, to define the best suppliers, many varied factors must be considered. That is why, the supplier selection decision is a multi-criteria decision-making (MCDM) problem which includes both quantitative and qualitative factors such as flexibility, service, culture. According to Sonmez (2006), the main criticality related to supplier selection process is that there is not a universal ideal way to perform it and organisations use a variety of different methods. Additionally, the degree of effort associated with this activity depends on the importance of the good or service required. From an operative standpoint, the four steps of the supplier selection process are the following (Sonmez, 2006):

1. *Problem definition*
2. *Definition of criteria*
3. *Supplier's qualification*
4. *Final choice*

Supply chain Management

Supply Chain Management is essential to enhance the competitive advantage of a company. Indeed, it allows to integrate suppliers into the company processes, improving their flexibility (Gunasekaran, 2004). Due to increase in technology evolution rate and competition, it gets always harder for companies to gain high profits on their products. That is the reason many companies choose outsourcing as purchasing strategy. Indeed, purchasing represents a great share of cost in the whole supply chain, even around 50% or more depending on the sector the firm is working in (Gadde et al., 2010). Therefore, companies have shifted their focus on the minimization of the total cost (Gadde et al., 2010), especially by exploiting their suppliers' capabilities. All this has consequently led to the development of rising important and strategic relationships with suppliers. To do so, particular attention was paid to defining and evaluating

the supply network, as well as to developing strategies to better manage such a supply base. Various models have been developed for this purpose, but the undoubtedly the most significant ones are those concerning purchasing portfolios in the context of strategic purchasing. Among these, the **Kraljic matrix** stands out in terms of relevance, as discussed more in detail in the next section.

Kraljic Matrix

Regarding purchasing portfolio models, the Kraljic matrix is probably the most used tool (Gelderman, 2003). It is based on a fundamental distinction, namely that between strategic impact, internal to the company, and supply risk, external to the company. According to Kraljic (1983), it is possible to better understand what bargain power of the company has, to reduce its risk exposure and at the same time to adopt the most appropriate strategy with respect to its product portfolio. On the one hand, the strategic impact is determined by the impact that the purchased item (in value or volume) has on the company's production and economic environment (costs and profitability), in terms of added value per product line, % of raw material/component costs on the total cost of the final product, potential business growth and dependency. On the other hand, the complexity of the supply market is measured by the balance conditions between supply and demand, the number of suppliers (e.g., existence of monopoly conditions), the availability of substitute or alternative products or services, the cost of switching suppliers, or a high pace of technological progress, which make supply in that market risky. Considering a company's product portfolio, these can be grouped into four categories, considering the above-mentioned two dimensions: leverage, strategic, non-critical and bottleneck, as shown in Figure 1.

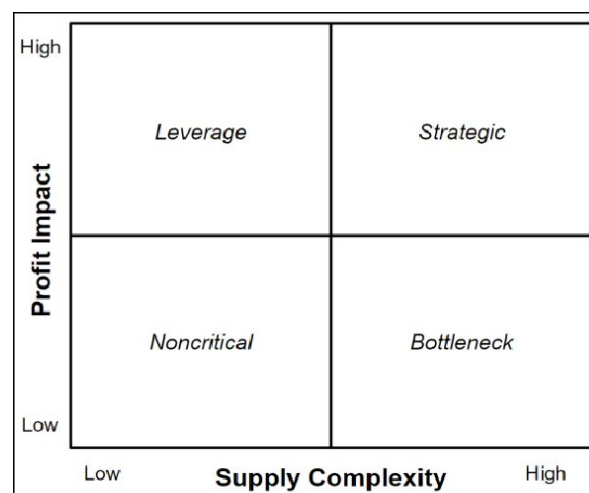


Figure 1 Kraljic Matrix

Leverage items are important for the company - with high profit impact - but easily available, being in low-risk markets and with abundant supply (non-turbulent supply markets). For these types of components, the company tends to maximise its bargaining power by selecting suppliers, continuously searching for substitutes, negotiating on price and optimising physical flows.

Strategic items are crucial for the company both in terms of economic impact and the conditions of supply from complex and/or risky markets. For such products, the focus is on long-term with continuous monitoring of the market situation, technical developments, evaluation of "make or

buy", creation of alternatives and development of stable relations, i.e., strategic partnership, and collaboration with the supplier.

Non-critical items have a minimal impact on the company and are found in abundance and/or in low-risk markets. In this case, the real advantage for the company is not in the price, but in the simplicity of the relationship and the reduction of transaction costs. It is important to standardize products and supplies to simplify purchasing management and optimise volumes and stock management.

Bottleneck items are the ones with a low-profit impact in economic terms but where the continuity of supply is at risk. The management of these components is aimed at creating medium to long-term partnerships between customer and supplier to guarantee supply, with less emphasis on cost. However, over time, certain limitations of this tool have been highlighted, such as the fact that the classification of the items and their positioning within the quadrants of the matrix is subjective, making the model inaccurate (Ritter, 2000; Cox, 2001) or that selecting dimensions and assigning relative weights can be hard and imprecise (Gelderman, 2003).

Research Framework

The proposed framework of this paper is presented in Figure 2 - Proposed Framework. For its developments two articles, Kannan (2018) and Shankar, Kumar et al. (2016) stood as foundation.

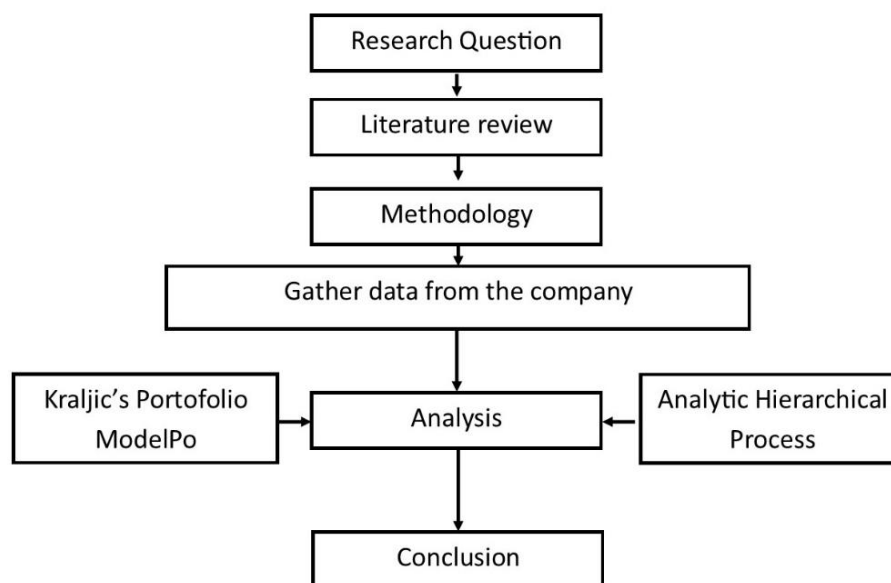


Figure 2 - Proposed Framework

The research questions were developed and established based on an area of research decided in the beginning. A literature review based on the research scope was done. Information about

how the search itself was conducted is introduced in the Research Methodology section. This paper focuses on analysing the *Marketer Distrilimpieza's* sourcing strategy. *Marketer Distrilimpieza Andina SA* is a company created in 1998 with the intention of meeting the needs of the retail market in the center of Colombia, considering three main aspects: quality, service and fair price. The level of sales has grown a lot since the hard discount stores began to be served in 2017. The company has made considerable efforts to ensure delivery levels to customers, which has made it invest several times in expanding warehouse space and generating a very robust logistics operations model. Today it is a recognized marketer that serves both the national retail market and hard discount stores. The operating model includes a main plant in the center of the country from where Bogotá is served. From there, other own distribution centers are served in other cities located in Cali (South-West), Medellín (East), Cartagena (North). Distribution to intermediate cities is done through affiliated marketers.

The current methodology was established followed by data collection from the company. The dataset range back to 2017 and was provided by a spanish Logistics and Operations coordinator, who has worked for years in Colombia. An analysis of the case will be done, based on product portfolio model, supplier selection and further improvements. In the end the conclusions and limitations will be discussed.

Research Methodology

Two sections, literature review and data gathering comprise the research methodology.

Literature review

Scopus and Google Scholar were established as databases from where to select the articles needed. Then some keywords were identified to be applied in the search. In Table 1 a summary of the search is shown. It is to be mentioned that more searches were done, but if no article was selected, they were not included in the summary.

Search Summary

<i>Keywords</i>	Limit to: English and not before 2019		Title	Abstract
<i>circular AND procurement</i>	180	97	17	5
<i>multi-criteria decision-making AND overview</i>	160	51	8	5
<i>analytic Hierarchical Process AND supplier selection</i>	45	32	6	3
<i>kraljic AND matrix AND (procurement or sourcing)</i>	24	12	7	4
<i>supply AND sourcing OR procurement AND strateg*</i>	3,671	970	26	12
<i>supplier AND select* AND strateg*</i>	3,015	728	35	10

Table 1 Search summary

The keywords applied, are in the first column for each topic. They are followed by the number of articles found. Two limitations were applied first, which are shown in the third column. The articles language should be only in English and their date of publication not older than 2019. The second and the third limitation was done based on title and abstract. A total of 21 articles is selected, based on the used limitations. More searches were conducted that are not mentioned. Table 1 serves as an example. Still when it comes to the evaluation of adequacy the number will be narrowed down. The literature review includes the following sub sections: circular procurement, multi-criteria decision-making, overview, analytic hierarchical process, supplier selection.

Hypothetic Interview protocol

The interview would have been realized based on the research questions established, and the literature review. A protocol to be followed would have been developed as a first step. The respondents would be employees from the sourcing, purchasing and warehouse logistics departments. The number of interviewed persons should have been between 5 and 10, maybe even more for a better accuracy of the data gathering. A period of maximum one month would have been chosen due to the limited amount of time for the research. Questions related with the data needed, like prioritization of criteria, lead times from suppliers, rate of return, respected delivery dates and so on would have been constructed. The data gathered for this report is qualitative and quantitative.

Solution methodology

The analysis is done using Kraljic's Portfolio Model and Analytic Hierarchical Process for evaluation and selection of the suppliers.

Discussion

Sourcing and strategic determination

The analysis was developed from a given initial database, whose main features are shown in Appendix 1A. In addition to this, a database of suppliers was also given, as shown in Appendix 1B. The analysis has been developed on a sample of 394 orders, from 15 different suppliers. Orders were analysed by category. Therefore, the conducted study and the differentiation in the Kraljic matrix was done on 20 different type of products. These categories are shown in Figure 3 Pareto Analysis. Pareto analysis is a useful tool to indicate the priority of actions to be performed. In fact, it makes it possible to prioritize purchases and direct efforts to the products with the greatest spending impact. The Pareto analysis focuses on the expense categories that have the greatest impact on total purchase costs, thus making purchasing activities more efficient. Starting from the Pareto analysis, shown in Figure 3, ABC analysis was developed. ABC Analysis allows inventory/purchasing managers to segregate and manage the overall inventory/suppliers into three major groups. The results obtained in the ABC analysis are shown in Table 2.

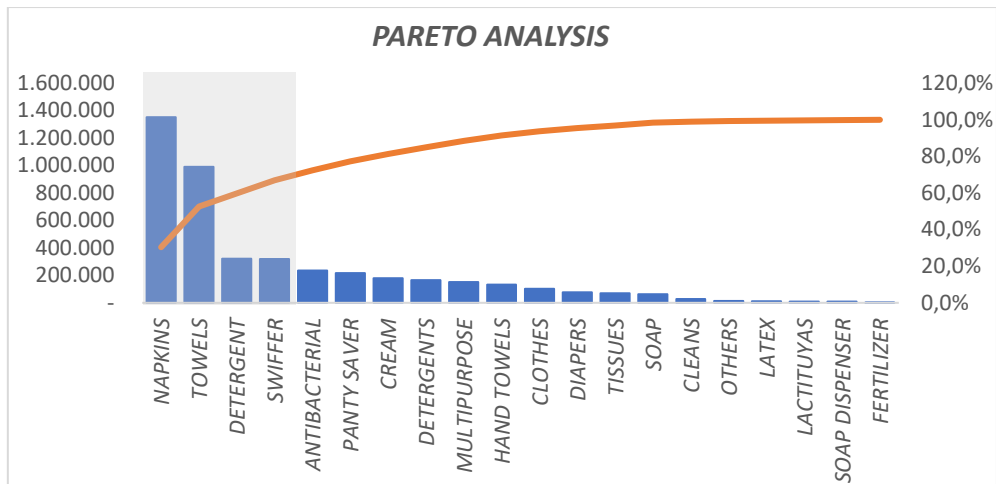


Figure 3 Pareto Analysis

A	B	C
2.982.758	1.084.124	381.181
12.250.394.243	7.205.441.444	2.444.356.146
55,9%	32,9%	11,2%

Table 2 ABC analysis

The ABC analysis, however, doesn't say anything else about the actions to be taken in order to reduce supply risk. It is necessary to use a strategic tool that focuses on 100% of total purchasing costs and indicates what actions to perform to reduce supply risk. As a matter of fact, companies need to consider multiple aspects: risks related to the supply chain, the value of spending, and supply strategies. From these considerations, a Kraljic matrix was developed. The financial impact of the purchased category is measured in terms of the economic impact each category has on the company's profit. In the following analysis, supply risk was measured as a weighted average of 6 main characteristics:

- 1) **Lead time**, constituting 30% of the supply risk
- 2) **Standard deviation of lead time**, constituting 10% of the supply risk
- 3) **Supplier qualification**, constituting 30% of the supply risk
- 4) **Geographic localization**, constituting 10% of the supply risk
- 5) **Numbers of suppliers**, constituting 10% of the supply risk
- 6) **Logistic complexity**, constituting 10% of the supply risk

From these considerations, the analysis was divided into 3 stages. The first stage involved the aggregation of data using a Pivot table and the development of Pareto analysis and ABC analysis. The second stage involved the determination of supply risk and financial impact. The third phase involved the development of the matrix.

Phase 1

Starting from the initial data, a Pivot table was created containing the purchasing order values for the first six months. Alongside these values, other values were given, as shown in Figure 4.

CATEGORY	Purchase quantity	Purchase value	Average Lead time	Average lead time standard devia	Average qualification
ANTIBACTERIAL	235489	1340604156	10,00	0,70	96,05
CREAM	180260	1232059958	19,50	1,84	96,07
DETERGENT	322048	2755701033	20,00	0,60	90,18
SOAP DISPENSER	8293	47506398	45,00	0,10	94,64
NAPKINS	1351353	2382566222	16,27	1,13	93,46
SOAP	62640	310363210	10,00	0,70	96,88
LACTITUYAS	9964	38638766	5,00	2,50	95,62
LATEX	10874	75269970	10,00	0,70	94,14
CLEANS	27935	254973235	5,00	2,50	95,62
FERTILIZER	2341	14324579	5,00	2,50	95,62
MULTIPURPOSE	152114	988751337	17,78	0,64	91,71
OTHERS	12666	111318232	5,00	2,50	95,62
DIAPERS	76206	329137962	7,00	1,90	93,33
CLOTHES	101670	777455912	11,94	0,88	96,21
TISSUES	68592	485367882	9,39	0,97	96,41
PANTY SAVER	217336	1101997749	10,00	0,70	94,14
DETERGENTS	166075	1329642346	18,00	0,64	91,56
SWIFFER	319204	2266579995	20,00	1,90	96,04
HAND TOWELS	132850	1212385898	10,00	0,70	96,05
TOWELS	990153	4845546993	28,64	2,32	94,69

Figure 4 Pivot table

From the analysis of the cumulative percentage of orders, first the Pareto analysis, and then the ABC analysis, were developed. After this analysis, financial impact and supply risk were assessed in Phase 2.

Phase 2

To develop the analysis, it was necessary to determine the values of the two axes of the Kraljic matrix: financial impact and supply risk. The financial impact was determined from the impact of purchasing value on sales. The values in the column “Purchasing value” were ordered on a decreasing scale and each of them was assigned a value proportional to the financial one. Supply risk was determined based on the six criteria previously mentioned and by means of a weighted average of the values obtained on a rating scale of 1 to 9, where 1 represents the lowest risk and 9 represents the highest one.

Phase 3

After obtaining the values for financial impact and supply risk, a Kraljic matrix was developed, as shown in Figure 5.

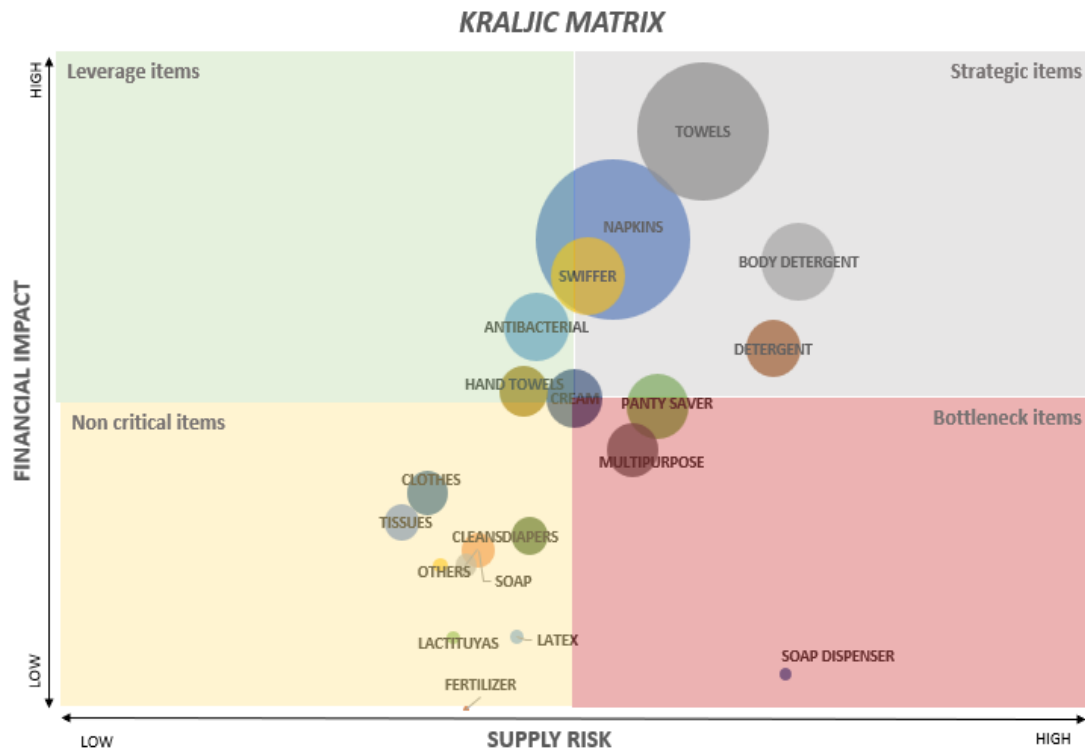


Figure 5 Kraljic matrix of the products categories

Group A articles are those with the highest annual consumption value. Indeed, they constitute 55.9 % of the total purchasing order. Since they generate most of the profit, these articles deserve to be monitored regularly and stored in safer areas. There are four types of products in category A: napkins, towels, body detergent, and swiffers. The matrix shows that category A products are positioned in the strategic quadrant. In particular, body detergents have a supply risk of 6,8. This is due to inadequate lead time and the qualification of suppliers. In fact, the average lead for the category is 20, and supplier qualification is 90%. It would be appropriate to contract with suppliers with the aim of shortening the lead time or using more qualified suppliers. Likewise, the other Group A categories should re-evaluate suppliers with higher qualifications. The results of the supply risk assessment are shown in APPENDIX 1C.

Category B accounts for 32.9% of the value of total orders. What emerges is that even for product category B, the supply risk is medium to high. Products such as antibacterial, panty savers, cream, detergents, and multipurpose should reduce their supply risk. Since lead time accounts for 30% of the impact of supply risk, it is particularly important that this value is low. It can be contracted with suppliers to lower the lead time from 19 to 10 days. Antibacterial, detergents, hands' towels, and panty saver should instead source from local or national suppliers. The logistic complexity of antibacterial, panty savers, cream, and detergent should also be decreased. The strategy for class B codes must look to continued competition among alternative sources as the most effective means of obtaining the best possible supply. It would be appropriate for class B codes to belong to the leverage quadrant of the matrix.

Class C codes account for 11% of the purchasing order. It can be seen from the matrix that class C product categories have typically a lower supply risk than class A and B products.

Almost all class C items belong to the non-critical item quadrant. The standard features of this type of procurement reduce its complexity from a supply market perspective; therefore, the procurement strategy for this type of supply should aim to seek maximum efficiency in the procurement process to minimize the expenditure of resources.

Panty savers, multipurpose items, and soap dispensers belongs to the bottleneck quadrant. Products and services that belong to the bottleneck quadrant have a low level of impact on the company's profit but are indispensable to ensure the continuation of the business. Disruption of the supply of these products/services could have serious consequences for the company, which must secure the supply or protect itself in case it is lacking. This situation leads to the generation of high volumes of inventories and/or supply contracts with significant penalties for breach or rupture of contract; the management of these components is aimed at creating medium- to long-term collaborative relationships between customer and supplier to ensure continuity of supply

Supplier evaluation and selection

The supplier selection and evaluation could have been done using the Quality Function Deployment (QFD) and AHP. The first one is focusing on customer needs, however data about customers was not provided. It is proposed in the next section, “Further Improvements”, that the company should take the QFD-AHP approach into consideration.

Since the number of suppliers and products is relatively high, the AHP analysis will be done only for one product, and it can serve as an example to be applied to all products. Based on the analysis performed in the previous section, the product chosen for AHP is part of category A of products, and strategic quarter, namely towels. Three suppliers are providing towels for the company. The comparison between the suppliers and the criteria is made based on the scale shown in Table 3 from S. Dhiman and Deb (2020).

Scale	Importance
1	Equal importance
3	Moderate importance
5	Strong importance
7	Very strong importance
9	Absolute importance
2, 4, 6, 8	Compromise between 1, 3, 5, 7, 9

Table 3 Scale for AHP

The values start from one, which means that two alternatives have equal importance and go until nine. There can be values between the odd ones used when a compromise is made between two alternatives.

The criteria chosen for the analysis was done by the company as well as its prioritization. There are three criteria. First, delivery, which refers to the quantity received and if it is the same with the one ordered. Second there is the quality, which refers to the number of returns on each

order. Third, the punctuality, which refers to the date of delivery and if the expected date is the same with the actual delivery date. All three alternatives are compared with each other for each criterion. As an example, the comparison regarding quality is presented in Table 4.

Pairwise comparison of alternatives for Quality criteria			
	The towel house	Towels manufacturer	The country towels
The towel house	1	0,25	0,2
Towels manufacturer	4	1	0,333333333
The country towels	5	3	1

Table 4 Pairwise comparison of alternatives for Quality criteria

The Towel House has the largest number of returns. By comparison, the *Towels Manufacturer* has four times less returns, while *The Country Towels* have five time less. By normalizing the table and calculating the average per row, the priorities are obtained. For the same example, Table 5 includes the obtained priorities also.

Normalization				
	The towel house	Towels manufacturer	The country towels	Average
The towel house	0,1	0,058823529	0,130434783	0,096419437
Towels manufacturer	0,4	0,235294118	0,217391304	0,284228474
The country towels	0,5	0,705882353	0,652173913	0,619352089
Sum	1	1	1	1

Table 5 Normalization for quality criteria

The weighting of the criteria was done by the company, as mentioned before and it is presented in Table 6. The most important one is delivery, followed by punctuality and quality.

Pairwise comparison of criteria			
	Delivery	Quality	Punctuality
Delivery	1	4	2
Quality	0,25	1	3
Punctuality	0,5	0,333333333	1

Table 6 Comparison of criteria

Same as for the alternatives a normalization is done in Table 7.

Normalization				
	Delivery	Quality	Punctuality	Average
Delivery	0,571428571	0,5	0,6	0,557142857
Quality	0,142857143	0,125	0,1	0,122619048
Punctuality	0,285714286	0,375	0,3	0,320238095
Sum	1	1	1	1

Table 7 Normalization of criteria

The rest of the calculations can be seen in Appendix: 1D. Once the comparison is done between alternatives and criteria, it must be checked whether the rating given is consistent or not. It cannot be that no inconsistency will exist. In this case the method calculates how much inconsistency is allowed. This is called consistency ratio (CR). The consistency index from the table regarding this rating, is compared with a random-like consistency index (RI), which is expected to be highly inconsistent. The values for the RI, are calculated by Saaty and Zoffer (2012) for different matrices of different sizes. In this case, for a size three matrix the RI is 0.58. The consistency ratio is the division between consistency index and a random-like matrix. If the value resulted is above 0.10, the analysis should be redone. If the value is under 0.10 it can be proceeded with the analysis. A summary with the CR for each criteria and their comparison is shown in Table 8 (Mu 2018).

Consistency ratio				
	Delivery	Quality	Punctuality	Comparison
CR	0,070082	0,074734	0,028083	0,015797

Table 8 Consistency ratio results

For each comparison, the CR is below 0.10, so the analysis can be continued. The average computed in the normalization tables for each alternative is multiplied with the average for each criterion. The results are presented in Table 9.

Global Weights			
Criteria	The towel house	Towels manufacturer	The country towels
Delivery	0,031614025	0,361373515	0,164155317
Quality	0,01182286	0,034851825	0,075944363
Punctuality	0,027324123	0,068286979	0,224626993
Score	0,070761007	0,464512319	0,464726674
Rank	3	2	1

Table 9 Global weights

In this case, the results are very similar for alternative two and three. A distinction could be done, by the supplier's location, but in this case, they are both located locally. One important aspect to be considered is that the suppliers do not deliver the same products or quantities, which can lead to misinterpretation of their actual performance. It is suggested that the three criteria should be calculated as a ratio per 100 items for example, so the comparison could be more accurate. Also, maybe they should prioritize the criteria differently. A sensitivity analysis is done, where the three criteria has the weights changed. Quality will become first in prioritization followed by delivery and punctuality. The results are shown in Table 10.

Global Weights			
Criteria	The towel house	Towels manufacturer	The country towels
Delivery	0,013589274	0,155336244	0,07056209
Quality	0,060090978	0,177138214	0,385995537
Punctuality	0,011713987	0,029274968	0,096298709
Score	0,085394239	0,361749425	0,552856336
Rank	3	2	1

Table 10 Global weights

The ranking is not changed, since the best supplier would be *The Country Towels*. However now third supplier is almost 20% ahead than the second compared to the previous analysis, when there was almost no difference. The rest of the calculations can be seen in Appendix: 1E. As mentioned before, it has to be considered that the third supplier delivers very few items compared to the other two, so in the end there is a possibility for one of the first two suppliers to perform better.

Further improvements

The interviews should include employees from customer relations, or marketing departments as well, if a QFD and AHP methods would have been applied. In this case qualitative data would have been gathered besides quantitative regarding the other factors considered for analysis of the suppliers.

The AHP analysis should consider more criteria for supplier selection and the company should consider including criteria related to sustainability and circularity. They could perform an analysis to identify the main drivers, barriers and practices regarding procurement, sourcing and develop some criteria for evaluation. The same could be done in relation with their customers, so an QFD-AHP analysis could be performed.

Additionally, for products residing in the routine quadrant of the Kraljic's matrix the company should consider starting the adoption of electronic and/or automated procurement systems to simplify the process. Indeed, an outdated purchase order process has an impact on employee productivity and the organisation's bottom line. Automated systems give purchasing departments total control (and traceability) of the purchase order cycle and the ability to quickly turn employee requests into purchase orders. In addition to this, not only will an eProcurement

platform reduce expenses through an accessible and intuitive system, but it will track business costs in real time and improve overall business performance. Indeed, the use of eProcurement software, firstly, brings together all supplier information and documentation in a digital register and, secondly, in the most advanced and powerful platforms, Artificial Intelligence technologies can replace the document verification activity that is usually the most time-consuming and energy-consuming step for the procurement department.

Furtherly, given that for the company, accuracy in quantity delivered and punctuality of delivery are the main criteria in the supplier selection process and considering that the products with the highest purchasing volume are mainly located within the strategic quadrant of Kraljic's matrix, what the company could do is to undertake a process of continuous improvement together with its suppliers, perhaps supported by the use of Lean Six Sigma methodology.

Obviously different levels of supplier involvement, sharing of improvement results to suit each supply chain may exist and this requires a paradigm shift in the buyer-supplier relations. Such a project can be implemented with different levels of relationship, progressively more integrated, for example:

- commercial contractual: the relationship is based on sporadic meetings where basic conditions of price and service are defined;
- specific improvement actions: the relationship evolves to address specific improvement issues (often originating from problems encountered with the product, or the need for a timely reduction in the cost of supply);
- lean kaizen improvement path: systematic integration of processes and sharing of improvement objectives over a multi-year time horizon.

However, it is important to highlight that all this must be supported by the development of a well-defined and agreed set of metrics to track suppliers' performances and progress, including savings achieved.

Conclusion

The main limitations of this report are represented by the characteristics of the data themselves on which the analysis was formulated.

Indeed, the numerical data used for computations refer to a limited period of time (only six months), are not recent and pertain to a very specific sales sector, namely the retail sector.

Given these limitations, it was not possible, for example, to consider how the advent of the pandemic impacted supplies or how they were modified to cope with such a dramatic change.

In addition to this, the lack of qualitative data, concerning specific customer requirements, limited the conduct of the analysis.

As far as future opportunities for this study are concerned, it would be interesting to see whether the selection criteria for selecting suppliers are changing over time. For instance, it is possible that the buyer's requirements will change, leading simply to different weights being assigned

to the same criteria, or completely new criteria could be introduced, concerning, for example, the supplier's performance in terms of circularity or sustainability.

Another opportunity for the future could be to conduct the analysis again using a different method (e.g., risk based, TCO based, etc...) to check whether the results obtained coincide or possibly investigate the reasons for potential differences. To do so, however, would require the integration of any missing information in the current database.

What is certainly possible to conclude is that supplier selection is one of the most important activities for companies and has a substantial impact on the efficiency and effectiveness of the entire supply chain, especially if considering that purchased content is more than 55 per cent of revenues of the finished product. Therefore, a correct supplier selection can lead to lower purchasing costs and better quality of the final product.

In conclusion, improving supplier selection and management for a company means ensuring that the supply chain is always functional and efficient to guarantee business continuity.

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APPENDIX 1A

ID	DESCRIPCION	GRUPO	PROVEEDOR	LEAD TIME	CALIFICACION	DESVEST_LT	INV.Inicial	VALOR	COSTO UNIDAD
60240	ANTIBACTERIAL	ANTIBACTERIAL	TOALLAS EL PAISA	10	96,05208333	0,7	20007,972	2958	2550
60230	ANTIBACTERIAL	ANTIBACTERIAL	TOALLAS EL PAISA	10	96,05208333	0,7	16894,089	6567,92	5662
60100	ANTIBACTERIAL	ANTIBACTERIAL	TOALLAS EL PAISA	10	96,05208333	0,7	18062,919	3198,12	2757
60140	ANTIBACTERIAL	ANTIBACTERIAL	TOALLAS EL PAISA	10	96,05208333	0,7	13531,455	11661,48	10053
60180	ANTIBACTERIAL	ANTIBACTERIAL	TOALLAS EL PAISA	10	96,05208333	0,7	12257,73	12474,64	10754
60370	ANTIBACTERIAL	ANTIBACTERIAL	TOALLAS EL PAISA	10	96,05208333	0,7	24950,025	4825,6	4160
60210	ANTIBACTERIAL	ANTIBACTERIAL	TOALLAS EL PAISA	10	96,05208333	0,7	7273,719	6624,76	5711
60170	ANTIBACTERIAL	ANTIBACTERIAL	TOALLAS EL PAISA	10	96,05208333	0,7	4147,848	3627,32	3127
60570	ANTIBACTERIAL	ANTIBACTERIAL	TOALLAS EL PAISA	10	96,05208333	0,7	3809,187	3977,64	3429
60220	ANTIBACTERIAL	ANTIBACTERIAL	TOALLAS EL PAISA	10	96,05208333	0,7	3278,29842	8587,48	7403
60300	ANTIBACTERIAL	ANTIBACTERIAL	TOALLAS EL PAISA	10	96,05208333	0,7	3248,748	13179,92	11362
60310	ANTIBACTERIAL	ANTIBACTERIAL	TOALLAS EL PAISA	10	96,05208333	0,7	2235,762	3457,96	2981

VENTENE	VENTFEB	VENTMAR	VENTABR	VENTMAY	VENTJUN	.2	COMPRASENE	COMPRASFEB	COMPRASMAR	COMPRASABR	COMPRASMAY
6048,945	6669,324	4359,636	4486,509	3876,12	3992,4036	.	7154	6501	6779	5360	9107
4938,057	4148,847	4120,875	5631,363	4814,181	4958,60643	.	7200	8893	7368	6892	5262
3858,138	6020,973	4610,385	3331,665	2915,082	3002,53446	.	5553	4337	4967	7034	5264
3918,078	4510,485	3901,095	3505,491	3369,627	3470,71581	.	6724	6582	4674	6397	4800
2931,066	4085,91	2681,316	2720,277	2349,648	2420,13744	.	4004	3815	2853	3087	2980
0	0	8316,675	333,666	1428,57	1471,4271	.	2016	2391	2934	3636	1788
1685,313	2424,573	1973,025	2017,98	1500,498	1545,51294	.	1863	1830	1827	3473	1659
256,743	71	1382,616	1301,697	812,187	836,55261	.	1259	854	1100	656	1473
226,773	599,4	692,307	1269,729	193	198,79	.	480	428	559	875	667
0	5	319,68	679,32	1060,938	1092,76614	.	592	561	872	806	826
167	944,055	1082,916	184	360,639	371,45817	.	450	787	596	690	555
562,437	745,254	477,522	243,756	514,485	529,91955	.	498	695	547	964	708
0	0	0	594,405	1001,997	1032,05691	.	686	363	497	719	652
942,057	797,202	460,539	52	17	17,51	.	643	643	417	443	468

TOTALVENT	PROMVENT	DEVESTVETAS	%DESVESTVENTAS	VALORVEN	TOTCOMP	PROMCOM	DESVECOM	%DESVCOMP	VALORCOMPRAS
29432,9376	4905,4896	1164,940407	0,237476888	87062629,42	39754	6625,666667	1497,962839	0,226084848	101372700
28611,92943	4768,654905	568,3127974	0,119176751	187920863,5	44177	7362,833333	1299,318039	0,176469843	250130174
23738,77746	3956,46291	1190,320118	0,300854613	75919458,97	33440	5573,333333	962,5255668	0,172701956	92194080
22675,49181	3779,248635	425,8526462	0,112681828	264429794,2	35641	5940,166667	939,425445	0,158147994	358298973
17188,35444	2864,72574	634,5329673	0,221498679	214418533,8	19781	3296,833333	484,7520672	0,147035661	212724874
11550,3381	1925,05635	3201,539452	1,663088694	55737311,54	14866	2477,666667	691,1065523	0,278934435	61842560
11146,90194	1857,81699	350,7437119	0,188793468	73845550,1	13954	2325,666667	827,3402363	0,355743258	79691294
4660,79561	776,7992683	532,1588905	0,685066158	16906197,13	6350	1058,333333	289,8652561	0,273888431	19856450
3179,999	529,9998333	422,746873	0,79763586	12648891,22	3941	656,8333333	208,145542	0,316892477	13513689
3157,70414	526,2840233	494,2821061	0,939192687	27116721,15	4405	734,1666667	128,8261102	0,175472568	32610215
3110,06817	518,344695	395,3849338	0,762783795	40990449,68	3729	621,5	116,1356965	0,18686355	42368898
3073,37355	512,228925	161,5065736	0,315301549	10627602,8	4321	720,1666667	187,2104876	0,259954391	12880901
2628,45891	438,076485	504,1806655	1,150896436	20013716,97	3290	548,3333333	159,0920069	0,290137399	21595560

IS1	IS2	ROP	QMAX	Q/2	IR	NE	.4	Location	Suppliers	Logistic
2791,07	2429,837	4417,199	28507,05	14716,47	20,92403	175,3062	.	Internationa	1	7,5
2149,082	1434,408	3729,852	17139,65	14305,96	30,74092	108,426	.	Internationa	1	7,5
2501,855	2372,087	3813,389	26554,39	11869,39	19,53916	202,4681	.	Internationa	1	7,5
1678,642	1096,432	2931,432	12155,48	11337,75	36,4657	97,02727	.	Internationa	1	7,5
1584,166	1343,716	2533,799	13163,98	8594,177	32,83678	138,6218	.	Internationa	1	7,5
3839,68	5466,359	4477,82	42754,17	5775,169	16,74181	669,9808	.	Internationa	1	7,5
966,5946	771,5066	1582,446	10258,49	5573,451	19,27044	166,5742	.	Internationa	1	7,5
789,6614	956,5032	1047,164	11166,09	2330,398	9,220455	433,6305	.	Internationa	1	7,5
598,4374	750,7166	774,128	8813,137	1590	7,975458	501,6284	.	Internationa	1	7,5
668,7409	867,9585	843,1997	8315,666	1578,852	11,67745	476,655	.	Internationa	1	7,5
567,2119	704,5013	739,0389	6687,264	1555,034	14,35723	389,186	.	Internationa	1	7,5
331,3062	319,2742	501,1059	6150,426	1536,687	7,3105	362,2167	.	Internationa	1	7,5
649,3994	874,989	794,6181	8311,246	1314,229	10,03213	572,3261	.	Internationa	1	7,5
542,776	724,7659	669,0914	7047,041	1143,154	9,771973	557,8927	.	Internationa	1	7,5

APPENDIX 1B

ODC	REF	DESCRIPTION	CATEGORY	SUPPLIER	LEAD TIM	Date. Source. C	Expected Delivery Date	Actual Delivery Da
100001	40016	NNORMAL 4(12NNX10)+IRX10+PNX10	TOWELS	THE TOWEL HOUSE	60	05/01/2020	05/03/2020	05/03/2020
100058	40460	TH YOURS INVIS RAPIS 24X10	TOWELS	THE TOWEL HOUSE	60	25/01/2020	25/03/2020	20/03/2020
100057	43200	DAILY PROTECTIVE TOWEL 12X80	TAMPONS	CLAIRE	10	25/01/2020	04/02/2020	04/02/2020
100058	40470	TH YOURS PLUS RAPIS 24X10	TOWELS	THE TOWEL HOUSE	60	25/01/2020	25/03/2020	25/03/2020
100057	43725	NOS.JOURNALS INV.LAR.20X36+36	TAMPONS	CLAIRE	10	25/01/2020	04/02/2020	04/02/2020
100001	40270	TH US GOOD NIGHT 18X10	TOWELS	THE TOWEL HOUSE	60	05/01/2020	05/03/2020	05/03/2020
100001	41190	NOS.PLUS 4X(12X10)+I.RAP.X10	TOWELS	THE TOWEL HOUSE	60	05/01/2020	05/03/2020	05/03/2020
100001	42010	TH YOURS MATERNITY 24X10	TOWELS	THE TOWEL HOUSE	60	05/01/2020	05/03/2020	05/03/2020
100001	40010	TH YOURS NORMAL 48X10	TOWELS	THE TOWEL HOUSE	60	05/01/2020	05/03/2020	05/03/2020
100001	42060	TH YOURS BASIC 24X10	TOWELS	THE TOWEL HOUSE	60	05/01/2020	05/03/2020	05/03/2020
100057	43290	DAILY TIME PROTECTOR NOR 36X15	TAMPONS	CLAIRE	10	25/01/2020	04/02/2020	04/02/2020
100001	41196	NOS.PLUS(DIST)4X(12X10+2IRGX10	TOWELS	THE TOWEL HOUSE	60	05/01/2020	05/03/2020	05/03/2020
100001	40273	NOS.B.NIGHTS RAP.18X10	TOWELS	THE TOWEL HOUSE	60	05/01/2020	05/03/2020	05/03/2020

SUPPLIER	LEAD TIM	Date. Source. C	Expected Delivery Date	Actual Delivery Da	Quantity	Qty Receive	returns	ncidental d
THE TOWEL HOUSE	60	05/01/2020	05/03/2020	05/03/2020	14.860	16.217	3	0
THE TOWEL HOUSE	60	25/01/2020	25/03/2020	20/03/2020	13.233	13.233	12	5
CLAIRE	10	25/01/2020	04/02/2020	04/02/2020	13.244	13.244	4	0
THE TOWEL HOUSE	60	25/01/2020	25/03/2020	25/03/2020	7.576	7.576	7	0
CLAIRE	10	25/01/2020	04/02/2020	04/02/2020	12	2	0	0
THE TOWEL HOUSE	60	05/01/2020	05/03/2020	05/03/2020	8.905	5	0	0
THE TOWEL HOUSE	60	05/01/2020	05/03/2020	05/03/2020	5.639	5.639	0	0
THE TOWEL HOUSE	60	05/01/2020	05/03/2020	05/03/2020	4.098	4.098	4	0
THE TOWEL HOUSE	60	05/01/2020	05/03/2020	05/03/2020	3.998	988	0	0
THE TOWEL HOUSE	60	05/01/2020	05/03/2020	05/03/2020	4.154	3.706	0	0
CLAIRE	10	25/01/2020	04/02/2020	04/02/2020	3.553	3.553	3	0
THE TOWEL HOUSE	60	05/01/2020	05/03/2020	05/03/2020	4.620	4.620	1	0

APPENDIX 1C

X	Y			
SUPPLY RISK	FINANCIAL IMPACT	QTY		
5,4	7,5	1.351.353		NAPKINS
6,1	9,0	990.153		TOWELS
6,8	7,2	322.048		BODY DETERGENT
5,2	7,0	319.204		SWIFFER
4,8	6,3	235.489		ANTIBACTERIAL
5,7	5,2	217.336		PANTY SAVER
5,1	5,3	180.260		CREAM
6,6	6,0	166.075		DETERGENT
5,5	4,6	152.114		MULTIPURPOSE
4,7	5,4	132.850		HAND TOWELS
3,9	4,0	101.670		CLOTHES
4,7	3,4	76.206		DIAPERS
3,7	3,6	68.592		TISSUES
4,3	3,2	62.640		SOAP
4,2	3,0	27.935		CLEANS
4,0	2,2	12.666		OTHERS
4,6	2,0	10.874		LATEX
4,1	1,8	9.964		LACTITUYAS
6,7	1,5	8.293		SOAP DISPENSER
4,2	1,0	2.341		FERTILIZER

APPENDIX 1D

Pairwise comparison of alternatives for Delivery criteria			
	The towel house	Towels manufacturer	The country towels
The towel house	1	0,142857143	0,111111111
Towels manufacturer	7	1	3
The country towels	9	0,333333333	1
	The towel house	Towels manufacturer	The country towels
The towel house	1	0,111111111	0,142857143
Towels manufacturer	9	1	3
The country towels	7	0,333333333	1
Sum	17	1,444444444	4,142857143
Pairwise comparison of alternatives for Quality criteria			
	The towel house	Towels manufacturer	The country towels
The towel house	1	0,25	0,2
Towels manufacturer	4	1	0,333333333
The country towels	5	3	1
	The towel house	Towels manufacturer	The country towels
The towel house	1	0,25	0,2
Towels manufacturer	4	1	0,333333333
The country towels	5	3	1
Sum	10	4,25	1,533333333
Pairwise comparison of alternatives for punctuality criteria			
	The towel house	Towels manufacturer	The country towels
The towel house	1	0,2	0,111111111
Towels manufacturer	5	1	0,142857143
The country towels	9	7	1
	The towel house	Towels manufacturer	The country towels
The towel house	1	0,333333333	0,142857143
Towels manufacturer	3	1	0,25
The country towels	7	4	1
Sum	11	5,333333333	1,392857143

Pairwise comparison of criteria			
	Delivery	Quality	Punctuality
Delivery	1	4	2
Quality	0,25	1	3
Punctuality	0,5	0,333333333	1
	Delivery	Quality	Punctuality
Delivery	1	4	2
Quality	0,25	1	0,333333333
Punctuality	0,5	3	1
Sum	1,75	8	3,333333333

Normalization				
	The towel house	Towels manufacturer	The country towels	Average
The towel house	0,058823529	0,076923077	0,034482759	0,056743122
Towels manufacturer	0,529411765	0,692307692	0,724137931	0,648619129
The country towels	0,411764706	0,230769231	0,24137931	0,294637749
Sum	1	1	1	1

Normalization				
	The towel house	Towels manufacturer	The country towels	Average
The towel house	0,1	0,058823529	0,130434783	0,096419437
Towels manufacturer	0,4	0,235294118	0,217391304	0,284228474
The country towels	0,5	0,705882353	0,652173913	0,619352089
Sum	1	1	1	1

Normalization				
	The towel house	Towels manufacturer	The country towels	Average
The towel house	0,090909091	0,0625	0,102564103	0,085324398
Towels manufacturer	0,272727273	0,1875	0,179487179	0,213238151
The country towels	0,636363636	0,75	0,717948718	0,701437451
Sum	1	1	1	1

Normalization				
	Delivery	Quality	Punctuality	Average
Delivery	0,571428571	0,5	0,6	0,557142857
Quality	0,142857143	0,125	0,1	0,122619048
Punctuality	0,285714286	0,375	0,3	0,320238095
Sum	1	1	1	1

Criteria	Priority	Local weights			Global Weights		
		The towel house	Towels manufacturer	The country towels	The towel house	Towels manufacturer	The country towels
Delivery	0,557143	0,056743122	0,648619129	0,294637749	0,031614025	0,361373515	0,164155317
Quality	0,122619	0,096419437	0,284228474	0,619352089	0,01182286	0,034851825	0,075944363
Punctuality	0,320238	0,085324398	0,213238151	0,701437451	0,027324123	0,068286979	0,224626993
				Score	0,070761007	0,464512319	0,464726674
				Rank	3	2	1

APPENDIX 1E

Pairwise comparison of criteria			
	Delivery	Quality	Punctuality
Delivery	1	0,333333333	2
Quality	3	1	4
Punctuality	0,5	0,25	1
	Delivery	Quality	Punctuality
Delivery	1	0,333333333	2
Quality	3	1	4
Punctuality	0,5	0,25	1
Sum	4,5	1,583333333	7

Normalization				
	Delivery	Quality	Punctuality	Average
Delivery	0,222222222	0,210526316	0,285714286	0,239487608
Quality	0,666666667	0,631578947	0,571428571	0,623224728
Punctuality	0,111111111	0,157894737	0,142857143	0,137287664
Sum	1	1	1	1

Criteria	Priority	Local weights			Global Weights		
		The towel house	Towels manufacturer	The country towels	The towel house	Towels manufacturer	The country towels
Delivery	0,239488	0,056743122	0,648619129	0,294637749	0,013589274	0,155336244	0,07056209
Quality	0,623225	0,096419437	0,284228474	0,619352089	0,060090978	0,177138214	0,385995537
Punctuality	0,137288	0,085324398	0,213238151	0,701437451	0,011713987	0,029274968	0,096298709
				Score	0,085394239	0,361749425	0,552856336
				Rank	3	2	1