

SERVICES, INDUSTRY EVOLUTION, AND THE COMPETITIVE STRATEGIES OF PRODUCT FIRMS

MICHAEL A. CUSUMANO,¹ STEVEN J. KAHL,² and FERNANDO F. SUAREZ^{3*}

¹ *Sloan School of Management, Massachusetts Institute of Technology, Cambridge, Massachusetts, U.S.A.*

² *Tuck School of Business at Dartmouth College, Hanover, New Hampshire, U.S.A.*

³ *Boston University School of Management, Boston, Massachusetts, U.S.A.*

Services of different types have become increasingly important for product firms. While these firms mainly focus on products, managers and researchers lack a comprehensive framework to understand when to make significant investments in particular kinds of services. We identify three categories of product-related services from a product firm—smoothing and adapting services, which complement products, and substitution services, which enable customers to pay for the use of a product without buying the product itself. We develop propositions about the relative level of these different kinds of services vis-a-vis industry evolution, as well as suggest how these services affect industry structure. We draw upon various literatures, though we conclude that the relationship between products and services is more complex and richer than any one literature suggests. Copyright © 2014 John Wiley & Sons, Ltd.

INTRODUCTION

In the past two decades, researchers in strategy, operations management, marketing, and other fields have noted the increasing importance of services in the strategies and business models of manufacturing firms and other product companies. Most of these firms are involved in business-to-business sales, though there are also some new types of services offered to individual consumers as well. The reasons why manufacturing companies or many product firms in general might invest more in services are varied, but the picture that emerges is fairly consistent and can be summarized as follows.

First, services can be complements to products in the sense that offering services sometimes helps product manufacturers generate sales. For example,

producers of complex industrial equipment such as General Electric, John Deere, and Caterpillar, or IBM in enterprise computing, rely heavily on the existence of service departments (owned either by themselves or by their dealers, or sometimes by independent third parties) to give customers the confidence to make the purchase (Oliva and Kallenber, 2003; Sawhney, Balasubramanian, and Krishnan, 2004; Wise and Baumgartner, 1999). Second, some products require sales of services that are important for customers to use the product, and product manufacturers may choose to capture some of these sales themselves. The sale of a car or a tractor, for instance, leads to services such as loans, leases, extended warranties, maintenance, and repair. Third, some companies combine one or more products with services tailored to the needs of a particular customer or group of similar customers, creating customer-specific or industry-specific “solutions” that are more competitive than generally available standalone products (Davies, Brady, and Hobday, 2006, 2007; Galbraith, 2002; Tukker and Tischner, 2006).

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*Correspondence to: Fernando F. Suarez, Boston University School of Management, 595 Commonwealth Ave., Boston, MA 02215, U.S.A. E-mail: fsuarez@bu.edu

Fourth, services can help build deeper relationships with customers such as through consulting, maintenance, and repair, and help firms continue to sell new versions of their products to existing customers over longer periods of time (Davies *et al.*, 2006; Sawhney, 2006). And fifth, product firms may shift some of their attention to services if the services provide a more stable source of revenue and profits than more volatile product sales (Quinn, 1992). Various authors have also noted that product-related service revenues can amount to five or more times the retail price of the product over the lifetime of its use (Gadiesh and Gilbert, 1998; Wise and Baumgartner, 1999).

Several scholars have argued that services become important sources of revenue for product firms especially when industries mature and the firms can no longer easily differentiate their products. Teece (1986: 251), for example, argues that services "do not loom large" for product or manufacturing firms until after a standard design emerges and industry dynamics shift toward cost-based competition. Some large-scale surveys have confirmed this intuition that services become more important to product firms as their businesses mature (Fang, Palmatier, and Steenkamp, 2008; Neely, 2009; Suarez, Cusumano, and Kahl, 2012). Company-level accounts illustrate how this can happen. Information technology firms such as IBM, SAP, Oracle, Cisco, Hewlett-Packard, Sun Microsystems, Dell, and EMC have all seen large relative increases in maintenance and other product-related services as a percentage of their total revenues as sales of their product lines have declined or as product prices have fallen (Cusumano, 2004, 2008). In automobiles, large manufacturers for many years have generated much of their revenue and profit from services, including loans and leasing as well as maintenance, repairs, and extended warranties (Cusumano, 2010a; Gadiesh and Gilbert, 1998).

In short, there is considerable evidence that product firms invest in services in order to diversify their revenue and profit streams when entering the mature phase of industry evolution, characterized by prices falling due to intensive competition among a decreasing number of firms or a shrinking market. Other cases, however, suggest that product firms might offer services under different competitive circumstances and not only as a response to industry maturity or product commoditization.

IBM and the mainframe computer illustrate this latter point. The first computers for business use introduced during the 1950s and 1960s were expensive machines based on a new, largely unknown technology, which made buyers reluctant to purchase the products (Attewell, 1992; Fisher, McKie, and Mancke, 1983). Various services, such as leasing arrangements that bundled maintenance and pay for usage contracts, were essential to entice customers to adopt the new products. In a sense, these services *preceded* and *substituted* for product sales. Xerox followed a similar services-based strategy when it introduced the plain-paper copier in the 1960s (Jacobson and Hillkirk, 1986). In contrast to automobile leasing, where customers do not pay for actual usage and remain responsible for maintenance, repair, and insurance, leases of mainframe computers and office machinery involved broader service agreements. Responsibility for maintenance, repair, and insurance stayed with the manufacturer, while users paid primarily for usage. These different examples reflect the wide range of opportunities for firms to shift more of their attention to services or service-like delivery and pricing of their products. The kinds of services from product firms described in the literature also range from financial to technical, including product customization and bundling of multiple products and services into customer-specific "solutions." Nonetheless, there is still no comprehensive framework that explains what types of services product firms tend to offer and when they should offer them. More specifically, managers and researchers need to understand better how particular services relate to the products themselves as well as what impact services might have on the performance of the product firm as well as industry competition and structure. Under what conditions can services ease adoption of a product or extend the functionality or even substitute for its purchase? Are services primarily complements to a product or something more? What is the relationship between services and evolutionary patterns we see in many manufacturing industries?

In this paper, we address these and related questions by proposing a framework to improve our understanding of services in the competitive strategies of product firms. The next sections explore what types of services product firms might offer and when should they offer them relative to industry evolution. We also explore how investment in services might affect firm performance and survival

as well as industry structure. We argue that some types of services should be more prominent or at least more useful strategically to the product firm under different stages of the industry lifecycle or under particular industry conditions.

TYPES OF SERVICES FROM PRODUCT FIRMS

Before we discuss specific types of services that product firms might offer, it is useful to clarify the definition of services in general. The service industry literature has defined a service as any economic commodity that is not a tangible, manufactured good (Bell, 1973). This literature has often used examples from "pure" service industries such as retail and banking. More detailed definitions of services, such as from operations management and marketing, point to more specific characteristics to distinguish services from products: services tend to be intangible; simultaneously produced and consumed; perishable; and heterogeneous (rather than standardized) in that each customer receives or experiences a service differently (Bitran and Logo, 1993; Cook, Goh, and Chung, 1999; Cooper and Edgett, 1999; Mansharamani, 2007; Miles and Boden, 2000; Quinn and Gagnon, 1986; Sampson and Froehle, 2006; Schmenner, 1986; Verma and Boyer, 2000; Vermeulen and Van Der Aa, 2003).

The definitions and insights coming from service industry research, however, do not help us fully understand the special nature of services offered by product firms or the more nuanced relationship between some services and some products. For example, digital goods seem to fall into a gray area between a tangible product and an intangible service. Digital media services or delivery of software product functionality over the Internet through Cloud Computing may seem intangible to the user but this offering also has some characteristics that resemble physical products. Cloud services are sometimes simultaneously produced and consumed, though the producer is likely to store digital products on computer servers and sometimes the consumer can do so as well. Like physical products, there may be a high degree of homogeneity or standardization across users of digital products as well as automation of the purchasing and delivery processes. In other examples, services such as product repair or design of customer-specific solutions consisting of tailored software products,

while intangible or heterogeneous (personalized) at some level, are inextricably coupled or linked to the products themselves. They may also require a very deep understanding of the product technology and how customers use the product (Anderson, 2012).

A common way to characterize services, especially in the strategic management and economics literatures, is as relatively simple product complements, where services facilitate product sales and usage (Oliva and Kallenberg, 2003; Quinn, 1992; Teece, 1986). Related literature on industry platforms and multi-sided markets similarly focuses on how products and services can reinforce each other and make each more valuable. From this perspective, we can view iTunes as a complementary music distribution service that makes the iPod, iPhone and other digital media players, smart-phones, and computers more valuable by providing easier access to digital products such as songs and videos. We can also view the hardware products as complements that make the iTunes digital media service more valuable (Eisenmann, Parker, and Van Alstyne, 2006; Gawer and Cusumano, 2002). Similarly, we can argue that professional services such as from Accenture, Infosys, and other information technology firms make complex software products such as SAP and Oracle applications more valuable, and vice-versa (Lah, 2005).

Viewing some kinds of services as an exchange process between the service provider and the customer offers additional insights into the complementarity between products and services beyond economic returns. Consultants interact directly with clients; the copier repair person visits the customer to fix the machines; trainers exchange detailed information with the customer as well as provide knowledge the company has accumulated. Because some services are grounded within actual consumer-producer interactions, they reveal information about consumption and usage: for example, what requirements or product features customers are looking for, how they plan to deploy the product, or optimal ways to use the product and potential obstacles. Firms can leverage this "use-based" knowledge in technology development because it helps establish the performance metrics that customers rely on to evaluate the value of the products (Christensen and Rosenbloom, 1995; Habermeier, 1990). In fact, Rosenberg (1983) not only recognized this potential relationship, but advocated increased attention to services as well as further

integration between service activities and product development.

A taxonomy of services from the product firm should address these different kinds of services as well as the variety of relationships services have with products. In contrast to prior literature, however, this paper does not try to characterize all types of services from all types of firms on any particular dimensions (intangibility, labor or capital intensity, customer interaction levels, etc.). Most of the services we refer to predate the digital age and fall more into the categories of financial services (loans, leasing, warranties) or professional services (consulting, customization, training, repair, and maintenance). More specifically, we focus on what types of *product-related* services do the *product makers* themselves generally offer.

Our analysis of the literature and different examples suggests that product-related services from product firms can be one of two types: They are either a *complement* or *substitute* for purchasing the product. Moreover, at some level, all complementary services facilitate product sales in that they make customers feel more comfortable when making the product purchase. However, the literature and various examples suggest that complementary services fall into two types: Some services *smooth* the product sale or usage without altering the product functionality significantly, for example, by making it easier for the customer to finance the purchase or get technical support. Other services *adapt* the product functionality, for example, by adding features to accommodate novel customer uses or modifying the product based on the environment or usage contexts.

Table 1 summarizes the different kinds of services offered by the product firm as well as the relationship of these services with products. In what follows, we provide a more detailed discussion of each type of service as well as when the product firm might offer these services, whether the goal is to facilitate the sales process, enhance product differentiation, or create an additional source of revenue and profit.

Product “smoothing” services

Our first type of complementary service from the product firm, *smoothing*, does not alter the product functionality significantly and involves a fairly unambiguous exchange between the product firm and its customers regarding financing or insurance

options, implementation issues, or basic training on how to use a product (see Table 1). Smoothing services tend to be loosely coupled with the products themselves in the sense that the service can be standardized and offered by the product maker or an independent service provider (Anderson, 2012; Sanchez and Mahoney, 1996; Simon, 1962). For example, in the automobile industry, some product manufacturers offer the same financing options that are available from independent banks or other financial services companies. In the information technology industry, some product manufacturers may offer the same consulting, customization, training, and support services that third-party services firms provide.

Various researchers have noted that firms in many different industries, from defense contracting to telecommunications, transportation systems, medical devices, and computer software and hardware, offer some or all of these smoothing services with their standalone products or as part of a solutions bundle (Davies *et al.*, 2006, 2007; Galbraith, 2002; Sawhney, 2006). Some or all of these smoothing services are also frequently available in consumer businesses. For example, an individual may purchase a computer from Hewlett-Packard or Dell, a software product from Microsoft, or a cell phone from Apple, and receive technical support via the telephone or Internet as well as automated maintenance upgrades via the Internet. Likewise, a customer may purchase a dishwasher from Whirlpool but then purchase a separate maintenance or extended warranty contract from the manufacturer or a local dealer.

Product “adapting” services

Our second type of complementary service, *adapting*, significantly expands the product functionality or helps the customer develop new uses for the product or adapt it to novel conditions (see Table 1). Adapting services tend to be more tightly coupled with the products compared to smoothing services in the sense that the knowledge required to provide the service is difficult to separate from detailed knowledge of the product itself (Anderson, 2012; Brusoni, Prencipe, and Pavitt, 2001). For example, in the electric power industry, some users may require generators or nuclear reactor equipment to be modified for use in extreme weather conditions. The manufacturer, such as General Electric, might provide these modifications to the standard

Table 1. Taxonomy of services offered by the product firm

Complementary with products	Adapting	Replacement Substituting
<p>Smoothing</p> <p>Services that “smooth” the product sale or usage without significantly altering the product functionality. These involve a fairly unambiguous exchange between the product firm and its customers.</p> <p>Examples</p> <ul style="list-style-type: none"> • Financing • Warranty/insurance • Maintenance/repair • Technical support • Training in basic uses 	<p>Services that significantly expand the functionality of a product or help the customer develop significant new uses or adapt the product to novel conditions. These tend to be tightly coupled with products and require more knowledge exchange between the product firm and its customers.</p> <p>Examples</p> <ul style="list-style-type: none"> • Major customizations that create new features initially specific to a user, usually offered after the product sale. • Training or consulting that introduces new uses for the customer. • Integration of the core product with other products or “solutions” (bundles of tailored products and services). 	<p>Services that replace the purchase of a product, challenging the view that services are always complements to products.</p> <p>Examples</p> <ul style="list-style-type: none"> • Data processing services sold in lieu of mainframes. • Software as a Service (SaaS) sold in lieu of software products. • Zapmail service (FedEx) offered instead of fax machines. • Rolls Royce “Power by the Hour” instead of engine purchases by airlines or aircraft owners, where the customer pays by degree of usage and maintenance costs.

products. These kinds of adapting services, by our definition, tailor products to specific customers and, unlike smoothing services, cannot simply be standardized and reproduced from one customer to the next because the requirements of each customer are at least slightly different.

Substituting services

In contrast to complementary services, *substituting* services replace the purchase of a product. They directly challenge the assumption that services in product industries are primarily complements to products. This has happened in several industries, for short or long periods of time, including telephones, computers, copiers, fax machines, industrial and agricultural equipment, and automobiles. In these examples, leasing or rental arrangements leave the responsibility for repair or maintenance of the product with the manufacturer or leasing company, with the customer paying primarily for usage of the product (e.g., charges for monthly telephone equipment rental, computing time used, miles driven or time used, or number of paper copies made). We recognize that service providers may sometimes bundle some customer-specific adjustments to these substitution services that resemble adapting or smoothing complementary services,

such as in the ferment phase of the lifecycle. However, the primary idea we want to emphasize here is that customers are purchasing not a *product with services* (adaptive or smoothing), but rather they are purchasing a *service instead of the product*.

For example, Rolls Royce, one of the largest manufacturers of aircraft engines, has recently expanded its “Power by the Hour” service through which airlines may purchase the use of aircraft engines instead of buying the product directly. Indeed, engine usage and maintenance contracts (rather than sales of the engines themselves) have become an important revenue source for Rolls Royce (Davies *et al.*, 2006, 2007; Knowledge@Wharton, 2007; Neely, 2009).

Business software is another example. Software products have traditionally been installed directly at a customer’s site, along with computer hardware. In the late 1990s, some software product companies began offering application hosting as a service. This has led more recently to different pricing and usage models that make traditional software purchases or licensing unnecessary. Salesforce.com, established in 1999, provided a substitution service when it pioneered Software as a Service as a way to offer a relatively streamlined version of a normally expensive customer-relationship management (CRM) product. It priced this as an inexpensive and convenient

monthly service, bundling the product functionality with technical support and maintenance including in a single monthly fee (Anding, 2010; Bandulet *et al.*, 2010; Benioff, 2009; Cusumano, 2010b; Dubey and Wagle, 2007). In another case, prior to the widespread commercial introduction of the fax machine, FedEx offered a service called Zap-mail during 1984–1986 that enabled customers to send faxes. FedEx would collect documents and fax them from one depot to another office near the recipient and then deliver the printed fax document (Coopersmith, 1994).

SERVICES AND THE INDUSTRY LIFECYCLE

We noted earlier that most researchers in strategic management, marketing, operations, and related areas who have written about services from product firms have associated the beneficial effects mainly with countermeasures to commoditization in the mature phase of an industry (Davies *et al.*, 2006; Fang *et al.*, 2008; Galbraith, 2002; Oliva and Kallenberg, 2003; Quinn, 1992; Sawhney *et al.*, 2004; Teece, 1986; Tukker and Tischner, 2006; Wise and Baumgartner, 1999). The perspectives from these authors are similar in that they focus on the complementary nature of services with products and particularly on how services, when sold alongside products, can ease the sale and become a differentiating factor as well as a potential additional source of revenue and profit. Consequently, they explain investment in services by product firms in relation to what is happening with their products in the marketplace.

As noted in the previous section, we argue that product firms offer several different types of services, some of which complement products and others which substitute for products. We also raise a larger, related issue: *When* should product firms offer particular services or at least place more emphasis on one type versus another? A way to think about this question is to consider how different service types might help the product firm in different competitive conditions as represented by the different phases of the industry lifecycle. Industry lifecycle models are described in the technology management and industry evolution literatures (Abernathy and Utterback, 1978; Anderson and Tushman, 1990; Gort and Klepper, 1982; Klepper, 1996, 1997; Utterback, 1994; Utterback and

Abernathy, 1975). This literature collectively identifies different phases of an industry characterized by variation in technological design alternatives, investments in different kinds of innovation, number of firms, and the basis of competition. It is our contention that the differences in these industry phases encourage the development of certain kinds of services over others. Therefore, it is important to characterize these shifts and identify key factors that help explain changes in services.

Although they disagree somewhat on the evolutionary mechanisms,¹ the main scholars writing about industry lifecycles, namely Abernathy and Utterback (1978), Anderson and Tushman (1990), and Klepper (1997), generally agree that earlier stages are characterized by high levels of producer uncertainty and cost. As the market evolves, uncertainty and cost decrease. Producer uncertainty refers to the potential alternative underlying technologies, designs, and production techniques for their products that compete for acceptance in an evolving market, and cost refers to how much firms need to pay to secure the level of resources and capabilities required to build their products. The two are related and tend to move together. Uncertainty increases costs as firms need to explore more alternatives and because it can be difficult and expensive to secure inputs for small-scale production under uncertainty. Cost can constrain which alternatives firms actually explore, which in turn increases uncertainty.

In this paper, for clarity's sake, we adopt Ferment, Transition, and Mature to capture these three main lifecycle phases described in the literature. Prior research is still mostly product-focused, however, and does not explicitly consider other related skills, such as services. Since services coordinate activities between the producer and customer, we extend the producer-focused lifecycle explanations to include the levels of uncertainty and costs for the customer. For customers, the uncertainties focus on how to use the product, its performance, and the cost of implementing and using it. As with the product technology, customer uncertainty and cost are high early in an industry because customers are unsure how to use the product, information can be

¹ For instance, Klepper (1997, p. 151) focuses on the increasing returns from investment into process research and development for larger firms; by contrast, Abernathy and Clark (1978) and Anderson and Tushman (1990) focus more on the stabilization of the technology in the form of a dominant design as the primary driver.

confusing and hard to obtain, and the products themselves are unreliable. As the industry matures, the products become more reliable and better understood, and more standard uses develop, lowering customer uncertainty and cost.

We draw upon this basic insight to explain changes in services over the lifecycle. More specifically, we are interested in explaining the relative levels of the three kinds of services in each industry phase as a function of the changes in product/customer uncertainty and cost. In what follows, we develop propositions for each lifecycle phase.

Services in the ferment phase

The “ferment” phase in the industry lifecycle is characterized by a high level of uncertainty (Agarwal, Sarkar, and Echambadi, 2002; Anderson and Tushman, 1990; Utterback and Abernathy, 1975). When a technology is new, it is unclear to customers and producers how products will perform, what problems will surface, and what functional and technical characteristics will be important. In this period, product firms often experiment with different technical designs and business models (Utterback, 1994). They search for the best possible solution in a market where both technology and customer needs are in flux. A given product’s core technology may evolve along a number of possible trajectories and design hierarchies (Clark, 1985; Dosi, 1982). Product firms cannot easily predict these directions in advance and they may even vary by institutional setting (Murmann and Homburg, 2001). Output volumes are low, and firm entry is high during this period, with entrants focusing on product innovation.

From a market perspective, customers may be unsure what the technology is, what functional and technical characteristics matter most, and whether they really need to buy the product (Utterback, 1994; Utterback and Abernathy, 1975). Customers may also be uncertain about the internal changes required to implement the new technology and how best to use the products to achieve their goals (Leonard-Barton, 1988). For example, when faced with computers for the first time, many customers did not know what they should use them for, how they should use them, or even how to install them (Fisher, McKie, and Mancke, 1983; Yates, 1993, 2005). This uncertainty increases the risk and cost for the customer to implement the new product.

The uncertain and fast-changing conditions of the early lifecycle phase influence what types of services product firms invest in and develop. From our discussion above, smoothing services require simple, unambiguous exchanges between the product firm and customers regarding the product technology and its uses. However, the high level of uncertainty with regard to the technology and the market during the phase of ferment implies that both product firms and customers have not accumulated significant knowledge yet about products, their performance characteristics, or usage patterns. During these early periods of the industry lifecycle, technologies and product designs often change frequently, and design novelty attracts technically inclined customers who may have a specific need that differs from mainstream customers (Rogers, 2003). After purchase, customers may be uncertain about the internal changes required to implement the technology and how best to use a technology to achieve desired goals (Leonard-Barton, 1988). This variation makes it difficult to find connections, commonalities, and patterns across the initial implementations that support smoothing services.

In contrast, the uncertainty about product performance and customer use favors the customization characteristics of adapting services. Given the general lack of understanding and the still-evolving product design, early adopters require significant product modifications to fit their particular needs. The customer may ask for knowledge-intensive customization and integration work that actually creates new functionality or new uses of existing functions, such as within a large and complex industrial system (Murmann and Frenken, 2006). Creating major new functions for specific customers usually requires a deep understanding of the product technology that characterizes adapting services. More generally, adapting types of services enable experimentation and broaden the functionality of the product so that customers can get modifications to the new technology for their particular needs as these become more apparent.

We also recognize that there can be situations when customer and producer uncertainty may be so high during the early phase of an industry that services emerge as substitutes for products because many buyers are reluctant or unable to commit to the purchase. Using novel, unproven products requires expensive and time-consuming use-specific solutions and knowledge, and integration with other products and systems that may

be difficult to achieve (Simon, 1962). Product companies also need to acquire specific organizational skills and adopt different processes than used in manufacturing to interact properly with customers under these conditions (Davies and Brady, 2000; Edmondson, Bohmer, and Pisano, 2001). Buyers can perceive the existing uncertainty as a sign that a novel product is likely to fail due to technical reasons or possible misalignments during implementation (Leonard-Barton, 1988). In the absence of a proven record for the novel product, it can be hard for buyers to justify the purchase and adopt the new technology (Rogers, 2003). Carpenter and Nakamoto (1989) have also shown that, in the presence of technological uncertainty, buyers tend not to commit to product-specific learning but instead adopt a “wait-and-see” attitude.

The firm wants to sell its novel product, but the customer wants some guarantees that the investment will pay off and will not become obsolete with technological changes or exit of the firm from the industry. For technologies surrounded by such high uncertainty, this can become a “Catch 22” or “chicken-and-egg” problem. In less uncertain environments, there are ways for product firms to break the deadlock and encourage customers to buy—such as by offering services that help the customer understand, use, or finance the product. In conditions of high uncertainty, particularly when the customer’s “wait and see” attitude due to high uncertainty is compounded by a high product cost, a different type of approach is required. This should take into account the understandable reluctance of the customer to buy the product. Offering a service as a substitute for the product purchase can be a pragmatic response to this deadlock situation. That is, the product firm can retain the larger risk of owning the product but offer the product functionality as a service, where the customer pays for usage in short intervals without a long-term commitment. Based on these arguments surrounding the environmental conditions of product and market uncertainty, we propose the following:

Proposition 1A: During the ferment phase of an industry, firms are more likely to offer adapting services rather than other types of services.

Proposition 1B: During the ferment phase of an industry, under extreme cases of uncertainty and high cost, some product firms will offer substitution services.

The evolution of basic Enterprise Resource Planning (ERP) software products during the mid-1990s and the early commercialization of the computer provide good illustrations of how high levels of uncertainty and cost can prompt product firms to develop adapting services. Core ERP products enable users to integrate business processes such as manufacturing and accounting, and are sold by software product firms such as SAP and Oracle. But when ERP systems first appeared in the early 1990s, there was significant uncertainty among customers. Organizations were beginning to move some operations off mainframe computers and onto powerful work stations and then personal computers (Plattner, 2000; Pollock and Williams, 2009; Symonds, 2003). Most large customers had a different mix of old and new software (some of which they had developed themselves in-house) as well as industry-specific requirements. For example, a manufacturing firm required order entry, inventory management, and production control functionality that a bank or an educational institution did not, and each user within these categories had a different configuration of legacy systems. The early ERP products only provided common functions for managing finances and human resources, and handling some industry-specific tasks (mostly in manufacturing), but did not provide other industry-specific, let alone customer-specific, solutions.

To solve this problem, many of the early ERP vendors developed their own service departments to adapt the core products to meet specific customer needs so that they could persuade customers to make the purchase. In Oracle’s case, during the 1990s, the company often wrote their own software to integrate with industry-specific software providers such as i2 Technologies for supply-chain management products (Symonds, 2003). In SAP’s case, the company customized the products to specific company needs in different industries (Plattner, 2000; Pollock and Williams, 2009). In subsequent years, as SAP and Oracle recognized a set of common needs among users in particular industries, they began to offer industry-specific or “vertical” versions of their basic (“horizontal”) application products. Oracle even hired an ex-consultant to run the applications and consulting business as well as established engineering teams within the consulting division to facilitate this knowledge-transfer process (Symonds, 2003).

Some other industries, such as scientific instruments, industrial machinery, and machine tools,

also sell products that, especially when first introduced, have required extensive modifications to meet the needs of particular customers (von Hippel, 1988). These modifications are adapting services in our terminology. For example, Jaikumar (1986), in his discussion of the machine tool industry, argued that, at least for these companies, "Manufacturing now responds much like a professional service industry, customizing its offerings to the preferences of special market segments" (p. 76). Again, if enough customers require similar modifications, the product companies may eventually offer versions of their products with features for particular types of customers, such as stamping presses or machine tools designed specifically for the automobile industry. In these cases, adapting services may give way to vertical-specific versions of the products.

The mainframe computer, as summarized in Fisher, McKie, and Mancke (1983) as well as Attewell (1992), provides a particularly vivid illustration of how uncertainty and cost can be so high in the early phase of an industry that services substitute for the product purchase. Acquiring a mainframe computer in the 1950s and 1960s, or even in the 1970s, was "not just a matter of purchasing objects (the computer and software) but required considerable skills" (Attewell, 1992: 9)—expertise that most buyers did not have in-house. As late as 1982, 70 percent of U.S. businesses under 20 employees had no in-house computer specialist. The reluctance of buyers to invest in the new, expensive technology meant that, "A two-stage process in which firms initially purchased computer data-processing *services* from other organizations, and later purchased in-house computers was especially important in the early decades of diffusion" (Attewell, 1992: 9, emphasis in the original). Computer manufacturers, led by IBM, opened large services units that "greatly facilitated the marketing of their equipment to users by reducing the users' risks in installing that new, unfamiliar, and expensive object, the computer" (Fisher, McKie, and Mancke, 1983: 172). The importance of services in the early computer industry led Attewell to observe that "the theoretical importance of the service bureau as an agent of technological diffusion has not been recognized by scholars" (Attewell, 1992: 10). In later years, it became much more common for users to purchase their own computers.

Services in the transition phase

Industries often experience transitional periods from ferment to maturity. Several mechanisms have been identified to characterize this shift: the emergence of a dominant product design (Abernathy and Utterback, 1978), growing market demand around these stabilized products (Anderson and Tushman, 1990), and increased return from investment in process research and development (Klepper, 1997). Increasingly standardized products with progressively better-understood usages accompanied by shifts toward a focus on process innovation move the focus of competition away from technological differentiation and elaborated product extensions towards product reliability and cost. Less firm entry also limits product variation, and the scale of some of the remaining firms begins to expand considerably (Klepper, 1997). Consequently, the transition period is characterized by decreasing uncertainty and product cost.

This shift towards decreasing uncertainty and cost favors investment in smoothing services over adapting services. As the market gradually shifts away from variation in product design and use, there is less of a need to provide services that adapt or develop specialized uses of the product. In contrast, as some producers make significant gains in scale, smoothing services can help with customer acquisition and retention as demand grows. Smoothing services are less resource-intensive than adapting services, which complements the shift toward greater scale and increased cost-based competition and investment in process innovation. Moreover, as product uncertainty and cost drop, and greater knowledge of product usages and performance becomes available, customers should start purchasing products instead of services. Consequently, to the extent that adapting services occurred early in the lifecycle, we would expect them to decline during this period. Based on decreasing uncertainty and product cost, we propose the following:

Proposition 2A: During the transition phase of an industry, most product firms that offer services will shift from adapting services toward smoothing services.

Proposition 2B: During the transition phase of an industry, the number of firms offering substitution services will decline.

Information technology products such as enterprise software and storage systems provide another

good example of this transition. As the technology and usage patterns became more standardized during the 1980s, 1990s, and 2000s, companies such as IBM, SAP, Oracle, and EMC relied less on consulting, customization, integration, and other complex “professional” services, which would be adapting services in our terminology, in favor of maintenance services (minor product updates, quality patches, and basic technical support, paid for in annual increments), which would be smoothing services in our terminology (Anderson, 2012; Cusumano, 2004, 2008, 2010a; Lah, 2005).

Services in the mature phase

In contrast to the ferment phase, the mature phase experiences low levels of product and market uncertainty and increased cost-based competition. There is less product differentiation as the number of competitors has been substantially reduced (Klepper, 1997). The remaining ones set similar technological agendas, or may follow a dominant design or focus on process innovations to improve efficiency (Utterback and Abernathy, 1975). From a customer perspective, a “dominant use” may also emerge, which means that customers are using the technology to perform similar functions (Kahl, 2007). Moreover, new customers during this period tend not to introduce novel uses or major changes to the product because they tend to be less savvy and conform to existing practices (Rogers, 2003).

We believe that the low level of uncertainty and strong cost-based competition that prevails in the mature phase of the lifecycle creates especially appropriate conditions for smoothing services. During the mature phase, the lack of variation and uncertainty makes it easier to find connections, commonalities, and patterns across implementations that support the unambiguous exchanges between the product firm and customers of smoothing types of services. Even though mature technologies may be more reliable, customers may keep mature products in operation for long periods of time, which tends to increase the demand for smoothing services such as maintenance and repair. New customers that purchase products in the mature phase may also not be technology savvy and may not be able to maintain or repair products on their own (Rogers, 2003). The product firm may try to earn more profit by offering financing alternatives or extended warranties. This has occurred in industries ranging from automobiles to computers

and consumer electronics. The low uncertainty conditions allow for the clearer separation of roles and domains of expertise. As a result, the product firm or its dealer network or third parties can provide these smoothing services.

Moreover, the cost dynamics of the mature phase should make adapting services less attractive. In this stage of the lifecycle, most customers are price sensitive and do not necessarily appreciate the feature enhancements that extended services could create—particularly if the original product is good enough (Rogers, 2003). In addition, maintenance services (smoothing) typically provide incremental upgrades to existing customers, which helps with retention. Building the organizational capabilities to offer adapting services usually requires substantial financial and resource commitments, which may be increasingly difficult for firms experiencing price competition.

While smoothing services become predominant in the mature phase and adapting services continue to decline, substitution services may re-emerge. This would occur as a result of the competitive dynamics at this stage. As product firms reduce their prices and focus on expanding their production scale, demand often reaches levels close to saturation. As production expands to cover most of the addressable market, product firms have incentives to further expand the market by offering their standard products as a service to reach new customer segments. These adjacent segments are often customers that have some need for the product, but whose scale and purchasing power is not high enough to justify the product purchase. The fact that a dominant use (Kahl, 2007) is well established in the mature phase also makes it easier for product firms to create substitution services. In the mature phase, customers are well aware of the characteristics, performance, and usage of the product, and this facilitates offering substitution services to customers with relatively low demand for the product. Firms are less likely to invest in adapting services because they incur higher costs and it is unclear that potential customers are willing to pay for more customized features. Based on the above discussion, we propose the following:

Proposition 3A: During the mature phase of an industry, most product firms that offer services will offer smoothing rather than other types of services.

Proposition 3B: During the mature phase of an industry, some product firms will offer substitution services to expand the demand for their products into customer segments that otherwise might not buy their products.

General Electric's locomotive business illustrates the emphasis on smoothing services over other kinds of services during the mature phase. In the 1990s, the market for locomotives was well-established and cost-competitive given the entry of competitors from developing countries. GE used services to make the purchase, ownership and operation of its locomotive products easier for their customers. Through GE Capital, its financial arm, the company financed not only the locomotives, but also other rail assets such as intermodal containers and maintenance vehicles. GE also set up and ran locomotive maintenance facilities, offered boxcar scheduling and routing services, and provided tracking services to help its customers improve track utilization (Wise and Baumgartner, 1999). In other mature industries, such as home appliances, we have seen product firms such as Whirlpool invest significantly in smoothing services like maintenance and repair to increase customer preference and loyalty.

Hilti, the power tools producer, is another example of a product company that increased its

substitution services in the mature phase. For years, Hilti produced professional-grade tools to sell to the most demanding, heavy-use customers. In order to grow an increasingly saturated market, Hilti (as well as some competitors) started to offer tool rental services aimed at home users and small contractors. For these users, owning some of the tools was not cost-effective due to their small scale and relatively less intensive usage. By substituting services for products, tool manufacturers like Hilti were able to increase revenues and reach new customers (www.aprentals.net/hilti-dealer.asp, accessed May 8, 2013). A similar example is provided by John Deere's rental services, through which the manufacturing company rents farm equipment to small producers for whom purchasing the products is not always financially feasible (www.deere.com/en_US/rentalsales/products_equipment/, accessed May 8, 2013).

Summary

Figure 1 summarizes our overall argument for the prevalence of different kinds of services during the industry lifecycle. As an industry matures, the level of product and market uncertainty and product cost decrease. These shifts have implications for the relative investment in services as shown by the shaded regions of the different kinds of services. In

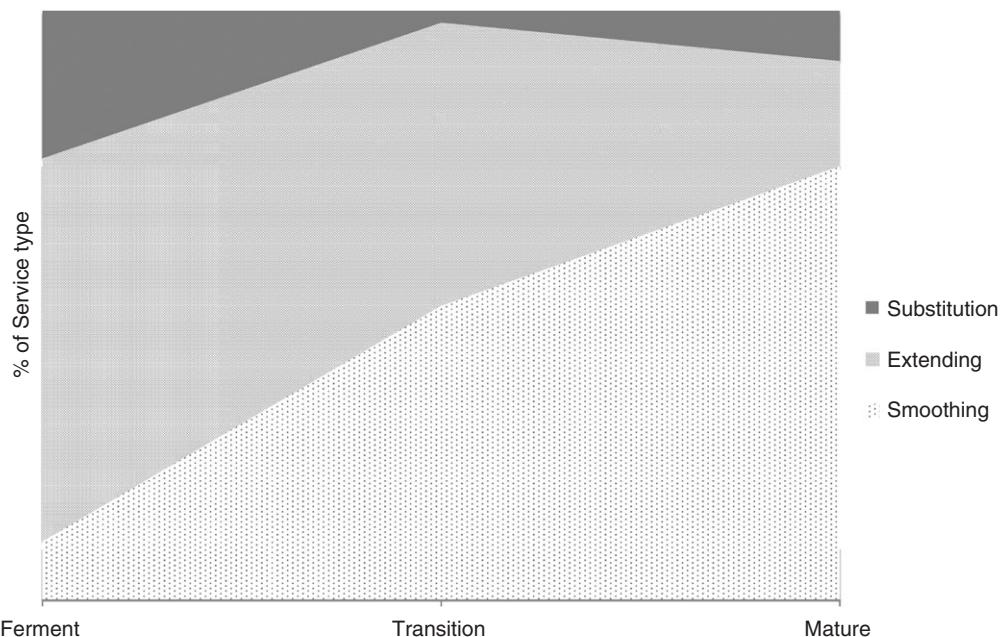


Figure 1. The relative levels of services over the industry lifecycle

the ferment phase, we expect product firms to offer more adapting services, except when, in extreme cases of uncertainty, substitution services prevail. Although these latter cases may be uncommon, when they occur, services can comprise the majority of the sales of that industry, and the services will still require a high degree of provider-customer interaction given the fluid state of the industry. As costs and uncertainty decrease throughout the transition to maturity, adapting and substitution services decrease as smoothing services increase. Indeed, we propose that it is during the transition phase that the revenues from smoothing services surpass those of adapting services. Finally, in the mature phase, we expect smoothing services to be more prevalent than other services, but substitution services can re-emerge when firms seek to expand the market to attract customers without the scale to justify purchase of the product. Occasionally, the industry lifecycle can be disrupted to establish new cycles (Anderson and Tushman, 1990). Similar to Anderson and Tushman (1990), we view such disruptions as re-establishing a new ferment phase in that it increases uncertainty, product variation, and investment in product innovation.

IMPACT ON INDUSTRY STRUCTURE AND DYNAMICS

How effectively product firms combine services with their products, in addition to affecting their competitive positioning or revenue and profit flows, may have an impact on industry structure and competitive dynamics. In other words, the decision to move into services more aggressively may help determine which firms survive as well as how an industry evolves, for example, in terms of sub-markets (Klepper and Thompson, 2006) or strategic groups (McGee and Thomas, 1986; Porter, 1980). In this section, we discuss these and related questions.

Firm entry, exit, and performance

Services can have an impact on the observed patterns and modes of entry and exit of firms as well as their performance. For instance, substituting services such as Software as a Service or equipment leasing with usage and maintenance contracts can be considered a different form of entry into a

products industry and, as noted earlier, can disrupt existing industry structures.

It is possible that the ability of certain product firms and not others to add services successfully to their portfolio may impact the shakeout phenomenon observed in many product industries (Gort and Klepper, 1982; Klepper, 1997, 2002; Klepper and Simons, 2000; Murmann and Frenken, 2006; Suarez and Utterback, 1995; Utterback and Suarez, 1993). In other words, mastering the difficult challenge of developing different organizational capabilities needed to offer services (Nambisan, 2001) may help some product firms delay exit and survive longer. The reason may simply be the additional revenues and profits generated by services; in particular, smoothing services tend to have an important effect on revenues and profits since they are easier to replicate and scale than other types of services. Or increased firm survival rates may come from subtle but important improvements in product technology or "stickier" sales that arise from deeper customer relationships and other benefits when integrating downstream, closer to the customer. This is particularly the case with adapting services that, by definition, require a deeper knowledge of the product and its use by specific customers. Klepper and Simons (2000) found, for example, that tire producers which invested in extensive distribution networks for product marketing enhanced their chances of survival, particularly if they were not technology leaders. It is also possible that services may delay product firms' exit from the industry but not help them survive longer than product firms that are technology leaders.

Another way in which services can influence competitive dynamics and industry structure is when product firms subsidize or give away particular services simply to encourage more product sales and get faster product adoption. This type of "free" service can be especially attractive for industrial products where services are complex and customer-specific (e.g., adapting services) and therefore comprise the majority of the total cost for the customer (Wise and Baumgartner, 1999). The potential role of services as a kind of product subsidy also has potential importance in platform competition in the presence of network effects or, more broadly, competition in multi-sided markets where products and services traditionally have been separate segments. For example, in "multi-sided pricing," the market can be divided into two or more distinct groups, and the product firm can then

subsidize one of these “market sides” in order to attract the other side. So far, the existing literature on platform pricing has focused on subsidizing the product (or a version of it) to obtain the desired effect on adoption. However, a product firm may choose to subsidize or give away particular services as part of its multi-sided pricing strategy. We can see this in how Google gives away both the Android operating system (a software product) and a variety of internet-based services (such as search, maps, and email), but charges another side of the market (advertisers) (Eisenmann, Parker, and Van Alstyne, 2006; Suarez and Cusumano, 2009). In addition to the case of platform market competition, firms may choose to subsidize services in the early phase of an industry in order to overcome customers’ reluctance to buy the products.

The impact of services on the financial performance of product firms may also influence their entry, exit, or survival, at least indirectly. Although there is limited empirical research, existing studies indicate that product firms investing in services first experience a decline in market value and operating profitability. However, such profitability decline seems to be temporary and the overall effect is more like a U-shaped curve. In other words, after services reach a certain percentage of revenues, the impact of services on financial performance of the product firm becomes positive (Fang *et al.*, 2008; Suarez, Cusumano, and Kahl, 2012). Neely (2009) finds that this effect may not hold for the larger manufacturing firms. But product firms that successfully couple services with their product business may also alter the profile of what successful firms or “strategic groups” in an industry should look like (McGee and Thomas, 1986; Porter, 1980). They might pressure new entrants or survivors to become more hybrid in their business models and capabilities, that is, able to offer both products and related services in order to compete effectively. Certainly, in complex product markets characterized by solutions selling (combinations of products and adapting services tailored to the needs of a particular customer), this situation seems to occur (Davies, Brady, and Hobday, 2006, 2007; Galbraith, 2002; Sawhney, 2006; Sawhney, Balasubramanian, and Krishnan, 2004; Wise and Baumgartner, 1999).

Vertical integration and service provisioning

Although our theory does not attempt to explain the “make or outsource” decision by the product

firm, we note that product firms may sometimes compete or cooperate with independent third parties or the customers themselves for provision of product-related services. When product firms provide the services themselves, such as when Oracle and SAP create in-house service divisions or when an automobile company invests in a dealer network to provide sales and services for its product customers, this is a form of vertical integration. When independent specialized firms enter the industry to provide the services, this may signal a de-integration of the industry (if the services had previously come from the product firms) and lead to the formation of a distinct “sub-market” within the industry (Klepper and Thompson, 2006). The independent services firms would then compete with the service departments of product firms, although we can also view them as complementors of the product firms. It is possible as well that a product industry may begin with independent services firms and then the product firms later integrate into services. This seems to have happened in the software business, for example (Cusumano, 2008; Suarez, Cusumano, and Kahl, 2012).

This discussion of firm entry, exit, survival, and performance as well as our framework of different service types raises another important question for future research: Who is best positioned to provide different services to the customer? For instance, Jacobides (2005) argues that coordination simplification and information standardization in the value chain tend to be associated with the “emergence of new intermediate markets that divide a previously integrated production process between two sets of specialized firms in the same industry (p. 465).” Several scholars and practitioners have noted the rise of outsourced services in product industries (e.g., Raa and Wolff, 2004). We know that firms consider some knowledge proprietary and choose not to outsource it, and view other knowledge or activities as more routine and thus easier or safer as well as potentially cheaper to outsource (Carmel and Tija, 2005). In other cases, firms might view their knowledge as “sticky” and difficult to transfer, and so may prefer to work in-house (von Hippel, 1994). However, we still lack a specific rationale for what types of complementary or even substituting services customers and product firms are more likely to externalize and under which conditions.

The outsourcing literature suggests that firms outsource standardized activities, which third-party firms can then provide as services (Carmel and

Tija, 2005). While we have not addressed the service standardization issue directly in this paper, our framework has clear implications. Periods of uncertainty seem to favor customer-specific adapting services; these are often offered by the product firms themselves because, under these conditions, it is difficult to codify and transfer localized knowledge to build standardized service solutions that solve problems for a general audience. In contrast, periods of low uncertainty exhibit lower levels of variation and change, which facilitate codification, knowledge transfer, and causal inferences to support building standardized or even automated solutions, such as offered by outsourcing firms or Internet-based services firms. This intuition suggests that periods of low uncertainty favor smoothing services. Additional research into the levels of standardization of each type of service would help further explain the competitive implications for a product firm to invest in adapting service capabilities and shed additional light on the unbundling or de-integration of industries as well as strategic outsourcing of services by customers or even the product firms.

Outsourcing brings us to a related issue: When customers go outside for third-party services, under what circumstances might the product firms themselves (for example, IBM, SAP, Oracle, Cisco, or EMC) have an advantage in providing consulting, customization, integration, maintenance, and other services compared to specialized services firms (for example, Accenture or Infosys)? This answer may again be related to the degree of standardization possible for the services or at least the availability of product knowledge so that independent firms may build service practices around the products of other companies—a common occurrence in many industries.

CONCLUSIONS

Our main argument in this paper is that services are not simply complements to products and only important when products are mature. They can be much more for the product firm. Services can help ignite a new market during the era of ferment, accelerate industry shakeout or the establishment of a dominant design, improve the financial performance of firms competing in mature industries with declining product businesses, or even create a market disruption. Services may also be effective substitutes for product purchases under the right

conditions. The challenge for managers of product firms, then, is primarily to figure out what services to offer, and when. We have provided a strategic rationale based on the competitive dynamics during different periods of the industry lifecycle that encourage investment in one kind of services over another.

While we have focused on lifecycle theory as the basis for explaining shifts in service offerings from product firms, other theories could potentially explain this shift. A transaction cost explanation, for example, could argue that different kinds of services are optimal based on the asset specificity of the transaction. From this perspective, adapting services would be more asset-specific than smoothing services because they are highly customized exchanges. However, our approach provides insights beyond a transaction-cost explanation. We explicitly model how environmental shifts may alter a product firm's decision as to the level and type of services it will offer.

Another potential explanation comes from the institutional literature (DiMaggio and Powell, 1983)—product firms could adopt service strategies by simply imitating other successful firms, regardless of the levels of uncertainty. While these isomorphic mechanisms may explain the diffusion of these practices, they do not address why the successful firms make the initial investment decisions into services, which our framework addresses. This is not to say that normative pressures are not present; rather, they complement our explanations by providing insights as to how these service practices might diffuse throughout the industry.

Finally, it is worth noting that the pattern of firm entry and exit prescribed by lifecycle theory, despite being quite common, is not a universal feature of industry evolution (Klepper and Thompson, 2006). Indeed, some industries, such as scientific instruments and machine-tools, have not experienced the shakeout characteristic of the onset of the mature lifecycle phase despite having existed for many years. Moreover, as noted, adapting services prevail over smoothing services in these industries because of the complexity of the products and complex use conditions. We note that this observation is still consistent with our theory, but we need additional research to explore the implications of industries that do not fully respond to the traditional lifecycle theory (such as the laser industry described in Klepper and Thompson, 2006).

While our arguments have primarily been conceptual in nature, we have referred to examples from different industries to illustrate the generalizability of our framework. We have identified similarities in service strategies in consumer and business-oriented industries and different product industries (including aircraft engines, farm equipment, automobiles, and computer hardware and software), as well as different industry lifecycle phases. Nevertheless, certain conditions may limit the applicability of our arguments. For instance, some products may not be sufficiently complex or may be so expensive to use that they require certain kinds of services, such as adapting. Future research could therefore explore the contextual boundaries of our framework. This empirical work should also provide greater insight into the strategic mechanisms that underlie our general propositions.

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