# II.C
# Service Systems

*Handbook of Industrial Engineering: Technology and Operations Management, Third Edition.*
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# CHAPTER 21

# Service Industry Systems and Service Quality

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## 1. INTRODUCTION

Since the beginning of the 20th century, most economically advanced western societies have evolved from predominantly manufacturing-based to predominantly service-based economies (Bell 1973; Fitzsimmons and Fitzsimmons 1998; Heskett 1987; Mills 1986; Rust et al. 1996; Zeithaml and Bitner 2000). This transition has been especially dramatic in the United States (Ginsberg and Vojta 1981), where from 1948 to 1978 the service sector increased from 54% to 66% of GNP. A similar trend can be discerned in employment. From 1948 to 1977, employment in the service sector has risen from 27.2 million to 54.4 million, more than the total number of people employed in 1948. Currently, the services sector employs approximately 80% of the workforce and accounts for about 75% of GNP (Fitzsimmons and Fitzsimmons 1998; Zeithaml and Bitner 2000). Apart from national indicators, trade in services is growing globally. For the United States, the positive trade balance for services has helped to offset the negative trade balance for goods (Henkoff 1994; Zeithaml and Bitner 2000).

The increased importance of the service sector regarding both national economies and international trade has led to increased attention by marketers on the marketing of services during the last three decades (Swartz and Iacobucci 2000). The marketing field has moved quite rapidly beyond mere definitional issues to the development of models of service management and organization (Swartz et al. 1992). A major research topic in the marketing field currently is service quality (Parasuraman et al. 1985, 1988, 1991; Rust and Oliver 1994). This emphasis on service quality in marketing can be explained to a large extent by the fact that several authors have demonstrated a positive relationship between (service) quality and economic performance (Anderson and Fornell 1994; Buzzell and Gale 1987; Reichheld and Sasser 1990; Rust et al. 1995).

In Section 2, we will explore the nature of services. In Section 3, we will discuss the service encounter, which is at the heart of the majority of service organizations. During the service encounter, service quality is rendered to the customer in the interplay among customer, customer-contact service employee, and service organization. In Section 4, we will focus on defining service quality and discuss the conceptual model of service quality, a framework for the management of service quality. In Section 6, we will describe a measurement instrument, SERVQUAL, that has been derived from this model. In Section 7, we will present a critical review of the conceptual model of service quality and the SERVQUAL instrument.

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## 2. THE NATURE OF SERVICES

Initially, in the marketing field it was assumed that the marketing of goods and services were essentially identical. However, marketers increasingly realized that the marketing of services is separated from the marketing of goods by a number of attributes (Grönroos 1978; Shostack 1977a, b; Zeithaml 1981). Generally, the following four attributes are used to distinguish goods from services (Zeithaml et al. 1985):

1. *Intangibility:* Services are much less tangible than physical goods. Services are experiences rather than objects that can be possessed.
2. *Inseparability of production and consumption:* Goods are first produced and then consumed. Services, on the other, hand, are characterized by simultaneous production and consumption.
3. *Heterogeneity:* The quality of a service may vary from service provider to service provider, from consumer to consumer, and from day to day.
4. *Perishability:* Because services are experiences rather than objects, they cannot be stored. As a result, service providers may find it difficult to synchronize supply and demand.

Intangibility is generally recognized as critical to the dichotomy between goods and services (Zeithaml et al. 1985). The other three attributes can be viewed as consequences of intangibility. Each attribute leads to specific problems for service marketers, which in turn necessitate special marketing strategies to solve them. For instance, intangibility may affect the marketing communications of an organization because services cannot be easily communicated to consumers.

Quality management in service organizations is especially strongly affected by these attributes of services vis-à-vis goods. First, because services are performances rather than objects, service organizations might find it difficult to understand how consumers perceive and evaluate service quality. Consequently, uniform and consistent quality standards can rarely be set (Berry 1980; Zeithaml 1981). Secondly, services are characterized by simultaneous production and consumption. Thus, services are not manufactured at a plant but are generally the result of the interaction between customer and service provider. Consequently, quality control will be rather difficult to ensure (Grönroos 1978). Thirdly, services, especially those with high labor content, are heterogeneous. As a result, consistent and uniform quality will be a serious problem because it is contingent on the interaction between customer and customer-contact service employee (Bitner 1990; Czepiel et al. 1985). Finally, perishability means that services cannot be stored and hence quality cannot be verified in advance of the sale (Shostack 1977a). In the next section, we will discuss the service encounter, which is at the heart of the majority of service organizations.

## 3. THE SERVICE ENCOUNTER

Findings from the American Customer Satisfaction Index and other national indexes reveal that services are consistently the lowest-scoring sector on customer satisfaction, with public services scoring lowest (Anderson and Fornell 1994). In service organizations, customer satisfaction is often determined by the quality of individual encounters—the service encounter (Bitner 1990; Solomon et al. 1985). The service encounter has been defined as ''a period of time during which a consumer directly interacts with a service'' (Shostack 1985, p. 243). This definition emphasizes that the service encounter encompasses all elements of the interaction between consumer and service organization: the intangible as well as the tangible elements. Others, however, indicate that the service encounter is mainly conceived as interpersonal interaction between service provider and customer (Chase 1978; Solomon et al. 1985). Solomon et al. (1985, p. 100) define the service encounter as ''the face-to-face encounter between a buyer and a seller in a service setting.'' Although we acknowledge the importance of the personal elements in the service encounter, we feel that tangible elements need to be included in the service encounter (cf. Bitner 1990). For instance, the use of advanced technology and equipment may bestow a feeling of trust and a connotation of high quality on the customer.

The nature of the service encounter is succinctly depicted in Figure 1. Essentially, the service organization consists of two parts: a visible and an invisible part (Chase 1978; Langeard et al. 1981; Shostack 1985). The invisible part is concerned with all organizational processes in the service organization that support the visible part in delivering the service to the customer. The visible part consists of the tangible elements (Bitner 1990) and intangible elements—the customer-contact service employee.

The evaluation of the service encounter can be approached from several perspectives (Bateson 1985; Czepiel et al. 1985): (1) an organizational perspective, (2) a customer perspective, and (3) a customer-contact service employee perspective. The service organization is mainly interested in the performance of the customer-contact service employee because this perspective allows the service organization to attain its objectives. It is therefore essential for the service organization to identify organizational factors that affect the performance of service employees. The customer is mainly

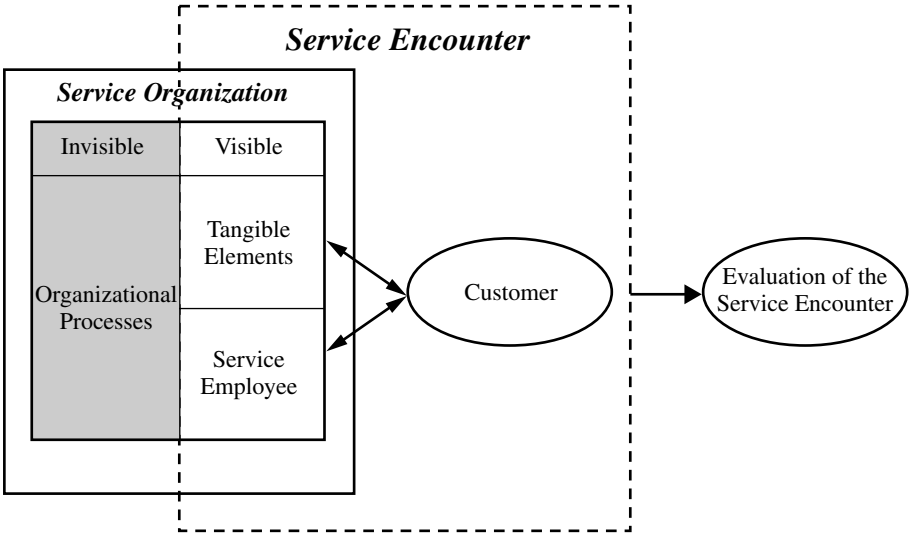


**Figure 1** The Service Encounter. (Partly based on the SERVUCTION system model developed by Langeard et al. 1981)

interested in the service quality and customer satisfaction derived from the service encounter. If the evaluation of service quality and customer satisfaction is positive, the customer may decide to remain loyal to the service organization (Bateson 1985; Czepiel et al. 1985). The customer-contact service employee perspective is mainly concerned with the primary rewards of the service encounter, such as pay, promotion, job satisfaction, and recognition from the employee's colleagues and supervisor. These primary rewards are mainly contingent on the employee's performance in the service encounter. However, it should be noted that customer-contact personnel generally really care about the customer and are willing to exert the greatest possible effort to satisfy the customer's needs (Schneider 1980; Schneider and Bowen 1985).

The marketing field has concentrated mainly on the service customer. The customer-contact service employee has been relatively neglected in marketing academia (cf. Hartline and Ferrell 1996). One notable exception is the conceptual model of service quality (Parasuraman et al. 1985), where perceived service quality is determined by four organizational gaps. This model was later extended by adding organizational control and communication processes (Zeithaml et al. 1988). In the next section, we will explore the definition of service quality, which is used as the basis for conceptual model of service quality.

## 4. DEFINING SERVICE QUALITY

Quality is an elusive and fuzzy concept and as a result is extremely hard to define (Garvin 1984a, b; Parasuraman et al. 1985; Reeves and Bednar 1994; Steenkamp 1989). This may partly be caused by the different perspectives taken by scholars from different disciplines in defining quality. Multiple approaches to defining quality have been identified by various authors (Garvin 1984a, b; Reeves and Bednar 1994). Garvin (1984b) distinguishes five major approaches to define quality.

The *transcendent approach* defines quality as "innate excellence" (Garvin 1984b, p. 25): Proponents of this approach contend that quality cannot be precisely defined but rather is absolute and universally recognizable. This approach finds its origins in philosophy, particularly in metaphysics (Reeves and Bednar 1994; Steenkamp 1989). However, its practical applicability is rather limited because quality cannot be defined precisely using this perspective (Garvin 1984a, b; Steenkamp 1989).

The *product-based approach* posits that quality differences amount to differences in the quantity of a particular desired attribute of the product (Steenkamp 1989). Garvin (1984b, p. 26) provides the following illustration of this approach: "[H]igh-quality ice cream has a high butterfat content, just as fine rugs have a large number of knots per square inch." The assumption underlying this approach suggests two corollaries (Garvin 1984b). First, higher quality products can only be obtained at higher cost because quality is reflected in the quantity of a particular desired attribute. Secondly, quality can be evaluated against an objective standard, namely quantity.

The *user-based approach* to defining quality is based on the notion that ''quality lies in the eye of the beholder'' (Garvin 1984b, p. 27). In essence, this approach contends that different consumers have different needs. High quality is attained by designing and manufacturing products that meet the specific needs of consumers. As a result, this approach reflects a highly idiosyncratic and subjective view of quality. Juran (1974, p. 2-2), a proponent of this approach, defines quality as ''fitness for use.'' This approach is rooted in the demand side of the market (cf. Dorfman and Steiner 1954). Two issues should be addressed with regard to this approach (Garvin 1984b). The first issue concerns the aggregation of individual preferences at the higher level of the market. The second issue deals with the fact that this approach essentially equates quality with (a maximization) of satisfaction. In other words, as Garvin (1984b, p. 27) puts it: ''A consumer may enjoy a particular brand because of its unusual taste or features, yet may still regard some other brand as being of higher quality.'' As opposed to the user-based approach, the *manufacturing-based approach* to quality originates from the supply side of the market, the manufacturer. This approach is based on the premise that meeting specifications connotes high quality (Crosby 1979). The essence of this approach boils down to this: quality is ''conformance to requirements.'' (Crosby 1979, p. 15). This approach to defining quality is quite elementary, being based on an objective standard or specification (Reeves and Bednar 1994). A critical comment on this approach is articulated by Garvin (1984b), who finds that although a product may conform to certain specifications or standards, the content and validity of those specifications and standards are not questioned. The perspective taken in this approach is predominantly inward. As a result, firms may be unaware of shifts in customer preferences and competitors' (re)actions (Reeves and Bednar 1994).

The ultimate consequence of this approach is that quality improvement will lead to cost reduction (Crosby 1979; Garvin 1984b), which is achieved by lowering internal failure costs (e.g., scrap, rework, and spoilage) and external failure costs (e.g., warranty costs, complaint adjustments, service calls, and loss of goodwill and future sales) through prevention and inspection.

The *value-based approach* presumes that quality can be defined in terms of costs and prices. Garvin (1984b, p. 28) uses the following example to clarify this perspective: ''[A] $500 running shoe, no matter how well constructed, could not be a quality product, for it would find few buyers.'' Reeves and Bednar (1994) emphasize that this definition of quality forces firms to concentrate on internal efficiency (''internal conformance to specifications'') and external effectiveness (''the extent to which external customer expectations are met''). However, this approach mixes two distinct, though related, concepts: quality and value (Reeves and Bednar 1994). Because of its hybrid nature, this concept lacks definitional clarity and might result in incompatible designs when implemented in practice.

Reeves and Bednar (1994) propose one additional approach to quality: quality is meeting and/or exceeding customers' expectations. This approach is based on the definition of perceived service quality by Parasuraman et al. (1988, p. 17): ''Perceived service quality is therefore viewed as the degree and direction of discrepancy between consumers' perceptions and expectations.'' This definition was initially conceived in the services marketing literature and as such takes an extremely user-based perspective (Grönroos 1990; Parasuraman et al. 1985). Grönroos (1990, p. 37) in this respect emphasizes: ''It should always be remembered that *what counts is quality as it is perceived by the customers*'' (emphasis in original).

Relying on only a single approach to defining quality might seriously impede the successful introduction of high-quality products; a synthesis of the above approaches is clearly needed. Garvin (1984b) proposes a temporal synthesis, in which emphasis shifts from the user-based approach to the product-based approach and finally to the manufacturing-based approach as products move from design to manufacturing and to the market. The user-based approach is the starting point because market information must be obtained using marketing research to determine the features that connote high quality. Next, these features must be translated into product attributes (the product-based approach). Finally, the manufacturing approach will need to ensure that products are manufactured according to specifications laid down in the design of the product. This notion is readily recognizable in the conceptual model of service quality conceived by Parasuraman et al. (1985).

## 5. THE CONCEPTUAL MODEL OF SERVICE QUALITY

Parasuraman et al. (1985) distinguish three premises concerning service quality:

1. Service quality is more difficult for the consumer to evaluate than goods quality.
2. Service quality perceptions result from a comparison of consumer expectations with the actual service performance.
3. Quality evaluations are not made solely on the outcome of a service; they also involve evaluations of the process of service delivery.

From these three, Parasuraman et al. (1985) develop the conceptual model of service quality based on executive interviews and focus group interviews. In this model, GAP5 (perceived service quality)

is defined as perception ($P$) minus expectations ($E$) and is determined by the magnitude and direction of internal gaps, GAP1–GAP4. The four internal gaps can be described as follows:

1. *Marketing information gap* (*GAP1*)*:* the difference between actual customer expectations and management perception of customer expectations
2. *Standards gap* (*GAP2*)*:* the difference between management perception of customer expectation and service quality specifications
3. *Service performance gap* (*GAP3*)*:* the difference between service quality specifications and the service actually delivered
4. *Communication gap* (*GAP4*)*:* the difference between the service delivered and what is communicated about the service to customers

GAP5 (perceived service quality) is multidimensional in nature. Parasuraman et al. (1985) distinguish 10 underlying dimensions of perceived service quality. These dimensions are summarized in Table 1. Using these original 10 dimensions, Parasuraman et al. (1988) developed a measurement instrument for perceived service quality: SERVQUAL.

## 6. THE SERVQUAL INSTRUMENT

The SERVQUAL instrument for measuring service quality has evolved into a kind of gospel for academics and practitioners in the field of service quality. With the 10 dimensions in Table 1 as a starting point, 97 items were generated (Parasuraman et al. 1988). Each item consisted of two components: one component reflected perceived service or perceptions and the other component reflected expected service or expectations. Both components were measured on seven-point Likert scale with only the ends of scale anchored by ''Strongly disagree'' (1) and ''Strongly agree'' (7). The items were presented in a two consecutive parts. The first part contained the expectation components for the items, while the second part contained the perception components for the items. In order to prevent distortion of the responses by acquiescence bias or ''yea-saying or nay-saying'' tendencies, about half of the items were negatively worded and the other half positively worded—reverse statement polarization.

Two stages of data collection and scale purification were subsequently carried out. The first stage of data collection and scale purification, using coefficient $\alpha$, item-to-total correlations and principal components analysis, resulted in a reduction of the number of factors to seven. Five of the original factors were retained in this configuration (see Table 1): (1) tangibles, (2) reliability, (3) responsiveness, (4) understanding/knowing the customer, and (5) access. The remaining five dimensions (communication, credibility, security, competence and courtesy), were collapsed into two dimensions. The number of factors was further reduced in the second stage of data collection and scale purification. The results of principal components analysis suggested an overlap between the dimensions understanding/knowing the customer and access and the dimensions communication, credibility, security, competence and courtesy. Consequently, the overlapping dimensions were combined to form two separate dimensions: (1) assurance and (2) empathy.

Parasuraman et al. (1991) present a replication and extension of their 1988 study. In particular, they propose a number of modifications to the original SERVQUAL instrument (Parasuraman et al. 1988). The first modification is concerned with the expectations section of SERVQUAL. Confronted with extremely high scores on the expectations components of the individual statements, Parasuraman et al. (1991) decided to revise the expectation part of the instrument. Whereas the original scale

**TABLE 1 Dimensions of Service Quality**

1. Reliability involves consistency of performance and dependability.
2. Responsiveness concerns the willingness or readiness of employees to provide service.
3. Competence means possession of the required skills and knowledge to perform the service.
4. Access involves approachability and ease of contact.
5. Courtesy involves politeness, respect, consideration, and friendliness of contact personnel.
6. Communication means keeping customers informed in language they understand and listening to them.
7. Credibility involves trustiness, believability and honesty.
8. Security is freedom from danger, risk, or doubt.
9. Understanding/knowing the customer involves making the effort to understand the customer's needs.
10. Tangibles include the physical evidence of the service.

Adapted from Parasuraman et al. 1985, p. 47.

reflected normative or ideal expectations, the revised instrument reflected predictive expectations relative to an excellent firm in the industry. For example, with regard to statement no. 5, the expectation item (E5) of the original instrument is formulated as follows: ''When these firms promise to do something by a certain time, they *should* do so'' (Parasuraman et al. 1988, p. 38). In the revised SERVQUAL instrument, the wording of expectation item no. 5 (E5) has been changed to ''When *excellent telephone companies* promise to do something by a certain time, they *will* do so'' (Parasuraman et al. 1991, p. 446).

A second modification related to the use of negatively worded items for the responsiveness and empathy dimensions in the original instrument. For the modified instrument, all negatively worded items were replaced by positively worded items. Moreover, in their 1991 study, Parasuraman and his colleagues suggest adding an importance measure to instrument in order to be able to calculate ''a composite, weighted estimate of overall service quality'' (Parasuraman et al. 1991, p. 424). Parasuraman et al. (1991) propose that importance should be measured by allocating 100 points to the individual dimensions of service quality in accordance with their perceived importance.

## 7. THE SERVQUAL INSTRUMENT: A CRITICAL REVIEW

Several conceptual and measurement concerns have been raised with regard to the SERVQUAL instrument. The single most important strength of the conceptual model underlying the SERVQUAL instrument is its inherent parsimony. However, Iacobucci et al. (1994) argue that this strength is simultaneously its major shortcoming. The conceptual model of service quality is based on relative evaluations. The absolute level of perceptions (P) and expectations (E) does not enter the equation. The ultimate consequence of this definition is that service quality will be evaluated favorably as long as expectations are met or exceeded. The absolute level of either perceptions or expectations is not explicitly taken into consideration. Iacobucci et al. (1994, p. 16) use the example of Joe's Diner, a truck-stop restaurant with very low expectations, to illustrate the importance of absolute levels of expectations: ''[T]he customer who enters Joe's Diner with appropriately low expectations and indeed experiences poor food and rude service. It is unlikely that predicting a favorable evaluation is valid, even though the customer's prior expectations had been met.''

Another consequence of this conceptualization of service quality is that services exceeding expectations in the same magnitude (and direction) are predicted to lead to similar levels of perceived service quality. For example, assume that a seven-point Likert-type rating scale is used to capture both perceptions and expectations. Further, assume service A scores 2 on expectations and service B scores a 6 on expectations. The corresponding perception scores are a 3 for service A and a 7 for service B. These results in the same perceived service quality score for both service A ($7 - 6 = 1$) and service B ($3 - 2 = 1$). However, it would be rather unrealistic to assume that both services result in the same level of perceived service quality, since service B exhibited both a higher level of perceptions and expectations.

The multidimensional nature of service quality has been acknowledged in the European as well as the North American research traditions in services marketing (Grönroos 1990; Parasuraman et al. 1988, 1991). Although the exact number of dimensions remains open to discussion, the general notion of multidimensionality seems to be generally accepted. The generalizability of the five SERVQUAL dimensions in other than the original industries (Parasuraman et al. 1988, 1991) is still rather problematic (e.g., Babakus and Boller 1992; Carman 1990; Cronin and Taylor 1992; Paulin and Perrien 1996).

Furthermore, it could be argued that a service encounter consists of two major components: (1) the service process and (2) the service outcome (Grönroos 1990; De Ruyter and Wetzels 1998). The five dimensions identified in the conceptual model of service quality are directed towards the interaction between customer and service provider and therefore focus on the service process (Lapierre 1996). De Ruyter and Wetzels (1998) find in an experimental study that service process and service outcome interact. Although service process is an important determinant of evaluative judgments (e.g., customer satisfaction), it may not wholly compensate for an unfavorable service outcome.

An additional problem with the conceptual model of service is its implicit assumption that each service encounter consists of only a single stage (Lemmink et al. 1998; De Ruyter et al. 1997). In particular, if a service encounter consisted of multiple stages, the dimensions of the conceptual model of service quality would require an extension at the level of the individual stage level. Rust et al. (1995) take this train of thought to an even more extreme position. They are structuring service quality as structures around the business process. Apart from introducing stages into the model, such an approach also ensures managerial relevance.

An issue that has received ample attention in academia in this respect is the differentiation between service quality and customer satisfaction (Cronin and Taylor 1992, 1994; Iacobucci et al. 1994, 1996; Oliver 1993). The confusion surrounding these two constructs in services research can be accounted for by the fact that both are based on the same canonical model (Iacobucci et al. 1996). Service quality and customer satisfaction models share the following characteristics (Iacobucci et al. 1996):

1. Customers are thought to hold the expectations prior to their purchases.
2. Customers make perceptions regarding their purchases.
3. Customers compare their perceptions to their expectations.
4. This comparative process results in evaluations of quality and/or satisfaction (and subsequent effects, e.g., future purchase intentions).

Oliver (1993) proposes that service quality and customer satisfaction differ in four fundamental characteristics. To begin with, the dimensions underlying quality are quite specific, while customer satisfaction can result from any dimension related to the service encounter. Secondly, service quality is based on ideals or "excellence" (Parasuraman et al. 1988, 1991), whereas customer satisfaction can be based on a host of alternative standards, such as predictive norms and experience-based norms (Iacobucci et al. 1994, 1996). Iacobucci et al. (1994, p. 15), following similar reasoning, propose a similar approach: "Perhaps satisfaction is indeed judged by consumers against their own internal standards, whereas quality is would be better defined as judgment relative to managerial or competitive standards." In fact, they propose that service quality is based on external standards and customer satisfaction on internal standards.

This classification of standards is closely related to the following third characteristic suggested by Oliver (1993), who contends that service quality does not require experience with service or service provider. Customer satisfaction, on the other hand, is an experiential construct. Customer satisfaction can only be evaluated by actually experiencing the service encounter (Anderson and Fornell 1994; Iacobucci et al. 1994). Anderson and Fornell (1994) suggest that in general, customer satisfaction is influenced by price, whereas service quality is viewed as independent from price. Price or costs incurred are often modeled using value; value is thus operationalized as the ratio of perceived quality relative to price (cf. Zeithaml 1988).

Finally, service quality and customer satisfaction are based on different sets of antecedents. The antecedents of service quality are mainly limited to communication, both personal and impersonal, and situational characteristics (Zeithaml et al. 1993). Customer satisfaction has been hypothesized to be influenced by a number of cognitive and affective processes, such as disconfirmation, equity, attribution, mood states, and emotions (Oliver 1993).

Another major weakness of the conceptual model of service quality is its omission of financial factors (Anderson and Fornell 1994; Iacobucci et al. 1994; Lemmink et al. 1998; De Ruyter et al. 1997). During the past decade, various competing models have been advanced to explain consumer evaluations of services (Iacobucci et al. 1996). Many of these models include service quality and satisfaction as their basic focal constructs, departing from a comparison between customer expectations and service provider performance (Iacobucci et al. 1994).

Value has frequently been conceptualized as the outcome of a price/quality ratio or the comparison of what one receives with the cost of acquisition (Anderson et al. 1994; Zeithaml 1988). According to this point of view, service customers will attempt to maximize the level of quality in relation to the disutility of price. Price in this case may be interpreted as a psychological price in terms of time and distance. It has been argued that customers will favor service providers that maximize quality minus the disutility from prices. Therefore, while the quality of a service may be conceived of as good, its net or marginal value may still be rated poor if the price of that service is perceived to be too high (Rust and Oliver 1994). This conceptualization of value as a proxy for the quality price ratio may be labeled the value-for-money approach. This approach closely focuses on value as a cognitive construct because an explicit comparison between price and quality is made by consumers. However, it has been emphasized recently that affect should also be considered in determining postpurchase responses (Oliver 1993). If value is perceived as a summary cognitive and affective response then an affective component should also be incorporated in a conceptualization of value. De Ruyter et al. develop a conceptualization of value, in which they introduce three dimensions: (1) emotional, (2) practical, and (3) logical (e.g., Lemmink et al. 1998; De Ruyter et al. 1997).

Moreover, several empirical concerns have also been raised with regard to the conceptual model of service quality, particularly with regard to the measurement instrument SERVQUAL instrument. The dimensionality of the SERVQUAL instrument is a well-researched issue (Asubonteng 1996; Buttle 1996; Paulin and Perrien 1996).

In their initial study, Parasuraman et al. (1988) report relatively high values of coefficient $\alpha$ for the individual dimensions of SERVQUAL. Moreover, using exploratory factor analysis to assess the convergent and discriminant validity, they find that each item loads high only on the hypothesized factor for the four participating companies.

These favorable results, however, seem not to have been replicated in their 1991 study (Parasuraman et al. 1991). Although the reliabilities in terms of coefficient $\alpha$ were still relatively high, their factor-analytic results seemed somewhat problematic. In particular, the tangibles dimension loaded on two dimensions (one representing equipment and facilities and one representing personnel and communication materials), thus casting considerable doubt on the unidimensionality of this dimen-

sion. Furthermore, responsiveness and assurance (and to some degree reliability) loaded on the same factor, while in general interfactor correlations were somewhat higher than in their 1988 study. These divergent results might be caused by an artifact: restraining the factor solution to five factors. Therefore, Parasuraman et al. (1991) proposed that a six-factor solution might lead to a more plausible result. Although responsiveness and assurance seemed to be slightly more distinct, tangibles still loaded on two factors, whereas the interfactor correlations remained high.

Replication studies by other authors have fared even less well than the studies by the original authors. Carman (1990) carried out a study using an adapted version of SERVQUAL in four settings: (1) a dental school patient clinic, (2) a business school placement center, (3) a tire store, and (4) an acute care hospital, and found similar factors (although not an equal number) as compared to Parasuraman et al. (1988, 1991). However the item-to-factor stability appeared to be less than in the original studies. Carman (1990) also notes that the applicability in some of the settings requires quite substantial adaptations in terms of dimensions and items. Babakus and Boller (1992) report on a study in which they applied the original SERVQUAL to a gas utility company. Using both exploratory and confirmatory (first-order and second-order) factor analysis, Babakus and Boller (1992) were unable to replicate the hypothesized five-dimensional structure of the original SERVQUAL instrument. Finally, Cronin and Taylor (1992, 1994) used confirmatory factor analysis and found that a five-factor structure did not provide an adequate fit to the data. Subsequently, they carried out exploratory factor analysis and a unidimensional factor structure was confirmed.

Authors using a more metaanalytic approach have reported similar results (Asubonteng et al. 1996; Buttle 1996; Parasuraman et al. 1991; Paulin and Perrien 1996). In general, they report relatively high reliabilities in terms of coefficient $\alpha$ for the individual dimensions. However, results differ considerably when looking at different service-quality dimensions. Paulin and Perrien (1996) find that for the studies included in their overview, coefficient $\alpha$ varies from 0.50 to 0.87 for the empathy dimension and from 0.52 to 0.82 for the tangibles dimension. However, the number of factors extracted and factor loading patterns are inconsistent across studies. Furthermore, interfactor correlations among the responsiveness, assurance and reliability dimensions are quite high (Buttle 1996; Parasuraman et al. 1991). Finally, Paulin and Perrien (1996) suggest that the limited replicability of the SERVQUAL instrument may be caused by contextuality (cf. Cronbach 1986). They find that studies applying SERVQUAL differ in terms of units of study, study observations, and type of study.

Empirical research, however, has found that the inclusion of an importance weight as suggested by Parasuraman et al. (1991) may only introduce redundancy (Cronin and Taylor 1992, 1994). Therefore, the use of importance weights is not recommended; it increases questionnaire length and does not add explanatory power.

The SERVQUAL instrument employs a difference score (perception minus expectation) to operationalize perceived service quality. However, the use of difference scores is subject to serious psychometric problems (Peter et al. 1993). To begin with, difference scores per se are less reliable than their component parts (perceptions and expectations in the case of SERVQUAL). Because reliability places an upper limit on validity, this will undoubtedly lead to validity problems. Peter et al. (1993) indicate that low reliability might lead to attenuation of correlation between measures. Consequently, the lack of correlations between measures might be mistaken as evidence of discriminant validity. Furthermore, difference scores are closely related to their component scores. Finally, the variance of the difference score might potentially be restricted. Peter et al. (1993) point out that this violates the assumption of homogeneity of variances in ordinary least-squares regression and related statistical techniques. Finally, an alternative might be the use of a nondifference score, which allows for the direct comparison of perceptions to expectations (Brown et al. 1993; Peter et al. 1993).

Empirical evidence indicates that the majority of the respondents locate their service quality score at the right-hand side of the scale (Brown et al. 1993; Parasuraman et al. 1988; 1991; Peterson and Wilson 1992). This distribution is referred to as negatively skewed. A skewed distribution contains several serious implications for statistical analysis. To begin with, the mean might not be a suitable measure of central tendency. In a negatively skewed distribution, the mean is typically to the left of the median and the mode and thus excludes considerable information about the variable under study (Peterson and Wilson 1992). Skewness also attenuates the correlation between variables. Consequently, the true relationship between variables in terms of a correlation coefficient may be understated (Peterson and Wilson 1992). Finally, parametric tests (e.g., t-test, F-test) assume that the population is normally or at least symmetrically distributed.

A less skewed alternative for measuring service quality is the nondifference score for service quality. Brown et al. (1993) report that the nondifference score for service quality is approximately normally distributed. Moreover, several authors have suggested that the number of scale points might have considerably contributed to the skewness of satisfaction measures (Peterson and Wilson 1992). Increasing the number of scale points may increase the sensitivity of the scale and consequently reduce skewness.

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