



Customer-supplier duality and bidirectional supply chains in service organizations

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Abstract *Supply chains are quite easy to define for manufacturing organizations where each participant in the chain receives inputs from a set of suppliers, processes those inputs, and delivers them to a distinct set of customers. With service organizations, one of the primary suppliers of process inputs is customers themselves, who provide their bodies, minds, belongings, or information as inputs to the service processes. We refer to this concept of customers being suppliers as "customer-supplier duality." The duality implies that service supply chains are bidirectional, which is that production flows in both directions. This article explores the customer-supplier duality as it pertains to supply chain management, including practical and managerial implications.*

Introduction

Two current trends in business operations management are emphases on supply chain management and on services management. Although neither discipline has a singular origin, they are both spurred by a common compulsion, namely the demands of global economic evolution.

As the economies of developed and less developed nations evolve, manufacturers are increasingly forced to shift production and sourcing to locations far from primary consumer markets (Krause *et al.*, 1998). This extension of production and distribution across diverse national boundaries makes some form of supply chain management imperative. Companies who plan and produce without regard for supplier and customer conditions will find it increasingly difficult to compete. World class manufacturing is increasingly a collaborative effort across global supply chains (Strader *et al.*, 1999).

Services likewise are motivated by the evolution of the world's economies. Just as the more developed economies of the world shifted from being agrarian-based to being manufacturing-based, those economies have continued their evolution to becoming predominantly service-based. Services now account for two-thirds of the output of the advanced economies of the world (Kelly, 1997). Further, they represent the majority of employment in those nations. In response, academics and practitioners are scrambling to define and understand the driving principles of services management.

Besides sharing a common compulsion, supply chain management and services management also share an academic basis in manufacturing management. Supply chain management clearly emerged out of manufacturing contexts, and all of the major supply chain management concepts are rooted in

manufacturing concerns. So also, much of what people proclaim as “services management” is in fact inappropriately applied principles and techniques from manufacturing management. It is not the purpose of this article to expound the folly of haphazardly applying manufacturing management approaches to service situations. Suffice to say that services are markedly different from manufacturing, with different managerial emphases (Fitzsimmons and Fitzsimmons, 1998, pp. 23-35). The purpose of this article is to explore the uniqueness of services as it pertains to supply chain management concepts.

In the next section we will consider a few of the ways services have been defined as distinct from non-services, such as manufacturing. We will introduce the concept of customer-supplier duality. In the subsequent section we will discuss the implications of duality on service supply chain management, introducing the concept of bidirectional supply chains. That will be followed by sections that explore practical and managerial implications of duality. The final section summarizes.

Defining services

Many perspectives have been proposed for defining services. These various perspectives focus on different aspects of services. Does it make any difference how services are defined? Indeed it does. Various definitions will have varying managerial implications. A question from the present study is which perspectives have significant implications pertaining to supply chain management.

One perspective which has been popularized over the years is that services are “intangible products.” If this were true, then service supply chains would involve the sourcing and delivery of intangibles. As such, a major challenge in supply chain management would be dealing with the intangible nature of the product. The following are a few examples:

- *Intangibles may be difficult to store.* An amusement park delivers the intangible product of enjoyment. It may be impossible to produce and stock-pile enjoyment during the off season to help meet the surge in demand during the busy season. This relates to the true concept of *simultaneous production and consumption* of services, i.e. services are usually produced at the time of demand and not before. As such, just-in-time (JIT) delivery is a requirement, not an option. The supply chain management issue of production timing to meet customer needs becomes largely dichotomous – either the service provider is capable of producing at the time of customer demand, or the service provider is not. The manufacturing issue of “production smoothing” is a non-issue for most services. (Although demand smoothing can be employed through price incentives, etc.)
- *It can be difficult to account for intangibles.* Most intangibles are not depleted by their being sold – after the intangible is delivered, the service provider often continues to have the same capacity to deliver the intangible. This is to say that the intangibles are not used up, but are continually available for sale. For example, when an attorney gives

advice to a client it does not mean that the attorney now has less advice to give to the next client. This is very different from manufacturing, where a product that is sold is no longer available for sale. The supply chain management issue of product replenishment could be confounded for services by the inability to measure (account for) changing levels of the intangible product.

- *It could be difficult to identify the supplier of intangibles.* A university delivers the intangible product of knowledge. Who is the supplier of that knowledge? The knowledge may be viewed as coming from a lot of suppliers, including many who are not compensated for supplying the knowledge. Examples include knowledge from books the instructor checks out at the library, knowledge from the instructor's interaction with other colleagues, and knowledge from the instructor's experience outside of academia. When an instructor delivers an excellent lecture on a given topic, does anyone attempt to go back and recognize or compensate the supplier of the topic knowledge? Is it even possible to trace the origin of the knowledge? Probably not. This implies that the supply chain of such an intangible is virtually intractable, and thus difficult to manage.

The main problem with the intangibility perspective is that it is generally not a true means of defining services. No services are purely intangible. This is seen by applying the dictionary definition of intangibility as "incapable of being perceived by the senses, especially of touch." Can you touch services? Yes. You can touch the service provider (barring a sexual harassment lawsuit), the service facility and furniture, the machines used to deliver the service, etc. What about the takeaway items from the service? Can they be touched? Often they can. We can touch the food from a restaurant, the money from the bank, and the stitches from the doctor's office.

The counter-argument is that the core product, or benefit, of most services is intangible. While that is true, it is equally as true for manufacturing. We buy manufactured cars for transportation and excitement. We buy furniture for comfort and aesthetic pleasure. We buy books for knowledge and entertainment. We buy sporting goods for recreation. The fact is, we do not purchase any manufactured items that do not have intangible benefits at the core.

Other definitions of services have been set forth which are considerably more definitive than the intangibility supposition. Some examples include:

- A service is a personal performance (Levitt, 1972).
- A service is a product which is a process (Henkoff, 1994; Shostack, 1987).
- Services are processes involving customer contact (Chase, 1978).
- A service is a deed, act or performance (Berry, 1980).

These definitions consider the production process of service, focusing on customer involvement in the process. Such definitions make sense, however they do not easily lead to insights in supply chain management, since they

focus on the specific process and not on activities outside of the process. What we need is a definition that defines services as an integral element of a service supply chain.

A definition that meets this need is based not on the nature of the service production process, but on the inputs and outputs of services. This input/output perspective has been discussed by various authors, making it difficult to identify an originating individual (Fitzsimmons and Fitzsimmons, 1998, p. 27). Lovelock alludes to this perspective in his taxonomy of services (Lovelock, 1983; Lovelock, 1996, pp. 28-33). He describes how all services can fit into one or more of four categories:

- (1) services that act on people's minds (e.g. education, entertainment, psychology);
- (2) services that act on people's bodies (e.g. transportation, lodging, funeral services);
- (3) services that act on people's belongings (e.g. landscaping, dry cleaning, repair);
- (4) services that act on people's information (e.g. insurance, investments, legal services).

To summarize, all services act on something which is provided by the customer. This is true. The implication is that *all services have customers as primary suppliers of inputs*. In other words, customers *are* suppliers in all service businesses, which is the *customer-supplier duality*.

Customer-supplier duality

With services, customers are suppliers of significant inputs to the service production process. These inputs include customer minds and selves, customer belongings and/or customer information.

An example of customer-supplier duality is seen in the television repair process. The inputs to the process include spare parts, labor, testing equipment, etc. The output is a repaired television. The customers' role is to receive and "consume" (use) the output. However, the customers' role is also to provide the key input – a broken television set. Therefore, the customer is both a supplier (of a broken television) and a consumer (of the repaired television). So also, health-care customers are suppliers (of illnesses and injuries) and consumers (of improved health). Landscaping customers are suppliers (of yards) and consumers (of improved scenery), etc. Many other examples of this duality will be introduced below in Figures 1 and 2.

In defining customer-supplier duality, we specifically exclude *feedback* from the list of "customer inputs" since feedback occurs *after* some amount of production (Morris, 1981, p. 482). We also exclude general customer sentiment (such as market research information) from the list of "customer inputs," since general customer sentiment is not tied to a specific element of production. Given these two exclusions, the customer-supplier duality does not apply to

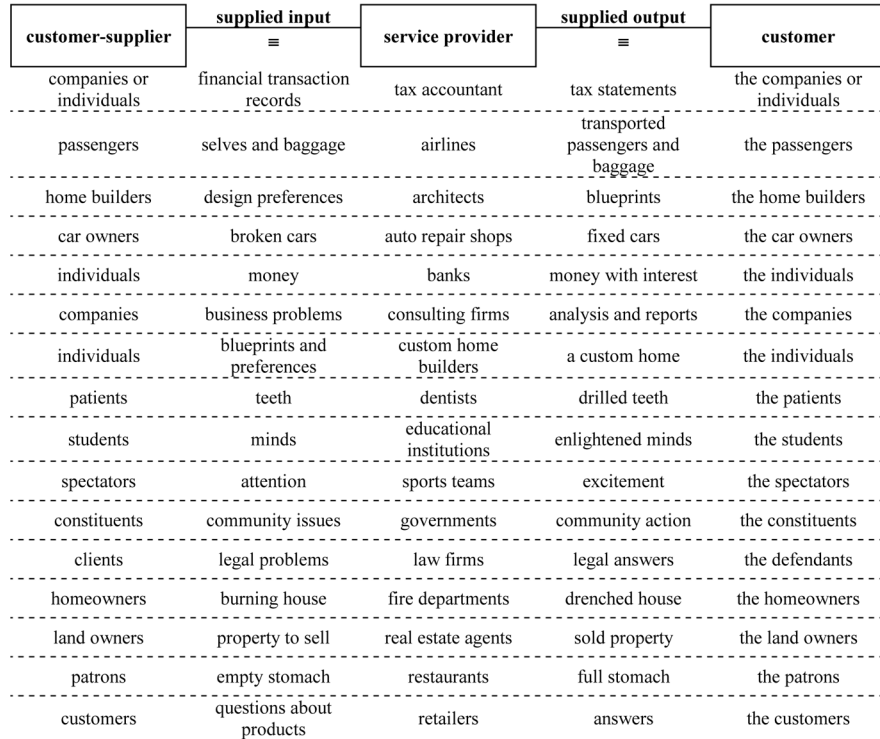


Figure 1.
Examples of single-level bidirectional supply chains

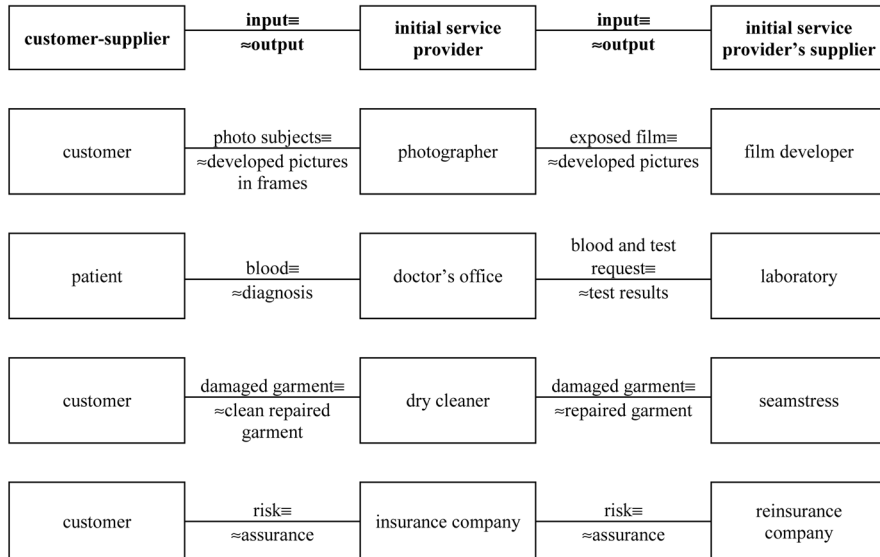


Figure 2.
Examples of two-level bidirectional supply chains

non-services such as manufacturing. With manufacturing, suppliers are suppliers and customers are customers with generally no overlap between the two groups. If a manufacturer begins operating on customer inputs, that manufacturer begins to look and act like a service provider.

This idea that customers are suppliers for service businesses has major implications for services management. Examples include:

- Major portions of production cannot begin until customers have supplied their inputs. This is a restatement of the concept of simultaneous production and consumption. (In our television repair example, the main portion of the repair process cannot begin until the broken television has been provided.)
- Service outputs tend to be heterogeneous, since customers present heterogeneous inputs. This implies that services tend to have non-standard production. (For television repair, each repair is likely to be somewhat different than other repairs, unless there is a common manufacturing defect.)
- Services tend to be labor intensive, since non-standard production limits the ability to employ automation, and since customers often prefer personal treatment of their inputs. (Despite advances in technology, television repair continues to be labor intensive.)
- Service location decisions tend to be customer-based instead of (non-customer) supplier-based. (Television repair shops tend to be near customers.)

There are dozens of other implications, which will not be enumerated here but have been enumerated elsewhere. What is of interest here are the implications of the customer-supplier duality for supply chain management, which is the focus of the next section.

Supply-chain implications of customer-supplier duality

With manufacturing, the supply chain proceeds from suppliers to customers. Physical goods flow from supplier to customer, with payment and feedback information flowing from customers to suppliers. With regard to production inputs and outputs, the supply chain is unidirectional, as depicted in Figure 3 where “→” represents the flow of production, including raw materials, work-in-process, and finished goods. An integrated supply chain involves co-ordination and information sharing up and down the process.

With services, customer-supplier duality implies that production flows not only from suppliers to customers, but also from customers to suppliers.

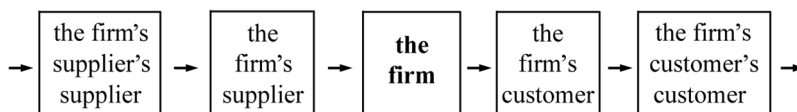


Figure 3.
Unidirectional
manufacturing supply
chain

Therefore, production flow is bidirectional, which is a key factor in linking traditional supply-chain concepts to service process realities. The simplest form of a bidirectional supply chain is for the customers to provide their inputs to the service provider, who converts the input into an output which is delivered back to the customer. This single-level bidirectional supply chain is depicted in Figure 4.

Again, we consider the example of television repair with respect to the Figure 4 model. A customer supplies a broken television to the television repair shop. The shop also receives parts and equipment inputs from other suppliers. After repairing the television it is returned to the customer. In this process the television was supplied by the repair shop who got it from the customer. Therefore, the customers are their own second-tier supplier (the supplier of their supplier), since they supplied the television that is ultimately delivered back to them. Other examples of single-level bidirectional supply chains are shown in Figure 1.

Things get more complicated when the service provider employs another service provider to assist with the processing of customer inputs. For example, some electronics retailers offer television repair but outsource the actual repair process. The result is a two-level bidirectional supply chain: customers supply broken televisions to the retailer who then supplies them to the repair contractor. Such a two-level bidirectional supply chain is depicted in Figure 5.

Another common example of a two-level bidirectional supply chain is professional photography. Often, professional photographers do not process exposed film themselves, but instead send the film to a film processing company. The supply chain is as follows: customers provide their subjects (themselves, their kids, etc.) to the photographer who records them on film which is supplied to the film processing company. Therefore the end customer is a second-tier supplier to the film processing company. The film processing company supplies completed prints back to the photographer, who makes them available to the end customer. Therefore, the film processor is a second-tier

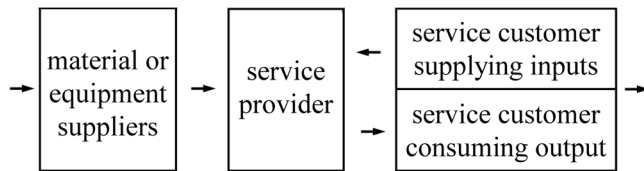


Figure 4.
Single-level bidirectional supply chain

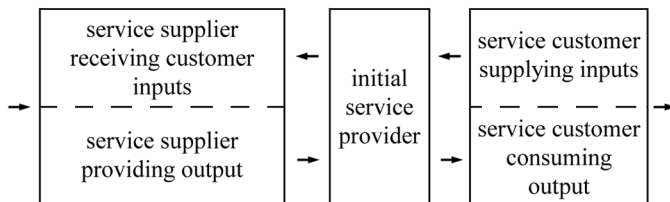


Figure 5.
Two-level bidirectional supply chain

supplier to the end customer. By providing the subjects to be photographed, and by receiving the finished prints, the end customers are in fact fourth-tier suppliers to themselves! This and other examples of two-level bidirectional supply chains are shown in Figure 2.

With two-level bidirectional supply chains, the initial service provider is an interface between the service customer and the service supplier. That initial service provider functions as a value-adding go-between in the process.

There is a third type of service supply chains that is not bidirectional, but incorporates the customer-supplier duality. This is a class of service processes in which the customer provides inputs to the service provider, who processes the inputs and delivers them to an entity which is different from the customer. Even if the original customers never see the original delivered output, they do receive benefits from the delivery.

An example is postal or package delivery, where customers deliver their documents or packages to the delivery service provider to be spatially transformed (i.e. moved) to a desired location. The item being delivered might be informational, such as a voice being processed by a telephone company. Another example is broadcast television where customers, the advertisers, provide their advertisements as input to the production process. Broadcasters package the advertisements with television programming and deliver it to the viewers. The advertisers who provide the input may never personally see the advertisements but will still receive the benefit of increased product awareness in viewers.

Practical implications

In this section we will consider some general observations pertaining to customer-supplier duality and the resulting bidirectional supply chains. These observations will be helpful in uncovering significant managerial implications, which is the topic of the subsequent section.

(1) Bidirectional supply chains are generally short

Single-level bidirectional supply chains consist merely of three stages: the transfer of customer inputs to the service provider, the processing by the service provider, and the transfer of the processed output back to the customer. With many services the supply chain is even simpler than that, since the three stages are simultaneous as far as service-provider involvement is concerned. For example, when a customer arrives at the barber for a haircut, he brings his hair with him. At the instant the service provider is cutting the hair, the customer is receiving delivery of the haircut (which is the concept of simultaneous production and consumption). The result is an extremely compressed supply chain.

We might consider whether a service supply chain extends beyond the customer supplier. Might the customer-supplier have a supplier? In some cases, the customer-supplier may be the originator of their own inputs. For example, phone company customers supply their own voices for processing.

In other cases, the customer-suppliers may have other suppliers. However, these are often difficult or impractical to co-ordinate with. One reason is that

every customer-supplier may have a unique supplier. For example, various customers of a shoe repair shop may each bring shoes that were obtained from a different source. It is likely to be impractical for a shoe repair shop to implement any degree of co-ordination with those various shoe suppliers – such as to standardize shoe components.

Nevertheless, in other cases it may be possible and desirable to co-ordinate with the suppliers of customer-suppliers. This topic will be discussed in the next section under the heading of partnering.

Two-level bidirectional supply chains are a generally more complex than single-level versions, since they also involve the transfer of inputs to and from the service supplier. At this point it probably needs to be mentioned that two-level bidirectional supply chains are not very common, at least relative to the occurrence of single-level bidirectional supply chains. Bidirectional supply chains of level greater than two are extremely rare, if they exist at all.

(2) Service providers usually do not pay for inputs coming from customer-suppliers

With manufacturing supply chains, materials and other production inputs flow downstream from suppliers to customers; and payment (and feedback) flows upstream from customers to suppliers. With bidirectional supply chains the situation is quite different. While production inputs flow from customers-suppliers to the service provider, those customer-suppliers are not directly paid for those inputs. Why not? Because if the chain is bidirectional, they will get the inputs back after they are processed. When a customer brings their broken car as an input to an auto repair shop, the shop does not pay the customer for the input. Nor does the shop charge the customer for the car after it is repaired, but only charges for the value added in the repair.

This may seem like a trivial point, but it does have significant implications for costing. With many services, customers provide the majority of the variable inputs. Since the service provider does not pay for these inputs, they are not accounted for in financial analysis. Therefore, such analysis indicates that variable costs are negligible. For example what is the variable cost of an airline? The primary variable inputs to the air transportation process are passengers and their baggage, which the airline does not pay for. The only variable production costs which are relevant to airlines are peanuts or meals and drinks, and perhaps a small amount of additional fuel. Therefore, the variable cost of airlines is virtually nothing, and fixed costs (planes, labor, etc.) dominate the cost structure. This explains why airline profitability is so dependent on utilization.

(3) Bidirectional supply chains are inherently JIT

With manufacturing supply chains, a major issue is where inventories will exist in the supply chain and the extent of those inventories. Manufacturers may choose to keep large inventories of supplied inputs to be prepared for

future production, or to reduce inventories to low levels by implementing a JIT system (Chase *et al.*, 1998, p. 327). JIT systems are based on careful timing of the delivery of process inputs.

Service providers often do not have the luxury of regulating the delivery of inputs from customer-suppliers. Those inputs come at the time of demand, which is likely to be a random occurrence. When customer-supplied inputs are delivered, the customer expects them to be processed either immediately or within an extremely short period (JIT). Whereas a manufacturer may keep multiple months worth of inventories of inputs on hand, service providers often have to process customer inputs within days, hours, or in some cases minutes.

For example, customers provide themselves as inputs to the restaurant process. If the restaurant is not immediately ready to process those customer inputs then the customers will sit in inventory (i.e. a waiting room). If customers are kept in inventory more than an “acceptable” amount of time, they will take their demand elsewhere. How long is an “acceptable” amount of time? Depending on the restaurant it may be 20 or 30 minutes, but unlikely to be as much as an hour. Restaurants have JIT processing of customer inputs.

Since bidirectional supply chains are inherently JIT, it can be beneficial to plan the arrival of customer inputs where possible. This can be accomplished through reservations systems, which schedule the arrival of customer inputs at times when production capacity is expected to be available. In many cases, reservations systems are not practical. Service providers can still influence the arrival of customer inputs such as through price incentives. For example, movie theaters attempt to shift the arrival of customer inputs to times of low utilization by offering discount tickets for matinee movie showing.

(4) Bidirectional supply chains have implicit expectations for value added

Manufacturers receive inputs from suppliers and add some degree of value. The customers purchase the value-added outputs with no idea of how much value was added by the manufacturer. Shrewd manufacturers will attempt to obtain good inputs at low costs, such as by foreign outsourcing, so that large profits can be generated even if the manufacturer adds little value. For example, a major shoe company might inexpensively outsource all of the production of shoes to a producer in a cheap-labor country, but distribute the shoes at high prices in more developed countries. The customers may have no idea that the \$80 shoes only cost the company \$10, including production and shipping.

On the other hand, the value added by service providers can be closely monitored by customers. This is because when customers supply major inputs they know exactly what condition those inputs were in. Then, when they subsequently receive the output from the service provider they can easily assess the amount of value added by the service provider.

An example of this was the author’s visit to a dentist. The dentist claimed he discovered the start of a cavity, and insisted on filling it. The author reluctantly

submitted, and then suffered months of a tooth with temperature sensitivity pain. Prior to that dental visit the tooth was not a problem. The assessment is that the dentist destroyed value instead of adding value.

This phenomenon of implicit expectations for value added occurs in nearly all bidirectional supply chains. It can both simplify and complicate the communication across the supply chain. On one hand, it can simplify the process of demonstrating the real value which is added by the service provider. Customers should be able to readily discern real changes to their supplied inputs.

On the other hand, it can put service providers in a precarious position when customers provide sub-standard inputs with unrealistic value-adding expectations for the service provider. For example, a person may have a stained shirt that they wash and dry but the stain remains. So, they take the shirt to a dry cleaner, who is unsuccessful at removing the stain. (The fact is, dry cleaners cannot remove most stains once they have been baked-in with a clothes dryer.) The customer is upset that more value was not added to the shirt by the stain being removed. The dry cleaner added as much value as he/she could and charges for the shirt cleaning anyway.

This issue implies that it is often helpful to explicitly communicate value adding expectations with customers prior to service production processes. Further, customers may need to be informed when their inputs limit the amount of value adding which is possible. This and other managerial implications will be expounded in the next section.

Managerial implications

In this section we will consider some of the managerial themes of supply chain management and their relevance to bidirectional supply chains. First, we will look at issues surrounding the establishment of a base of suppliers.

Supply base issues

Manufacturers are faced with three levels of decisions pertaining to determining the supply base, namely make versus buy, many versus few suppliers, and supplier selection. At the first level, the manufacturer decides whether to obtain the ability to make particular process inputs, or to buy them from an outside supplier or suppliers. If a firm chooses to make the input, they are inherently deciding on a degree of vertical integration. If they decided to buy from outside suppliers, then a question to be resolved is whether to have many suppliers compete for the business, or to only involve one or a few suppliers of the input. An advantage of many suppliers is a propensity to compete on price. An advantage of few suppliers is the improved opportunity for partnering. In either case, the manufacturer is then faced with the issue of supplier selection-determining the criteria for selecting suppliers and conducting some form of vendor analysis to determine the most suitable supplier(s) (Jayaraman *et al.*, 1999). Common criteria include price, quality, flexibility, location, and reputation (Heizer and Render, 1999, p. 425; Stevenson, 1999, p. 702).

Now, let us consider these fundamental supply base issues as they would pertain to bidirectional supply chains. For two-level bidirectional supply chains, the manufacturing supply base issues apply with regard to service suppliers. The service firm decides whether to employ the service supplier, or whether to complete the service itself. Photographers might choose to procure the equipment to develop film in-house. Doctors offices might choose to establish their own in-house laboratory for doing blood analysis. If the service firm decides to outsource, they then decide whether to employ many or few suppliers, although the logistics of getting customer inputs to the service supplier generally favors having one or a few service suppliers. Finally, the service firm needs to select the supplier based on relevant criteria. The consideration of service suppliers in two-level bidirectional supply chains is not markedly different from the decision processes for manufacturers.

What is more interesting is the relevance of the supply base issues with regard to customer-supplier duality. In the presence of customer-supplier duality there is usually not an option of make versus buy, since the service provider must “outsource” customer inputs which must come from customer-suppliers. Since customer-provided inputs are central to the service, they cannot usually be produced in-house by the service provider.

The choice of many versus few customer-suppliers will almost always favor “many,” since more customer-suppliers means more customers. Supply base reduction is usually undesirable because it would limit the number of customers and the amount of revenue. Finally, supplier selection is usually not an issue under customer-supplier duality, since it is the *customers* who choose to be input suppliers to the service provider, not the service provider who chooses the customers.

Supply chain integration

Manufacturing supply chains become integrated by co-ordinating the efforts among the various stages of the supply chain. This can be accomplished in various ways, including communication, partnering, and vendor development.

As mentioned previously, bidirectional supply chains have inherent communication of expectations. Communication needs to occur between customers and suppliers to prevent inadequate fulfilling of unrealistic expectations. The concept of “garbage-in, garbage-out” implies that the quality of a company’s output will be limited by the quality of supplied inputs. If a customer supplies lousy inputs, and that customer is subsequently upset with the shoddy outputs, who is to blame? In an integrated service supply chain everyone must take some responsibility, including the service provider and the customer. As appropriate, service providers need to inform customers about process capabilities and limitations. With the photography example, customers may need to be informed that certain color combinations will look bad, regardless of how good the photo processing is done. This implies that service providers need to understand the capabilities of their service suppliers, so that relevant conditions can be communicated to customers up front.

Service providers may also initiate communication of customer-input delivery expectations, such as through reservation systems. Since these supply chains are inherently JIT, it is essential that changes in production schedules or requirements are effectively communicated with customer-suppliers. For example, if a consulting firm states it will take two months to complete some analysis, and delays extend the time to three months, the customer must be informed of the delay if goodwill is hoped to be retained.

The communication with customer-suppliers needs to be timely, as illustrated by the following example. The author hired an engineering firm to calculate specifications for the foundation of a home. The foundation included a 16 foot retaining wall. The engineer took many times as long as he originally said the project would take, and the project still was not finished. The author supposed that the engineer was incapable of completing the project in a satisfactory manner. Finally, the author confronted the engineer about this and learned that the engineer was capable of doing basic foundation design but not something as complex as a 16 foot retaining wall. The engineer only charged for the portion of the project which was completed, even though he spent a much greater amount of time working on the retaining wall design. Further, the author was upset that the project had dragged on. Early communication in this bidirectional supply chain might have avoided the significant wasted time.

Communication of production changes or problems is particularly important with two-level bidirectional supply chains. Customers do not want to hear a service provider blame a service failure on their service-supplier, even if it is that supplier's fault. For example, a photographer who blames the film processor for shoddy prints is like an auto dealer blaming the steel mill if a metal auto part breaks prematurely. Service providers are responsible for the work of chosen suppliers, and for choosing other suppliers when necessary.

Partnering

In many cases, partnering with customer-suppliers makes sense, and can bring advantages to both the customer-supplier and the service provider (Vokurka, 1998). Service providers have an incentive of getting better quality inputs from customer-suppliers, and customer-suppliers have an incentive of getting better quality outputs from the service provider.

One example of customer-supplier partnering takes place in higher education. Students provide their minds and prior knowledge as inputs to the education process. There can be great advantage if the quality of the prior knowledge adequately prepares the students for the university's value-adding process. Universities can partner with students by providing programs which prepare students for matriculation. Further, universities might partner with the suppliers of the student-suppliers, namely the high schools or preparatory schools. Such partnering might include exchanging information about curriculum and about knowledge and skills which are desirable in students.

Universities can even partner with the customers of their customers, namely the employers and graduate schools. This partnering can again include exchanging information about curriculum and about knowledge and skills which are desirable in graduates.

One challenge to partnering with customer-suppliers is the huge quantity of customer-suppliers to partner with. In manufacturing, partnering initiatives are often preceded by supply base reduction, which we have deemed unreasonable under customer-supplier duality. Therefore, if service providers are going to partner with customer-suppliers, they will likely have to do it in a relatively efficient manner. For example, many airlines and hotels offer some form of frequent user program. Some of these programs provide regular customers with simplified reservation and check-in system, and automatic billing. The airlines or hotels hopes that providing these services and other perks will promote an enduring service relationship.

Supplier (vendor) development

Manufacturers who seek to integrate their supply chain may invest in vendor development. This is typically appropriate in situations of sole sourcing, where a long-term relationship with the supplier is expected.

A challenge with bidirectional supply chains is that there is seldom an assured long-term relationship with the customer-suppliers. This can discourage any development of customer-suppliers, who may defect to other service providers at any time. However, there are some services in which customer-supplier development can be accomplished in an effective manner. For example, the theory of managed health care is that if customers take better care of their bodies, such as through preventative actions, the health care provider can do a better job of promoting their good health. Health maintenance organizations and insurance companies implement customer-supplier development by providing programs to promote good health and train customers in healthy practices. The companies benefit from lower occurrence of insurance claims, and the customers benefit from better health.

Role of information technology (IT)

Because of the heightened communication requirements of integrated supply chains, the communications mediums often tend to be highly automated. For example, electronic data interchange (EDI) can be established to allow suppliers to know customer requirements almost at the instant the customer needs occur. A challenge in establishing EDI is that it is traditionally quite costly (Hornback, 1994). As just mentioned, a “huge quantity” of customer-suppliers is likely to exist in services, potentially making general EDI in service situations cost prohibitive. However, three factors can improve the prospects for service EDI. First, service providers may choose to partner only with the “A” category customer. For example, Federal Express will put a computer

terminal in the mail room of companies who provide a lot of inputs (packages), whereas small-time customers would have to rely on other ways of communicating with the company.

Second, the Internet has dramatically decreased the cost of communicating with a large number of customer-suppliers (Wheeler, 1998). The prevalence of customized portals – “my” services such as MyYahoo, MyNetscape, MyFamily, etc. – means that Internet-based services can maintain personalized communications about the needs and interests of numerous customers.

Finally, there is a certain economy that comes from EDI under bidirectional supply chains: under customer-supplier duality, an EDI link with a customer-supplier implies a simultaneous EDI link with a customer. In between the customer-as-input-supplier and customer-as-output-consumer stages, the customer can be kept informed of service delivery progress. For example, many on-line retailers start with electronic ordering and finish with electronic billing. In between, the customer can check the order status and be notified of shipment conditions, all electronically.

Supply-chain approach to service design

In manufacturing processes, supply chain concepts such as those described in the prior section motivate design which considers the needs and capabilities of various players in the process. It is not good enough to be “locally optimal,” meaning that each element of the supply chain does what is in its own best interest without regard for players up or down the supply chain. For example, a component manufacturer may produce a part in a way which is easy to produce, but difficult for the customer to attach to the final assembly. The engineers who design the component need to consider the impact the design has on later stages of the supply chain.

Again, we see a parallel concept in the design of service processes. Decisions at one stage of the service supply chain can impact later (or earlier) stages of the supply chain. The interesting thing under customer-supplier duality is that the customer is involved in early and late stages of the supply chain. Therefore, the process involving the customer as a supplier of inputs will have an impact on the process involving the customer as consumer of the output. It may only be locally optimal to design the input-receipt process without regard to the output-delivery process. As a result, the customers may be dissatisfied with an output which was caused by an inadequate input.

For example, part of the airline process is checking and receiving luggage. That process may be designed to be efficient. Another customer process is picking up luggage at the destination. If the two processes are designed independently, customers may be upset if their fragile luggage was damaged, even though it was inadequately packed. By designing the luggage process from start to finish, the luggage checking process will assure sufficient quality inputs to allow a successful luggage claim output.

The flowcharting method called “service blueprinting” is a good way to diagram service-process design. This method considers these bidirectional

interactions with customers (see Kingman-Brundage, 1989; Shostack, 1984; Shostack, 1987). A well-drawn service blueprint will clearly show the impact of customer inputs on customer-received outputs. For this reason, service blueprints tend to not be linear, but two-dimensional: one dimension can show the passage of time and the other can show the visits and re-visits to customer interaction (Sampson, 1999, pp. 418-23).

Summary

In this article we have considered the defining issue of customer-supplier duality in service organizations. This duality implies a particular type of supply chain which is bidirectional in nature. These bidirectional supply chains are similar to traditional supply chains in some respects, but quite different in others. Interesting characteristics of bidirectional supply chains are that they are typically short, have implied JIT, and have inherent communication of value-added expectations. Further, the costing of inputs is peculiar, since service providers do not typically pay for customer-supplied inputs.

There are various managerial implications of customer-supplier duality. Supply-base reduction is not a reasonable option when the suppliers are customers. Bidirectional supply chains can be integrated by various methods such as communication, partnering, and customer-supplier development. Communication is particularly important to prevent compounding the effects of possible quality problems. Partnering and supplier development are often difficult given the magnitude of customer-suppliers to deal with and the inability to tie them to the organization. Some service providers are able to partner with diverse customer-suppliers in ways that are relatively efficient and effective, such as through the Internet. Exploring methods for mass-partnering is an interesting topic for future research.

References

- Berry, L.L. (1980), "Services marketing is different", *Business*, pp. 24-9.
- Chase, R.B. (1978), "Where does the customer fit in a service operation?", *Harvard Business Review*, Vol. 56 No. 6, pp. 137-42.
- Chase, R.B., Aquilano, N.J. and Jacobs, H. (1998), *Production and Operations Management: Manufacturing and Services*, Eighth Edition, Irwin/McGraw-Hill, New York, NY.
- Fitzsimmons, J.A. and Fitzsimmons, M.J. (1998), *Service Management: Operations, Strategy, and Information Technology*, 2nd ed., Irwin/McGraw-Hill, New York, NY.
- Heizer, J. and Render, B. (1999), *Operations Management*, 5th ed., Prentice-Hall, Upper Saddle River, NJ.
- Henkoff, R. (1994), "Service is everybody's business", *Fortune*, Vol. 129 No. 13, p. 48.
- Hornback, R. (1994), "An EDI costs-benefits framework", *EDI Forum: The Journal of Electronic Commerce*, Vol. 7 No. 4, pp. 41-6.
- Jayaraman, V., Srivastava, R. and Benton, W.C. (1999), "Supplier selection and order quantity allocation: a comprehensive model", *Journal of Supply Chain Management*.
- Kelly, R.F. (1997), "A new perspective of trade policy for services: interdependence and relationships (speech given 13 September, 1996)", *Vital Speeches of the Day*, Vol. 63 No. 6, pp. 175-8.

- Kingman-Brundage, J. (1989), "The ABSs of service system blueprinting", in Bitner, M.J. and Crosby, L.A. (Eds), *Designing a Winning Service Strategy*, American Marketing Association, Chicago, IL.
- Krause, D.R., Handfield, R.B. and Scannell, T.V. (1998), "An empirical investigation of supplier development: reactive and strategic processes", *Journal of Operations Management*, Vol. 17 No. 1, pp. 39-58.
- Levitt, T. (1972), "Production-line approach to services", *Harvard Business Review*, Vol. 43.
- Lovelock, C. H. (1983), "Classifying services to gain strategic marketing insights", *Journal of Marketing*, Vol. 47, pp. 9-20.
- Lovelock, C.H. (1996), *Services Marketing*, 3rd ed., Prentice-Hall, Upper Saddle River, NJ.
- Morris, W. (1981), *American Heritage Dictionary*, Houghton Mifflin Company, Boston, MA.
- Sampson, S.E. (1999), *Understanding Service Businesses*, 2nd ed., Brigham Young University Creative Works, Provo, UT.
- Shostack, G.L. (1984), "Designing services that deliver", *Harvard Business Review*, Vol. 62, pp. 133-9.
- Shostack, G.L. (1987), "Service positioning through structural change", *Journal of Marketing*, Vol. 51 No. 1, pp. 34-43.
- Stevenson, W. J. (1999), *Production Operations Management*, 6th ed., Irwin/McGraw-Hill, New York, NY.
- Strader, T.J., Lin, F.-R. and Shaw, M.J. (1999), "The impact of information sharing on order fulfillment in divergent differentiation supply chains", *Journal of Global Information Management*, Vol. 7 No. 1, pp. 16-25.
- Vokurka, R.J. (1998), "Supplier partnerships: a case study", *Production and Inventory Management Journal*, Vol. 39 No. 1, pp. 30-5.
- Wheeler, C.A. (1998), "Web commerce: a growing force in the broader economy", *EDI Forum: The Journal of Electronic Commerce*, Vol. 11 No. 3, pp. 54-7.