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Enhancing the Customer Contact Model

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EXECUTIVE SUMMARY

Most services are provided in the presence of the customer. In most service operations, the customer is not only present but also directly participates in the service delivery process. Such encounters with the service system and the customer's involvement in the service production process have important implications for operations efficiency and effectiveness. Thus, the nature and extent of contact between the customer and the service system should be carefully evaluated in designing service facilities.

One approach that has been considered a useful conceptual tool for aiding operations managers in their service design decisions is the customer contact model (CCM). This model classifies service systems into "high contact," "low contact" and "mixed" services based on the extent of contact between the customer and the service facility. Recently, however, this model's effectiveness as a service management tool has been challenged. CCM has been criticized for failing to sufficiently distinguish between service systems that involve high interaction and customization and those that primarily provide accommodation. The model's capability to assess a service facility's potential efficiency has also been questioned.

This paper reevaluates CCM in view of the recent concerns raised about it and offers some extensions which improve the model's performance. It proposes a broadened definition of "customer contact" and differentiates between "active" and "passive" contact. Based on these distinctions, it presents a revised approach for classifying services and for assessing the potential efficiency of service facilities. The extensions provided in this paper would help overcome many of CCM's shortcomings and thus enhance its potential as a viable tool for managing service operations. Therefore, this study, while recognizing the valid criticisms leveled at CCM, asserts that the customer contact concept still provides a useful framework for understanding, designing and controlling service systems.

INTRODUCTION

The service product consists of a bundle of tangible goods and intangible benefits provided in a particular environment (Fitzsimmons and Sullivan (1982)). In service operations, there is simultaneity of production and consumption, and often the customer is not only "on site" while the service is being provided but also participates in the production of the service output.

The presence and participation of the customer in the service production process brings with it a unique set of problems and opportunities. On the one hand, the physical presence and involvement of the customer in service operations allows variable customer demands to occur. These tend to adversely affect production efficiency (Larsson and Bowen (1989)). Moreover, the presence of the customer in the service system exposes the facilities, production processes and employees to the customer, and this has important implications for the perceived quality of the service (Berry, Zeithaml, and Parasuraman (1985)). On the other hand, customer involvement may help reduce the cost of labor and improve service availability (Lovelock and Young (1979)).

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It may also enhance sales opportunities and customer satisfaction by more easily identifying customer needs (Bowen and Schneider (1985)). In designing service systems, therefore, it is necessary to determine the nature and extent of contact between the customer and the service provider (Tansik (1990)).

The customer contact model (CCM) has been developed to facilitate the service design decision by determining the tasks that should be performed in the presence of the customer and those that should be processed in the back office (Chase and Tansik (1983)). Based on the extent of contact with the customer, CCM groups services into: (1) high-contact or "pure" services, (2) low-contact services or "quasi-manufacturing" and (3) "mixed" services.

CCM has been considered a useful framework for designing, analyzing and understanding service organizations, and further extensions of the approach have been articulated in several works. Recently, however, the model's ability to sufficiently classify service systems and its usefulness as a tool for assessing the potential efficiency of service facilities have been questioned (Schmenner (1986)). The proponents of CCM still maintain that Schmenner's criticisms, although valid, do not challenge the basic logic of the customer contact model (Tansik (1990)).

This paper reexamines the customer contact model in view of the recent criticisms leveled against it and proposes certain revisions aimed at enhancing its effectiveness. The next section of this paper discusses the shortcomings of the customer contact model as a tool for classifying services and proposes a broadened definition of "customer contact." A revised contact-based classification system is also provided. The following section reviews the model developed by Chase (1981) for assessing the efficiency potential of service facilities and proposes a revised potential efficiency assessment model. (Examples illustrating the application procedure are given in Appendix B).

CLASSIFICATION OF SERVICES

Although services have certain common characteristics, they also have important differences. Several classification approaches have been suggested in the literature to facilitate the analysis and understanding of the operation of different service organizations (Lovelock (1983); Snyder, Cox, and Jesse, Jr. (1982)). Appendix A presents a summary of the major classification approaches reported in the literature. Of the various service classification methods listed in the table, the customer contact approach has attracted the most attention in the literature, because unlike most other taxonomies which tend to be descriptive, CCM offers guidelines which facilitate the design and operation of service systems (Wemmerlöv (in press)). The ensuing discussion will focus on the customer contact model as a service classification and potential efficiency assessment approach.

Classifying Services Based on Customer Contact

As indicated above, the customer contact model classifies service systems based on the extent of contact between the service facility and the customer. It classifies service systems "according to the types and amounts of interactions customers have with the service facility" (Chase, Northcraft, and Wolf (1984, p.543)). However, the model does not clearly define customer contact (Wemmerlöv (in press)), and it does not sufficiently distinguish between services which primarily require the physical presence of the customer in the service facility and those which involve a high degree of interaction and customization (Schmenner (1986)). Thus, services which require the presence of the customer and which also involve *high* interaction and

customization would be placed in the same category as those which require the customer's presence but involve very *limited* interaction and customization. For example, according to CCM, airlines, railroad services, health centers and psychiatric services would all be categorized as "pure services." It is clear, however, that most airlines and railroad services require limited interaction and provide little customization of their services in contrast to health centers and psychiatric services which provide a high degree of customization and interaction. This has led some researchers to question the effectiveness of CCM as a service classification tool. For example, Schmenner (1986) observed that the use of ". . . contact time simply does not capture completely what is challenging about service sector management" (p. 24) and proposed a matrix approach for classifying services. Schmenner's "service process matrix" is based on the degree of labor intensity on one axis and the degree of interaction and customization on the other.

Table 1 compares the service classification methods offered by Chase and Schmenner. (To facilitate the comparison, most of the services selected are those cited as examples by Chase and

TABLE 1
COMPARISON OF THE CHASE AND SCHMENNER SERVICE CLASSIFICATION APPROACHES

a. Chase's Customer Contact Approach (Chase (1978, 1981))

High Contact < ——————————————— > Low Contact

Pure Services	Mixed Services	Quasi-Manufacturing
Entertainment centers		
Health centers	Branch offices of:	Home offices of:
Hotels	• Banks	• Wholesale houses
Public transportation	• Post office	• Government
		• Administration
		• Post offices
Restaurants		
Schools		
Automatic teller machines (ATMs)		

b. Schmenner's Service Process Matrix (Schmenner (1986))

		Degree of Interaction and Customization	
		Low	**High**
Degree of Labor Intensity	**Low**	**Service Factory:** • Airlines • Trucking • Hotels • Resorts and recreation	**Service Shop:** • Hospitals • Auto repair • Other repair services
	High	**Mass Service:** • Retailing • Wholesaling • Schools • Retail aspects of commercial banking	**Professional Service:** • Doctors • Lawyers • Accountants • Architects

Schmenner). Some striking differences can be observed between the two classification schemes. In the CCM, public transportation, hotels and schools are all considered "high contact" or "pure" services. In Schmenner's service process matrix approach, public transportation and hotels are classified as "service factory" while schools are considered "mass service." Further, the services categorized as "professional services" in the Schmenner model would be classified as "pure services" in the CCM. Thus, service systems included in the "pure services" category in the CCM would fall in all four cells of the Schmenner model.

Although in general an improvement over the unidimensional CCM, Schmenner's service process matrix also has its shortcomings. It tends to place service systems which typically require the customers' physical presence in the same category as those that do not require such physical presence, as long as the degree of interaction, service customization and labor intensity involved are about the same. Accordingly, in the Schmenner model, home offices of banks, insurance firms and the post office will fall in the same category (service factory) as airlines and hotels.

The physical presence of customers in the service facility is a unique feature of most service systems which has important implications in their operations. Furthermore, interaction and service customization dimensions do not necessarily presume physical presence. Hence, service classification systems should duly consider the "physical contact" dimension along with the other pertinent factors such as labor intensity, and the degree of interaction and service customization. This paper proposes an enhanced customer contact classification approach which also takes into account the extent of interaction and service customization.

Definition of Customer Contact

In CCM, "customer contact" is defined as "the physical presence of the customer in the system" (Chase (1978, p. 138)). This definition is too restrictive since a customer does not always have to be physically present to make a direct contact with a service facility. Telebanking, insurance, and travel services which perform most of their activities by phone and other telecommunications systems are examples where contact can be made without requiring the physical presence of the customer. It appears that the major shortcomings of CCM originate from this rather narrow definition of customer contact. Therefore, a broader definition of customer contact is needed, one which incorporates service encounters involving direct, although not necessarily face-to-face, contact between the customer and the service facility. The following definition addresses this concern.

> Customer contact refers to a direct encounter between the customer and the service system. This encounter may be face-to-face, either by the customer's presence in the service system or the presence of the service system's representative in the customer's facilities, or it may be mediated through the use of communication technologies such as the telephone.

Active and Passive Contact

Most tasks performed in the process of providing services involve direct contact with the customer; other tasks may be performed away from the customer (i.e., in the back office). The level of customer contact required may range from low to high. Where contact is low, most of the tasks are performed in the back office, but where contact is high the customer is in direct contact with the service system through most of the service delivery process.

Customer-service system contact may be active, passive or both, based on the nature of the service. In this paper, *active contact* is defined as direct contact between the customer and the

service provider which involves direct customer-service system interaction. Typically, this leads to the customization of the service. The degree of interaction involved and the resulting customization may vary from giving vital information to the provider which could influence the type and outcome of the service (e.g., health care), to providing specific data which would enable the delivery of the preferred service from a standard menu of available services. It is also here that customer preferences and idiosyncracies cause disruption of established procedures and system inefficiencies by making unique demands on the service delivery system.

Passive contact is defined as direct contact between the customer and the service system which does not involve customer-service system interaction. Typically, this form of contact requires the physical presence of the customer in the service system. However, passive contacts do not generally require the customization of the service product. Consequently, passive contact services are more amenable to standardization and automation. An example of passive contact would be riding a subway or city bus.

A service output generally involves *both* active and passive contact. For example, hotels/motels generally involve active interaction with patrons at the point of making reservations (if done by telephone), during registration and checkout, and occasionally during their stay in the facility. However, the contact involved is predominantly passive. Public transportation is another example of service with high passive contact. Here, although passengers are in direct contact with the service facility, interaction between customers and service providers is quite limited. In psychiatric services, on the other hand, much of the contact is active since the nature of the service involves interaction between the service provider and the patient, often through the physical presence of the customer in the service facility. For inpatient care, where a patient stays in a hospital with frequent visits and interactions with health professionals, both active and passive contacts are high.

The above examples illustrate that services involve both active and passive contacts although one type of contact may be predominant in a certain type of service. It is also clear that active and passive contacts entail significant difference in resource requirements and managerial complexities. The CCM, which uses a unidimensional continuum for classifying services, tends to conceal the important differences embodied in active and passive contact.

It is not just the relative amount of contact that is important in service design decisions, but also the *type* of contact. Thus, instead of the unidimensional contact continuum used by the CCM, this paper proposes a customer contact matrix for classifying services, using "passive contact" on one axis and "active contact" on the other (Table 2). This classification scheme is based on the basic logic of CCM while addressing the major criticisms directed at it.

Services that fall in Cell (a) of the table are those that require high customer involvement and interaction with service providers and, typically, the customer must be physically present to obtain these services. Most of the activities performed in providing this type of service involve direct interaction between the customer and the service provider (hence, high active contact), and passive contact activities for this type of service are rather limited. Services included in this category are often personalized to suit the specific needs of the customer.

Cell (b) includes services which require both high active and high passive contact. The high active contact that this type of service requires suggests that customer interactions with the service provider should be high enough to meet the special needs of the customer; this normally requires some form of customization. However, such services also require that the customer perform certain activities without interacting with the service providers even though the performance of such activities may have been influenced by prior interactions, e.g. taking

TABLE 2
CUSTOMER CONTACT MATRIX

		Passive Contact	
		Low	**High**
Active Contact	**High**	(a) • Health centers • Psychiatric services • Dental services	(b) • Hospital inpatient care • Restaurants • Schools
	Low	(d) • Data processing services • Catalog merchandising services • Home offices of banksm insurance companies, etc.	(c) • Hotels/motels • Public transportation • Resorts

physician-prescribed medication; doing assigned homework; occupying a hospital bed; etc. If different service packages are available, the interaction may lead the customer to select a service package that best suits his/her needs.

Cell (c) represents services which typically require the physical presence of the customer in the service facility although the interaction with the service personnel is rather limited (hence, high passive contact and low active contact). Finally, Cell (d) represents services which may not require direct physical encounters between the customer and the service provider. As a result, it is possible to decouple the service production and delivery stages. Services in this category will not be affected by the factors that typically constrain service delivery in the front office. The absence of direct face-to-face contact with the customer enables the service organization to schedule production at the most convenient time and to automate the service delivery process.

The various tasks performed by the same service facility may fall in different cells. For example, hospital in-patient care would be classified as high active, high passive contact (cell b); but preparing patient bills would fall in the low active and low passive contact cell (cell d). Thus, within the same organization, it may be necessary to design the various stages of the service process differently to suit the specific nature of the process at a particular stage.

ASSESSING POTENTIAL OPERATING EFFICIENCY OF SERVICE SYSTEMS

The customer contact model maintains that the extent of contact between the customer and the service facility relative to the total service production time determines the potential operating efficiency of the service facility (Chase (1981, p.700), Chase and Tansik (1983, p. 1039)). Thus,

$$\text{potential operating efficiency} = f\left(1 - \frac{\text{customer contact time}}{\text{service creation time}}\right)$$

Here, *customer contact time* refers to the time that the customer has been in direct physical contact with the service facility, and *service creation time* refers to the time needed to perform the various tasks required to provide the desired service including activities performed in the back office.

The model asserts that high contact systems are inherently limited in their efficiency potential, and that the higher the ratio of customer contact time to service creation time, the lower the potential efficiency of the facility. However, given the definition of "customer contact" as "the physical presence of the customer in the system" (Chase (1978, p. 138)), the model suggests that all that matters in determining a service facility's potential operating efficiency is the extent of the customer's presence in the service facility, regardless of the nature of the contact. Accordingly, "pure" services would have less potential efficiency than "mixed" services; and services classified as quasi-manufacturing would have the highest potential efficiency. However, the efficiency levels of services placed in the "pure" and "mixed" categories by CCM are not consistent with the above assertion. For example, Schmenner (1986) has shown that hotels which are classified by CCM as "pure" services have higher efficiency than the postal service which the model classifies as "mixed" service.

As noted earlier, CCM asserts that the extent of customer contact relative to service creation time is the primary determinant of potential operating efficiency of service facilities. However, due to the fact that CCM does not sufficiently distinguish between the different forms of contact required for creating the service product, its assessment of potential operating efficiencies of different service facilities tends to be inconsistent. Therefore, this paper presents a revised potential efficiency assessment model based on the notion that: (a) both the type and amount of customer contact are important determinants of potential operating efficiency in service systems; and (b) although both active and passive contacts cause relative inefficiencies, active contact is particularly critical in determining the potential operating efficiency (P.O.E.) of service organizations. Hence,

$$\text{P.O.E.} = f\left(1 - \frac{\text{active contact time}}{\text{service creation time}}\right)$$

where service creation time consists of the sum of active contact time, passive contact time, and back office service time.

Typically, each type of contact requires the services of different providers or the use of different mix of resources. Accordingly, relative weights may be assigned to the various components of active contact, passive contact, and back office service required for each unit of service output, and the total weighted service time for each type of contact may be obtained as shown below:

$$A = \sum_{i=1}^{n} x_i s_i,$$

$$P = \sum_{k=1}^{k} w_k p_k, \text{ and}$$

$$B = \sum_{t=1}^{T} w_t b_t$$

where: A = total weighted active contact time

s_i = relative weight assigned to service contributed by service provider i;

x_i = extent of active service time by provider i;

P = total weighted passive contact time

w_k = relative weight assigned for passive contact type k;

p_k = extent of passive contact type k;

B = total weighted time for back office services

w_t = relative weight assigned for back office service type t;

b_t = extent of back office service type t.

Here, potential efficiency will thus be the function of total weighted active contact time, A, to total service creation time (which will be the sum of A, P and B). The higher the ratio of A to total service creation time, the lower the potential efficiency of a service system. Alternatively, potential efficiency of service systems can also be computed as the function of P or B to total service creation time. If the latter approach is used, the potential efficiency will tend to be higher when the ratio of P or B to total service creation time is higher.

It may also be possible to determine the length of time for each type of contact needed to produce a unit of service output. Then, relative weights could be assigned to each type of contact based on the required level of resource consumption or skill. Here, P.O.E. may be determined as follows:

$$\text{P.O.E.} = f\left(1 - \frac{w_a a}{w_a a + w_p p + w_b b}\right)$$

Where: w_a = weight assigned for active contact time

a = total active contact time between the customer and service providers;

p = total passive contact time between the customer and service system;

w_p = weight assigned for passive contact time

b = total back office service time;

w_b = weight assigned for back office service time.

Determining Relative Weights

The efficiency of a service system is determined by the cost involved in the production and delivery of the intended service (Chase, Northcraft and Wolf (1984)). This would involve the costs of active contact time, passive contact time and back office task performance time. For many services, a major production cost component is labor which varies according to the skill levels of the providers. Hence, differential weights need to be assigned for the time spent by each provider based on resource requirements, task complexity and employee skill level needed for the production of each service output. For example, in health care, personnel of significantly differing skill levels such as physicians, nurses, technicians and nurse aides provide service to the patient. Where service providers of diverse skill levels engage in active contact with customers, it would be necessary to determine the contact time for each group and to assign different weights for their respective services. Hence, the total active contact time, A, per unit of service output is the weighted sum of the contact times of different service providers.

Determining relative weights for passive contact time and back office service time may not be as forward as that of active contact time, and often these may only be estimated based on accounting records. Appendix B provides examples of determining relative weights for different types of contacts.

Treatment of Waiting Time

Another important difference between the Chase model and the proposed potential efficiency assessment model is the treatment of waiting times. In service operations, some waiting may be an essential element of the service. For example, in a surgical procedure which involves the use of anesthesia, some time must elapse between administering the anesthesia and performing the surgery. Such waiting must be considered an integral part of the service delivery process. On the other hand, the customer may be subjected to non-essential waiting which obviously extends the customer's presence in the service facility. Even though there may have been contact between the customer and the service system to the extent that the customer has been in the facilities, only a fraction of that time may have been utilized for actual service production. Therefore, variations in customer waiting time could distort the efficiency levels of different facilities.

In the Chase model, the effect of any waiting time would be to lower the efficiency potential of the service system, since this increases the total contact time relative to the service creation time. It should be noted, however, that while excessive waiting time is undesirable (due to customer balking, loss of return business by customers that had to wait very long, etc.), a "reasonable" length of waiting by customers enables the service organization to utilize its scarce resources more efficiently since the queue serves as a constant source of input (Fitzsimmons and Sullivan (1982)). Therefore, to prevent possible distortions due to the inclusion of waiting time, the potential efficiency assessment model must have a mechanism for sifting out non-required waiting time. In the approach proposed here such distortions are minimized by taking into account only those contacts which are required to provide the service. (Please see Appendix B for examples.)

SUMMARY AND CONCLUSIONS

CCM has been criticized for its failure to distinguish between service systems that involve high interaction and customization and those that primarily "accommodate" the customer. The model's capability to assess the potential efficiency of service facilities has also been questioned. This paper has proposed approaches for improving CCM's effectiveness as a service management tool. Accordingly, the definition of "customer contact" is broadened to incorporate services that can be provided without requiring the physical presence of the customer. A distinction is made between active and passive contact, and a customer contact matrix is proposed for classifying service systems utilizing the basic logic of CCM. The proposed service classification approach overcomes the major criticism leveled at CCM—that it does not differentiate between service systems which merely provide "accommodation" to the customer and those which involve considerable interaction and service customization.

The potential operating efficiency assessment model presented in this paper reflects the revised definition of customer contact and the distinctions made between active and passive contact. It asserts that *both* the *type* and *amount* of customer contact are important determinants of potential efficiency in service delivery systems. Moreover, this study concurs with earlier assertions (Chase (1981), Chase and Tansik (1983)) that, for most types of services, customer contact (whether active or passive) has adverse impact on potential operating efficiency.

However, it is active contact that primarily inhibits the efficiency improvement potential in service systems. This assertion, of course, applies only to those services whose efficiency would be adversely affected by experiencing direct customer contact. In some service systems, promoting customer involvement and direct contact would increase the level of customer satisfaction and operating efficiency (Bowen and Schneider (1985), Chase and Tansik (1983), Lovelock and Young (1979)).

For over a decade, the customer contact model has provided a useful conceptual framework which greatly contributed to understanding the complexities involved in designing and controlling service systems. The extensions provided in this paper would help overcome many of the shortcomings for which the model has recently been criticized, and thus enhance its effectiveness as a tool for managing service operations.

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APPENDIX A
SERVICE CLASSIFICATION APPROACHES†

Author	Primary Bases of Classification	Remarks
Rathmell (1974)	- Type of buyer/seller - Buying practice and motives - Degree of tangibility - Degree of regulation	- Classification system may be applied both for goods and services, but is oriented towards marketing rather than operations.
Shostack (1977)	- Degree of tangibility and intangibility of each good or service	- By placing services along a tangibility-intangibility continuum, the approach seeks to provide a framework for service comparison and market positioning.
Hill (1977)	- Services that affect persons vs. those that affect goods - Effect of the service - Reversibility of these effects - Services which bring about physical changes vs. those that bring about mental changes - Individual services vs. collective services	- Primary focus of this classification scheme is on the effects/benefits that different services bring about.
Sasser, et al. (1978)	- Percent of tangible goods vs. intangible benefits contained in each service "bundle"	- Same remark as in Shostack above. Further, it shows that there are no pure goods and services but rather a bundle of both goods and services.
Thomas (1978)	- Technology used in service production (i.e., primarily people-based vs. primarily equipment-based	- Although it does not address most of the characteristics of services, it offers a useful approach for understanding services.
Chase (1978)	- Extent of contact with the customer	- On a continuum ranging from high contact to low contact, services are classified as high contact, mixed services, or quasi-manufacturing.
Mills & Margulies (1980)	- Personal interface between the customer and the service organization.	- Based on the dimensions of the interaction between the organization and its customers, three types of organizations—maintenance-interactive, task-interactive and personal-interactive—are identified.

APPENDIX A CONTINUED
SERVICE CLASSIFICATION APPROACHES†

Author	Primary Bases of Classification	Remarks
Kotler (1980)	- Type of technology used - Need for the customer to be present in the service production process - Satisfaction of personal needs vs. satisfaction of business needs - Purpose of the service organization	- Classification is comprehensive and incorporates many of the approaches used in prior works.
Fitzsimmons and Sullivan (1982)	- People-changing - People-processing - Facilitating services	- This classification builds on earlier work by Hasenfeld and English (1975) who used people-changing/ people-processing categories.
Lovelock (1983)	- Nature of the service act (tangible vs. intangible act) - At whom (or what) is the service act directed - Type of relationship between the service organization and its customers - Potential for customization and employee discretion - Nature of service demand and supply - Method of service delivery.	- Synthesizes prior research and offers the most comprehensive service classification approaches yet. Further, classification is tied to strategy development.
Schmenner (1986)	- Degree of labor intensity. - Degree of customer-provider interaction and service customization	- Classification is based on two dimensions—(1) degree of interaction and customization and (2) degree of labor intensity. Schmenner claims that his model offers an improvement over the customer contact model.
Haywood-Farmer (1988)	- Degree of labor intensity - Degree of interaction - Degree of customization	- This three-dimensional classification system overcomes many of the criticisms of the customer contact approach and Schmenner's service process matrix classification system.
Wemmerlöv (1990)	- Nature of customer/service system interaction - Degree of routinization of the service process - Objects towards which service activities are directed	- The taxonomy is process based and can facilitate understanding of service systems design and operations.

†This summary is based on the work of C.H. Lovelock, "Classifying Services to Gain Strategic Marketing Insight." *Journal of Marketing*, vol. 47, no. 3, 1983, pp. 9-20. A few, more recent classification approaches are added.

APPENDIX B
APPLICATION PROCEDURE OF THE PROPOSED EFFICIENCY ASSESSMENT APPROACH

This section provides the application procedure for the proposed efficiency assessment approach. In general, the procedure involves: (1) identifying the various stages of the service process; (2) determining the nature and extent of customer-provider contact at each stage; (3) assigning relative weights to services contributed by different providers; and (4) computing potential efficiency. The procedure is illustrated using two hypothetical examples: outpatient health clinic and a motel.

EXAMPLE 1: POTENTIAL EFFICIENCY ASSESSMENT FOR A HEALTH CLINIC

Consider an outpatient clinic which offers primary medical care to the community. Patients visit the clinic at the appointed time, although some walk-ins are also accepted. In the process of receiving the desired service, patients come in contact with various service personnel as shown in Table B1. It is assumed that the processes described in the table and the time shown for each service are typical for the clinic. In determining relative efficiency for the outpatient clinic, the following assumptions are also made:

1. Travel time between departments is negligible. Hence, although the patient moves from one office to another, such travel time is ignored.
2. Out of a total of 39 minutes waiting time experienced at different stages of the process, 7 minutes (time needed to perform laboratory tests while the patient was waiting) is considered a required waiting time based on the assumption that it was necessary for the physician to get laboratory test results during that visit to facilitate timely diagnosis of the patient's condition. This required waiting time comprises *passive contact*.
3. The balance of the waiting time (32 minutes) is considered non-required waiting time and the service system could, if it so chooses, eliminate such waiting by increasing capacity. How much of the non-required waiting time should be eliminated involves a trade-off between the cost of having the patient wait and the cost of adding capacity to avoid queues at different stages of the service. In computing potential efficiency, therefore, non-required waiting time is not considered part of the service creation time.
4. The time needed to test the specimen in the laboratory comprises part of the back office service.

Deriving Weighted Service Time

Although different approaches could have been used, salary is selected as a weighting factor in this example. It can be noted from Table 4 that the service providers involved were receptionist, registered nurse, physician, laboratory technician and cashier/check-out clerk. Their hourly pay rates are assumed to be \$8.00, \$15.00, \$50.00 \$12.00 and \$9.00, respectively. The physician's pay rate is used as the basis of standardization. For example, the receptionist's time is assigned a weight of 0.16 (i.e., \$8.00/\$50.00) and the nurse's time is given a weight of 0.30 (\$15.00/\$50.00). Similarly, the laboratory technician's time and the cashier's time are assigned relative weights of 0.24 and 0.18, respectively. Thus, the total weighted active contact time is:

$$A = (0.16 \times 4 \text{ min.}) + (0.30 \times 10 \text{ min.}) + (1.00 \times 14 \text{ min.}) + (0.24 \times 6 \text{ min.}) + (0.18 \times 3 \text{ min.}) = 19.62 \text{ minutes.}$$

This indicates that the total active contact time the patient received in the clinic is equivalent to 19.62 minutes of physician time.

If there is evidence that there are different forms of passive contact requiring different resource levels and complexities, these should also be weighted using a similar approach. In the outpatient clinic example above, the only passive contact is assumed to be waiting time by the patient while the laboratory was testing the specimen (7 minutes). This passive contact time is weighted using allocated overhead cost for space rental, utilities and furniture depreciation per patient visit. Based on past records it is assumed that such costs average \$4.50 per patent visit. It is also assumed that, on the average, a patient spends about 45 minutes in the clinic (hence, about \$0.10 per minute for each patient). It has been shown earlier that the physician's time costs the clinic \$50.00 per hour or \$0.833 per minute). Thus, the weight for passive contact time relative to the physician's time is 0.12. The total weighted passive time in this example will, therefore, be 0.84 minutes (0.12 x 7 minutes). Note that although the total time involved waiting for the laboratory test results has been 25 minutes, only the fraction of time needed for actual testing is considered here.

The production of a service output typically involves performing some tasks in the back office in addition to active and passive contacts. Services performed in the back-office can take various forms involving different levels of complexity. Accordingly, back office tasks may also be weighted using the same approach used for assigning relative

weights for active and passive contact time. In this example, the back office costs can be grouped into two broad categories: allocated overhead costs (administrative, medical records, etc.) and the laboratory test cost. For the latter, the cost will include the lab technician's pay, supply costs (if any), and the allocated overhead cost pertaining to back office activities. Here, it is assumed that the average back office administrative time is 4 minutes per patient visit and that the average salary for the administrative staff is $15.00 per hour. As indicated earlier, the lab test required 7 minutes. Thus, the back office service cost will comprise the lab technician's pay and the cost of administrative overhead per visit. Weighted in terms of the cost of physician time, this will be equivalent to (0.30 x 4 min.) + (0.24 x 7 min.) = 2.88 minutes.

The overall potential operating efficiency (P.O.E.) for the health clinic then can be determined as:

$$\text{P.O.E.} = f\left(1 - \frac{\text{active contact time}}{\text{service creation time}}\right)$$

$$= 1 - \frac{19.62}{19.62 + 0.84 + 2.88} = 0.1594$$

The result suggests that the potential efficiency of the clinic is low.

TABLE B1
THE SERVICE PROCESS IN AN OUTPATIENT HEALTH CLINIC

Activity	Service Provider	Time Elapsed (in minutes)	Type of Contact
1. Patient arrives at clinic	none	-	
2. Waits to register	none	2	nrw*
3. Registers for service	receptionist	4	active
4. Waits for nurse	none	5	nrw
5. Preliminary examination done by nurse	nurse	10	active
6. Physician examines patient	physician	9	active
7. Patient waits for lab. test	none	5	nrw
8. Gives specimen	lab tech.	6	active
9. Waits until lab. results are available (actual test time is 7 minutes; 18 min. is non-required waiting time	none	25	nrw/ passive
10. Physician evaluates lab. results; discusses overall diagnosis with patient; etc.	physician	5	active
11. Waits for turn	none	2	nrw
12. Checkout process completed; makes appointment; pays bill)	clerk	3	active
13. Leaves clinic		-	
Total active contact time		37 minutes	
Total passive contact time		7 minutes	
Total non-required waiting time		32 minutes	
Total back office time		11 minutes**	

*nrw = non-required waiting time

**This includes allocated back office time per patient visit (medical records, bookkeeping, scheduling, etc.) which is estimated to be about 4 minutes/patient visit. The balance is the time needed to test the specimen in the lab.

EXAMPLE 2: POTENTIAL EFFICIENCY ASSESSMENT FOR A MOTEL

A motel located in the suburb of a large Eastern city charges $48.00 per day. Past experience shows that although guests rent rooms for a 24-hour period, they stay for an average of about 16 hours. The registration process averages about six minutes (including reservation time). During their stay in the motel, guests typically call the front desk twice for information and assistance. The two telephone encounters take a total of about five minutes, and checking out requires four minutes. It can be noted from the above that although guests occupy rooms for 16 hours, there is active contact with motel personnel only for 15 minutes. The remaining time is for passive contact. Assuming that the front office personnel earn an average of $12 per hour, total active contact cost per room-day is $3.00 (0.25 hour x $12.00).

The relative weight for passive contact time is based on the allocated cost per room for such expenses as housekeeping, supplies, utilities, maintenance, space and equipment lease, and depreciation. The total passive contact cost is estimated to be $0.75/hour/room or $18.00 per room-day.

Providing a motel service requires that certain activities be performed in the back office in addition to services given during active and passive contact. These include allocated administrative overhead, laundry, purchasing, etc. It is assumed that these back office activities cost 10% of room revenues. Total back office service time will, therefore, cost $4.80 per room-day.

Based on the allocated costs per room-day for active contact, passive contact and back office services, the potential operating efficiency of the motel can be determined as follows:

$$\text{P.O.E.} = 1 - \left(\frac{3.0}{3.0 + 18.00 + 4.80} \right) = 0.884$$

This indicates that the motel has a relatively high potential operating efficiency.