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**Managing the New Service Development Process: Multi-Disciplinary Literature Synthesis and Directions for Future Research**

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**INTRODUCTION**

The development of new services is an increasingly important subject, particularly given today's rapidly growing service economy (Schmenner 1995; Fitzsimmons and Fitzsimmons 1998; Zeithaml and Bitner 2000). Although the development of physical goods has received substantial attention in the past decade, relatively little literature addresses detailed steps in the development process for new services (Edvardsson, Haglund, and Mattsson 1995; Martin and Horne 1993). To date, few systematic empirical studies of new service development have been conducted (Tax and Stuart 1997; Fitzsimmons and Fitzsimmons 2000). For these and other reasons, there is a pressing need to identify potentially fruitful areas for future empirical research on new service development.

We view new service development as the organizational process that links marketing and operational capabilities to conceive, design and implement a service valued by a customer. We believe a multi-disciplinary and integrated perspective is necessary to address this fundamentally cross-functional activity. The relative lack of research on new service development may stem from the fact that no functional discipline has claimed the topic to be completely in its domain. This chapter reviews extant literature from several disciplines—service operations, services marketing, and product innovation—to identify future research areas. We hope that the summarization and integration of these literatures helps inform readers from disparate disciplines about the broad literature and potential extensions to it. Further, we introduce some concepts (such as "service architecture" and "design for implementation principles") which we believe merit further study.

The first section distinguishes the development of services from that of physical goods. It reviews the archetypal differences between services and physical goods with an emphasis on the implications of these differences for the service development process versus the physical goods development process. The next section provides an overview of the service development process at the level of the individual new service development project, and notes that the service development process has a "front end" and a "back end," where the front end selects a service concept to develop more fully, while the back end implements this chosen service concept.

The section that follows summarizes literature and presents research issues regarding the front end. It addresses service positioning, idea generation and evaluation, and the use of formal marketing research. The next section summarizes literature and presents research issues regarding linking the front and back ends so that an effective service-delivery process can be developed. This section introduces a number of important concepts. First it identifies the four major categories of elements that must be developed and implemented in the back end: the overall service-delivery process sequence, personnel, facilitating goods, and supporting facilities. The notion of "internal newness" that captures the required degree of change from extant operational capabilities for each category is discussed. This section introduces the concept of the "service architecture" which assists in integrating the traditionally marketing-oriented front end and traditionally operational-oriented back end activities, and discusses tools to specify a service architecture. The final sections summarize literature and pose research issues regarding the back end of service development—the development and implementation of the overall service-delivery process sequence, personnel, facilitating goods, and supporting facilities. This is followed by the conclusion of the chapter.
DIFFERENCES BETWEEN SERVICES AND GOODS: IMPLICATIONS FOR THE DEVELOPMENT PROCESS

We distinguish services new product development (SNPD) from physical goods new product development (PNPD) to clearly address commonalities and differences between the two. There has long been a sense that “goods” and “services” are different. One key difference is the intended output of the product development process: The output of the PNPD process is a fully developed physical entity. That is, a physical product, manufactured product, or good such as a television set, table, or automobile. In contrast, the output of the SNPD is a fully developed service-delivery process. This is a system, sequence, flowchart, or script of: (1) service tasks, sub-tasks, and interactions between the service provider and the customer; (2) who does what and when; and (3) the necessary supporting materials, equipment, facilities, and services. The output of the SNPD is, at its core, a series of steps and a statement of all the elements that go into supporting the accomplishment of that series of steps. Further, because the word “process” takes on a variety of meanings, it is necessary to differentiate two processes in the service context: the service new product development process and the service-delivery process. The SNPD process develops the service-delivery process. It is often said (see Chase, Aquilano, and Jacobs 1998, p. 147) in services that the product is the (service-delivery) process.

Although the outputs of the SNPD and PNPD are different, should the development process for a service differ from that for a physical good? Services have been described as having four characteristics which, although not orthogonal, do collectively explain essential differences between services and physical products. The differences are: (1) intangibility; (2) simultaneity (or simultaneous production and consumption, also called “co-production” or “inseparability”); (3) heterogeneity (variability in service provision); and (4) perishability (Palmer and Cole 1995; Edgett and Parkinson 1993; Zeithaml, Parasuraman, and Berry 1985). Intangibility means that services, which are performances or actions rather than objects, cannot be seen, felt, tasted, or touched in the same manner as goods. Simultaneity refers to the fact that most services are produced and consumed at the same time. Whereas physical products are produced first, then consumed, many services are produced and consumed at the same time in the presence of both the customer and the service provider. Heterogeneity means that service performances are rarely uniform across customers and providers—there is non-trivial variety in the process of providing the service and in the perception of quality of the service. Finally, perishability refers to the fact that services cannot be saved, inventoried, resold, or returned. If service capacity is unused, it is lost. And if demand is in excess of capacity, the potential to serve that demand is often lost. Table 10.1 explores how these four characteristics influence the need for a different development process for services or emphasis on certain aspects of the process.

### Table 10.1 The Four Unique Service Characteristics and Their Implications for the Development Process.

<table>
<thead>
<tr>
<th>1. Intangibility.</th>
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<tr>
<td>• First, services cannot be readily displayed or communicated (Zeithaml, Parasuraman, and Berry 1985). During development of new services, those who must communicate with each other—marketing and operations, service franchises and franchisees, management and employees, and perhaps most importantly employees and customers—may not envision the same new service characteristics. It is more difficult to gain a “shared understanding” of the service concept, and it is more difficult to conduct market research for early marketing evaluation purposes.</td>
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<th>2. Simultaneity.</th>
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<td>• Second, firms may partially resolve this problem by “tangibilizing” the service concept. This involves making the concept “hard” through prototypes, flowcharts, drawings or pictures which may more easily communicate the intended service. Third, because new services are often intangible and abstract, and may have unclear potential benefits (in the customers’ eyes), the service firm’s image and reputation can help overcome the customer’s initial adoption uncertainty.</td>
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Both customers and providers are involved in the service activity. The customer often experiences the service in the presence of employees of the firm. Accordingly, the process by which the service is produced, consumed, and delivered is critical.

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<th>3. Heterogeneity.</th>
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<td>• First, operations personnel (particularly customer contact personnel) are intimately involved in the service-delivery process, and so should be active in the SNPD process. Developing new services can mean more work and complexity for operations employees (who are often already busy with continuing operations), and so such personnel may limit the number of ideas for new services (Easingwood 1986). This behavior may provide a needed “reality check” regarding extant operational capabilities and the feasibility of a proposed new service. Appropriate performance measurement and reward systems may encourage operational involvement and ideas.</td>
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<th>4. Perishability.</th>
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<td>• Second, customers may have insight regarding perceived service effectiveness and quality not only because they are recipients of the service, but also because they are involved in the production and delivery of the service. They too should be participants in the new service development process.</td>
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<th>5. Centralization.</th>
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| • Third, it is often not possible to gain significant economies of scale through centralization or mass production of the customer contact portion of the service (the “front room”). Accordingly, the SNPD process should consider relative front
room versus back room work content, design, and implications for volume and product variety.

- Fourth, because the customer is involved in and observes the service production process, the outcome of the service transaction may be influenced by the customer. The potential input and process variability introduced by customers must be considered during the SNPD.

3. Heterogeneity.

Heterogeneity makes contact personnel central to effective delivery.

- First, because services are heterogeneous across time, organizations, and employees, considerable effort must be expended to assure that employees fully understand new services and deliver them in ways consistent with the provider’s vision of them. If employees are unprepared, poor execution could threaten the commercialization of new services. Ensuring consistent service quality is challenging because different employees (and customers) interpret the service in different ways. Again, involving employees and customers in the SNPD process may help.

- Second, the development of robust service-delivery systems is important—these systems should be designed to accommodate some planned degree of variation in inputs and processing.

4. Perishability.

Because many services cannot be inventoried, developers of new services must focus on demand and capacity management issues.

- On the demand side, effective demand forecasting, methods to shift demand (for example, via pricing), and systems to prioritize and allocate demand to available supply (reservation systems, yield management systems) are helpful.

- On the capacity side, having service-delivery systems that can readily accommodate varying demand volume is helpful. Multipurpose equipment, flexible facilities, and service-delivery systems shared with other service products may help. Labor cross-training and having additional labor available during peak demand periods may help provide flexible capacity.

- Capabilities on both demand and supply sides must be developed during the SNPD rather than as a post service introduction afterthought. The issue of matching supply and demand in services has received considerable attention (Sasser 1976; Shemwell and Cronin 1994; Lovelock 1984b; Northcraft and Chase 1985; Kimes 1989a, 1989b).

5. Another Issue: Imitability.

It is argued that services, due to their intangibility, are easily imitated by competitors. Several implications arise if this is true.

- First, the firm should be able to rollout the same service product more widely and faster than the competition. This gets at rapid speed-to-market via fast product introduction and market launch.

- Second, the firm should be able improve the service continually, either through new services or continuous process innovation, to maintain competitive advantage. It is the rate of improvement that is important. Systems can be developed during the SNPD process to collect information and assess areas meriting improvement once the service is in operation.

- Third, the firm can work to reduce the imitability of the service through marketing and/or operational approaches. For example, building and relying on a favorable brand reputation and corporate image may reduce imitability. Further, development of hard-to-copy operational competencies such as personnel skills or proprietary information, physical goods or processing technologies may also reduce imitability.

- Fourth, legal barriers to imitation may be applied. It is argued that much of a new service cannot be legally protected by patents or copyrights, therefore allowing quick imitation by competitors. Nonetheless, some materials, equipment and processes can be protected, even if the service at large cannot.

Certain prescriptions emerge from Table 10.1. First, the abstractness of services calls for "tangibilizing" the concept so the idea is clear to all parties. An emphasis on the need for involvement of customers and service-delivery personnel—during the development process—is noted, as is the importance of meaningful cross-functional involvement of the service marketing and service operations functions. The need for service-delivery systems to be designed to be robust, and also inherently amenable to improvement, is highlighted.

THE OVERALL SNPD PROCESS

At a high level, the service development process can be described as consisting of three macro stages: the front end, the back end and product introduction. The front end essentially chooses what service concept should be developed, the back end implements the chosen service concept, and the product introduction opens the implemented service for
use by actual customers. The three macro stages and their elements are detailed in Table 10.2. Front end steps are traditionally conducted by marketing, back end steps by operations, and product introduction steps by both marketing (in product rollout, post-introduction market evaluations) and operations (in managing the service during and after its introduction).

The phenomena of product development processes having two qualitatively different pre-introduction stages has been widely observed in PNPD (Smith and Reinertsen 1998; Bacon et al. 1994). The front end is often called “fuzzy” due to its relative abstractness, while the back end is acknowledged to be implementation and execution oriented (Khurana and Rosenthal 1997; Tatikonda and Rosenthal 2000a; Tatikonda and Montoya-Weiss, 2001). This chapter focuses primarily on the front end and back end stages.

Although there is a natural temporal sequence to the steps in Table 10.2, the accomplishment of these steps in any real-life development project is rarely completely linear (Ramaswamy 1996; Zeithaml and Bitner 2000; Tax and Stuart 1997). There are many iterations within and among steps; steps are sometimes skipped, and steps are sometimes conducted simultaneously (analogous to concurrent engineering in physical products).

A number of services-specific prescriptive and descriptive process models have been presented in the literature. These models generally capture in a more detailed form the steps outlined in Table 10.2. Prescriptive models include Scheuing and Johnson’s (1989) 15 step sequence of SNPD activities; the “blueprinting” approach of Shostack (1984a, 1984b) and Shostack and Kingman-Brundage (1991); and the health care specific services development model by Bushman and Cooper (1980) and Cooper and Butterbaugh (1993). Descriptive models (based on case studies, surveys or interviews with company personnel) include those by Bowers (1985, 1987, 1989) and Easingwood (1986).

**TABLE 10.2 Archetypal Macro-Stages, Steps, and Elements in the Service New Product Development Process.**

<table>
<thead>
<tr>
<th>Macro-Stage</th>
<th>Major Steps</th>
<th>Activity Elements</th>
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| **Front End** | Strategic Positioning | • determine market opportunities or niches  
• define how a potential new service is different from extant services  
• determine the congruence between a given market opportunity or potential service and the company’s strategy and competencies  
• encourage and collect many ideas for a new service that may fill the market position |
| Idea Generation | Concept Development | • screen and refine the abstract ideas into a single, less abstract service product concept  
• employ early prototypes (drawings, flowcharts) to communicate the concept to and obtain feedback from stakeholders (including customers)  
• clearly define the service concept (via an iterative process employing the early prototypes) |
| Back End | Concept Implementation | • create implementation plans to physically realize the service concept  
• develop personnel procedures and training; design and select supporting goods and materials; design and test the service facilities (both front room and back room); refine the overall sequence of steps in the service-delivery process  
• iteratively develop and refine the overall service-delivery process model and specific elements of the service |
| Product Introduction | Full Prototype Tests | • test, in a real-world or simulated environment, the complete fully implemented service-delivery process |
| | Market Rollout | • rollout the service to one or more sites (product launch and market ramp-up) |
| | Performance Evaluation | • analysis of market and operational results  
• continuous improvement of the service-delivery system |

**RESEARCH ISSUES IN THE FRONT END OF SNPD**

This section discusses research issues in the front end of service development projects: service positioning, idea generation, concept development and evaluation; and use of formal marketing research.

**Service Positioning**

Positioning involves designing the company’s offering so that it occupies a distinct and valued position in the target customer’s mind (Kotler 1991). The service position is what is in the customer’s mind, whether or not it is the image planned or desired by the
organization (Zeithaml, Parasuraman, and Berry 1992). An organization or a particular offering of an organization is successfully positioned if it has established and maintains a distinctive and desirable place for itself in the consumer's mind relative to competing organizations or offerings (Ries and Trout 1985). If a service is successfully positioned, the mention of the service will conjure up in the customer's mind an image that is distinct from images of similar service offerings. The image, or position, that the organization chooses for the service will dictate to some extent the essential features and design of the service-delivery process (see, for example, Shostack 1987).

Service positioning is critical in establishing an image for a proposed new service. Ideally, positioning begins by examining how customers perceive proposed and or existing brands in a market (Aaker and Shansby 1982). After understanding customer perceptions of a market, a firm creates an offering or targets its existing offering to fall in a particular location on the perceptual product map (for example, Stumpf 1976; Wind 1982). In the most effective instances of positioning, companies locate new products and services near the ideal points of key customer segments, avoiding places where existing brands already prevail and seeking underserved but desirable places. Positioning and targeting are important strategic functions in new product development because they determine whether needs exist for potential new offerings and keep companies from introducing “me-too” products in already too competitive marketplaces.

Positioning and targeting are used more frequently by product firms than by service firms for several reasons. First, evidence indicates that service firms do less marketing research than goods firms (Lovelock 1984a), and positioning depends on marketing research (for example, perceptual mapping) approaches to locate brands in perceptual space. Second, because services are intangible—and the criteria for them are more ambiguous—it is more difficult to define the consumer's perceptual space and ideal points. Third, because services are heterogeneous, it is more difficult for service marketers to identify the set of competing services that the customer views as relevant. In all, it appears that service firms do not engage in service positioning and targeting for their new products to the degree that product firms do.

**RESEARCH ISSUE:** How should service companies position and differentiate themselves? Besides product maps, what tools are or could be effective in positioning a given new service? What additional tools are needed? What are the bases for service positioning (as in Zeithaml, Parasuraman, and Berry 1992)?

Customers can have a difficult time grasping new service concepts. This ambiguity leads to uncertainty, which reduces the willingness of consumers to try and use new services. The more a service company possesses a known and positive image, the more successful the new service will be. Related to the existence of image, new services that are communicated with a distinct brand image and unique positioning were found to be clear winners over modest winners (Aaker and Shansby 1982; Ries and Trout 1985; Cooper et al. 1994).

**RESEARCH ISSUES:** How can firms improve their service images in the context of a new service? How can new services without service images compete with well-established brands?

**Idea Generation, Concept Development, and Evaluation**

Companies use various techniques for generating ideas and concepts. Some are quite familiar, such as brainstorming or free association. Others are more structured and specific approaches such as structured brainstorming (Lueke and Suther 1991). In structured brainstorming, a sample of customers and potential customers is assembled. A facilitator leads the group through a series of exercises on creativity and then has the customers describe an ideal provider of the service. The facilitator probes “what” customers want (to elicit fundamental requirements), “why” they want it (to elicit specific service features). Other types of concept research include: (1) features research, which involves environmental scanning and querying of customers about desirable features of possible services; (2) lead user research, which brings in customers who are innovators or opinion leaders (von Hippel 1988); (3) synectics, which defines lead users more broadly than in standard lead user research and allows them to refine potential new concepts and ideas (Zeithaml and Bitner 2000); and (4) opportunity and capability models, which act as decision mechanisms for determining the next steps a business should take (Anderson 1987).

As in PNPD, the customer is the user of the product, and so can aid in determining what product best meets the customer’s needs. Further, in many cases the customer is part of the service-delivery system and can provide ideas on their role in the service-delivery process. Further, employees who deliver the service and interact directly with customers are also sources of new service ideas. They have insight into what can and cannot be delivered and where a proposed service-delivery process might break down. One study indicates that 89 percent of the sampled companies claimed they experienced problems of either staff or customer confusion in introducing new services (Easingwood 1986). The new service concept can be evaluated by asking employees whether they
understand the idea of the proposed service, whether they feel it satisfies an unmet need, and whether they are favorable to the concept.

Once a new idea surfaces and is regarded to be a good fit with a firm’s business and positioning strategies, it is ready for initial development. In the case of a tangible product, this would mean formulating the basic product definition and then presenting consumers with descriptions and drawings to get their reactions. Drawing pictures and describing an intangible service in concrete terms is difficult. It is therefore important that agreement be reached at this stage on exactly what the concept is. After clear definition of the concept, it is important to produce a description of the service that represents its specific features and characteristics and then to determine initial customer and customer-contact employee responses to the concept. A good service design document would describe the problem addressed by the service, discuss the reasons for offering the new service, itemize the service process and its benefits, and provide a rationale for purchasing the service (Schueing and Johnson 1989).

**RESEARCH ISSUES:** What other techniques are useful for generating new service ideas? Can techniques be developed that overcome the challenges presented by service characteristics? What approaches are useful for translating abstract service ideas into more defined service concepts?

How do firms currently involve service operations employees and, in particular, customer contact employees in the idea generation and concept development stages? What mechanisms are most effective?

**Use of Formal Marketing Information and Research**

The lack of understanding market needs was found to be the leading reason for new product and service failure (Kuczmarski and Associates 1993). In spite of this obvious and well-understood fact, firms often use a hit-and-miss approach instead of a market-oriented approach in developing new services (de Brentani 1993; Bowers 1985). Rather than depending on marketing research to determine the needs of the market, examine the viability of new service concepts, and evaluate potential through test markets, firms often create new services in a haphazard way (Schueing and Johnson 1989; Shostack 1984a). More often than not, new services are introduced on the basis of managers’ and employees’ subjective opinions about their design and potential rather than on objective data about customer perceptions and market needs (de Brentani 1993; Booms and Bitner 1981). The intangibility characteristic of services is in large part responsible for the tendency not to rely on market research.

**Marketing Research in the Front End.** Virtually all researchers who have studied the topic agree that new services that meet existing and unserved needs of customers are most likely to succeed (for example, Lovelock 1994; Zeithaml and Bitner 2000; Tax and Stuart 1997). The primary vehicle used to identify customer needs is collection of marketing research and information. Market research has been shown to be appropriate in the new service development process for confirming requirements for the service, assessing points of value, testing delivery experience, propelling rapid learning and concept iterations, identifying the variability in points of quality, analyzing the impact in customers’ processes, and customizing alternative approaches (Terrill and Middlebrooks 1997).

Marketing research appropriate for the front end typically includes qualitative research techniques, such as focus groups or in-depth interviews, to probe the needs of service customers. These qualitative approaches are open-ended and ask potential customers about existing and potential services, probing for attributes and benefits that are desired but not available. In their purest forms, these studies are conducted with no preconceived ideas about what will be suggested by customers. In these situations, marketers are truly focused on customer needs and are using marketing research to identify them.

One of the most frequently used types of marketing research used in the front end phases is the concept test. Concept tests with physical products involve the presentation of photographic representatives or dummy advertisements of new products to potential customers. On the basis of the favorability of the product concept evaluations, firms eliminate or retain and develop the concepts into prototypes. Because services are more difficult to grasp mentally, concept tests are more difficult to do with services than with products. Due to intangibility and the difficulty of describing services in a manner that is clearly understood by respondents, concept tests tend to be less reliable for services than for goods. For this reason and others (including perhaps a lower level of market research sophistication), service firms rarely engage in concept tests.

Other types of research are appropriate after the initial developmental research has been completed. Among the most useful are multidimensional scaling, which creates product maps, and conjoint analysis, which investigates the customer’s trade-offs among product attributes (see Wind et al. 1989 for illustration of conjoint analysis applied to Courtyard by Marriott). These research studies are not used as frequently as they could or should be. The lack of market research has strong implications for the success of new service projects. Studies have examined the extent to which market research and market focus affect the success of new services (de Brentani 1993; Bowers 1985). In a recent study
comparing highly successful versus modestly successful new service projects, financial results showed that projects where customer needs, wants, and buying behavior were understood, where adequate resources were devoted to market research, and where market research was used to test customer responses to the service strategy were more successful (Cooper et al. 1994). The same study showed that another measure of new service success—relationship enhancement—was also strongly affected by a new service development process that included evaluation of customer needs and the use of market research.

RESEARCH ISSUES: What marketing research tools are most effective in determining the potential of new service concepts? What different tools are most appropriate for different service types?

Test Marketing. Later in the development process, a tangible product might be introduced in a limited number of trading areas to determine marketplace acceptance of the product and accompanying marketing mixed variables such as promotion, pricing, and distribution vehicles. Bowers (1989) found that almost 69 percent of hospital administrators reported that they seldom or never engaged in the market testing of new services. A variety of reasons have been offered for the tendency to ignore this stage. First, many new services are introduced to complete a product line, and are therefore predetermined to be offered whether or not they succeed in a test market. Second, many new services are introduced as copies or near copies of a competitor’s existing product, making speed to launch critical. Third, competitors could easily copy services that were being test marketed, introducing them before the testing firm (Terrill 1992). Finally, the cost of a test market would not be appreciably less than the cost of a full launch (Easingwood 1986).

When test markets are used for new services, they are typically conducted to ensure proper functioning of service rather than to provide a base for national sales projections. “The intention is not at all to replicate a national launch on a local basis so as to estimate customer response, as in a [traditional] test market, but more to make sure the new [service] is operating correctly” (Easingwood 1986, p. 272).

Despite the relative lack of test marketing with new services, researchers have shown that the more successful service launches include this activity (Bowers 1985; Easingwood 1986; Shostack 1984a). Terrill (1992) suggests that if imitability of the service is a concern, that market research be conducted initially with internal customers before services are taken to external markets.

RESEARCH ISSUES: How valid is test marketing with internal customers for predicting the success of a service with external customers? In what ways can test marketing be accomplished without giving away new service concepts? What are low-cost but effective techniques for test marketing?

RESEARCH ISSUES IN LINKING THE FRONT AND BACK ENDS OF SNPD

As we have noted, the service concept communicates, both to customers and service providers, the overall intent of the proposed new service. In our view, the front end of the SNPD concludes when a single service concept is chosen, appropriately positioned, and well defined. At this point, the back end commences in order to implement the service concept. The back end develops the service-delivery system to realize the service concept. This section addresses several important issues which arise in linking the front and back ends.

First, we discuss the four major categories of elements that must be fully developed and implemented in the back end. These categories are (1) the overall service-delivery process, and the (2) people, (3) goods, and (4) facilities elements of the overall service-delivery process. Second, we discuss “internal newness”—the degree of change from extant capabilities required in each category, and the implications of this newness in terms of development challenges. Third, we introduce the very important notion of the “service architecture” as a means to link the front end and back ends. Fourth, we describe the blueprinting and quality function deployment tools as possible means to specify a service architecture.

Four Categories of Development Work

What major elements need to be developed and implemented in the back end of the new service development process? A few essential categories can be derived from the literature. The services marketing literature explains that the traditional “four Ps” of the marketing mix for physical products (product, place, promotion, price) do not fully represent services. And so, an additional three Ps—people, process, and physical evidence—are added for services (Zeithaml and Bitner 2000). Physical evidence includes supporting facilities and goods. In the service operations literature, Fitzsimmons and Fitzsimmons (1998, p. 23) state: “a service is a package of explicit and implicit benefits performed within a supporting facility and using facilitating goods.” Some of the benefits, tangible and intangible, are provided by people. This definition of the service package considers what is provided, by whom, and with what supporting facilities or goods...
to achieve the overall process-sequence of the service. Combining marketing and operations perspectives leads to our list of four essential categories of elements that must be developed: the overall service-delivery process sequence, and the people, facilities, and supporting goods pieces of that overall delivery process.

**Newness as Degree of Change**

The PNPD literature presents several frameworks for classifying the newness of a physical product from the point of view of the development organization (Abernathy and Clark 1985; Henderson and Clark 1990; Tatikonda and Rosenthal 2000b). For example, Wheelwright and Clark (1992a) classify new products as "breakthrough, platform, or derivative" based on the degree of product technology and manufacturing process technology change to be undertaken for the new product. They describe technology change relative to existing technology with which the organization is familiar. This classification gives a rough sense of the development skills necessary and complexity to be undertaken for that PNPD project.

A similar perspective is necessary for SNPD. An organization developing a new service must understand the nature and amount of development work required for each category. Having a sense of the "newness" of each category is helpful. We contrast newness from the service provider's point of view with newness from the customer's perspective. The provider's sense of newness, what we call "internal newness," relates closely to operational requirements while newness felt by the customer relates more closely to market requirements.

The internal newness indicates what needs to be changed in the service-delivery process and how much. It is the degree of change from extant operational capabilities of the firm and so identifies what must be developed rather than relied on from before. We believe any new service can be described as some degree of change from a previous or existing service, where the degree of change may range from none at all, to a minor or major modification, to a completely new service delivery system. The sense of newness relative to existing systems is important because many new services share the service delivery system with existing services (Easingwood 1986; Tax and Stuart 1997), be it the company's own or one the company may license, purchase, or share. This is analogous to a new physical good that is to be manufactured in an existing factory. The new good may be produced on existing or modified manufacturing equipment, and so shares part of the production system with or prior goods.

To link the front end and back end of SNPD, and to have the back end commence in the most effective manner, we believe an organization must determine the degree of newness for each of the four categories. Each category should be described per the degree of change from extant operational capabilities of the firm, which in turn identifies the capabilities that must be developed and implemented.

**The Notion of a "Service Architecture"**

In PNPD, the implementation challenge (that is, the work of the back end) is to develop a manufacturing process that economically produces a quality product in volume. The SNPD implementation challenge is similar—devising a delivery system to produce the service as it was conceived, at reasonable cost, in a reasonable amount of time, and at necessary volumes.

We suggest that a clear understanding of the "service architecture" for a given new service would aid greatly in linking the traditionally marketing-oriented front end with the traditionally operationally-oriented back end of SNPD. The service architecture aids in converting the service concept into a viable service-delivery process by translating the service concept into a plan for achieving the service concept. The service architecture partitions the development work of the back end into the four major categories. That is, the service architecture operationalizes the service concept by specifying the major elements of each of the four categories to be developed in the back end; stating the degree of change from previous operational capabilities for each category; and providing implementation plans for each category. The implementation plans detail specific development activities and resources for implementation of each category.

The notion of a product architecture has gained attention in the PNPD literature (Ulrich 1995; Baldwin and Clark 1997; Meyer and Lehnerd 1997; Smith and Reinertsen 1998; Tatikonda 1999). The product architecture is the scheme that identifies and organizes the major elements of the product, and states how these elements interact (Ulrich and Eppinger 2000). The architecture also serves to partition and disaggregate the overall development work into relatively substantial pieces. Each piece may be developed or sourced by different specialists or groups.

To illustrate our notion of the service architecture and its four categories, we borrow a well-known, simple example of a service blueprint—that of the corner shoesine stand (Shostack and Kingman-Brundage 1991, p. 244). The first category is the overall service-delivery process sequence. This involves specifying the key execution steps in the service-delivery process: brushing the shoes, applying polish, buffing the shoes, and collecting payment. The people category involves, among other things, determining who will perform which shoesine tasks, and what skills and training are required to do so. The facilitating goods category involves determining what goods are required for each
step (for example, polish, cloth), and selecting and sourcing these goods. The supporting facility category involves, among other things, design and selection of the customer shoeshine chair, signage, and other furnishings of the shoeshine stand. If the shoeshiner keeps an appointment calendar or accounts book (electronic or physical), then that constitutes the information technology aspect of the supporting facility.

A complete service architecture would list the elements that need to be developed in each category, identify how new these elements are with respect to extant operational capabilities, and specify what resources would be used in what manner to develop these new elements. The back end then develops and implements the four categories, in time resolving any uncertainty about each.

The amount of newness and development effort in each category are decision variables for the development organization. Choices made regarding each category affect the performance of other categories and the overall service-delivery system. Accordingly, appropriate selection of the elements in each category is required, as is coordination of the development of the multiple categories. Further, each new service will necessarily have a unique emphasis on different categories. For example, not all new services will require the same amount of development effort in the people category. This is dependent on the degree of change required in each category to satisfactorily achieve the service concept.

How should a firm go about deriving the architecture for a new service? Doing so requires specifying the overall service-delivery process, and its major elements, in a way that the overall process and its pieces can be effectively and feasibly developed. The service concept must be translated into implementable components. The blueprinting approach may be used to specify or derive a service architecture, although other approaches (for example, quality function deployment (QFD) (Behara and Chase 1993; Stuart and Tax 1996; Ramaswamy 1996)) may also apply.

We assert that a service architecture is key to successful new service development because it helps translate the service concept into an implementable service-delivery system. But we are aware of no study of how companies systematically determine service architectures (if at all) and what tools they use to do so.

**RESEARCH ISSUES:** How often do firms specify a service architecture for their products? What specific tools or approaches are employed in practice to develop service architectures? How do these approaches vary for different types of services? How often are structured processes used to specify service architectures? What is the frequency of usage of blueprinting and quality function deployment (QFD) techniques for developing service architectures?

What are the most effective means for translating the service concept into a set of partitioned and feasible development subtasks? What other tools or refinements of existing tools would increase the effectiveness of service concept translation into implementation plans? More generally, what other cross-functional techniques or approaches should be developed or adapted to bridge the front and back ends?

Can QFD and blueprinting be applied together to aid in cross-functional determination of the service architecture? How can QFD processes and blueprinting techniques be integrated to gain synergies from both approaches?

**RESEARCH ISSUES IN THE BACK END OF SNPD**

This section discusses research issues in the development and implementation of the four categories of elements in the back end of SNPD: supporting facilities (front room, back room, and the coordination of the two); personnel (both employees and customers); facilitating goods, and the overall service-delivery process sequence.

**Supporting Facility**

The supporting facility refers to all fixed physical (including electronic) resources necessary for provision of the service. Interior elements, exterior elements, and location issues have traditionally been considered aspects of the supporting facility for a branch-type service. We add information technology to this list. Interior elements that may be considered and developed include: facility layout (both front room and back room), supporting equipment (see the section on facilitating goods), furnishings, signage, and interior decoration and design. Exterior elements include: exterior decoration and design, landscaping, architectural appropriateness, signage and parking. The primary location issue involves determining where to locate the service facilities, and typically requires consideration of space and land requirements in conjunction with analysis of the location of customers, suppliers and supporting services. Information technology includes both electronic and physical hardware and software that enable the communication and information processing requirements of the service organization.

Here we focus on the interior facility. The supporting facility for the service is often described as having a front room and back room. The key distinctions between facilities in SNPD and PNPD are: (1) services have a front room, while physical products do not; and (2) development of the front room and back room requires close coordination.

The front room and back room can be, but are not always, located in the same physical location. The back room is largely isolated from the customer and has a strong efficiency orientation. Although the back room is rarely seen by the customer, it can influence service performance and customer satisfaction.
The back room resembles traditional manufacturing operations, and so can be designed and managed as such (Chase and Tansik 1983). Traditional operations analysis and industrial engineering techniques (including process flow charting (Kimes and Mutchowski 1989) for design of the physical conversion process and physical layout readily apply (Chase, Aquilano, and Jacobs 1998). Development of the back room differs from traditional manufacturing plant development for physical products in that the back room has an associated front room, and must be developed in coordination with the front room. The SNPD process must assure this coordination. Further, once the service is introduced, the ongoing service must have coordinated operation of the front room and back room.

The customer interacts with the service organization in the front room. Although much of the back room development is operational in nature, development of the front room requires both operations and marketing perspectives. Types of factors to consider in front room design include the functional, operational objectives of the new service; customer participation in the service process; and the aesthetics and ambiance of the service facility. The degree of customer contact and involvement with the service provider creates opportunities and constraints on the design and layout of the front room facility (Schmenner 1986; Chase and Tansik 1983). After all, the front room is where customers "experience the sights, sounds, smells, attitudes, actions, and other cues of the service context" (Haeckel and Carbone 1996, p. 9). The interaction of customer and service provider has been called the "service encounter." The interaction of customer and provider results in one or more "moments of truth" where the customer evaluates the service (Normann 1984). The service encounter need not be left to chance—it can be designed (Collier 1996; Fitzsimmons and Fitzsimmons 2000). The reality of customer contact calls for application of behavioral approaches in addition to traditional operations process flow analyses.

One behavioral issue is the "psychology" of waiting lines (Maister 1985)—how to manage human queues to "entertain, enlighten, and engage" the customer rather than frustrate them (Katz, Larson, and Larson 1991). Some principles include acknowledging the customer when he or she enters the service facility, and providing pleasant and informative distractions while the customer waits for service. These approaches are used in addition to classical analytical queueing models (Davis 1991; Davis and Maggard 1990, 1994) for service process design. Another behavioral issue involves design of the facility to reduce disorientation of the customer, and has been referred to as managing the "environmental psychology" of the service (Wener 1985). This involves putting in place cues to help the customer understand the service process. For example, a bank or fast food restaurant can have the physical layout of the front room designed to make it very clear where a customer should line up for service or go for supporting materials.

The issues of service environment, waiting line psychology, customers' learned scripts (see "personnel" in the next section), and customer co-production of the service all tie together and can be supported through appropriate front room facility design.

Other front room design issues arising from customer contact include personnel and customer training, and personnel selection and rewards (see "personnel" in the next section). Further, means to reducing personnel and customer errors, or unnecessary variability in the process, are helpful. These include "fail-safing" methods (Chase and Stewart 1994), which are applications of Japanese poka yoke principles in the service context.

Several frameworks have been presented to aid in service facility design. Schmenner (1986) classifies service facilities based on two dimensions: level of interaction with the customer and degree of customization of the product. Wemmerlov (1990) addresses facility design and process choice by considering these two dimensions in addition to the primary "what" that gets processed: goods (for example, a dry cleaning service), information or images (for example, ATM cash withdrawal), or people (for example, haircut, medical operation). Bitner (1992) considers the degree of customer involvement and degree of complexity of the facility (ranging from lean to elaborate). Each framework suggests design implications and prescriptions for the respective service type.

**RESEARCH ISSUES:** What aspects of the front room are most critical in delivering customer and employee satisfaction? What methods are most effective for coordinating the simultaneous and integrated development of the front room and back room? How should the front room and service encounter be designed when the front room is primarily computer-mediated (for example, ATM machine or Web page for product sales)?

**Personnel**

It is generally acknowledged that selecting and motivating personnel is a key managerial challenge in services (Schneider and Bowen 1993). Here we address the "development of people" in the context of the new service. "People" refers to customer contact personnel, backroom personnel, other service personnel (for example, those who serve the servers), service managers, and customers. "Development" refers to recruiting, selecting, training, motivating, rewarding, and providing feedback to the people.

Regarding personnel selection, Schneider and Schechter (1991) advocate evaluation of potential hires along two dimensions: service competencies (skills) and service inclination (willingness to do services work). The ideal candidate scores highly on both dimensions. Regarding training, personnel require understanding of: (1) the service delivery system as a whole; (2) the work procedures for an individual's specific job; (3) work...
RESEARCH ISSUES: How should firms go about recruiting, selecting, training, and motivating personnel in the context of new services (versus ongoing services)? What is different about personnel development for new services versus existing services?

When are new personnel (those new to the company or service situation) more appropriate than established personnel (those familiar with the previous service or a similar service)? How should firms select, train, and motivate new personnel versus established personnel for a new service? How do firms involve established customer-contact employees in the service implementation stages?

How is personnel development best conducted in an ongoing service situation (where current services continue to be offered)? This is analogous to ramping up a new product in a factory that also has responsibility for manufacture of current products.

Explore employee reward systems in the context of new services. Determine how such systems need to be different from reward systems for ongoing services. Determine how to appropriately balance rewards for ongoing versus new services.

Management training is also necessary. In contrast to traditional PNPD, SNPD requires development of managers of the people who interact with customers. Further, for services that are intended for mass rollout (for example, same service to multiple sites), large volumes of managers trained in some standardized fashion may be required.

RESEARCH ISSUES: What are the most effective means for training managers for new services?

Customers must also be "developed" because customers learn routines and roles they play in different service situations (Solomon, et al. 1985). These "scripts" are in part defined by previous service experiences and social norms. A new service that requires different customer roles in turn requires customer training or socialization (for example, through signage, brochures, advertising, direct service personnel intervention, or physical layout cues) on how to accomplish the new role (Kelley, Donnelly, and Skinner 1990). This is a service design decision—in some cases a new service can be designed with little or no need for new customer scripts. Further, customers can be co-producers of the service (Lovelock and Young 1979). They influence the service delivery process and in turn influence service quality and their own satisfaction levels. Accordingly, it is helpful to view customers as "partial employees" of the firm (Mills and Morris 1986), and to design the service so that the customer's "job" is well defined (Chase 1978; Mills, Chase, and Margulies 1983). The notion that the customer is really an employee suggests the use of employee management methods and ideas to assure role or task clarity, appropriate tools to aid in task performance, and motivation in the form of appropriate rewards for task performance. All of these are service design and implementation variables at least in part under management's control. Customers (or some meaningful customer proxy) can be involved throughout the service development process to help define their service needs and their role in the service delivery process (Kelley, Donnelly, and Skinner 1990).
RESEARCH ISSUES: How do companies involve customers in their SNPD processes? How should customers be involved for maximum effectiveness? Are different types of customer involvement appropriate for different customer classes and different service types?

When can or should divergence from established scripts be avoided? What are effective methods for the design of services having varying levels of divergence from established scripts?

Facilitating Goods

Facilitating goods are physical goods employed in the service-delivery process which may or may not be seen by the customer. For a fast food restaurant, facilitating goods include relatively permanent physical goods such as cooking equipment and customer tables; consumable materials such as order slips, packaging, raw materials (e.g., uncooked french fries); and items that aid in communication such as menus, employee uniforms, and facility signage. Facilitating goods in services share many aspects of:

1. Product development for physical goods, and
2. Supplier selection, inventory management and distribution issues of physical goods.

Physical Product Development. Because a facilitating good is a tangible, physical good, it can be developed using largely traditional PNPD processes (see Wheelwright and Clark 1992b; Rosenthal 1992; and Ulrich and Eppinger 2000 for excellent discussion of PNPD at the project level). Nonetheless, a facilitating good differs from just any physical good in that it is part of the service delivery system, and so has a role in contributing to overall service system effectiveness. The facilitating good should support the system in a functional sense, but must also be congruent with the system in an aesthetic sense. Some facilitating goods are visible to the customer and so enhance or detract from the intended ambience of the service. Accordingly, during the early development stages of the facilitating good, there needs to be a strong emphasis on usability and human interaction with the good (since customers or employees may use the item). Early customer feedback about that facilitating good is also called for. The tools of industrial design (Lorenz 1990; Norman 1990; Adler and Winograd 1992) and ergonomic design apply (Kroemer, Kroemer, and Kroemer-Elbert 1994). See Coughlin (1993) for a case description of the development of chinaware for British Airways' first-class cabin, and see Blank and Lawrence (1988) for description of the development of the Federal Express hand held tracker.

Supplier Selection, Inventory Management, and Distribution.

RESEARCH ISSUES: Should industrial design, ergonomic design, and related "human-oriented" design approaches differ for facilitating goods in services versus generic physical goods? What are the SNPD implications of these differences?

Development of a facilitating good for a service may be more challenging than the development of a typical physical good because the facilitating good must fit within the overall service delivery system. There are potentially more interactions between that good and other system elements. These interactions must be accounted for and designed. Therefore, integration of the good into the broader system (both the overall process and other elements such as people, facility, and other facilitating goods) is necessary. This may be achieved through careful and integrated original specification of the good, and through ongoing monitoring of the good's development to make sure the physical product continues to meet service system-level integration requirements.

RESEARCH ISSUES: Determine the most effective means to coordinate different types of service facilitating goods in the context of development of the overall service-delivery system.

It appears that different types of facilitating goods may have different implications for physical development of the good. For example, in the case of placemats for a fast food restaurant, the major development implementation challenge may simply be printing. Beverage cups may be purchased in a commodity-like manner on the open market. In contrast, development of a beverage dispensing machine may require a substantial PNPD process (or perhaps none at all if it is an industrial product which is simply purchased). Development of worker uniforms may require both considerable user input (regarding comfort and functionality) and aesthetic input from service designers and customers (since uniforms contribute to the overall service image).

RESEARCH ISSUES: Future research should classify facilitating goods in new services in terms of their development characteristics because different types of facilitating goods may require different types of PNPD processes.

Supplier Selection, Inventory Management, and Distribution.

Developing and acquiring facilitating goods for a new service involves many of the same issues that arise in developing and acquiring physical parts for a new physical good. Firms must determine what to design and develop in-house versus outsource (Clark 1989; Clark and Fujimoto 1991). If outsourcing is chosen, then vendors must be
provided appropriate physical product specifications so that vendors can produce the intended good. Vendor selection, screening, quality control, and quality assurance issues also hold for new service development. Implementation of vendor communication systems such as EDI may be necessary. Development of suppliers, such as aiding suppliers, so they may gain essential skills in producing the goods, may be required. "The opening of the first McDonald's in Moscow required substantial supplier development. Management not only had to build a commissary to prepare all products for the restaurant, but also had to show farmers how to plant and harvest the crops that were needed (for example, potatoes and lettuce)" (Fitzsimmons and Fitzsimmons 1998, p. 467).

Also necessary is development of inventory ordering, storage, and control policies and systems for the facilitating goods. Much traditional inventory management theory and the philosophies of supply-chain management apply here (Vollmann, Berry, and Whybark 1997). Development of a physical distribution system to transport facilitating goods may be necessary. This includes physical distribution of goods the company owns or controls, distribution of goods from vendors, distribution of goods among service sites, and "take back" of materials from service sites.

RESEARCH ISSUES: Explore how issues of supplier selection, supplier development, and supply-chain logistics differ for facilitating goods in new services versus physical goods alone. Determine implications for SNPD.

Service-Delivery Process Sequence

Prototypes. The blueprinting technique described earlier can be used to design and evaluate, on paper, the proposed service-delivery process in terms of: specific execution steps; the sequence of steps; flow of materials, information, and people (both customers and employees); and other support elements such as equipment and facility requirements.

Blueprinting is referred to as a "prototyping" tool because it leads to an approximation or representation of the proposed new service. The PNPD literature notes that many types of prototyping tools exist, and that they differ in their objectives, scope, tangibility, analytical depth, and location of use in the development process (for discussion of different types of prototypes see Ulrich and Eppinger 2000, Chapter 12; Wheelwright and Clark 1992b, Chapter 10; and Bowen et al. 1995, Chapter 7). Here we differentiate prototypes along two dimensions: scope and physicality. Regarding scope, prototypes range from complete service-delivery system prototypes (for example, system level blueprints or a full-scale model retail store) to prototypes for a small part of the overall process. These elemental prototypes are used to express and evaluate a piece within the larger system (for example, a single facilitating good). Regarding physicality, prototypes range from very abstract to very tangible. An abstract prototype may be described orally in broad terms. A less abstract prototype is described on paper via pictures and flowcharts (such as a blueprint). The most tangible prototype is the actual service-delivery process, with all its facilitating goods, supporting facility, and personnel in place. The example of a working McDonald's restaurant is a system-level, fully physical prototype.

RESEARCH ISSUES: Develop a complete conceptual classification of the different types of prototyping tools applicable to services. Determine the effectiveness of these different tools for different types of services, at different stages in the SNPD process, and for different SNPD objectives. Develop new prototyping tools for those service situations that require improved tools.

Prototype Iteration. Here we focus on system level prototypes. First, system level prototypes are typically revised many times during the SNPD process as ideas progress, more information is gained, and consensus achieved. Second, although creating a system level prototype may be costly, it does provide benefits in terms of assessing overall service system performance and feasibility. Some firms introduce the service product to actual customers, and then revise subsequent versions of the service product as they introduce the product more widely. Here, the product introduction not only garners real sales, but also serves as a full-scale field prototype.

RESEARCH ISSUES: What different strategies for the prototyping process are appropriate under different service development conditions? When should system level physical prototypes be tested internally versus at an actual field site? When is a system level prototype ready for rollout?

"Design for Implementation" Principles. Design for manufacturability (DFM) guidelines, and the more specific design for assembly (DFA) guidelines, are employed during the concept evaluation and product architecture development stages of physical products. These guidelines help assure ease of product manufacture, which in turn leads to lower development costs, shorter production times, and higher product quality and reliability (Nevins and Whitney 1989; Boothroyd and Dewhurst 1987; Andreasen, Kahler, and Lund 1983). A substantial literature, and even software support, exists in the area of DFM and DFA for physical products.

An analogue to DFM and DFA principles in the SNPD context is a set of rules or suggestions we call design for implementation (DFI) principles. These principles would
guide service concept evaluation, service architecture development, and both overall and detailed design of the service-delivery process sequence. Such principles would help assess and assure the feasibility and consistency of the service-delivery process. For example, one DFI principle is to consider, during service concept evaluation and architecture development, the degree of change required for each of the four back end categories. This involves evaluating whether an aspect of the proposed service leverages existing service operations delivery capabilities or would require new capabilities. A second principle would be to apply fail-safing techniques (Chase and Stewart 1994) once a high-level process sequence is chosen for the service. Such guidelines help increase the repetitive quality of the process. Another principle would be to have a bias for simpler rather than complex service-delivery mechanisms (Hagel 1988). This is analogous to the DFA guideline to “minimize the number of parts.” These three principles are merely representative. In general, development of DFI principles for services deserves considerable attention. Such principles, like DFA guidelines, should be widely applicable but may hold greatest potential for services that are to be rolled out to many sites.

**RESEARCH ISSUES:** Assess the degree of applicability of physical products DFM and DFA principles to service contexts. Modify physical products’ principles as necessary.

Develop a systematic, generalized set of DFI principles to increase ease of implementation of the service concept. Determine how DFI guidelines must vary for different service types and service-delivery elements. Assess whether application of DFI principles is more beneficial for replicated (multi-site) services than for single-location services.

Determine general costs and constraints associated with application of DFI principles. Assess the organizational challenges of implementing and utilizing DFI principles.

**CONCLUSIONS**

This chapter identified areas for future research on new service development. Although the increasing importance of new service development is now widely recognized, development of new services has not received the broad attention that development of physical goods has. To determine relevant areas for research, we drew on and reviewed literature from multiple disciplines including service operations, services marketing, and product innovation. This fundamentally cross-functional activity requires such a multidisciplinary perspective.

The chapter first addressed archetypal characteristics of services which in turn suggested that the development process for services must differ from that for physical goods in a number of important ways. The chapter then described the steps and stages in the service development process, and explained that development projects have qualitatively different objectives in the early stages (the front end) and later stages (the back end) of the development process. Research questions on the front end topics of service positioning, idea generation and evaluation, and the use of formal marketing research were presented. Questions addressing the linkage of the traditionally marketing-oriented front end with the typically operationally-oriented back end were then identified. We introduced our concept of the “service architecture” as a means to aid this linkage. Research issues were then presented regarding back end topics—the development of service personnel, facilitating goods, supporting facilities, and the overall service-delivery process sequence. We introduced our notion of “design for implementation principles” to guide development of an easy-to-implement and highly repeatable service-delivery process. Finally, research issues regarding organizational coordination and integration were posed, including questions on the use of structured development processes, cross-functional service development groups, and dedicated service development personnel and groups. A theme that arose throughout the chapter was the need for integration of multiple functional perspectives.

This chapter covered considerable ground by addressing in some detail research issues that span the front and back ends of individual new service development projects. Still, there are many salient issues regarding service innovation that are beyond the scope of this chapter. Perhaps most important is software development and information technology development in the context of new services. After all, software is the enabling technology for many services. The role of structured development processes, dedicated teams, cross-functional teams, and organizational coordination in general merit study. Other research areas include planning of service product platforms, families, and portfolios; designing services for mass customization; the unbundling, bundling, and centralization of service operations; research and development of service technologies, process automation, and electronic delivery channels; and the role of service innovation in the overall competitive strategy of the firm. Another area is the use of post-audits and post-launch reviews to assess completed new service development projects. The development of systems to capture continuous operational and market information (including customer satisfaction) on an implemented service is an important area. Such systems would aid in performance measurement and continuous improvement, and support service guarantees and service recovery.

This chapter presented a substantial agenda for inquiry on new service development. We believe research on the issues raised would greatly increase both theoretical and practical understanding of this essential management process.
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NEW DIRECTIONS in Supply-Chain MANAGEMENT

Technology, Strategy, and Implementation

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