

Developing Regional Strategies Based on Tourist Behaviour Analysis: A Multiple Criteria Approach



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Abstract Tourism is a vital sector of the Greek economy that undoubtedly needs support for its strategic planning. In this work, we provide policy makers with a strategic plan for a touristic destination strategy. Our recommendations have a regional scope and are results of a large survey that was conducted at the airports of the island of Crete. Having collected more than 5000 questionnaires, we applied a multiple criteria customer satisfaction methodology to assess tourists' satisfaction. This multiple criteria analysis is combined with some demographic statistics, as well as it is followed-up by a loyalty analysis. Eventually, we were able to deliver a strategic plan with the shape of a SWOT analysis. This plan confirms that tourists visiting Crete are heterogeneous, yet the competitive advantage of the destination is unanimously its environment, and the dominant patterns of the touristic product should not be challenged. However, the plan also suggests marginal improvements that could contribute to improving tourists' satisfaction.

1 Introduction

Tourism is a vital sector of the Greek economy and a major contributor of its economic development. Recent studies (published periodically at <http://www.insete.gr>—a non-profit civil partnership supported by the national professional body of the tourism sector) estimate that the direct contribution of tourism to the Greek gross domestic product (GDP) is around 9%. Should we consider the indirect effects to the national economy, the overall contribution of tourism is estimated at more than

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20% of the GDP. In particular, for certain regions (Crete, South Aegean, Ionian), tourism contributes more than 50% to the regional GDP, making tourism the most critical economic activity.

The need to support this critical sector with effective strategic planning is therefore quite straightforward. However, it is not clear what should be the focus of such a strategy design. Historically, the focus was on individual touristic organizations (e.g., hotels) (Ward 1998). Later, the concept of touristic destination emerged as the principal element (Wang and Pizam 2011), while governmental efforts push to widen the scope at a national level (Witt et al. 2013). There are two main reasons that make the touristic destination level more suitable for this work: First, the global trend that indicate that destinations are the biggest brands in the travel industry (Chaperon 2017; Morgan et al. 2011), and second, country-specific circumstances. More specifically, Greece is a country where the importance of tourism varies significantly across regions. Moreover, due to political turbulences, a national strategic plan is not yet established, allowing regions to take initiative on the touristic strategy design.

Focusing on touristic destinations, a critical competitive advantage for the corresponding regions is tourists' satisfaction (Fuchs and Weiermair 2004). Tourist satisfaction itself, for a particular destination, can be improved by harmonizing tourists' expectations with the destination's performance (Kozak 2002). The importance of service quality evaluation in general, and of the tourism product in particular, through customer satisfaction measurement is reinforced by the necessity of adopting a "continuous improvement" philosophy and understanding customer perceptions (e.g., needs, expectations) (Song et al. 2012). Generally, the main reasons for measuring customer satisfaction are comprehensively summarized by (Evangelos Grigoroudis and Siskos 2010). Outlining some of the major arguments, we regard customer satisfaction to constitute the most reliable market information. It provides a business organization with the ability to evaluate its current position against competition, and design its future plans accordingly. Moreover, the main principles of continuous improvement require the development of a specific customer satisfaction measurement process. This way, any improvement action is based on standards that take into account customer expectations and needs. Finally, customer satisfaction measurement may help business organizations to understand customer behavior, and particularly to identify and analyze customer expectations, needs, and desires.

A common approach to measure tourist satisfaction is the confirmation/disconfirmation paradigm (Bowen and Clarke 2002; Michalkó et al. 2015; Vasconcelos et al. 2015). A relevant method is the HOLSAT model, which is a characteristic approach used to evaluate satisfaction from a particular destination (Tribe and Snaith 1998). The model is based on the disconfirmatory paradigm outlined before and adopts the philosophy of the SERVQUAL model (Parasuraman et al. 1991). The main results of the HOLSAT model focus on the difference between "expectation" and "experience" scores for each attribute, which gives a quantitative measure of the level of satisfaction shown by the vacationers (Truong and Foster 2006).

Despite the context and the multivariate nature of tourist satisfaction measurement (Jannach et al. 2014), Multiple Criteria Decision Analysis (MCDA) has not been widely applied in evaluating service quality in the tourism industry. Rozman et al. (2009) apply the DEX method, which combines traditional MCDA approaches and elements of expert systems and machine learning, in order to assess tourist farm service quality. An AHP model, combined with fuzzy TOPSIS, is applied in (Hsu et al. 2009) for a preference analysis for tourist choice of destination in Taiwan. In Tsitsiloni et al. (2013), authors use a multiple criteria methodology to combine satisfaction importance and performance results and provide a SWOT analysis for the whole set of the tourist satisfaction criteria.

The aim of this work is to support the formulation of a strategy plan for a specific touristic destination, by analyzing tourists' behavior through a multiple criteria methodology. We used an established method from the family of aggregation-disaggregation methods to elaborate on tourist satisfaction, and eventually deliver strategic recommendations through a SWOT analysis. The next section describes the application context and the foundations of the multiple criteria method. Then we present some general statistics that describe the population, before focusing on the satisfaction analysis. Finally, we pipeline the results of the multiple criteria method into a qualitative strategy technique, a SWOT map.

2 Methodology

2.1 Application Context

The data for this study was collected from inbound individual adult tourists who had arrived by charter flights at Crete, Greece. The survey was realized through personal interviews based on a structured questionnaire. The interviews were conducted at the two big, international airports of the island (N. Kazantzakis & Y. Daskalogiannis) a few minutes before boarding. The questionnaire was translated into six languages (English, French, German, Italian, Swedish and Russian) and it consisted of six sections: personal data, travel data, staying details, satisfaction, loyalty, special topics. Interviews began in June, 2008 and finished 4 months later, October 2008. The final population interviewed reached 5144 tourists, adult men and women.

In order to select the satisfaction dimension, we made an initial list of relevant criteria based on the literature of customer satisfaction for tourism destinations (Arabatzis and Grigoroudis 2010; Karakitsiou et al. 2007; Pizam et al. 1978; Tsai and Wang 2017; Yuksel 2001), and then, survey sponsors (local stakeholders) made the adjustments they considered practical. Finally, we used the following set of satisfaction dimensions (criteria):

- (1) Accommodation: Refers to the characteristics of accommodation e.g., room, staff, service, cleanliness, etc.

- (2) Eating: This particular criterion refers to the food related activities, offered inside or outside the accommodation facilities and includes food quality, the variety of dishes, the environment (decoration, aesthetics), the provided services, the prices, etc.
- (3) Environment—People: A rather composite criterion that describes the natural environment, the climate conditions, the local architecture, as well as the behavior, and the friendliness of the locals.
- (4) Infrastructures—Safety: Besides feeling safe, in this criterion we ask about the information available to tourists, public spaces, etc.
- (5) Entertainment: This criterion refers to the entertainment/recreation options offered to tourists during their stay and includes the available choices, the service offered, the venues, the prices, etc.
- (6) Airports: This dimension concerns the characteristics of the service provided in island's airports.
- (7) Local transportation: By local transportation we mean bus and taxi services, rented cars, etc. The criterion includes all the characteristics of the provided services (availability, service from personnel, prices, etc.).

Every item is a question for which tourists are asked to express their satisfaction using a 5-point ordinal scale (dissatisfied, somehow dissatisfied, neither satisfied nor dissatisfied, somehow satisfied, satisfied).

2.2 *The MUSA Method*

The MUSA (MULTicriteria Satisfaction Analysis) method is an established multi-criteria preference disaggregation approach, which provides quantitative measures of customer satisfaction considering the qualitative form of customers' judgments. A detailed presentation of the method can be found in (E. Grigoroudis and Siskos 2002; Evangelos Grigoroudis and Siskos 2010) while it have been applied in several domains, from healthcare (Manolitzas et al. 2014) to tourism (Muhtaseb et al. 2012). The basic mathematical formulation can be found in the appendix, however in the following paragraph we briefly present its essential concepts. The main objective of the MUSA method is the aggregation of individual judgments into a collective value function, assuming that client's global satisfaction depends on a set of n criteria or variables representing satisfaction dimensions. We use the notation X_i to represent a criterion i with a monotonic variable. The MUSA method infers an additive collective value function Y^* and a set of partial satisfaction functions X_i^* , given customer's global satisfaction Y and partial satisfaction X_i according to criterion i (ordinal scaling). The main objective of the method is to achieve the maximum consistency between the value function Y^* and the customers' judgments Y . Based on the modeling of preference disaggregation approach, the ordinal regression

equation becomes as follows:

$$\tilde{Y}^* = \sum_{i=1}^n b_i X_i^* - \sigma^+ + \sigma^- \text{ with } \sum_{i=1}^n b_i = 1$$

where \tilde{Y}^* is the estimation of Y^* , b_i is the weight of the i^{th} criterion, n is the number of criteria, and σ^+ , σ^- are the overestimation and the underestimation errors, respectively.

MUSA provides the following key results:

- *Criteria weights:* The weights are value trade-offs among the criteria. They represent the relative importance of the assessed satisfaction dimensions.
- *Average satisfaction indices:* The level of customers’ satisfaction in a range of 0–100%. They can be considered as the basic performance norms.
- *Average demanding indices:* They represent the average deviation of the estimated value functions from a “normal” function, and they are calculated according to the shape of global and partial value functions. These indices are used in customer behavior analysis, but they may also indicate the extent of company’s improvement efforts: the higher the value of the demanding index, the more the satisfaction level should be improved in order to fulfill customers’ expectations.
- *Average improvement indices:* These indices represent the improvement efforts and they depend on the importance of satisfaction criteria and their contribution to dissatisfaction as well. They suggest the improvement margins on a specific criterion, and hence its priority rank.

3 Results

3.1 General Statistics

To describe the age distribution of the sample population, we cut the age into five groups (younger than 24, 25–34 years old, 35–44, 45–60, and older than 61 years old). The percentage of the first four levels seems quite balanced in the overall population (see Fig. 1a), while the last category is suggestively less frequent. However, the percentages vary significantly across prefectures. These differences are illustrated in Fig. 1b, where the vertical axis crosses the horizontal one at the percentage that corresponds to the total sample (percentages of Fig. 1a). We can observe that in the Heraklion prefecture, the age group of young tourists (younger than 24 years) is over-represented. Likewise, in Chania, we observe an over-representation of the top-three elder age groups.

Prefectures’ visitors are also nationality-wise different. The top-five most popular nationalities per area are presented in Tables 1–4. The numbers in these tables correspond to the percentage of each nationality with respect to the total visitors of that particular area.

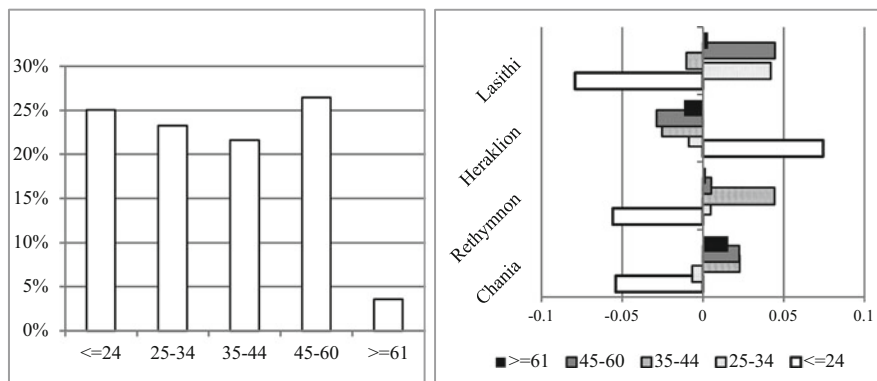


Fig. 1 (a) Frequency distribution for the entire sample per age level. (b) Differences in the age levels' frequencies per prefecture

Table 1 Most popular nationalities for Chania

Nationality	Percentage
Swedish	17.87
Norwegian	16.27
Danish	16.07
German	11.20
British	10.60

Table 2 Most popular nationalities for Rethymon

Nationality	Percentage
German	18.49
French	11.50
Russian	9.46
British	7.57
Norwegian	7.42

Table 3 Most popular nationalities for Heraklion

Nationality	Percentage
British	18.32
German	17.97
Dutch	12.91
French	9.20
Italian	7.54

Table 4 Most popular nationalities for Lasithi

Nationality	Percentage
French	29.06
British	19.69
German	14.53
Italian	8.44
Other	5.78

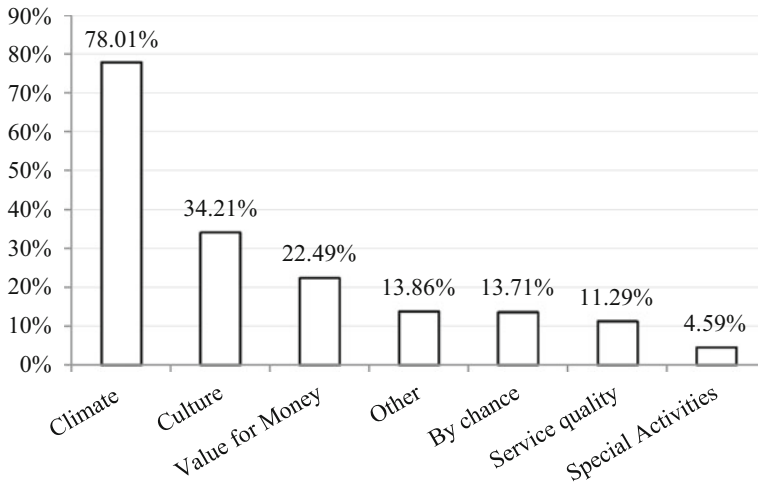


Fig. 2 Reasons that guide touristic destination selection

To investigate the reasons why tourists choose the region of Crete as their destination, we used a direct question. In particular, we asked them to choose between “Climate-Natural Beauty (sun-sea)”; “Culture (history, archaeological monuments)”; “Value for money”; “Service Quality”; “Special Activities” (agro-tourism etc.); and “By chance (last minute reservation)”. We allowed multiple checking of responses. There was also an additional open-ended response to fill, if applicable. The popularity of these reasons is presented in Fig. 2 where the superiority of “Climate” is evident.

As long as for the length of staying, the mean value is calculated to be 10.18 days for the total sample, and this value does not differ significantly among prefectures. However, there are two peaks in the frequency distribution: on 7 days, and on 14 days, a fact that is in accordance with the way that tour operators organize their vacations’ packages for Crete.

3.2 Satisfaction Analysis

In this paragraph we present the results for the total sample. We have also conducted multiple tests by filtering data on tourists’ nationality, age, place of stay, etc. We noticed some marginal differences among groups, however in order to keep the presentation of results in scope, we present here only some highlights.

With respect to nationality, Russians are in general more satisfied while the least satisfied are Dutch tourists. Italians consider the accommodation’s elements as the most significant, Russians the food-related elements, and Dutch the environment-people criterion. Satisfaction indices are also negatively correlated with the educational level, and the income of tourists.

The overall satisfaction index is 84.22%. The best performing criterion is “Environment-People” (88.89%), and the worst performing one is the “Airports” one (73.27%). The performance for every criterion can be seen in Fig. 3, where the dashed line plots the overall satisfaction index. We may recall at this point that the overall index is calculated as a weighted sum of the marginal indices, considering the criteria significance weights. These weights are depicted in Fig. 4. Quite remarkably, the most important criterion is the best performing one, while the worst performing criterion is the least important one. This fact is reflected in the corresponding action diagram (Fig. 5), where “Airports” seem to be a

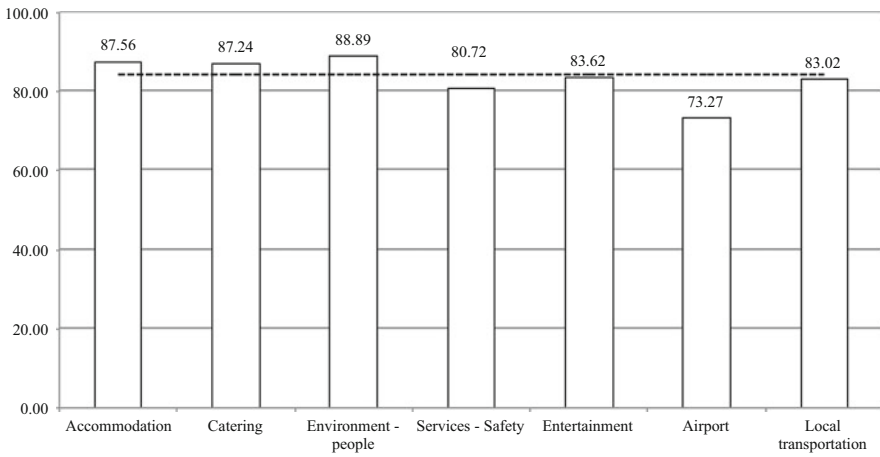


Fig. 3 Satisfaction indices for each criterion. The dashed line indicated the overall performance

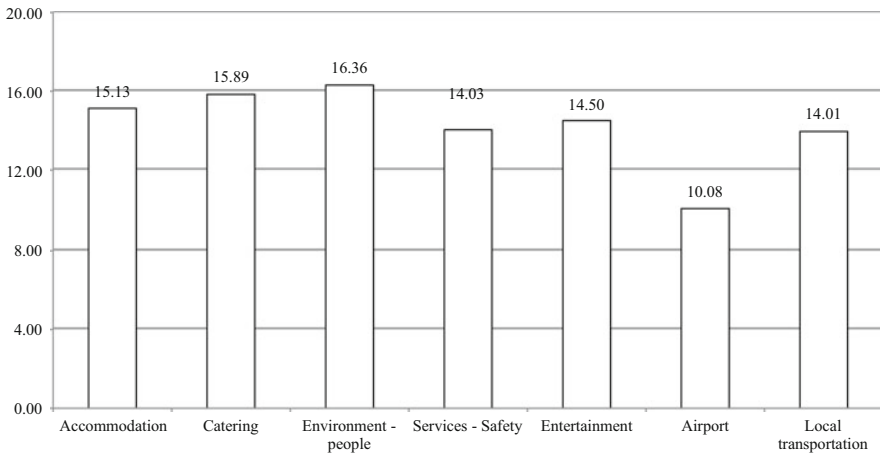


Fig. 4 Significance weights of the criteria. The weight of each criterion indicates its relative importance

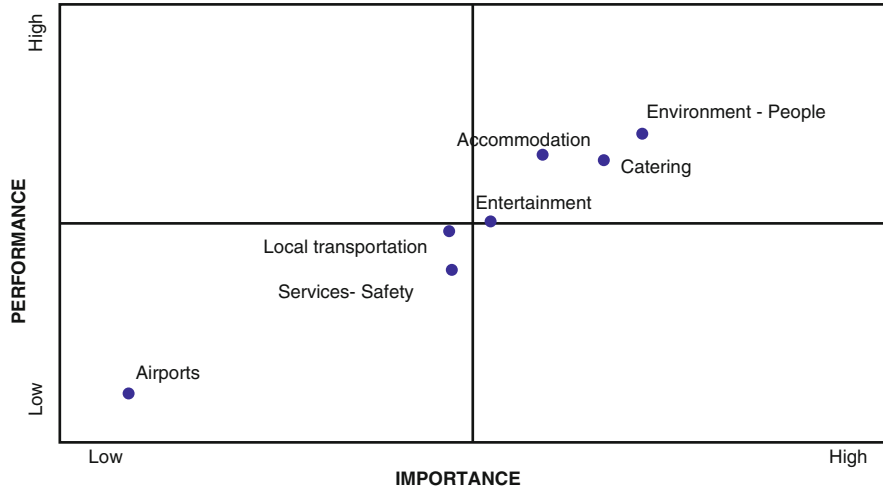


Fig. 5 Action Diagram for the overall satisfaction (high-level criteria). The placement of criteria in the plot correspond to their relative order

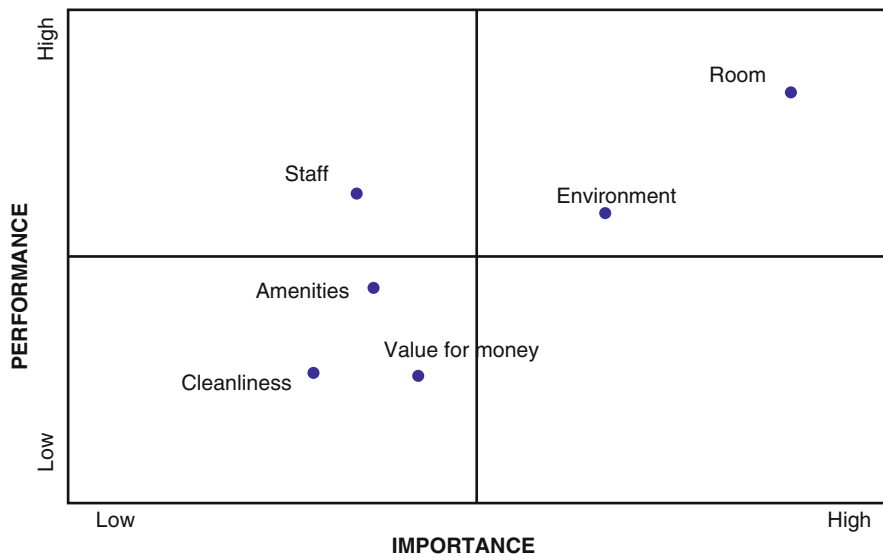


Fig. 6 Action Diagram for the “Accommodation” criterion. The placement of sub-criteria in the plot correspond to their relative order

typical “status quo” criterion, and “Environment—People” a typical “Leverage opportunity”, meaning that it can be used as an advantage against competition.

Considering the satisfaction dimensions of the “Accommodation” criterion (Fig. 6; Table 5), the highest performance is reached by the most important sub-

Table 5 Satisfaction analysis for the “Accommodation” criterion

Sub-criterion	Satisfaction Index	Weight
Room	89.44%	22.78%
Staff	87.22%	14.35%
Amenities	85.09%	14.67%
Value for money	83.12%	15.53%
Cleanliness	83.20%	13.49%
Environment	86.77%	19.19%

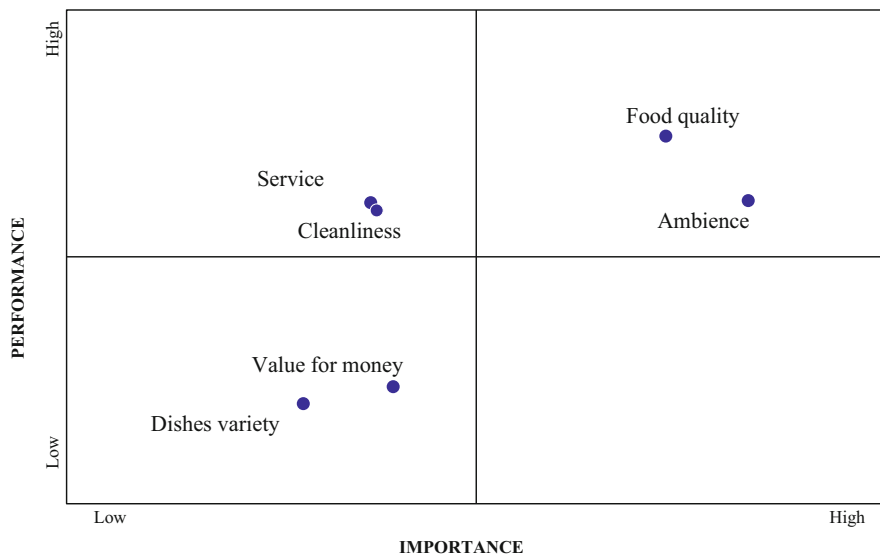


Fig. 7 Action Diagram for the “Eating” criterion. The placement of sub-criteria in the plot correspond to their relative order

criterion (i.e., the “Room”). The fact that the sub-criterion “Staff” achieves high performance with simultaneously low importance is an indication that it should be exploited more (either by transferring resources to a more important criterion, or by administering a plan to augment its contribution to satisfaction). Correspondingly, for the satisfaction dimension of the “Catering” criterion, we regard that the tourism product of Crete performs well in the important dimensions (food quality and ambience), while it performs poorly to less important sub-criteria (e.g., dishes variety). In this dimension, we identify “Service” and “Cleanliness” as opportunities for further exploitation (Fig. 7; Table 6).

In the “Environment—People” criterion we meet the top two performing sub-criteria among the entire set. These are the “Climate” and the “Natural environment” (Fig. 8; Table 7). However, the dimension of “Hospitality—locals” deserves special attention since it has the same importance with “Climate” and “Natural environment”, but it does not reach the same satisfaction levels.

Table 6 Satisfaction analysis for the “Catering” criterion

Sub-criterion	Satisfaction Index	Weight
Food quality	88.13%	19.21%
Dishes variety	84.11%	14.36%
Service	87.12%	15.26%
Value for money	84.36%	15.54%
Cleanliness	87.02%	15.33%
Ambience	87.16%	20.30%

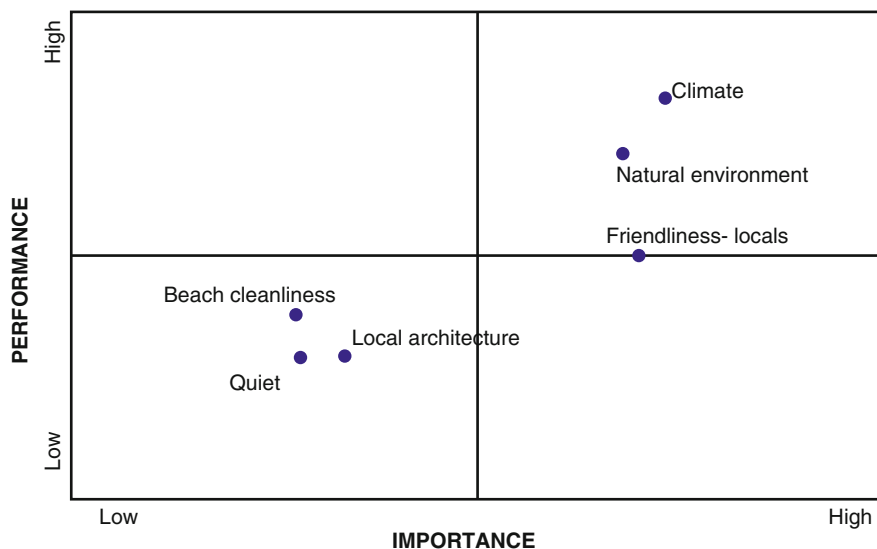


Fig. 8 Action Diagram for the “Environment—People” criterion. The placement of sub-criteria in the plot correspond to their relative order

Table 7 Satisfaction analysis for the “Environment—People” criterion

Sub-criterion	Satisfaction Index	Weight
Climate	96.85%	21.24%
Natural environment	93.27%	20.20%
Beach cleanliness	83.13%	12.21%
Quiet	80.34%	12.32%
Local architecture	80.44%	13.41%
Friendliness—locals	86.83%	20.62%

The “Infrastructures—Safety” criterion includes one of the overall best performing sub-criteria, the “Feeling safe”. At the same time, it includes one of the worst performing sub-criteria, the “Roads—sidewalks”. However, the tourism destination of Crete is favored by the fact that “Feeling safe” is far more important than “Roads—sidewalks” (Fig. 9; Table 8).

The variety of entertainment options and airports’ control services are the two single satisfaction dimensions with the poorest performance. Figures 10 and 11 and

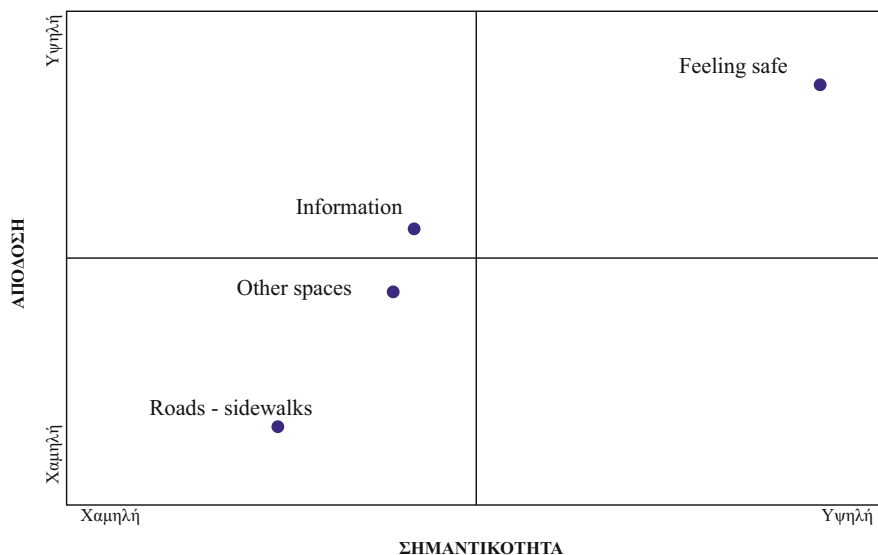


Fig. 9 Action Diagram for the “Infrastructures—Safety” criterion. The placement of sub-criteria in the plot correspond to their relative order

Table 8 Satisfaction analysis for the “Infrastructures—Safety” criterion

Sub-criterion	Satisfaction Index	Weight
Information	77.60%	22.73%
Roads—sidewalks	60.03%	17.78%
Other spaces	72.03%	22.00%
Feeling safe	90.35%	37.49%

Tables 9 and 10 plainly suggest taking actions to improve tourists’ satisfaction to those particular dimensions.

In general, we observe that Crete as a tourism destination achieves high satisfaction levels for the important dimensions, while its weaknesses remain mainly in less important dimensions. There are few exceptions to this observation: the variety of the entertainment options, and the airports’ control services. The worst performing sub-criteria are “Road safety” and “Roads—sidewalks” (Fig. 12; Table 11). On the other hand, the top performing sub-criteria are “Climate”, “Natural Environment”, and “Feeling safe”.

3.3 Loyalty Analysis

Loyalty can be measured via various approaches (Hill and Alexander 2006; Sato et al. 2016). Because of its importance for a touristic destination, in this work, we applied three different techniques. First, we examined returning visitors, i.e., tourists

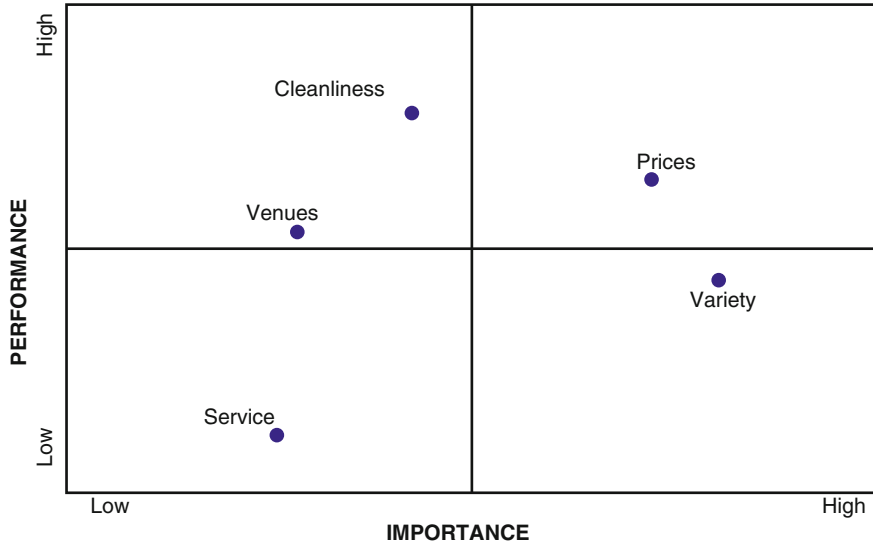


Fig. 10 Action Diagram for the “Entertainment” criterion. The placement of sub-criteria in the plot correspond to their relative order

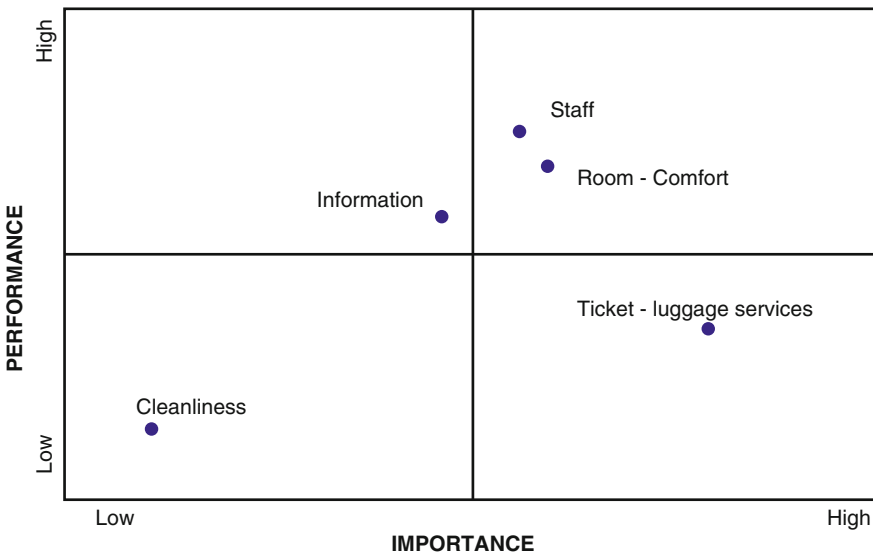


Fig. 11 Action Diagram for the “Airports” criterion. The placement of sub-criteria in the plot correspond to their relative order

that have been in Crete for vacations at least once during the past. To measure a relevant metric, we asked tourists directly. The overall percentage of returning visitors is a bit greater than one third of the population (37%). However, this

Table 9 Satisfaction analysis for the “Entertainment” criterion

Sub-criterion	Satisfaction Index	Weight
Variety	81.56%	29.00%
Venues	82.73%	13.63%
Cleanliness	85.70%	17.81%
Service	77.71%	12.93%
Prices	84.05%	26.61%

Table 10 Satisfaction analysis for the “Airports” criterion

Sub-criterion	Satisfaction Index	Weight
Room—Comfort	78.61%	20.71%
Staff	81.04%	20.44%
Information	75.04%	19.69%
Cleanliness	59.93%	16.89%
Ticket—luggage services	67.05%	22.26%

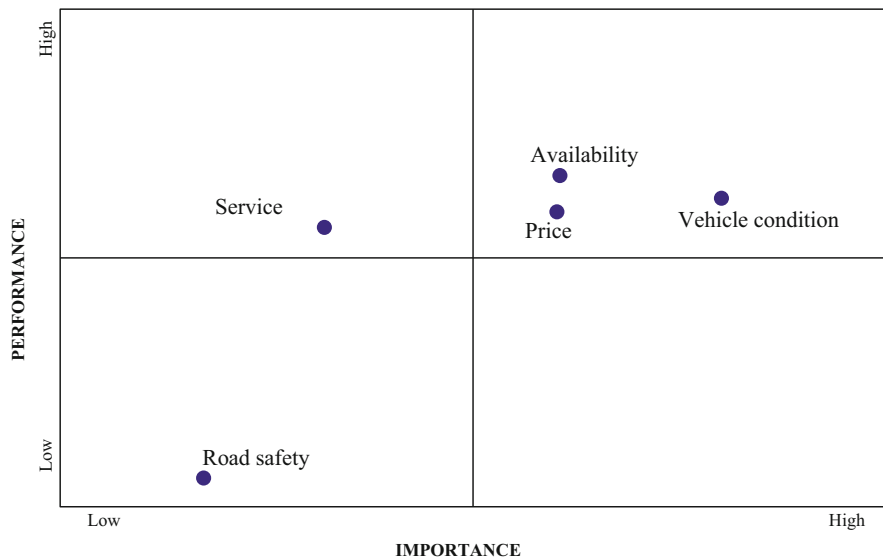


Fig. 12 Action Diagram for the “Local transportation” criterion. The placement of sub-criteria in the plot correspond to their relative order

Table 11 Satisfaction analysis for the “Local transportation” criterion

Sub-criterion	Satisfaction Index	Weight
Availability	90.27%	21.53%
Service	84.52%	17.35%
Vehicle condition	87.80%	24.40%
Price	86.19%	21.49%
Road safety	56.32%	15.22%

percentage is significantly improved according to the following factors: Geographic location (tourists of the prefecture of Chania are far more loyal since more than 50% of them are returning visitors); Aged tourists (more than 61 years old) appear expectedly larger figures; single travelers as well as wealthy travelers have also greater percentages; tourists that prefer to stay in all-inclusive hotels have lower percentages. Last, there are some nationalities that include more returning visitors than the average. In particular Germany, United Kingdom, and the Scandinavian countries have the greatest percentages while Italy and Russia hold the smallest ones. Yet, we have to recognize that Russia is a relatively new market for the touristic product of Crete. It is also interesting to note that among returning visitors, more than one over four (approximately 10% of the total population), has visited Crete for vacations more than three times.

The third approach we applied to measure loyalty was the degree of expectations' confirmation. We asked tourists to rate their vacations experience when compared with their pertinent expectations. Every tourist could choose an option of a five-level ordinal scale corresponding to the whole spectrum from exceeding expectations to disconfirming expectations. We present the relevant results factored by nationality in Fig. 14. Results suggest that approximately one third of the population responds with the neutral level option (expectations met—"More or less as expected"). However, the positive levels (expectations exceeded—"Somehow better" and "Better") correspond to a percentage of 59.03%, while the cumulative percentage of the negative levels ("Somehow worse" and "Worse") have just 5.51%. These results are in accordance with the satisfaction analysis, where we regarded a similar percentage for the low levels of the satisfaction scale. Regarding the factors that affect expectations' confirmation, we regarded that income and nationality are the important ones. In particular, the higher the income, the lower the level of the expectations' confirmation. The role of nationalities is illustrated in Fig. 14.

Second, we analyze loyalty by asking the following pair of questions: "How likely is it that you will visit Crete again on holidays in the near future?" and "How likely is it that you will recommend to friends/relatives to visit Crete on holidays?". We used a five-level ordinal scale (ranging from "Not at all likely" to "Definitely"), and results (illustrated in Fig. 13) suggest that the touristic destination of Crete reaches satisfactory levels of loyalty. It is noteworthy that the factors identified when using the previous approach (returning visitors), have the same effects, namely aged tourists, and single travelers appear more loyal, and tourists that stay in all-inclusive hotels appear less loyal. However, geographic locations do not make any difference to these loyalty metrics.

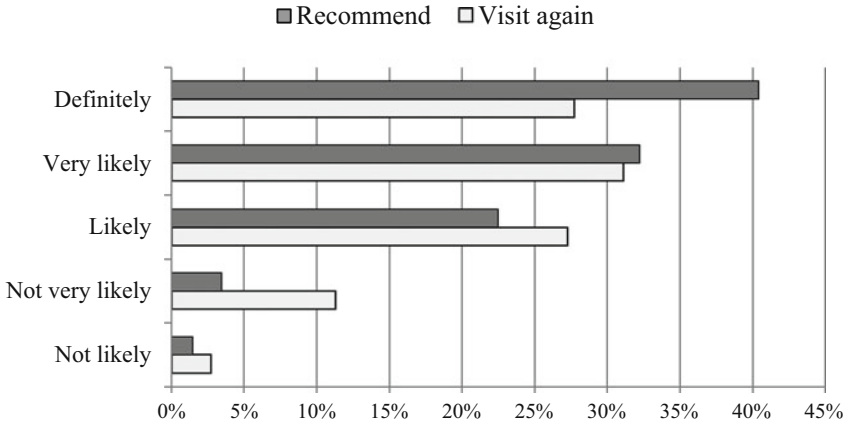


Fig. 13 Measuring loyalty by asking direct questions if tourists will visit again, and if they would recommend the destination to other persons

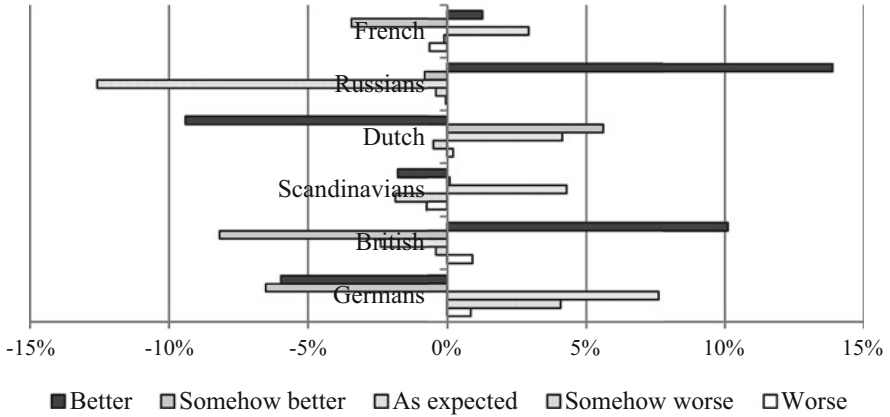


Fig. 14 Expectations' confirmation per nationality. The center of the horizontal axis is the overall average

4 Strategic Plan

To deliberate the numerous (diverse) dimensions of tourist satisfaction, and to provide effective recommendations to exploit the potential of the opportunities and strengths, as well as to minimize the effect of weaknesses and threats, in the following, we group the elements that affect satisfaction in four groups:

- *Strengths* are the elements that guide high-level satisfaction (tourists demand high performance and the tourism destination of Crete delivers). Such elements are ultimately the reasons why tourists select this particular destination, and can be considered as the competitive advantages. This is why maintaining a

Table 12 SWOT Analysis for tourists’ satisfaction

Strengths	Weaknesses	Opportunities	Threats
Environment— People (Climate, Natural environment) Feeling safe Accommodation (Room, environment) Catering (Food quality, Ambience)	Airports (Control services)	In general service/staff related elements	Airports’ cleanliness/sanitation Road safety Service in recreational places Roads and sidewalks Beach cleanliness, noise Value for money for accommodation and eating

high-level satisfaction to those elements is vital (if these characteristics begin to deteriorate, the overall satisfaction will be significantly reduced). Strengths are contained in the upper right quadrant of the action diagrams.

- A *weakness* is identified when the destination does not fulfill tourists’ expectations. In such cases, it is necessitated to take immediate actions of improvement, considering that their existence contributes to dissatisfaction. We can detect weaknesses by looking at the lower right quadrant of the action diagrams.
- An *opportunity* emerges when the destination performs well in a less-important dimension. There is a twofold interpretation for an opportunity: It is an indication either to transfer resources towards a more important element, or to try to exploit this element as an advantage against competition (inflate its importance through marketing). Opportunities are located in the upper left quadrant of action diagrams.
- Last, a *threat* is an element that exhibits low performance, yet it is not that important. We can identify threats by looking at the lower left quadrant of action diagrams. The threat can be generated when the element’s importance grows.

The particular SWOT Analysis for the target destination is outlined in Table 12. The tourism destination of Crete, even if it does not fully satisfies tourists to all dimensions, it achieves to make them overall satisfied. This happens because it achieves very good performances to the most important dimensions (environment-people, accommodation, and eating), while simultaneously it holds down the poor performances to the less important dimensions (airports, and infrastructures).

5 Conclusions

Customer satisfaction is a reliable feedback, considering it reflects customers’ preferences and expectations directly, expressively, and objectively. It acts effectively as a baseline for performance, and as a standard of excellence (Gerson 1993). Therefore, satisfaction is not only a metric to-be improved, but a drive for strategy formulation. Because of the multivariate nature of tourist satisfaction, the multiple criteria paradigm looks prominent to support the analysis. In this work, we used

an established multiple criteria method of the aggregation-disaggregation methods' family to analyze the satisfaction of tourists of a specific touristic destination.

Although the sample population was impressively large, there are some inherent limitations when the goal is a global strategy: We were able to sample just tourists arriving with charter flights, ignoring the part of people arriving via ferries (mostly domestic tourists). Moreover, the current study could yield far more interesting results if it was compared to studies of other competitive destinations (unfortunately no such data are available yet).

Considering the results, our work plainly suggests the weaknesses and the threats of the destination, and it indicates clearly actions for improvement. However, it seems that the essential profile of the destination is based on its nature/climate conditions, and there is very narrow space to modify it.

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Appendix: The MUSA Method

The MUSA method infers an additive collective value function Y^* and a set of partial satisfaction functions X_i^* . The main objective of the method is to achieve the maximum consistency between the value function Y^* and the customers' judgements Y . Based on the modelling approach presented in the relevant section and introducing a double-error variable (see Fig. 15), the ordinal regression equation becomes as follows:

$$\tilde{Y}^* = \sum_{i=1}^n b_i X_i^* - \sigma^+ + \sigma^-$$

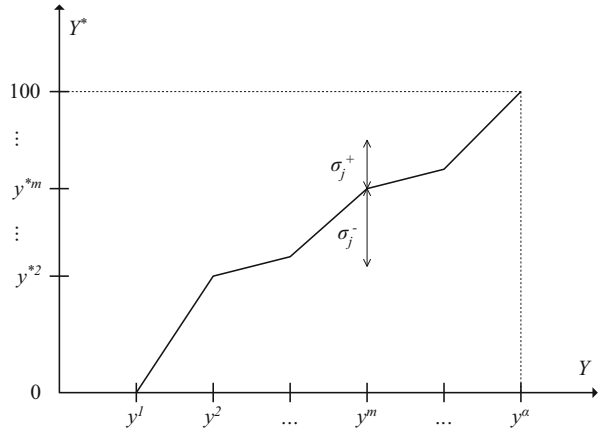
where \tilde{Y}^* is the estimation of the global value function Y^* , and σ^+ and σ^- are the overestimation and the underestimation errors, respectively.

The global and partial satisfaction Y^* and X_i^* are monotone functions normalised in the interval [0,100]. Thus, in order to reduce the size of the mathematical program, removing the monotonicity constraints for Y^* and X_i^* , the following transformation equations are used:

$$\begin{cases} z_m = y^{*m+1} - y^{*m} & \text{for } m = 1, 2, \dots, \alpha - 1 \\ w_{ik} = b_i x_i^{*k+1} - b_i x_i^{*k} & \text{for } k = 1, 2, \dots, \alpha_i - 1 \text{ and } i = 1, 2, \dots, n \end{cases}$$

where y^{*m} is the value of the y^m satisfaction level, x_i^{*k} is the value of the x_i^k satisfaction level, and α and α_i are the number global and partial satisfaction levels.

Fig. A.1 Error variables for the j -th customer



According to the aforementioned definitions and assumptions, the basic estimation model can be written in a linear program formulation, as follows:

$$\left\{ \begin{array}{l}
 [\text{min}] F = \sum_{j=1}^M \sigma_j^+ + \sigma_j^- \\
 \text{subject to} \\
 \sum_{i=1}^n \sum_{k=1}^{x_i^j-1} w_{ik} - \sum_{m=1}^{y^j-1} z_m - \sigma_j^+ + \sigma_j^- = 0 \quad \text{for } j = 1, 2, \dots, M \\
 \sum_{m=1}^{\alpha-1} z_m = 100 \\
 \sum_{i=1}^n \sum_{k=1}^{\alpha_i-1} w_{ik} = 100 \\
 z_m, w_{ik}, \sigma_j^+, \sigma_j^- \quad \forall m, i, j, k
 \end{array} \right.$$

where M is the size of the customer sample, and x_i^j, y^j are the j^{th} level on which variables X_i and Y are estimated.

The preference disaggregation methodology includes also a post optimality analysis stage in order to overcome the problem of model stability. The final solution is obtained by exploring the polyhedron of multiple or near optimal solutions, which is generated by the constraints of the previous linear program. This solution is calculated by n linear programs (equal to the number of criteria) of the following

form:

$$\left\{ \begin{array}{l} [\max] F' = \sum_{k=1}^{\alpha_i-1} w_{ik} \quad \text{for } i = 1, 2, \dots, n \\ \text{under the constraints} \\ F \leq F^* + \varepsilon \\ \text{all the constraints of the previous LP} \end{array} \right.$$

where ε is a small percentage of F^* . The average of the solutions given by the n *post-optimality* LPs may be taken as the final solution. In case of non-stability, this average solution is less representative.

The assessment of a performance norm may be very useful in customer satisfaction analysis. The average global and partial satisfaction indices are used for this purpose and are assessed through the following equations:

$$\left\{ \begin{array}{l} S = \frac{1}{100} \sum_{m=1}^{\alpha} p^m y^{*m} \\ S_i = \frac{1}{100} \sum_{k=1}^{\alpha_i} p_i^k x_i^{*k} \quad \text{for } i = 1, 2, \dots, n \end{array} \right.$$

where S and S_i are the average global and partial satisfaction indices, and p^m and p_i^k are the frequencies of customers belonging to the y^m and x_i^k satisfaction levels, respectively.

Combining weights and average satisfaction indices, a series of action diagrams can be developed (Fig. 16). These diagrams indicate the strong and the weak points of customer satisfaction, and define the required improvement efforts. Each of these maps is divided into quadrants, according to performance (high/low) and importance (high/low) that may be used to classify actions:

- *Status quo* (low performance and low importance): Generally, no action is required.
- *Leverage opportunity* (high performance/high importance): These areas can be used as advantage against competition.
- *Transfer resources* (high performance/low importance): Company's resources may be better used elsewhere.
- *Action opportunity* (low performance/high importance): These are the criteria that need attention.

In several cases, it is useful to assess the relative action diagrams, which use the relative variables b'_i and S'_i in order to overcome the assessment problem of the cut-off level for the importance and the performance axis. The normalised variables b'_i

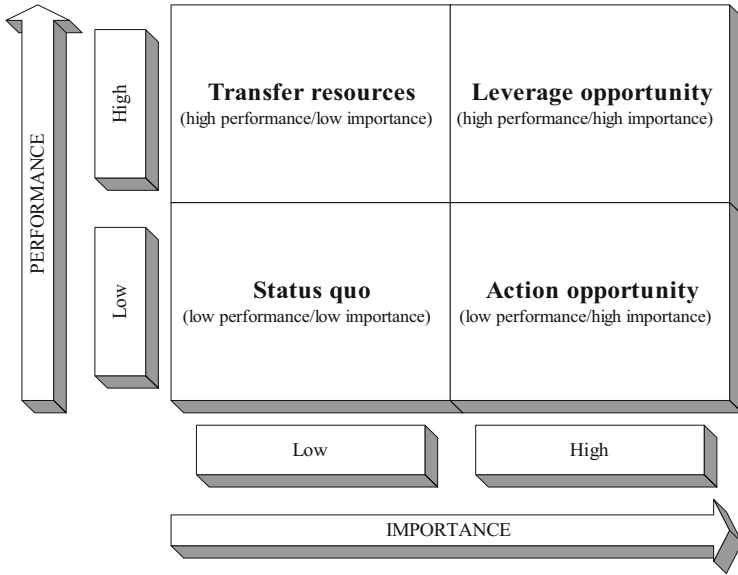


Fig. A.2 Action diagram advised by (Customers Satisfaction Council 1995)

and S'_i are assessed as follows:

$$\begin{cases} b'_i = \frac{b_i - \bar{b}}{\sqrt{\sum_i (b_i - \bar{b})^2}} \\ S'_i = \frac{S_i - \bar{S}}{\sqrt{\sum_i (S_i - \bar{S})^2}} \end{cases} \text{ for } i = 1, 2, \dots, n$$

where \bar{b} and \bar{S} are the mean values of the criteria weights and the average satisfaction indices, respectively. This way, the cut-off level for axes is recalculated as the centroid of all points in the diagram.

This type of diagram is very useful, if points are concentrated in a small area because of the low-variation that appears for the average satisfaction indices (e.g., case of a high competitive market). These diagrams are also mentioned as decision, strategic, perceptual, and performance-importance maps, or gap analysis, and they are similar to SWOT analysis (Hill and Alexander 2006).

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