A survey of customer satisfaction barometers: Some results from the transportation-communications sector

E. Grigoroudis a,*, Y. Siskos b

a Decision Support Systems Laboratory, Technical University of Crete, University Campus, 73100 Chania, Greece
b Department of Informatics, University of Piraeus, 80 Karaoli & Dimitriou Str., Piraeus 18534, Greece

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Abstract

The most important efforts that have been reported for the development of generic satisfaction barometers during the last years refer to individual business organisations, industry sectors or the total of national economies. The main aim of these efforts is the data collection either for comparative analysis of companies’ performance regarding customer satisfaction or for monitoring the evolution of global and partial satisfaction indices. In addition, the generic satisfaction barometers provide the ability to correlate basic economical dimensions with customer satisfaction like productivity variations at a national level or changes in the general consumer price index. This study presents the most important efforts for the measurement of customer satisfaction at the transportation-communications sector within the frame of development and installation of national satisfaction barometers. Furthermore, the models, which constitute the basic methodological tools for the measurement and the analysis of the presented satisfaction barometers, are briefly presented through this paper.

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1. Introduction

The development and installation of a permanent customer satisfaction barometer provides the ability to evaluate current and future company’s performance. Thus, a business organisation has the opportunity to implement an integrated benchmarking program. The national satisfaction barometers presented in this paper constitute the most important efforts of generic satisfaction barometers that refer to a group of business sectors or national economies.

The national satisfaction barometers provide useful information regarding consumer behaviour given a uniform way of customer satisfaction measurement. These efforts count more than 10 years of life and focus mainly on the development of a customer satisfaction index that supplements the existing national measurement indices of each economy (e.g. consumer price index). This way,
although the satisfaction level is evaluated in both micro- and macro-economical level, these applications do not concern satisfaction surveys of individual companies. The development of national customer satisfaction barometers is mainly focused on the following basic objectives (ECSI, 1998):

**Economic returns**: Usually, the implemented methodology makes it possible to link customer satisfaction to economic returns, mainly though the correlation with financial performance indices.

**Economic stability**: A uniform national customer satisfaction index should help determine what percentage of price increases represent quality improvement and what are caused by inflation.

**Economic link**: A measure of the quality of economic output and productivity measures is essential for interpreting price.

**Economic welfare**: The quality of the provided products and services, as measured by customer satisfaction, constitutes at the same time an indication of economic well being.

**Economic output**: A national customer satisfaction index quantifies the value that customers place on products and services, and thus it drives quality improvement.

The development of national customer satisfaction barometers can be summarised in the following main efforts (Vavra, 1997; Evans and Lindsay, 1999; Grigoroudis and Siskos, 2002b):

- The first attempt to develop and install a national measure for customer satisfaction was reported in Sweden in 1989. Professor Claes Fornell was the main architect of the Swedish National Customer Satisfaction Barometer.
- The national quality and satisfaction barometer of Germany (The German Customer Barometer—Quality and Satisfaction) focuses mainly on the micro-economical level of business organisations and it was established in 1992.
- Professor Claes Fornell supervised the conduct of the preliminary analysis of the American Customer Satisfaction Index (ACSI) in 1993. This particular index constitutes an effort to adopt the Sweden satisfaction barometer in America, with some improvements, revisions, and reconciliation. The ACSI provides complete data since 1994.
- It should be noted that the European Union is interested in the development and installation of a comparative system of national satisfaction indices since 1998. The preliminary study in a limited number of industry sectors was conducted within 1999, while results for the European Customer Satisfaction Index (ECSI) were published in 2000.
- Other individual efforts of establishing national satisfaction indices in the European area concern Denmark, Austria, France, The Netherlands, Switzerland, and others.
- Both Taiwan and New Zealand measure and report the customer satisfaction of a limited number of companies since 1995. Also, the preliminary survey for the installation of a permanent satisfaction barometer in South Korea was conducted in 1998, while in Malaysia, a pilot survey is planned for the next year.

During 1999, more than ten countries were in the phase of the design for the installation of national satisfaction barometers. It should be noted, however, that 4–5 years are required until the final installation of a national satisfaction barometer (preliminary survey conduction, evaluation of results and correlation with general financial indices, development of database, etc.).

The purpose of the present paper is to analyse the most important customer satisfaction barometers and to present selective results from the transportation-communications sector. The paper consists of four sections. Section 2 briefly presents an overview of the methodologies addressing the customer satisfaction measurement problem, emphasising in the expectancy disconfirmation models (Fornell’s model) that constitute the basic tools for the evaluation of national satisfaction barometers and in the multicriteria preference disaggregation approach (MUSA method). The national satisfaction barometers of Sweden and Germany, the customer satisfaction indices in Europe and America, as well as a pilot survey in the Greek airline industry are analysed in Section 3. Finally, Section 4 summarises the main conclusions.
2. Satisfaction measurement methodologies

2.1. An overview of expectancy disconfirmation models

The approach of psychology and consumer behaviour analysis is based on the assumption that satisfaction is a mental condition of the customer. The performance evaluation of a provided product or service (or some of their characteristics) is quite subjective and for this reason it should be linked with some comparison standards.

A generic model of consumer behaviour analysis considers the working on a customer’s mind as a “black box”, implying that consumer’s psychology mediated the impact of performance observations on satisfaction judgements (Fig. 1). Alternative behavioural models try to describe and explain what exactly happens in this “black box” in order to unravel the processing of future performance (Oliver, 1977, 1996).

The most important theory for customer satisfaction analysis in the context of consumer behaviour concerns the approach of Oliver (Oliver, 1977, 1980, 1996; Churchill and Surprenant, 1982; Vavra, 1997). According to this particular methodological approach, satisfaction may be defined as a pleasant past-purchasing experience from a product or service given the anti-purchasing expectancy of the customer (Fig. 2). As it becomes obvious, the comparison process of the customer given his/her expectancies plays the master role in this particular model. For this reason, the approach of Oliver is also called as expectancy disconfirmation model. An analytical review of the expectancy disconfirmation model may be found in Yi (1991), Churchill and Surprenant (1982), and Erevelles and Leavitt (1992).

2.2. Fornell’s model

Fornell’s satisfaction model (Johnson and Fornell, 1991; Anderson and Fornell, 1991; Anderson and Sullivan, 1991; Anderson, 1994; Fornell, 1995) constitutes the basic measurement and analysis tool that is used in both the American Customer Satisfaction Index (ACSI) and the Swedish Customer Satisfaction Barometer (SCSB).

This particular approach is based on an economic structural model that links different customer satisfaction measures (e.g. expectations, loyalty, complaints, etc.) with specific and predefined formulas. Given these defined relations between included variables, the model produces a system of cause and effect relationships.

Generally, as presented in Fig. 3, the model variables are analysed in the following main categories:

- satisfaction causes (quality, expectations, etc),
- satisfaction, and
- satisfaction results (complaints and loyalty).

Fornell’s model expresses satisfaction as a result of three elements: perceived quality, expectations and perceived value. Customer satisfaction is measured as a latent variable using multiple indicators (for more details see Appendix A). A use of partial

![Diagram](http://example.com/diagram.png)

**Fig. 1.** The mediated performance model of satisfaction (Oliver, 1996).
least squares (PLS) is used to estimate this causal model. That is because PLS is an iterative procedure that does not impose distributional assumptions on the data. PLS estimates weights for the variable measures that maximise their ability to explain customer loyalty as the ultimate endogenous or dependent variable (Fornell et al., 1996).

Furthermore, confirmatory factor analysis and linear equation modelling have been conducted to validate the relationships depicted in the model and the overall framework (Vavra, 1997).

2.3. Other techniques and the multicriteria preference disaggregation approach

A wide variety of different oriented measurement approaches deals with the customer satisfaction evaluation problem, besides expectancy disconfirmation and structural equation models presented in Sections 2.1 and 2.2. These techniques focus on the evaluation of an overall satisfaction measure, the analysis of associations between several satisfaction norms, and the classification of customers into different distinctive segments. According to Grigoroudis and Siskos (2002b) the most important measurement approaches may be categorised into:

1. Statistical and data analysis techniques: These approaches consist of several traditional statistical methods, like multiple regression analysis, factor analysis, probit-logit and loglinear models, discriminant and cluster analysis, probability plotting methods, and descriptive statistical
analysis. A detailed presentation of these methods in customer satisfaction applications can be found in Vavra (1997).

2. **Quality approach:** Together with national quality awards, like Malcolm Baldrige and EFQM excellence model, the quality approach includes mainly the ideal point and the Servqual/Servperf models. While giving major importance to the linkage with the main principles of Total Quality Management, these approaches are not focused on the customer satisfaction measurement process.

3. **Consumer behavioural analysis:** These approaches consist of the expectancy disconfirmation model presented in Section 2.1, along with other behavioural theories (motivation, equity, and regret theory), which explain and analyse the consumers’ behaviour rather than evaluate a satisfaction measure. Oliver (1996) presents an analytical discussion of all these theories.

4. **Other methodological approaches:** This category includes Kano’s model, other quantitative methods (data envelopment analysis, multidimensional scaling), as well as customer loyalty analysis, which may be considered as an extension of the customer satisfaction problem. These techniques usually serve special purposes, like the efficiency analysis of a business organisation, or the determination of attractive quality characteristics.

The customer satisfaction evaluation problem may also be considered in the context of multi-criteria preference disaggregation analysis, when applying the MUSA method (Siskos et al., 1998; Grigoroudis and Siskos, 2002a). Assuming that customer’s global satisfaction depends on a set of criteria representing service characteristic dimensions, the main objective of the MUSA method is the aggregation of individual judgements into a collective value function.

Although the implementation of the MUSA method in real world applications refers mostly to individual business organisations (Siskos et al., 1998; Grigoroudis et al., 1999b; Mihelis et al., 2001; Siskos et al., 2001; Siskos and Grigoroudis, 2002), the preference disaggregation analysis may be applied in the evaluation of an industry satisfaction barometer (see Section 3.5). This particular approach can be considered as an extension of customer satisfaction benchmarking analysis for a set of competitive companies using MUSA method (Grigoroudis et al., 1999a; Grigoroudis et al., 2002).

The main results of the MUSA method are focused on the evaluation of average satisfaction indices, the importance of satisfaction dimensions (criteria weights), as well as on a set of additional diagrams (action and improvement diagrams). A detailed presentation of these results can be found in Grigoroudis and Siskos (2002a), while the extension of the MUSA method in the case of an industry satisfaction barometer is given in Appendix B.

In contrast to the aforementioned statistical approaches, the MUSA method fully considers the qualitative form of customers’ judgements and preferences, as they are expressed in a customer satisfaction survey. Thus, it avoids the arbitrary quantification of the collected information, because the coding of the qualitative scale is a result, not an input to the proposed method.

### 3. Satisfaction barometers

#### 3.1. Swedish Customer Satisfaction Barometer

The Swedish Customer Satisfaction Barometer (SCSB) counts approximately 10 years of life. It is conducted under the supervision of the University of Michigan–National Quality Research Center and the Swedish Post Office. The required data are collected through a telephone survey from a sample of approximately 23,000 customers, while currently, more than 115 companies participate in this particular survey. The survey is designed to obtain a nationally representative sample of customers of major companies in wide variety of industries. The companies surveyed in each industry sector are the largest share firms such that cumulative market share is more than 70% (Anderson and Fornell, 1991; Anderson and Sullivan, 1991; Fornell, 1992; Anderson et al., 1994).

The questionnaire employed 10-point scales to access each respondent’s expectations, perceived
quality, satisfaction and retention behaviour. An example of the questionnaire for the auto industry is presented in Fig. 4.

The analysis is based on Fornell’s approach, which is a cause and effect econometric model, as presented in Section 2.2. The model is self-weighting and estimates the indices and the strength of relationships between the variables in order to maximise the explanation of customer satisfaction, as expressed by the sample of customers.

The main characteristic of the approach is the multiple equations that correlate customers’ values and perception for quality with their satisfaction and loyalty, as it is expressed through price elasticity and repurchase intentions (Johnson and Fornell, 1991; Fornell, 1992; Anderson et al., 1994).

Fig. 5 shows the evolution of the national customer satisfaction index, in relation with the communications sector, while Table 1 presents the main results referring to individual industries in the transportation-communications sector. It can be observed that:

- Customers seem to be less satisfied from the transportation-communications sector, especially during the last four years.
• Higher satisfaction levels can be achieved in highly competitive market (e.g. express mail, mobile telephones).

3.2. German customer barometer

The German Customer Barometer (GCB) has been established by the German Marketing Association e.V. and the Deutsche Post AG and operates on a yearly basis since 1992. Its general philosophy focuses on the following points (Meyer and Dornach, 1996):

• Supplying single industries and suppliers with data to determine their position and deficiencies in market according to customers’ perspective.

• Information on the customers’ expectations as well as on the way through which they are modified.

• Continuous information and controlling of customer satisfaction measures.

• Developing and strengthening the customer orientation philosophy of the German industries, companies, organisations and institutions.

The required data are collected through a computer-aided telephone survey (CATI: Computer Assisted Telephone Interviewing) based on a random sample of approximately 45,000 customers, covering more than 50 industry sectors. The study is conducted separately in former West and former East Germany.
The German Customer Satisfaction Index (GCSI) has been increased significantly during the last 5 years (Fig. 6), following the trends of other national satisfaction indices. Table 2 presents summarised results for the transportation-communications industry, where changes on customer satisfaction index are also mentioned. Furthermore, GCB provides analytical results for different customer segments and industry sectors, including customer satisfaction on detailed quality attributes (Fig. 7).

The GCB supplies important data to German companies in order to implement an internal, industry or international benchmarks. But, as Meyer and Dornach (1996) state, traditional quantitative performance indicators such as market share or profitability should be combined with customer satisfaction and loyalty indicators provided by GCB.

It should be noted that GCB includes an employee satisfaction survey as well. It is an industry independent survey regarding the relationship

Table 2

<table>
<thead>
<tr>
<th>Industry sector</th>
<th>Average satisfaction index(a)</th>
<th>Difference from previous year(b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car manufacturers</td>
<td>2.00</td>
<td>–</td>
</tr>
<tr>
<td>Taxi</td>
<td>2.22</td>
<td>–1</td>
</tr>
<tr>
<td>Automobile club</td>
<td>2.22</td>
<td>+1</td>
</tr>
<tr>
<td>Mobile communication (telephone)</td>
<td>2.25</td>
<td>+1</td>
</tr>
<tr>
<td>Travel/tour operators</td>
<td>2.28</td>
<td>0</td>
</tr>
<tr>
<td>Airlines</td>
<td>2.39</td>
<td>–2</td>
</tr>
<tr>
<td>Mobile communication (net operators)</td>
<td>2.44</td>
<td>+4</td>
</tr>
<tr>
<td>Mobile communication (service provider)</td>
<td>2.53</td>
<td>+1</td>
</tr>
<tr>
<td>Airports</td>
<td>2.60</td>
<td>–5</td>
</tr>
<tr>
<td>Telephone services (fixed networks)</td>
<td>2.60</td>
<td>+2</td>
</tr>
<tr>
<td>Parcel and express delivery services</td>
<td>2.69</td>
<td>–2</td>
</tr>
<tr>
<td>Letter post office</td>
<td>2.71</td>
<td>–4</td>
</tr>
<tr>
<td>Public transportation</td>
<td>2.96</td>
<td>–2</td>
</tr>
<tr>
<td>Long distance transportation</td>
<td>3.11</td>
<td>–7</td>
</tr>
</tbody>
</table>

\(a\) A 5-point scale (with 1 the maximum value and 5 the minimum) is used for the satisfaction index.

\(b\) Difference of average values 1999 in points of base (rounded).
between customer and employee satisfaction and internal customer orientation.

### 3.3. American customer satisfaction index

As already mentioned, the American Customer Satisfaction Index (ACSI) was established in 1994 following several years of development and pre-testing. It is produced through a partnership of the University of Michigan Business School, American Society for Quality and Arthur Andersen. The National Quality Research Center (NQRC) at the University of Michigan Business School is responsible for researching and
producing the ACSI (National Quality Research Center, 1998, 2000).

The ACSI follows the general modelling and survey methodology of the SCSB adapted in the distinct characteristics of the US economy and it can be considered as an effort to develop an index similar to the national consumer price index (US Consumer Price Index).

The data are collected through a computer-assisted telephone interviewing system (CATI) that is based on a random digit dial selection. The sample size increases continuously and it exceeded 29,000 customers in 1997.

Although the number of companies varies from year to year as a result of mergers and acquisitions, the survey includes 7 main economic sectors, 35 industries, and more than 200 companies with revenues totalling nearly 40% of the GNP. The ACSI also measures customer satisfaction from non-US companies with major market shares and federal-governmental services as well.

Each company in the ASCI is weighted within its industry by its most recent years’ revenue. Also, relative sales by each industry are used to determine each industry’s contribution to the respective sector index, as shown in the following formula (National Quality Research Center, 1998):

\[
\begin{align*}
I_{ist} &= \sum_f S_{fist} \frac{I_{fist}}{\sum_f S_{fist}}, \\
I_{ist} &= \sum_i S_{ist} \frac{I_{ist}}{\sum_i S_{ist}}.
\end{align*}
\]

where \( S_{fist} \) and \( I_{fist} \) are respectively the sales and the satisfaction index for firm \( f \) in industry \( i \) in sector \( s \) at time \( t \), \( S_{ist} \) and \( I_{ist} \) are respectively the sales and the satisfaction index for industry \( i \) in sector \( s \) at time \( t \), \( S_{s} \) and \( I_{s} \) are respectively the sales and the satisfaction index for sector \( s \) at time \( t \). Obviously, the total sales for each economic sector and industry are given by

\[
\begin{align*}
S_{ist} &= \sum_f S_{fist}, \\
S_{s} &= \sum_i S_{ist}.
\end{align*}
\]

So, the national index is calculated using the percentage contribution of each sector to the GSP, taking into account the most recent estimate (National Quality Research Center, 1998):

\[
I_t = \sum_{t=T-3}^{T} \sum_s \frac{S_{st}I_{st}}{\sum_{t=T-3}^{T} \sum_s S_{st}}
\]

where \( I_t \) is the national satisfaction index at time \( t \).

All companies, industries and economic sectors in the ASCI were measured at the same time only for the baseline year (1994). Since that baseline year, ASCI is updated quarterly, on a rolling basis, with new data for one or two sectors replacing data from the prior year. This way, ACSI provides analytical results at different levels, i.e. for each economical sector, industry or a set of selective companies included in the survey.

Global ASCI results for current year shows that the transportation-communications-utilities sector has one of the lowest satisfaction indices, coming before only the service sector and federal agencies (Fig. 8). Table 3 justifies this result, presenting several industries with relevant low satisfaction indices, like airlines, broadcasting and publishing.

Focusing only on the transportation-communications sector, Table 3 shows that all industries have not worsened customer satisfaction comparing to previous year.

The most worried result for the transportation-communications sector is that, in general, customers have lower level of satisfaction year by year. As Fig. 9 presents, the sector index is relatively lower than the national ACSI, while the gap between them is increased during the last years.

### 3.4. European Customer Satisfaction Index

The European Customer Satisfaction Index (ECSI) is a new economical indicator, which has been developed by the EOQ (European Organisation for Quality) and EFQM (European Foundation for Quality Management). The ECSI is also supported by the European Commission and ESOMAR (European Society for Opinion and Marketing Research), and it is sponsored by the IPC (International Post Corporation). The CSI university network, which consists of 8 European universities, has also participated in the development of the ECSI.

The theoretical ECSI model constitutes a modified adaptation of the ACSI/Fornell’s model.
ACSI National Score 72.9

<table>
<thead>
<tr>
<th>Industry sector</th>
<th>Satisfaction index</th>
<th>% Change from previous year</th>
<th>Best company in industry</th>
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<tbody>
<tr>
<td>Parcel delivery–express mail</td>
<td>81</td>
<td>2.5</td>
<td>Federal Express (83)</td>
</tr>
<tr>
<td>US postal service</td>
<td>72</td>
<td>1.4</td>
<td>–</td>
</tr>
<tr>
<td>Airlines (scheduled)</td>
<td>63</td>
<td>0.0</td>
<td>Southwest Airlines (70)</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>72</td>
<td>-1.4</td>
<td>Othersb (77)</td>
</tr>
<tr>
<td>Broadcasting–TV</td>
<td>64</td>
<td>3.2</td>
<td>–</td>
</tr>
<tr>
<td>Utilities–electric service</td>
<td>75</td>
<td>1.4</td>
<td>Southern Company (80)</td>
</tr>
<tr>
<td>Publishing-newspaper</td>
<td>68</td>
<td>-1.4</td>
<td>–</td>
</tr>
</tbody>
</table>

a Results are presented in a 0–100 scale.

b All others non-measures companies.

Fig. 8. Global ACSI results for year 2000 (National Quality Research Center, 2000).

Table 3

ACSI results for the transportation-communications-utilities sectora (2000)

<table>
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<th>Industry sector</th>
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<td>–</td>
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<tr>
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<td>68</td>
<td>-1.4</td>
<td>–</td>
</tr>
</tbody>
</table>

a Results are presented in a 0–100 scale.

b All others non-measures companies.

Fig. 9. Comparison of ACSI results for 1994–2000 (National Quality Research Center, 2000).
It is a structural model employing stochastic approach and using simultaneous equation estimation techniques (ECSI, 1998, Eklöf and Westlund, 2000). As presented in Fig. 10, the model includes a set of variables in order to explain customer preferences, perceived quality and other behavioural aspects. The set of latent variables can be categorised as drivers for explaining satisfaction, customer satisfaction, and consequences of satisfaction (loyalty):

- **Image**: It is a measure of the underlying image (association and perception) of the considered brand name.

- **Expectations**: They relate to prior anticipations of the product or company in the eyes of the individual customer. Such expectations are the result of active company or product promotion as well as prior experience with the product or service provider.

- **Perceived quality**: The concept of perceived quality is divided into two parts The “hardware” component means the quality of the product as such, while software relate to associated service like guarantees given, after-sales service, conditions of product display and assortment, etc.

- **Perceived value**: It concerns the “value for money aspects as they are experienced by the customer.

**Customer satisfaction**: The index indicates how satisfied customers are, and how well there expectations are met.

ECSI considers the European economy as a whole, and thus, customer satisfaction indices can be compared with each other and with the European average. The ECSI model provides the ability to produce 4 levels of satisfaction indices, similarly to ACSI results:

- National customer satisfaction indices.
- Economical sector indices.
- Specific industry indices.
- Scores for companies and organisations within the survey.

The pilot survey of 1999 includes only retail banking, telecommunications (fixed line and mobile telephony), and Supermarkets. Moreover, given the priorities of its national economy, each country had the ability to select additional economical sectors (ECSI, 1999a,b). Totally, in the period March–May 1999, more than 50,000 customers in 11 European countries participated in the pilot survey. The minimum sample for each company was defined at 250 customers.

The average level of satisfaction differs between the surveyed countries, as Fig. 11 presents. In the
Concerning the industry rating, European customers seem to be more satisfied from banking and supermarkets, while telecommunications sector has the lowest satisfaction indices (Table 4). Further analysis concerning the reason for customer valuation is needed in order to explain the above results and to predict future customer behaviour and loyalty. The transportation-communications sector is not yet included in ECSI, and thus it is not possible to be compared with other customer satisfaction barometers.

The main advantage of ECSI is that provided results are comparable between companies and organisations on national, European, and global levels. ECSI has been built to be compatible with other national satisfaction barometers, especially ACSI (ECSI, 1998; Eklof and Westlund, 2000). Also, the methodology may be used to produce a trend and a benchmark measure for individual companies and organisations or industries and economical sectors.

By mid spring 2000, the EOQ decided to abandon the ECSI programme, and as a result, EFQM and the newly established IFCF (International Foundation for Customer Focus) are about to undertake the whole programme, carrying out regular ECSI surveys. Their intention is to go beyond customer satisfaction and include people and society results in accordance with the established dimensions in the EFQM excellence model.

### 3.5. Using MUSA method as an industry satisfaction barometer

The implementation of the MUSA method for evaluating a customer satisfaction barometer concerns the Greek airline industry. The pilot survey, conducted in the area of Athens during June 2001, was mainly focused on domestic flights. Due to mergers and acquisitions, it is important to mention that only three airline companies were operating in domestic flights, during the survey period. Final input data consist of almost 500 questionnaires, collected through personal interviews with customers.

An extensive preliminary consumer behavioural analysis defined three main satisfaction dimensions: satisfaction before, during and after flight. As presented in Table 5, these main dimensions are defined by a set of analytical quality characteristics/subcriteria.
Greek customers are not satisfied from the provided service, given that the global average satisfaction index has a relatively low value (65.8%). Although the overall average satisfaction index for the quality characteristics during flight has the highest value (78.3%), customers appear very dissatisfied from the service offered before and after flight (average satisfaction indices 56.7% and 51.7%, respectively). Furthermore, satisfaction benchmarking analysis reveals that characteristics related with delays (punctuality, care/info during delays, waiting time on board) may differentiate airline companies. The average satisfaction indices of these quality characteristics appear the highest variation within the airline industry (best/worst satisfaction index).

Table 5

<table>
<thead>
<tr>
<th>Service quality criteria</th>
<th>Industry index</th>
<th>Worst/best index within the industry</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Before flight</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price</td>
<td>45.2</td>
<td>41.0</td>
</tr>
<tr>
<td>Booking</td>
<td>72.3</td>
<td>68.0</td>
</tr>
<tr>
<td>Personnel (ground)</td>
<td>73.5</td>
<td>68.0</td>
</tr>
<tr>
<td>Check-in</td>
<td>69.3</td>
<td>65.0</td>
</tr>
<tr>
<td>Care/info during delays</td>
<td>38.0</td>
<td>27.0</td>
</tr>
<tr>
<td>Departure/arrival times</td>
<td>60.8</td>
<td>58.0</td>
</tr>
<tr>
<td>Punctuality</td>
<td>42.0</td>
<td>26.0</td>
</tr>
<tr>
<td><strong>During flight</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety standards</td>
<td>90.3</td>
<td>81.7</td>
</tr>
<tr>
<td>Snacks and drinks</td>
<td>62.6</td>
<td>57.0</td>
</tr>
<tr>
<td>Comfort</td>
<td>72.6</td>
<td>71.0</td>
</tr>
<tr>
<td>Appearance of aircraft</td>
<td>71.6</td>
<td>67.0</td>
</tr>
<tr>
<td>Personnel (on board)</td>
<td>86.3</td>
<td>83.0</td>
</tr>
<tr>
<td>Travelling bag closet</td>
<td>71.3</td>
<td>69.5</td>
</tr>
<tr>
<td>Noise level</td>
<td>65.9</td>
<td>61.0</td>
</tr>
<tr>
<td><strong>After flight</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waiting time (on board)</td>
<td>62.6</td>
<td>58.0</td>
</tr>
<tr>
<td>Delivery time (baggage)</td>
<td>49.6</td>
<td>44.0</td>
</tr>
<tr>
<td>Baggage handling</td>
<td>50.3</td>
<td>46.0</td>
</tr>
<tr>
<td>Reaction in case of baggage damage/loss</td>
<td>43.2</td>
<td>37.0</td>
</tr>
</tbody>
</table>

*Results are presented in a 0–100 scale.

- The strong points of the Greek airline industry are focused on the safety standards and the personnel on board.
- The quality characteristics that can be considered as “threats” consist mainly of the price subcriterion and the attributes related with baggage service (handling, delivery time, company’s reaction in case of damage/loss) and delays (punctuality, departure/arrival time, care/info during delays).

Detailed results of this customer satisfaction survey for each individual airline company can be found in Tzanakis (2001), while it should be emphasised that only the repetition of this survey can give valuable and comparable results, in the context of a permanent customer satisfaction barometer.

3.6. Other quality improvement efforts and satisfaction barometers

One of the most important categories of customer satisfaction surveys is syndicated or
multiclient surveys, which give the ability of comparison analysis with the most important competitors. One of the first industries that have conducted syndicated satisfaction surveys was US automotive industry.

The American auto industry has been using surveys since 1978 to help dealers measure their performance against other competitors in order to identify operations that needed improvement. In some cases, the surveys have become unwieldy 100-questions documents (Massnick, 1997). The National Automobile Dealers Association (NADA) intervened in 1994 with a much shorter approach to determining a customer satisfaction index. This approach provides a uniform methodology for measurement based on defined satisfaction dimensions (Table 6). Other syndicated customer satisfaction surveys and awards (e.g. J.D. Power) are presented by Vavra (1997).

Other research efforts concerning the transportation-communications industry are mainly focused on examining service quality dimensions (Hopkins et al., 1993; National Research Council-TRB, 1999), developing quality improvement strategies (Curtis, 1984; Gourdin, 1988; Tyworth et al., 1989; Tan and Wisner, 2000), analysing customer behaviour (Chow and Poist, 1984), and examining linkage between service quality and productivity (Truitt and Haynes, 1994).

![Fig. 12. Relative action diagram for the Greek airline industry.](image-url)

Table 6
NADA’s survey satisfaction dimensions (Massnick, 1997)

<table>
<thead>
<tr>
<th>Purchase</th>
<th>Service</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Partial dimensions</strong></td>
<td><strong>Service</strong></td>
</tr>
<tr>
<td>1. Cleanliness and condition of the car</td>
<td>1. Easiness of getting a service appointment</td>
</tr>
<tr>
<td>2. Courteousness and professionalism of the salesperson</td>
<td>2. Explanation of repairs</td>
</tr>
<tr>
<td>3. Sales transaction handling of the business/financial department</td>
<td>3. Service time</td>
</tr>
<tr>
<td>4. Explanation of warranty and maintenance schedule</td>
<td>4. Proper repairs</td>
</tr>
<tr>
<td>5. Explanation of owner's manual and operating controls</td>
<td>5. Service fees</td>
</tr>
<tr>
<td><strong>Global dimensions</strong></td>
<td></td>
</tr>
<tr>
<td>6. Overall satisfaction from the purchase of the new car</td>
<td>6. Overall satisfaction from the service experience</td>
</tr>
<tr>
<td>7. Overall satisfaction from the purchase and delivery process</td>
<td>7. Recommend (for service)</td>
</tr>
<tr>
<td>8. Recommend (for purchase)</td>
<td></td>
</tr>
</tbody>
</table>
4. Concluding remarks

The national customer satisfaction indices are macro-indicators allowing comparison between organisations, sectors, industries and/or countries. They constitute basic economical indicators that aim to explain changes in the national productivity level and the consumer price index. The implemented methodologies are quite generic, and thus applicable to very different cases in parallel. This way, however, the obtained results do not analyse in depth customer satisfaction. They simply provide a comparison standard and organisations have to analyse it as well as other performance measures and build their own indicators, taking into account their present situation and strategy.

The most important characteristic of the methodological approaches is that customer satisfaction estimation is not based in one and only standard, given that satisfaction is perceived through a set of customer comparison standards (Johnson and Fornell, 1991). Besides, using multiple measures for a particular variable increases reliability of results, especially in case of a market survey. Moreover, the linear equation modelling provides the ability to test the correlation of the model variables (e.g. in SCSB, the mean value of $R^2$ in the satisfaction equation is up to 0.75).

Concerning the provided results and data analysis, the main problems appearing focus on the asymmetry regarding the distribution of survey data and the inconsistencies observed in relation to other customer satisfaction data (Grigoroudis and Siskos, 2002b). For example, although customer complaints, as recorded in the European Consumer Center, have been doubled, ECSI is up to 70% for 1999.

Some crucial parameters for analysing consumer behaviour, like customer’s demanding level, are not considered in the aforementioned satisfaction surveys, and this is the main reason for this kind of inconsistencies observed. For this reason special attention should be based when analysing and interpreting results from national customer satisfaction barometers.

The comparative analysis of the results for all these satisfaction barometers is very difficult due to either the lack of data for a relatively long period, or the limited coverage of partial economical sectors. Despite these, it seems that the transportation-communications sector does not appear a relatively high satisfaction level. The public transportation industry, as well the customers’ high demanding level concerning other competitive industries (e.g. mobile telephony, airlines, etc.) seem as the main cause for this particular result.

Finally, it should be emphasised that the national customer satisfaction barometers presented in this paper constitute the most important efforts for determining an overall performance standard of companies and business organisations. The estimated indices usually provide a baseline against which it will be possible to track customer satisfaction over time. These results provide significant information to companies because customer satisfaction ultimately will affect customer retention and, therefore, profitability and competitiveness (ECSI, 1998, 1999a).

Appendix A. Mathematical development of the ACSI/Fornell’s model

The model presented in Fig. 3 may be mathematically expressed through a set of equations estimated by partial least squares. Table 7 presents analytically the assessment of the variables used in Fornell’s model.

The equation that relates the latent variables of the model shown in Fig. 3 has the following form (National Quality Research Center, 1998):

\[
\begin{align*}
\eta_1 &= \begin{bmatrix} 0 & 0 & 0 & 0 & 0 \end{bmatrix} \\
\eta_2 &= \begin{bmatrix} \beta_{21} & 0 & 0 & 0 & 0 \end{bmatrix} \\
\eta_3 &= \begin{bmatrix} \beta_{31} & \beta_{32} & 0 & 0 & 0 \end{bmatrix} \\
\eta_4 &= \begin{bmatrix} 0 & 0 & \beta_{43} & 0 & 0 \end{bmatrix} \\
\eta_5 &= \begin{bmatrix} 0 & 0 & \beta_{53} & \beta_{54} & 0 \end{bmatrix}
\end{align*}
\]

\[
+ \begin{bmatrix} \gamma_{11} \\
\gamma_{21} \\
\gamma_{31} \\
\gamma_{4} \\
\gamma_{5} \end{bmatrix} \xi + \begin{bmatrix} \zeta_{1} \\
\zeta_{2} \\
\zeta_{3} \\
\zeta_{4} \\
\zeta_{5} \end{bmatrix} (A.1)
\]

where $\beta_{ij}$ and $\gamma_{ij}$ are the estimated coefficient parameters of the model, $\xi$ is the error vector, $\eta$ and $\xi$ are vectors of unobserved endogenous and exogenous variables, respectively.
Table 7
Variables assessment in the ACSI model (National Quality Research Center, 1998)

<table>
<thead>
<tr>
<th>( \xi )</th>
<th>( \eta_1 )</th>
<th>( \eta_2 )</th>
<th>( \eta_3 )</th>
<th>( \eta_4 )</th>
<th>( \eta_5 )</th>
<th>( \eta_6 )</th>
<th>( \eta_7 )</th>
<th>( \eta_8 )</th>
<th>( \eta_9 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>customer expectations</td>
<td>perceived quality</td>
<td>perceived value</td>
<td>customer satisfaction</td>
<td>customer complaints</td>
<td>customer loyalty</td>
<td>customer expectations about overall quality</td>
<td>customer expectations about reliability</td>
<td>customer expectations about customisation</td>
<td>overall quality</td>
</tr>
<tr>
<td>price tolerance (reservation price)</td>
<td>reliability</td>
<td>customisation</td>
<td>price given quality</td>
<td>quality given price</td>
<td>overall satisfaction</td>
<td>confirmation of expectations</td>
<td>distance to ideal product (service)</td>
<td>formal or informal complaint behaviour</td>
<td>repurchase intention</td>
</tr>
</tbody>
</table>

Similarly, the equation of the measured variables of the model is as follows (National Quality Research Center (1998):

\[
\begin{bmatrix}
   x_1 \\
   x_2 \\
   x_3
\end{bmatrix}
= \begin{bmatrix}
   \lambda_1 \\
   \lambda_2 \\
   \lambda_3
\end{bmatrix} \xi + \begin{bmatrix}
   \delta_1 \\
   \delta_2 \\
   \delta_3
\end{bmatrix}
\]  

(A.2)

where \( \lambda_{ij} \) are estimated factors, while \( \delta \) and \( \varepsilon \) are error vectors.

Based on Eqs. (A.1)–(A.3), the ACSI is estimated as follows (Fornell et al., 1996):

\[
ACSI = \frac{E[\xi] - \text{Min}[\xi]}{\text{Max}[\xi] - \text{Min}[\xi]} \cdot 100
\]

(A.4)

where \( \xi \) is the latent variable for ACSI, and \( E[\cdot] \), \( \text{Min}[\cdot] \) and \( \text{Max}[\cdot] \) denote the expected, the minimum and maximum value of the variable respectively.

The minimum and the maximum values are determined by those of the corresponding manifest variables (Fornell et al., 1996):

\[
\begin{aligned}
\text{Min}[\xi] &= \sum_{i=1}^n w_i \text{Min}[x_i], \\
\text{Max}[\xi] &= \sum_{i=1}^n w_i \text{Max}[x_i],
\end{aligned}
\]

(A.5)

where \( x_i \) are the measured variables of the latent customer satisfaction, \( w_i \) are the weights, and \( n \) is the number of measurement variables. In the ACSI there are 3 indicators of customer satisfaction in a 1–10 range, and thus the calculation may be simplified as follows (Fornell et al., 1996):

\[
ACSI = \frac{\sum_{i=1}^3 w_i \bar{x}_i - \sum_{i=1}^3 w_i \bar{X}_i}{9\sum_{i=1}^3 w_i} \cdot 100
\]

(A.6)

where \( w_i \) are the unstandardised weights.

Appendix B. A variation of the MUSA method in a case of a satisfaction barometer

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 the \( i \)th criterion (ordinal scaling). 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 modeling of preference disaggregation approach, the ordinal regression equation becomes as follows:

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

(B.1)

where \( \tilde{Y}^* \) is the estimation of the global value function \( Y^* \), \( b_i \) is the weight of the \( i \)th criterion with \( \sum_i b_i = 1 \), \( n \) is the number of criteria, and \( \sigma^+ \)
and $\sigma^-$ are the overestimation and the underestimation errors, respectively.

The global and partial satisfaction $Y^s$ and $X^s_i$ 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 $Y^s$ and $X^s_i$, the following transformation equations are used:

\[
\begin{aligned}
  z_m &= y^{sm+1} - y^{sm} \\
  w_{ik} &= b_i X_i^{sk+1} - b_i X_i^{sk} \\
  \end{aligned}
\]

for $m = 1, 2, \ldots, x - 1$, $k = 1, 2, \ldots, a - 1$, and $i = 1, 2, \ldots, n$, \hfill (B.2)

where $y^{sm}$ is the value of the $y^m$ satisfaction level, $X_i^{sk}$ is the value of the $x^k_i$ satisfaction level, and $x$ and $a_i$ are the number global and partial satisfaction levels.

The basic estimation model in the case of a satisfaction barometer can be written as follows:

\[
\begin{aligned}
  \{\min\} F &= \sum_{j=1}^{M} \sum_{t=1}^{T} \sigma_{ij}^+ + \sigma_{ij}^- \\
  \text{subject to} & \\
  \sum_{i=1}^{n} \sum_{k=1}^{q_i} w_{ik} - \sum_{m=1}^{z_m} z_m - \sigma_{ij}^+ + \sigma_{ij}^- &= 0 \\
  \text{for} & \quad j = 1, 2, \ldots, M \text{ and } t = 1, 2, \ldots, T, \\
  \sum_{m=1}^{z_m} z_m &= 100, \\
  \sum_{i=1}^{n} \sum_{k=1}^{q_i} w_{ik} &= 100, \\
  z_m, w_{ik}, \sigma_{ij}^+, \sigma_{ij}^- &\geq 0 \quad \forall \ m, i, j, k, t, \\
  \end{aligned}
\]

where $q_i$ and $q_{j|i}$ are the global and partial satisfaction judgements of the $j$th customer for the $t$th company with $y^{thj} \in Y = \{y^1, y^2, \ldots, y^{thj}, \ldots, y^x\}$ and $x^{thj}_i \in X_i = \{x^1_i, x^2_i, \ldots, x^{thj}_i, \ldots, x^a_i\}$, $M$ is the number of customers, and $T$ is the number of competitive companies.

The MUSA method includes also a post optimality analysis stage in order to overcome the problem of model stability. The final solution is obtained as the average of the optimal solutions provided by $n$ linear programs of the following form:

\[
\begin{aligned}
  \{\max\} F' &= \sum_{k=1}^{n} w_{ik} \\
  \text{for} & \quad i = 1, 2, \ldots, n \\
  \text{under the constraints} & \\
  F' &\leq F^* + \varepsilon, \\
  \text{all the constraints of LP (B.3)}, \\
  \end{aligned}
\]

where $\varepsilon$ is a small percentage of $F^*$.

Using the final solution, the average global and partial satisfaction indices, $S_i$ and $S_i$, respectively, for each company included in the survey are assessed through the following equations:

\[
\begin{aligned}
  S_t &= \frac{1}{100} \sum_{m=1}^{x} F_t w_{tm} y^{sm} \\
  S_i &= \frac{1}{100} \sum_{k=1}^{a_i} F_i x_{ik} \\
  \end{aligned}
\]

and $t = 1, 2, \ldots, T$, $i = 1, 2, \ldots, n$, \hfill (B.5)

where $p_t$ and $p_i$ are the frequencies of customers belonging to the $y^m$ and $x^k_i$, respectively, for the $i$th company.

Thus, following the approach of the major national satisfaction barometers and using a weighted sum formula, the average satisfaction indices for the whole industry are:

\[
\begin{aligned}
  Sind &= \frac{1}{\sum_{i=1}^{C_i}} \sum_{t=1}^{T} C_i S_t, \\
  Sind_i &= \frac{1}{\sum_{i=1}^{C_i}} \sum_{t=1}^{T} C_i S_i, \\
  \end{aligned}
\]

for $i = 1, 2, \ldots, n$, \hfill (B.6)

where Sind and Sind, are industry’s average the global and partial satisfaction indices, respectively, and $C_i$ is the sales of the $i$th company.

The calculation of criteria weights, satisfaction functions, and the development of action diagrams is similar to the basic MUSA method presented by Grigoroudis and Siskos (2002a).

\textbf{References}


Massnick, F., 1997. The customer is CEO: How to measure what your customers want—and make sure they get it, AMACOM, New York.


