Expert Systems with Applications 40 (2013) 7096–7110

Contents lists available at SciVerse ScienceDirect

Expert Systems with Applications

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

A fuzzy ServQual based method for reliable measurements of education quality in Italian higher education area

Toni Lupo *

Dept. of Chemical, Management, Informatics and Mechanical Engineering, Università degli Studi di Palermo, 90132 Palermo, Italy

ARTICLE INFO

Keywords:
ServQual
AHP
Fuzzy Sets Theory
Education services performance
Student satisfaction

ABSTRACT

In recent years, the attention that the European Community has focused on the education sector has produced a new university commitment addressed to quality aspects for all education related services. In fact, a quality oriented service requires excellence in the design and planning of service activities, as well as during its delivering and also for the adopted service performance evaluation method. However, considering that service performance evaluations are deeply based on stakeholders' judgments, they can be characterized by possible uncertainties related to incompleteness for partial ignorance, imprecision for subjectivity and even vagueness. Therefore, under these conditions, unreliable results can be obtained by widely considered service analysis methods. In the present paper, a method based on a recent extension of the ServQual model and that uses in combined manner the Fuzzy Set Theory and the Analytic Hierarchy Process method is proposed to effectively handle uncertainty in service performance analyses. In particular, the Fuzzy Set Theory is considered to deal with such uncertainty, whereas the AHP method is adopted as tool to estimate the importance weights of the strategic service attributes. Subsequently, the strategic analysis of the service value tree related to the Management Engineering program at the University of Palermo (Italy) is performed by using the proposed method. The performed service analysis allows the most influencing service performance factors to be captured and commented upon. Finally, the obtained results show that the professors' perception of service quality meaningfully influences the overall service performance level.

1. Introduction

Quality is a term that is commonly considered to indicate a high level of customers' satisfaction with refers to factors that characterize a considered product or service. In particular, considering education services, the related quality concept arising from aspects and features of teaching, research and related activities, with refer to their capability to satisfy the explicitly set out objectives. Considering the Italian higher education area, the latter are defined at European level by the European Union, at national level by MIUR, *i.e.* the Italian Ministry of Education, University and Scientific Research, and at local level declared by each University in its services agreement and/or during the promotional and guidance activities. Therefore, a "quality University" is that one that guarantees to all stakeholders, primarily students, certainty about the capacity to obtain suitable results with respect to stated and promised objectives. For these reasons, it is necessary that quality of education services is continuously monitored and controlled by suitable monitoring procedures. However, the execution of reliable service performance evaluations can be a difficult problem to handle since, services are characterized by some significant aspects of complexity related to their peculiar characteristics. More in details, services are generally considered to be:

- intangible i.e. immaterial;
- inseparable, i.e. services are produced, delivered and consumed simultaneously;
- heterogeneous, i.e. a service provided to one customer is not exactly the same as that provided to the next customer;
- perishable, i.e. services cannot be produced in advance and stored for later delivery.
- sharing product, i.e. customers of a service are also service co-producers, since the achieved service performance level is directly influenced by their presence and interaction during service delivering (Glynn & Barnes, 1995)

In particular, since immaterial, services are not controllable and thus also measurable in their own technical and commercial specifications in quantitative terms by classical measuring techniques and conventional measure units. Implications with regard to the latter aspects involve the need for design suitable methodologies for reliable service performance evaluations, and to identify

* Tel.: +39 9123861879.
E-mail address: toni.lupo@unipa.it

0957-4174/$ - see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.eswa.2013.06.045

"atypical" measure units, if compared with those used in the manufacturing field, to highlight the achieved service performance level.

Service performance is an "unphysical quantity" that represents a latent trait of the service. More in detail, it cannot directly measured, *i.e.* its evaluation is done considering measurable and suitable service characteristics which performance levels provide an indirect measure of service performance (De Battisti, Nicolini, & Salini, 2005; De Battisti, Nicolini, & Salini, 2010).

For example, the evaluation of customer satisfaction represents an indirect measure of the service performance level, since it is performed with relation to proper service aspects whose performance levels, quantified by means of the so called "manifest variables", are intended as "latent manifestations" of service performance. The relationship between manifest variables and latent manifestations can be formalized by means of specific conceptual models (Ding, 2006). In the literature, several conceptual models have been formulated and among these the main classical ones are listed below:

- *ServQual* (Parasuraman, Zeithaml, & Berry, 1985), whose theoretical principle is the discrepancy or gap theory: the difference between service perceptions and expectations, weighted by the importance assigned to each service dimension, represents a manifest variable of the service performance;
- *Two-Way* (Schvaneveldt, Enkawa, & Miyakawa, 1991), based on the consideration that the latent factors are of "objective" (quality attributes) and "subjective" (satisfaction levels) kind;
- *SERVPERF* (Cronin & Taylor, 1992), in which only service perceptions represent manifest variables of the service performance;
- *Normed Quality* (Teas, 1993), whose theoretical principle assumes that a distinction between ideal and feasible expectations has to be done in order to evaluate the service performance;
- *Qualitometro* (Franceschini & Rossetto, 1998), according to which the perceptions and expectations measures have to be performed at different times.

In addition to those previously considered, other conceptual models have been proposed focused on operations aspects related to service delivering and on reliability service, *i.e.* its capacity to deliver what the customer wants (Ghobadian, Simon Speller, & Jones, 1994). However, to date the ServQual model is one of the most established conceptual models for determining customer satisfaction in services (Lupo, 2013a). Over the time, ServQual model has been used extensively in the service literature; several recent applications of the ServQual model in different service fields are described in: Chen, Chang, and Lai (2009), Large and König (2009), Liu and Lai (2009), Lin (2010), Büyüközkan, Cifci and Guleryuz (2011a) and Lupo (2013b).

The SERVQUAL model in its original formulation consists of 22 statements measuring 5 critical to quality dimensions of service quality namely *tangibility*, *reliability*, *responsiveness*, *assurance*, and *empathy*. The required data for the assessment of service quality through the SERVQUAL model are quantitative in nature which can be expressed in terms of exact numbers by linguistic-numerical evaluation scales. Moreover, in the service quality concept seven major Gaps are considered by the Authors, as shown in Fig. 1.

According to a recent development of the ServQual model (Curry, 1999; Luk & Layton, 2002), the three main Gaps, which are more associated with customer satisfaction, are: the Gap 1, the Gap 5 and the Gap 6; since they have a direct relationship with customers. More in detail, such Gaps measure the discrepancy between:

- customers' expectations and management's perceptions of service quality, for the Gap 1;
- customers' expectations and employees' perceptions of service quality, for the Gap 6.
- customers' expectations and their perceptions, for the Gap 5;

and they are evaluated with relation to critical to quality service criteria and sub-criteria.

By considering the cognitive sphere of the stakeholder, such service Gaps values can be obtained by the algebraic comparison between (Parasuraman et al., 1985):

- management's perceptions of the customers' expectations (P_M) and the customers' expectations (E): Gap 1 = $P_M - E$;
- employees' perceptions of customers' expectations (P_E) and the customers' expectations (E): Gap 6 = $P_E - E$:
- customers' perceptions (P) and the their expectations (E): Gap 5 = $P - E$.

Therefore, values assumed by the Gap 1 can be considered as a direct result of the lack of a marketing research orientation and inadequate upward communication, whereas Gap 6 values represent the result of the differences in the understanding of customer expectations by front-line service providers. Finally, Gap 5 values reflect the result of the influences exerted from the customer side and the shortfalls (Gaps) on the part of the service provider and therefore such values can be considered as direct indicators of the customer satisfaction degree. Therefore, customers' dissatisfaction is collected for the service aspects in which a negative value of the Gap 5 is obtained.

Given the financial and resource constraints under which academic organizations have to operate, as well as, the increased competition among academic organizations regarding student recruitment, understanding exactly what students expect is the most crucial step in defining and delivering a high-quality education service (Chou, Liu, Huang, Yih, & Han, 2011). In particular, it is fundamental that students' expectations and perceptions are properly measured and correctly understood and that, from the perspective of students, the critical to quality service criteria and sub-criteria are properly identified. In fact, the latter quantities should be taken into the design process to effectively support the decision maker in identifying suitable "Gaps oriented" service improvement solutions (Zeithaml, Berry, & Parasuraman, 1996; Zeithaml, Parasuraman, & Berry, 1990).

However, many critical factors are associated to the employment of ServQual model. Some difficulties are related to the use of linguistic-evaluation scales: the well-documented tendency of respondents to select central linguistic categories to express judgments, influence of the linguistic categories number in the evaluation process, the form and the type of the adopted linguistic variables and, finally, the transformation from cardinal to metric data. Other critical factors are related to ambiguity of expectations evaluation (Babakus & Boller, 1992) and the difficulties arising from the use of differential psychometric score (Brown, Churchill, & Peter, 1993; Peter, Brown, & Churchill, 1993).

In the light of the previous considerations, in the present paper the ServQual discrepancy paradigm is considered to evaluate the student satisfaction (SS) level. However, to estimate service expectations' levels required by the ServQual model, the Analytic Hierarchy Process (AHP) method is herein considered (Saaty, 1980). AHP is a multi-criteria decision making (MCDM) method that helps the decision-maker facing a complex problem with multiple conflicting and subjective criteria (e.g., location or investment selection, projects ranking, and so forth). AHP is based on three principles that determine the procedure steps of the method: (Forman & Gass, 2001): the principle of problem hierarchical decomposition; the principle of comparison judgments and the principle of the synthesis, considered to aggregate partial results in order to obtain