CHAPTER 22

Assessment and Design of Service Systems

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1. INTRODUCTION

1.1. Customer Service as a Key Success Factor in Competition

Services continuously gain relevance in all developed economies (Bullinger 1997). They are increasingly becoming a key issue in the discussion about growth and employment. Many firms now recognize the need, on the one hand, to strengthen ties with existing customers by offering innovative services and, on the other hand, to win over completely new customer groups and markets. Therefore, concepts for effective service management are relevant for both service companies entering into tougher and more global competition and manufacturing companies setting up a service business to support their core products by enhancing customer loyalty. Not only traditional service providers, but also companies for whom in the past services have only represented a small portion of total business, are nowadays required to satisfy ever-more complex needs by offering a whole series of new services to their customers. In particular, many companies are now awakening to the opportunities not merely for safeguarding and expanding their own competitive position with the aid of innovative services,

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but also for acquiring entirely new business segments. At the same time, they are confronted with the problem of not being able to avail themselves of the systematic procedures and methods that are essential above all to develop and manage complex services. All too often, many successful services are still no more than the ad hoc outcome of individual projects and the personal efforts of employees or management.

Only a minority of firms have appreciated from the outset that crucial competitive advantages will no longer be secured by advanced technology, cost leadership, or product quality alone. On the contrary, innovative, subtly differentiated services are turning into unique selling features that set a company apart from its competitors, representing a promising strategy for success when it comes to tapping new market potentials. In Europe in particular, the discussion about services has been reduced for far too long to the simple formula "services = outsourcing = job cuts." The opportunities that lie in the exploitation of new business segments and the accompanying creation of new jobs—especially when high-quality services are exported—have not been fully recognized.

The main objective of this chapter is therefore to provide guidelines for systematic design, management, and assessment of service systems with particular attention to the management of service quality. To this end, fundamental approaches for defining *service* and *service quality* are described, leading to a conceptual framework for the structure of service systems. From this an assessment method is derived that supports continuous improvement in service organizations. Additionally, an emerging research area, service engineering, is outlined.

1.2. The Need for Systematic Engineering of Services

While there exists a broad range of methodologies, and tools are available on the development of goods, the development and engineering of services have not been a common topic in the scientific literature. The service discussion has focused primarily on such issues as service marketing, management of service processes, and human resource management in service industries. Service development and design have been largely ignored. Of the small number of authors who have discussed the issue (e.g., Bowers 1986; Easingwood 1986), the majority belong to the service marketing discipline. Approaches based on engineering science are still rare in the service sector to this day. One exception is Ramaswamy (1996). This deficit can be attributed to a single basic cause: the lack of tangibility of services as a research and development goal. That is to say, the development of services is a much more abstract process than the development of material goods or software. So far only a few, very generic attempts have been made to reduce this high level of abstraction and try to capture services operationally as the goal of a systematic development procedure. However, many companies have recently begun (not least as a result of the growing pressures of competition) to rethink their strategies for service provision. They want their services to be "regular products," that is, reproducible, exportable, even tangible and therefore developable. Services must undergo a systematic design process like any other product.

During the second half of the 1990s, service engineering has emerged as a new research discipline (Fähnrich 1998; Meiren 1999). It is a technical discipline that is concerned with the systematic development and design of service products using suitable methods and procedures. What distinguishes the development of services from the development of conventional, material products is that with services, the interaction between customers and employees plays a crucial role. Thus, several questions require special attention (Hofmann et al. 1998):

- The design of the customer interface and customer interaction
- The design of the service processes
- The selection and training of personnel
- Optimized support for front-office staff (i.e., those employees in direct contact with the customers).

An interdisciplinary approach is essential for solving development tasks of this nature. Service development must therefore integrate knowhow from a variety of scientific disciplines, notably engineering sciences, business studies, industrial engineering, and design of sociotechnical systems. Topics receiving particular attention within the field of service engineering are:

- *Definitions, classifications and standardization of services:* Until now there has been only a diffuse understanding of the topic of service. In particular, international definitions, classifications, and standards, which are necessary in order to develop, bundle, and trade services in the future in the same way as material products, are currently not available. Research questions to be solved include which structural elements of services can be identified, how they should be considered in the development, and how they can be made operational, as well as which methods and instruments could be used for the description and communication of internal and external services.

- *Development of service products:* The development and design of services requires reference models, methods, and tools. Research topics include reference models for different cases (e.g., development of new services, development of hybrid products, bundling of services, reengineering or redesigning of services) and different service types, analysis of the transferability of existing methods (e.g., from classic product development and software engineering) to the development of services, development of new service-specific engineering methods, and development of tools (e.g., ''computer-aided service engineering'').
- *Coengineering of products and services.* Offers of successful, high-quality products are often accompanied by service activities. Particularly for companies willing to make the move towards an integrated product/service package methods for combined product/service development are presently not available. Concepts for simultaneous engineering of products and services are necessary, for instance.
- *R&D management of services.* The development of services must be integrated into the organizational structure of companies. In practice, there are very few conclusive concepts. The consequences of this include a lack of allocation of resources and responsibilities, abstract development results, and insufficient registration of development costs. Research topics include which parts of a company must be integrated in the service development process; which organizational concepts (e.g., R&D departments for service development, virtual structures) are suitable; how information flow, communication, and knowledge can be managed; how the development process can be controlled; and how a company can continuously bring competitive services to market.

2. FUNDAMENTALS OF SERVICE MANAGEMENT

2.1. Differences between Services and Material Goods

Are services essentially different from material goods? Once service management had been addressed by several scientific disciplines, a considerable amount of research effort was spent on this question. The service marketing literature, in particular, provides an ample variety of theoretical arguments and examples from various industries that underscore the distinction between services and material goods (for an overview, see Fisk et al. 1993). Meanwhile, this distinction becomes more and more blurred. Almost any product can be seen as a combination of material goods and services, and thus the notion of hybrid products (i.e., bundles of material goods and services) has become widely accepted (Stanke and Ganz 1996).

However, three properties of services are assumed to be fundamental:

- *Intangibility:* Unlike material goods, services normally do not exist physically. They consist of concepts and activities fulfilling a value proposition given to the customer.
- *Simultaneity of production and consumption:* Generally speaking, services are delivered at the time the customer needs them and to the location where they are needed. Therefore they can hardly be stored and shipped. This property is usually labeled the ''uno-actu-principle.''
- *Customer integration:* In most cases, the customer is integrated in a service delivery process, either personally as an object of the service or by providing his or her property or information as input.

Counterexamples can be easily found at least for the first two properties, intangibility and uno-actu-principle. The last distinction, the involvement of the customer in the service delivery process, appears to be more fundamental. Some authors even label it the only valid difference between services and goods: ''With services, the customer provides significant inputs into the production process. With manufacturing, groups of customers may contribute ideas to the design of the product, however, individual customers' only part in the actual process is to select and consume the output'' (Sampson 1999).

Although the relevance of each of these basic properties varies considerably between different types of services, they indicate some basic challenges that must be met in managing almost any service:

- *Definition and description of an intangible product:* Because product properties are mostly immaterial, describing and—even more important—demonstrating them to the customer is much more difficult than with material goods. In most cases, the customer does not have an opportunity to look at or to test the service prior to purchase, as can be done with a car, for example. Therefore, buying a service creates a certain extent of risk for the customer. The challenge for a marketing department consists at this point of communicating the service's characteristics to the customer and reducing this feeling of risk as much as possible. For a development or an

operations department the challenge lies in defining and describing the service product in a way that ensures its delivery without failure.

- *Managing resources* in terms of quantity and quality: Most services cannot be produced "on stock," which requires that the service provider keep capacity available, whether the service is purchased or not. For this reason, concepts such as yield management are extremely important in numerous service industries, such as the airline industry.
- *Managing the customer* as a part of the service that can be controlled in an indirect manner at most. In many cases, proper service delivery depends on the customer behaving and cooperating in a certain way. Therefore, a service provider has to find ways to ensure that the customer assumes his or her role in the process.

2.2. Definitions and Terminology

According to ISO 9004/2, services are "the results generated by activities at the interface between the supplier and the customer and by supplier internal activities to meet customer needs." The following notes are added to this definition:

- "The supplier or the customer may be represented at the interface by personnel or equipment."
- "Customer activities at the interface with the supplier may be essential to the service delivery."
- "Delivery or use of tangible product may form part of the service delivery."
- "A service may be linked with the manufacture and supply of tangible product."

The standard provides a rather general definition that contains various essential aspects. For purposes of service management, the definition needs to be refined. This can be done by analyzing the most common definitions of the services concept, the most widely accepted of which was originally established by Donabedian (1980). It states that a service bears three distinct dimensions:

1. A structure dimension (the structure or potential determines the ability and willingness to deliver the service in question)
2. A process dimension (the service is performed on or with the external factors integrated in the processes)
3. An outcome dimension (the outcome of the service has certain material and immaterial consequences for the external factors)

Combining the aspects that are considered in the standard with Donabedian's dimensions of service yields Figure 1.

2.3. Service Typologies

Most approaches to defining services aim at giving an general explanation of service characteristics that applies to all types of services. While this approach is valuable from a theoretical point of view, due to the broad variety of different services, it hardly provides very detailed guidelines for the design and management of a specific service. Classification schemes and typologies that classify services and provide distinctive classes calling for similar management tools are needed. Classifying services with respect to the industry that the company belongs to hardly provides further insight, since a particular service may be offered by companies from very different industries. Industries in the service sector are merging, generating competition among companies that were acting in separate marketplaces before (e.g., in the media, telecommunications, or banking industries). On the other hand, services within one industry may require completely different management approaches. Thus, services have to be classified and clustered according to criteria that relate to the particular service product rather than to the industry. Such typologies can give deeper insight into the special characteristics of a service as well as implications concerning its management.

Several attempts have been made in order to design such typologies. Some of them are based on empirical studies. The study presented in Eversheim et al. (1993) evaluated questionnaires from 249 German companies representing different service industries. By the application of a clustering algorithm, seven types of services were finally identified, based on 10 criteria.

A recent study on service engineering (Fähnrich and Meiren 1999) used 282 answered questionnaires for the determination of service types. It derived four separate types of services that differ significantly in two ways:

1. The intensity of interaction between service provider and customer
2. The number of different variants of the service that the customer may obtain

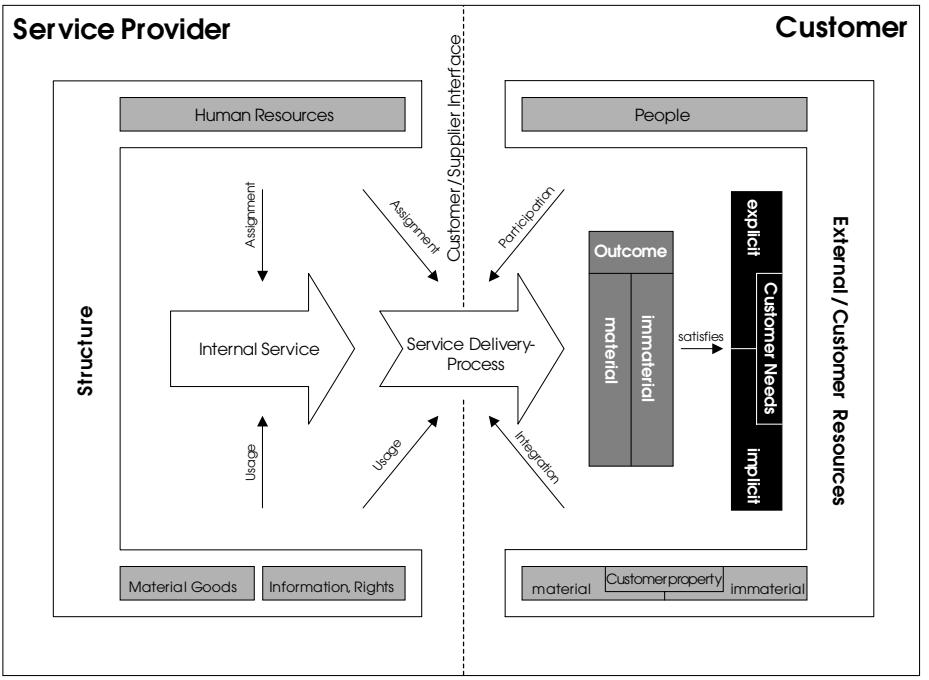

Figure 1 Elements of Service Definitions.

Strategies for service development and service operations can be assigned for the four types of services. Interestingly, these results are very similar to a typology of service operations introduced by Schmenner (1995), identifying four different types of service processes: service factory, service shop, mass service, and professional services. Figure 2 gives an overview of the typology, relating it to Schmenner's types.

3. MANAGEMENT OF SERVICE QUALITY

3.1. Service Quality Models

ISO 8402 defines quality as ''the totality of characteristics of an entity that bear on its ability to satisfy stated or implied needs.'' The standard explicitly applies to services, too, but it leaves space for interpretation. Therefore, some different notions of quality have emerged, depending on the scientific discipline or practical objective under consideration. Those notions can be grouped into five major approaches (Garvin 1984) and can be applied to goods as well as to services:

- The *transcendent approach* reflects a ''common sense'' of quality, defining it as something that is ''both absolute and universally recognizable, a mark of uncompromising standards and high achievement'' (Garvin 1984). Therefore, quality cannot be defined exactly, but will be recognized if one experiences it.
- The *product-based approach* links the quality of an item to well-defined, measurable properties or attributes. Therefore, it can be assessed and compared objectively by comparing the values of those attributes.
- The *user-based approach* focuses exclusively on the customer's expectations and therefore defines quality as the degree to which a product or service satisfies the expectations and needs of an individual or a group.
- The *manufacturing-based approach* derives quality from the engineering and manufacturing processes that deliver the product. Quality equals the degree to which a product meets its specifications.

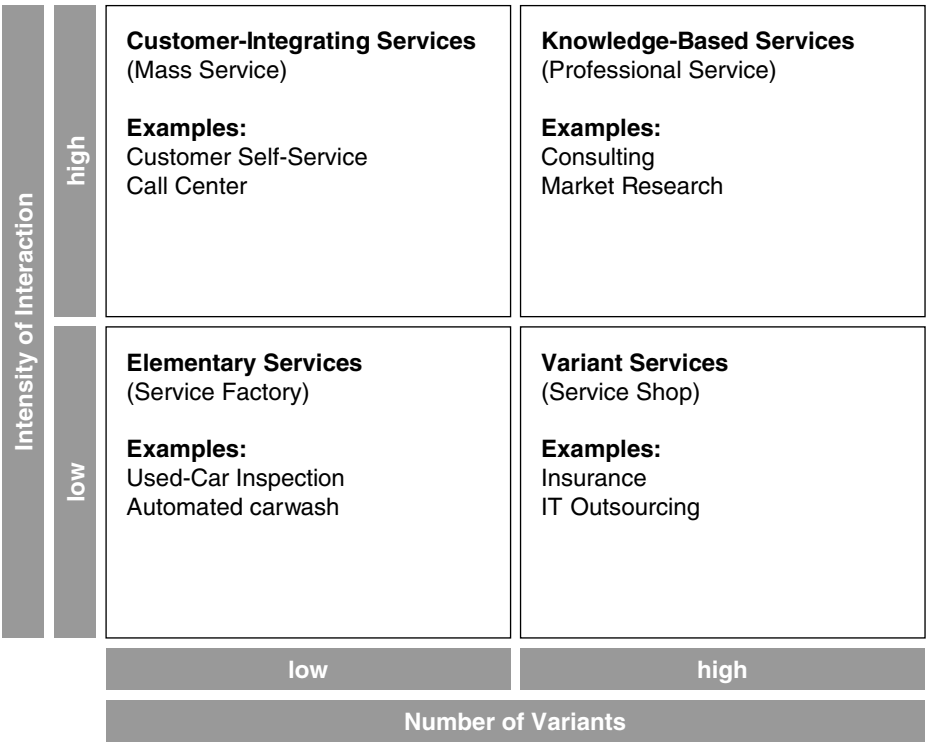

Figure 2 Four Basic Types of Service Products. (From Fähnrich and Meiren 1999)

- The *value-based approach* relates the performance of a product or service to its price or the cost associated with its production. According to this notion, those products that offer a certain performance at a reasonable price are products with high quality.

While the relevance of the transcendent approach is only theoretical or philosophical, the other approaches do influence quality management in most companies. Normally, they exist simultaneously in one organization: while the marketing department applies a user-based approach to quality, the manufacturing and engineering departments think of quality in a product- or manufacturing-based manner. The coexistence of the two views carries some risk because it might lead to diverging efforts in assuring product quality. On the other hand, today's competitive environment requires a combination of the different definitions (Garvin 1984) because each of them addresses an important phase in the development, production, and sale of a product. First, expectations and needs of the targeted customers have to be analyzed through market research, which requires a customer-based approach to quality. From those requirements, product features have to be derived such that the product meets the customers' expectations (product-based approach). Then the production process must be set up and carried out in a way that ensures that the resulting product in fact bears the desired characteristics. This implies that the production process should be controlled with respect to quality goals and therefore a manufacturing-based approach. Finally, the product is sold to its customers, who assess it against their expectations and express their satisfaction or dissatisfaction. The product specifications will eventually be modified, which again calls for a customer-based approach.

Because most definitions of service quality are derived from marketing problems, they reflect more or less the customer-based approach or value-based approach. There are several reasons for this one-sided view of service quality. In general, services do not bear attributes that can be measured physically. Furthermore, the customer is involved in the service-delivery process, so process standards are difficult to define. Additionally, the understanding of quality has moved from the product- and process-based view towards the customer- and value-based view in almost all industries, equaling

''quality'' and ''customer satisfaction.'' Therefore, the customer- and value-based approach has been used predominantly in recent research on service quality.

The most fundamental model for service quality that influences many other approaches is derived from Donabedian's dimensions, namely structure, process, and outcome (Donabedian 1980). Quality of potentials includes material resources and people, for example, the capability of customer agents. Process quality includes subjective experiences of customers (e.g., the friendliness of employees) during the service-delivery process, as well as criteria that can be measured exactly (e.g., the time needed for answering a phone call). In comparison to manufacturing, process quality has an even greater impact for services. A service-delivery process that is designed and performed extremely well ensures, as in manufacturing, the quality of its final outcome. Additionally, to the customer, the process is part of the service because the customer may observe it or even participate in it. The quality of the outcome of a service is the third component of service quality. It reflects the degree to which the service solves the customer's problems and therefore satisfies his or her needs and expectations.

Many models for service quality are derived from the concept of customer satisfaction. According to this notion, service quality results from the difference between the customers' expectations and their experiences with the actual performance of the service provider. If the expectations are met or even surpassed, the quality perceived by customers is good or very good, otherwise the customers will remain dissatisfied and rate the service quality as poor.

Based on this general assumption, several approaches to service quality aim at explaining the reasons for customer satisfaction (and therefore for service quality). This provides a basis for measuring the outcome quality of a service. Unfortunately, there are hardly any concepts that link the measurement of customer satisfaction or service quality to methods that influence it during service design or delivery. A first step towards this connection is the gap model, developed by Parasuraman et al. (1985) based on results from empirical research. The gap model identifies five organizational gaps within the process of service design and delivery that cause deficits in quality, leading to dissatisfied customers. The gaps occur in the following phases of the process:

- Gap 1 results from the fact that the management of the service provider fails to understand the customers' expectations correctly.
- Gap 2 denotes the discrepancy between management's conceptions of customers' expectations and the service specifications that are derived from it.
- Gap 3 is caused by a discrepancy between service specifications and the performance that is delivered by the service provider.
- Gap 4 consists of the discrepancy between the delivered perfomance and the performance that is communicated to the customer.
- Gap 5 is the sum of gap 1 through 4. It describes the discrepancy between the service the customer expected and the service that he or she actually experienced.

According to Parasuraman et al., customer satisfaction (i.e., gap 5) can be expressed in terms of five dimensions: tangibles, reliability, responsiveness, assurance, and empathy (Parasuraman et al. 1988). These dimensions are the basis for the SERVQUAL method, which is an well-known method for measuring the quality of services through assessing customer satisfaction. The following section addresses different approaches for measuring service quality.

3.2. Measuring Service Quality

Methods for the measurement of service quality are used during and after the delivery of a service in order to assess the customer's satisfaction and quality perception. They can be compared to quality tests in manufacturing, but there are some significant differences: service quality cannot be assessed by measuring physical attributes, and therefore some immaterial criteria that are related to quality have to be defined. Furthermore, if defects are detected, they generally cannot be ''repaired'' as can be done in case of material goods, since the customer normally participates in the service delivery process and therefore witnesses defects as they occur. Therefore, the main objective of measuring service quality is improving it on a mid- or long-term base rather than detecting and repairing defective units.

Depending on the chosen approach (see Section 3.1) service quality can be measured from the customer's and the service provider's point of view. Measuring from the service provider's point of view involves gathering data that are internally available, such as performance measures or quality cost (Eversheim 1997). They can be analyzed using well-known methods from quality management in manufacturing processes, such as statistical process control (Gogoll 1996). In addition, service quality can be assessed indirectly by an overall analysis of the quality system, which is done by a

quality audit or quality assessment. Those provide information regarding the capability of a service provider to deliver quality services rather than information about the quality of a specific service. Therefore, they are based on the assumption that there is a correlation between the quality of the structure and processes, on the one hand, and the outcome, on the other hand.

There are two basic approaches for measuring service quality from the customer's point of view. Both of them are based on assessing customer satisfaction.

Multiattribute methods are based on the assumption that the quality perception of customers is determined by assessing distinctive attributes of the particular service. With regard to each attribute, the customer compares the expected and the received quality. The overall judgment then results from a weighted addition of those comparisons. The most prominent example of this type of method is SERVQUAL (Parasuraman et al. 1988), a multiple-item scale consisting of 22 items grouped into five dimensions.

Another group of methods uses the assessment of *service encounters* or *moments of truth* (i.e., the contact between customers and the service provider) for measuring service quality. An example of those methods is the critical incident technique (Bitner et al. 1990). This method uses structured interviews to gather information about customers' experiences that have roused either very negative or very positive emotions. From those interviews, the most relevant problem areas are determined. This type of method allows the customer to describe the service encounter from his or her point of view instead of assessing it by predefined criteria. The method normally leads to the most significant causes of service failures.

Besides those activities that are initiated by the service provider, systematic analysis of customer complaints yields valuable information about quality problems. Typically, only a very small percentage of dissatisfied customers do complain, while most of them just buy from a competitor without further notice (Heskett et al. 1997). Effective complaint management therefore requires that the customer be encouraged to complain and that communication between customer and service provider be facilitated as much as possible. Customers whose complaints are treated in a satisfying manner often reward the service provider with increased loyalty (Reichheld 1997). Therefore, defective services can be ''repaired'' to a certain degree, which is normally described by the concept of service recovery (Heskett 1997)

3.3. Design of Service Processes

In addition to customer satisfaction, the process dimension of service quality has been addressed by numerous researchers and practitioners.

An important tool for service process design and management is the service blueprinting method, originally described in Shostack (1984). Service blueprinting subdivides each process into process steps, which are perceived by the customer directly, and supporting activities, which are necessary to deliver the service but are only perceived indirectly. The two areas are separated by a ''line of visibility.'' This differentiation is extremely important for customer-oriented service development processes because it permits concentration on the design of the customer interface at a very early stage. Service blueprinting was subsequently modified and named ''service mapping'' (Kingman-Brundage 1995). This method most notably includes two new lines of interaction. The first of these, the line of external interaction, subdivides the process as perceived by the customer into activities that are performed by the customer personally and activities in which the customer participates but which are in fact performed by the employees of the company offering the service. The second line, the line of internal interaction, differentiates between processes delivered by the supporting ''back office'' and those provided either by other companies or by other departments in the same company. Service blueprinting and service mapping are especially useful for service planning because they help identify potential errors very early on. Furthermore, they can be used as training material for employees and customers. Figure 3 shows an example of a service blueprint.

3.4. Resource-Related Quality Concepts

Approaches to service quality that apply to the *structure* dimension can be subsumed under the heading ''resource concepts.'' These include, most importantly, human resources concepts (especially qualification concepts), as well as the infrastructure necessary to deliver the service and service-support tools in the form of suitable information and communication technologies. The analysis of customer–employee interaction is crucial to enable appropriate recruiting and qualification of the employees who are to deliver the service.

Two questions arise immediately in regard to human resource management in services.

- There is an ongoing debate on whether the knowhow required for running a service system should be put into people or into processes. The job enlargement approach requires significant effort in recruiting, training, and retaining the kind of employees who are able to ensure high

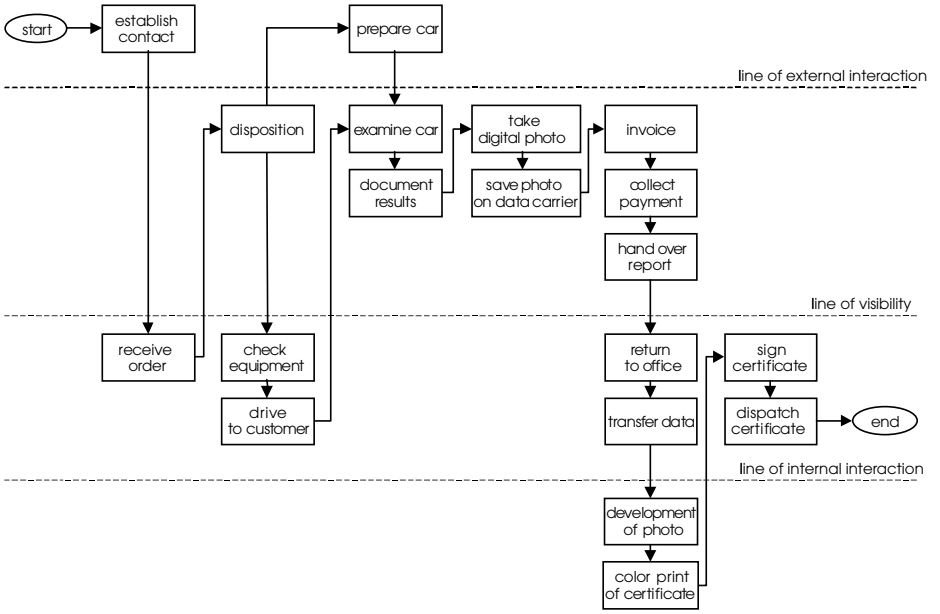

Figure 3 Service Blueprint of a Car Certification Service. (From Meiren 1999)

quality through personal effort and skills. The production line approach tries to ensure service quality by elaborated process design, therefore calling for lower requirements from the workforce involved.

- The management of capacity is crucial in services because they cannot be produced ''on stock.'' This calls for concepts that enable a service provider to assign the employees in a flexible way.

Role concepts are one way to deploy human resources during the service-delivery phase (Frings and Weisbecker 1998; Hofmann et al. 1998) that addresses both questions described above. ''Roles'' are defined groups of activities within the framework of a role concept. The roles are then linked to employees and customers. It is possible for several employees or several customers to perform one and the same role and for one employee or one customer to perform several different roles. Role concepts are a particularly useful tool for simplifying personnel planning, for instance in connection with the selection and qualification of the employees who will later be required to deliver the service. Most importantly, potential bottlenecks in the service-delivery phase can be identified extremely early on and suitable action taken to avoid them. Moreover, role concepts provide a starting point for formulating tasks in the area of work planning and enable customer behavior to be analyzed and planned prior to the service-delivery process. Finally, the use of roles does not imply any direct relationship to fixed posts or organizational units, and the concept is thus extraordinarily flexible.

4. THE STRUCTURE OF SERVICE SYSTEMS

Most service-management concepts discussed so far clearly show an affiliation to either the production line view or the human resource or customer and marketing-oriented view on services. These different views have not been integrated much, mainly because very different scientific disciplines are involved. Obviously, both approaches are needed. Nowadays service processes are highly complex and call for the application of sophisticated methods from industrial engineering, while on the other hand the outcome depends heavily on the performance of employees and customers.

One way to handle this complexity is to apply a system view to services, as proposed by several authors (e.g., Lovelock 1995; Kingman-Brundage 1995). Systems are made up of elements bearing attributes and the relationships between those elements. Elements may be (sub)systems themselves. If the elements of a service system are defined as those different components that have to be designed and managed, then the most elementary system model for services is made up of three basic elements:

1. *Customer:* The customer normally initiates a service delivery process and performs certain tasks within it. The customer partly reflects the outcome dimension of service quality by being either satisfied or dissatisfied with the service.
2. *Resources:* Human and material resources perform defined functions within a service process and interact with the customer. They reflect the structure dimension of service quality.
3. *Process:* Processes can be viewed as the definition of interactions between the resources and the customers in a service system. However, there are reasons for defining them as the third basic element within the system. Assuming the production line approach, processes are objects that carry information regarding the service, especially in IT-based services. They exchange information with other elements in the system or even control them to a certain degree.

For several reasons, it seems useful to define a fourth basic element within the system, namely service products. So far, the notion of a service product has not been used in a clearly defined way. However, in recent years the term *product* has been used more frequently to express the idea that services can be developed and produced in a defined and repeatable way. Defining the concept of products within a service system therefore yields several benefits:

- So far, the outcome dimension of a service has been considered mainly from the customer's point of view, taking outcome quality as equivalent to customer satisfaction. However, aiming only at customer satisfaction means that service quality easily becomes a moving target. This can be avoided by integrating all relevant information regarding the outcome of a service into a product model that is communicated internally and (to an appropriate extent) externally.
- The definition of a product clearly separates the outcome of a service from the way it is delivered. The product therefore acts as an interface between the market and customer view on a service (''what is delivered'') and a production or process view (''How it is delivered'').
- Product models support the modular set-up of services. Services that are offered with a wide range of variants are difficult to handle, particularly if the service depends heavily on information technology. A potential solution is the division of a service in separate modules that can be bundled according to the customer's needs. This also greatly supports the development of new products or variants because they (and the corresponding software systems) only have to be assembled from existing parts.

A product model for services cannot simply consist of a one-to-one application of traditional product concepts from manufacturing. Instead, the product model must be derived from the essential characteristics of service processes. This can be achieved by an analysis of generic models of service delivery (e.g., the universal service map [Kingman-Brundage 1995] or the process model [Eversheim et al. 1997]) that yields those points within a service process that require information from a product model. Thus, a typical service process can be described in the following way:

1. A service is initiated by the definition of a service concept (Heskett et al. 1997) that is communicated to the market and its targeted customers. The required resources are assigned in parallel.
2. Potential customers decide to contact the service provider in order to obtain additional information or to order the service instantaneously. For this purpose, the ways in which customers gain access to the service have to be defined and communicated. Traditionally, customers enter the service facility in person (e.g. a restaurant, a car repair shop). Depending on the particular service concept, this may be replaced by telephone or Internet access or a combination of those. In any case, an access system has to be defined that is located directly at the line of interaction between customer and service provider.
3. If the customer decides to order the service, some specifications regarding the desired variant have to be recorded by the access system.
4. The service delivery process must then be activated, using the specification that has been collected by the access system. First, however, a consistency check must be performed in order to verify whether the desired variant of the service is obtainable.
5. If the variant is valid, the configuration of the service will be set up, that is, those delivery processes that are required for the particular variant are activated.
6. If a process includes participation of the customer, the customer must be informed about the expected outcome and form of the cooperation. Results produced by the customer must be fed back into the delivery process.

7. As soon as all threads of the delivery process (carried out by the service provider or the customer) have been terminated, the outcome will be delivered and an invoice sent to the customer.
8. If the results are satisfactory, the contact between customer and service provider comes to an end and the overall process is finished. The customer may order some additional service or may return later to issue a new order. If the results leave the customer dissatisfied, a service-recovery procedure may be initiated or the customer may simply terminate the business relation.

The information needed to control such a process is normally distributed between the people involved (employees and customers) and the documents that define the processes. However, the reasoning outlined above shows that it is useful to combine some elements within a product model. These considerations lead to the product model depicted in Figure 4, which uses an object-oriented notation according to the Unified Modeling Language (UML).

Using the object-oriented notion of a system, the individual elements of the product model are displayed as classes that have a unique name (e.g., ''Service_Product''), bear attributes (e.g., ''External_Product_Information''), and use methods for interaction with other classes.

The product model is centered around the class Service_Product. This class identifies the product, carries information for internal use, and provides all information regarding valid configurations of the product. Service_Product may be composed of other, less complex products, or it may be an elementary product. It relates to a class Service_Concept that defines the customer value provided by the product, the customers and market it aims at, and the positioning in comparison to its competitors. The class Service_Product is activated by whatever provides the customer's access to the service system. Access_Module carries information on the product for external distribution and records the specification of the product variant as requested by the particular customer. Access_Module eventually activates Service_Product, which subsequently checks the consistency and validity of the requested product configuration and sets up the configuration by ''assembling'' individual modules of the service. Then Deliver_Product is carried out by activating one or several Service_Functions that make up the particular product configuration. During and after the service delivery process Service_Product may return statistics to the management system, such as cost and performance data. Also, Product_Features may be attached to a Service_Product, potentially including Material_Components.

Each Service_Product contains one or several Service_Functions that represent the Outcome of the service. A Service_Function carries information about the expected Quality Level (which may

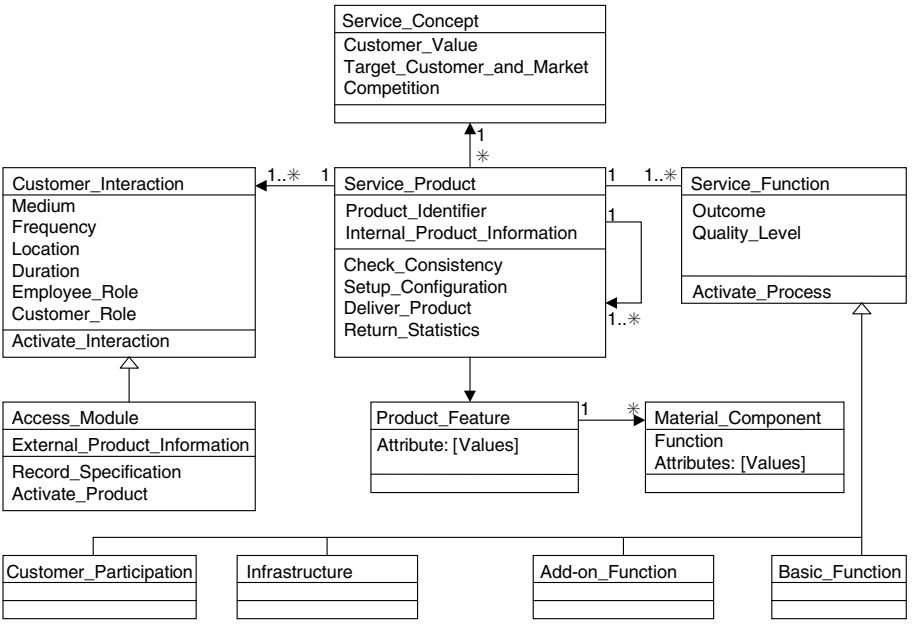

Figure 4 Service Product Model.

be expressed by criteria like the ones used in SERVQUAL and a relation to the internal or external service delivery processes that realize this function. Jaschinski (1998) names six different types of service functions, four of which can be expressed within the product model:

1. A Basic_Function contains the basic outcome a customer expects from the service, such as the transportation from location A to location B in the case of an airline.
2. An Add-on_Function realizes some additional features that enhance the service compared to its competitors. Staying with the airline example, the large variety of meals or the lounges in the airport are such Add-on_Functions.
3. Infrastructure is needed in many cases in order to enable the customer to use the service at all. An example is the check-in counters in the airport that provide the necessary preparation for boarding an airplane.
4. Customer_Participation denotes the part of the service's outcome that is produced by the customer. An example is the automated self-check-in that is used by several airlines.

According to Jaschinski (1998), interaction between customers and service provider and access to the service system represent two more functions. Within this product model, interaction is defined by the element Customer_Interaction, of which Access_Module must be regarded as a special instance.

The product model therefore acts as a central hub of a service system, coordinating the interactions of customers, employees, material resources, and processes. The product is activated by a customer, then initiates the required processes, which in turn call for necessary resources. This model explicitly shows the correlation between the elements of a service system and may serve as a template for designing a service from a product designer's point of view.

Based on this concept, a framework for the assessment of a service system will be introduced in the next section that serves as a methodology for continuous improvement.

5. CONCEPTUAL FRAMEWORK FOR THE ASSESSMENT OF A SERVICE SYSTEM

5.1. Quality Assessments

Usually the performance of a company is assessed by financial criteria. This may seem perfectly appropriate because the survival of a company depends on adequate profits. All other objectives (e.g., the quality of products and services) are pursued not for their own sake but rather in support of financial long-term success. Within the last decade, however, researchers and practitioners have come to the conclusion that because financial criteria relate to the past, they reflect only part of a company's performance. The future performance and growth of a company depend equally on soft factors that are difficult to quantify, such as the quality of leadership or the qualification of the employees. The idea of integrating soft and hard factors is realized in the balanced scorecard concept (Kaplan and Norton 1996), which is gaining increasing acceptance worldwide.

Assessment is another management concept that aims at integrating *all* relevant factors. Especially in the field of quality management, assessments have become very popular in recent years. There are numerous examples of successful application. Here the term *assessment* denotes several different but similar methods that serve mainly as a tool for analyzing and documenting the actual status of an organization. An assessment can also be used as the basis for a process of continuous improvement. This leads to three main objectives of an assessment:

1. Analysis of the status quo and determination of potential improvements
2. Support and acceleration of change processes
3. Measurement of whether objectives have been achieved

An assessment can be performed in different ways, depending on the particular objectives and the effort that is spent. Table 1 gives an overview of the most relevant variants.

Most companies use an established assessment model when they carry out a quality assessment. Well-known examples are the Malcolm Baldrige National Quality Award (MBNQA) in the United States and the European Quality Award in Europe. Several derivations of these models exist in different countries. All assessment models define criteria that address the various fields of improvement in an organization. Those criteria are grouped in categories and a procedure used both for gathering and evaluating information and for the calculation of the score is defined.

5.2. Areas for Quality Assessment in Service Organizations

While MBNQA and EQA address arbitrary organizations, this section presents ServAs (service assessment), an assessment model that has been specifically developed for service organizations. ServAs

TABLE 1 Various Types of Quality Assessment

Type	Objectives	Effort	Participants	Questionnaire	Shortcomings
Quick check	Getting started fast, overview of status quo		1 person, e.g., the quality manager	Complete questionnaire	The result shows the view of just one person
Assessment workshop	Awareness building for the management team, action plan		Ca. 5–7 persons	Complete questionnaire	Only the view of management is integrated
Survey	Appraisal of practices or processes by all relevant employees		All employees of the unit	Select and customized items	Broad understanding of the method and its topics has to be disseminated
Documented in-depth analysis	Profound analysis of all relevant processes and functions		Team of specialists	Specific questionnaire	Very high effort

contains 12 categories that describe those fields within a service organization that require attention from the management. Each category contains relevant criteria that describe the actual status of the organization with respect to the particular management field. The criteria are grouped within key areas. They have been derived from the relevant characteristics of a service system, combined with applicable elements from established assessment models (see Haischer 1996; Eversheim 1997). Figure 5 gives an overview of the categories of ServAs and the criteria.

According to the fundamental dimensions of service quality, the categories have been assigned to either the structure, the processes, or the outcome of a service. Five categories belong to the structure dimension:

1. *Customer focus:* How does the service organization ensure that the offered services meet the expectations and needs of customers?
2. *Leadership:* How is a service culture being established and maintained by senior management?
3. *Employees:* How are employees recruited, qualified and motivated in accordance with the company's overall objectives?
4. *Resources:* Is the usage of material resources effective and efficient?
5. *Quality system:* Does the service organization maintain a quality system that transfers quality objectives to products and processes?

Four categories assess process quality in a service organization:

1. *Service development:* Are service products systematically developed within a defined development process?
2. *Service delivery:* How does the service organization organize the core process of service delivery in an effective and efficient way?
3. *Cooperation management:* How does the organization build, use, and maintain partnerships along the value chain?
4. *Customer relationship and communication:* How does the service organization manage communication with customers and other external partners?

The three last categories address the fundamental dimensions of outcome any company strives for:

1. *Employee satisfaction:* How does the service organization measure and manage employee satisfaction?

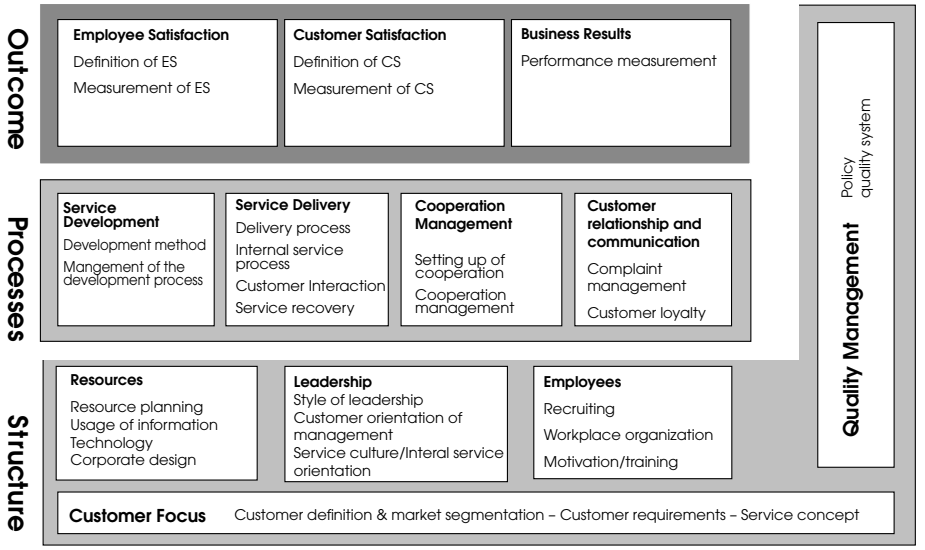

Figure 5 Categories and Key Areas for the Assessment of Service Systems.

2. *Customer satisfaction:* How does the service organization define and measure customer satisfaction?
3. *Business results:* How does the service organization establish performance measurements using financial and nonfinancial criteria?

A questionnaire has been derived from these categories and the related key areas. It is the most important tool in the assessment method. Each key area contains several criteria related to one or more items of the questionnaire. These items indicate the ''maturity level'' (see Section 5.3) of the service organization with respect to the criterion under consideration.

The questionnaire may be utilized for analyses at different depths, from an initial quick self-assessment by senior management to an in-depth discussion of the different key areas in workshops and quality circles. The results serve as a basis for planning improvement measures.

5.3. A Maturity Model for Quality Management in Service Organizations

The overall result of an assessment using ServAs is expressed in terms of the maturity level of the service organization. In recent years, models for maturity levels have been recognized as an appropriate base for improvement processes. They are based on the assumption that the development of an organization follows some distinctive steps or maturity levels. Several different maturity level models have recently been developed for particular industries (e.g., Humphrey 1989; Rommel 1995; Malorny 1996). They have been integrated into the development of ServAs.

Using a number between 1 and 5, the maturity levels indicate how far the service organization has proceeded towards total quality management (TQM). Each level describes a typical state that an organization assumes in developing quality management. Thus, the maturity level can be easily interpreted by management and employees. It can be used internally for motivating and communicating further efforts in an improvement program because it provides clear objectives: ''We have reached level 3—within a year we want to get to level 4!''

Table 2 displays the five maturity levels of ServAs with their underlying principles, their most important characteristics, and the key tasks at each level.

After the questionnaire is filled in, the overall maturity level of an organization is calculated using a two-step procedure. First, the maturity level has to be calculated for each individual category. For each category and each maturity level a certain threshold has to be passed (i.e., a given number of positive answers in the questionnaire must be met or exceeded) for the maturity level to be reached. Finally, the overall maturity level is calculated from the category levels according to several scoring rules.

5.4. The Assessment and Design Procedure

Usually, the conduction of a ServAs assessment is done within the organizational frame of a project. Figure 6 shows an overview of the main phases and activities of such a project.

TABLE 2 Maturity Levels of Service Organizations

Level	Principle	Characteristics	Key Tasks
1	Ad hoc management	Service quality is attained by coincidence or by repairing mistakes.	Quality and service policy, dissemination of a common understanding of quality
2	Repeatable	Given identical circumstances, a certain quality level can be reached repeatedly.	Structured documentation of processes and products
3	Process definition	ISO 9000 type of quality management.	Ensuring effectiveness and efficiency of processes by use of performance measures
4	Quantitative management	Feedback loops and performance measures are established.	Refining of feedback loops, ensuring the participation of each employee
5	Continuous improvement	All members of the company are involved in improvement actions.	Continuous review of measures and feedback loops

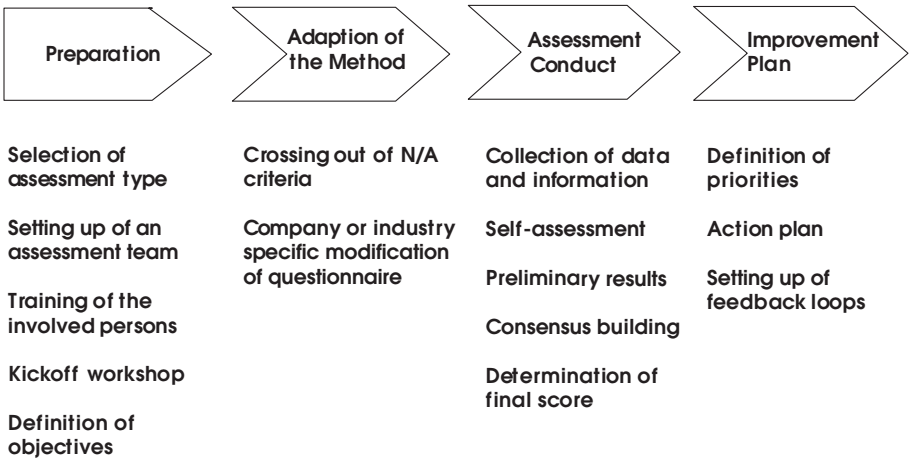

Figure 6 Procedure for Conducting an Assessment.

After the appropriate type of assessment is selected and the project team is set up and trained, the project should be initiated with a kickoff workshop that helps to communicate the project's background and objectives to all employees. During this workshop the most important and urgent problems can be gathered in order to fine-tune the project's objectives. In a second step the questionnaire has to be adjusted to company- and industry-specific requirements, which is done by eliminating criteria that do not apply or by adding company- and industry-specific criteria. Then information concerning the considered criteria is gathered within the organization, depending on the chosen mode of assessment. This information yields a preliminary result that has to be consolidated by eliminating contradictory statements, using different consensus-building methods. After the final score is determined, an action plan for improvement measures has to be decided on and its execution measured on a regular basis.

6. CONCLUSION

Managing customer service and service quality is a complex task that requires a holistic approach that takes into account people (customers and employees), material resources, and abstract entities such as products and processes. A system-oriented approach is useful for mastering this complexity because it supports the understanding of the manifold dependencies within a service organization.

The concept of a service product model that has been presented in this chapter helps to organize the variety of information that a service provider has to handle. It facilitates modularization of services and therefore the development of product bundles, variants, and entirely new products in service organizations. Defining service products enables service providers to distinguish the outcome of a service clearly from the processes and resources that lead to it, opening a variety of strategic options. However, one must keep in mind that service delivery can be never automated completely. The right balance between skilled people and intelligent products and processes is still required. The ServAs method helps to achieve this balance by supporting continuous improvement of the entire service system.

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