# Product, Process, and Service:

# A New Industry Lifecycle Model

Michael Cusumano
MIT Sloan School of Management
50 Memorial Drive, E52-538
Cambridge, MA 02142-1347 USA
617-253-2574
cusumano@mit.edu

Fernando F. Suarez
Boston University School of Management
595 Commonwealth Ave., Room 546-F
Boston, Massachusetts 02215, USA
617-358-3572
suarezf@bu.edu

Steve Kahl
MIT Sloan School of Management
50 Memorial Drive, E52-511
Cambridge, MA 02142-1347 USA
617-253-6680
skahl@mit.edu

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**Abstract**

Existing models of industry lifecycle evolution tend to focus on changes in products and processes and largely overlook the importance of services. Sales of services, however, are becoming increasingly significant in the revenues of many industrial and high-technology firms either because of industry evolution or strategic decisions or both. In this paper, we extend lifecycle theory by explicitly incorporating the role of services at different stages in the potential evolution of an industry. Building on the literature in service management and industry evolution, we provide theoretical support for our propositions regarding the potential role of services in the early, mature, and post-discontinuity phases of an industry lifecycle.



**Keywords: industry lifecycles, services, maturity, business models**

## 1. Introduction

One of the main tenets of how firms and industries evolve is that, as some businesses mature, the basis of competition shifts from product innovation to process innovation (Utterback and Abernathy 1975; Utterback and Suarez 1993; Utterback 1994; Klepper 1996, 1997; Adner and Levinthal 2001). For example, the model initially proposed by Utterback and Abernathy in 1975, holds that, early after the birth of a new industry, firms compete based upon product differentiation, investing heavily in developing new product features and determining what consumers want. But, as the market matures and customer needs become more defined, firms may shift their focus to competing on cost and economies of scale, investing more heavily in manufacturing and other processes in order to make production operations more specialized and efficient.

This product-process lifecycle model does not hold for all industries or firms; it seems to apply more to manufacturing settings where "dominant designs" or product standards emerge, and where competition then shifts to price (Utterback 1994). Sometimes a technological discontinuity interrupts this maturation process and the cycle starts over again (Tushman and Anderson 1986). In addition, as we have seen in industries such as automobiles, some firms may focus on process innovation as a source of competitive advantage (for example, Toyota) while other firms choose a different strategy and continue to focus on design innovation (for example, BMW). Nonetheless, this stylized lifecycle model has become an important framework in management literature to help us think about what strategies and investments companies should

emphasize at different periods in their evolution and in different competitive environments (Porter 1980, Oster 1994).

Based on recent research, we argue in this paper that the product-process lifecycle model is incomplete in that we see an increasing number of firms in many industries that seem to move on to an additional, third phase: a period where their emphasis, as indicated by the major source of revenues or profits or both, shifts to services. Figure 1 reflects our proposal; we have added a services curve (dotted line) to the well-known products-process curves originally proposed by Utterback and Abernathy (1975). Much of the evidence to support our claim comes from studies conducted after the original industry lifecycle theory was proposed in an area of research known as "service management". Several authors in this area of research have noted the increasing importance of the service sector in most industrialized nations (e.g. Fuchs, 1968; Quinn, 1992). Others have looked at the advantages of focusing on services and the differences between service firms and manufacturing firms (e.g. Heskett et al, 1997; Zeithaml, Parasuraman & Berry, 1990). However, to our knowledge, no author so far has explicitly linked the emergence of services to the industry lifecycle.

Shifting a firm's strategic focus due to changes in the environment can be a major challenge but also have important competitive benefits. For instance, a successful transition from products to processes requires firms to change their organizational structure and acquire new capabilities (Utterback and Abernathy, 1978). At the same time, a successful shift from a focus on product innovation to process innovation appears to affect firm survival (Suarez & Utterback, 1995). Likewise, an additional shift towards services suggests that, as an industry matures, firms cannot simply focus on cost-based

competition as prevailing lifecycle theories suggest. Maintaining low costs through efficient processes is still important in the proposed third phase of the industry lifecycle, but companies might also want to acquire service-related capabilities, particularly if these become important to competition and feed directly into an enhanced business model that includes service revenues. IBM, for example, targeted services under new CEO Lou Gerster and then saw this part of its business rise from 23 percent of revenues in 1992 to 52 percent in 2005. The story of IBM is particularly well-known, but it is only one of an increasing number of examples in computer software and hardware as well as other industries (IBM, 2005; Cusumano, 2004; Sawhney, Balasubramanian & Krishnan, 2004). In line with previous research, attempting a transformation from processes to services seems to be challenging as well, as the new capabilities in services often differ significantly from traditional production capabilities (Nambisan, 2001).

In this paper, we provide the theoretical underpinnings for a "product, process, and service" lifecycle model. In particular, we examine how services fit into existing industry lifecycle theory as well as present an important strategic alternative for firms in maturing businesses. Existing lifecycle theory does not seem to be able to explain all the competitive responses we observe today in mature industries and industries that undergo discontinuous change. By explicitly incorporating services into existing theory, we shed additional light on the conditions that explain changes in the competitive dynamics of industries. We suggest several hypotheses that could be later tested by empirical research.

## THEORETICAL UNDERPINNINGS

### Industry LifeCycle Theory and Competitive Strategy

Two related streams of literature that evolved separately constitute the backbone of industry lifecycle theory. Starting from a management of technology and operations background, Abernathy and Utterback (1975) described the evolution of an industry's technology over time. They also described how industry evolution tends to shape the firms that populate an industry in any given period. Gort and Keppler (1982), using concepts and rationales from "supply-side" microeconomics and evolutionary economics, derived similar industry lifecycle results. In both streams of literature, industries evolve by first experiencing significant firm entry (and little firm exit) with a corresponding increase in the total number of firms. After reaching a peak in the number of firms, a period of rapid increase in firm exit and restricted firm entry follows in what is typically described as a "shake out" (Utterback and Suarez, 1993). Industry maturity then ensues, defined as a period when the number of firms tends to be stable at a low level. Sometimes a significant technological change interrupts the mature phase by introducing a discontinuous change to the marketplace. This technological discontinuity, in turn, reinitiates a new cycle (Anderson and Tushman, 1990). A more recent stream of literature has derived a similar lifecycle model by focusing on demand characteristics: the heterogeneity of customer preferences and satisfaction of these needs (Adler and Levinthal, 2001).

In general, lifecycle theories agree that the basis of competitive strategy can and probably should change for most firms as the industry evolves. During the early phase (also called fluid phase or era of ferment), most firms focus on product innovation. This phase begins with the introduction of a new technology that identifies new user needs or presents a new way to satisfy existing needs (Utterback and Abernathy, 1975). Firm entry generally is high and competition is based upon the functional features and performance of products that try to respond to evolving customer needs. Often, several different variations of the technology compete in the marketplace. For example, in early power generation, AC systems competed with DC systems (Hughes 1983); in automobiles, the internal combustion engine competed with steam and electric engines (Abernathy 1978). Production in the early phases of a new industry tends to be of small scale and inefficient as firms try to respond flexibly to unique and quickly evolving customer needs.

During the mature phase, in contrast, most firms focus on process improvement. The onset of the mature phase is usually triggered by the emergence of a dominant product or technology design. For example, AC emerges as the standard over DC; the internal combustion engine wins out over the steam and electric engines. Rising volume coupled with more technical and market certainty limits firm entry and slows product innovation. Most firms now focus on reducing production costs by investing in process changes such as specialized capital investments and exploitations of economies of scale (Utterback 1994). The overall firm population begins to decrease as exiting inefficient firms are not replaced by entering firms (Suarez & Utterback, 1995). At the end of the cycle, a relatively small number of firms remain in the industry.

**The Rise of Services**

One of the earliest discussions of services in the context of industrial evolution came in 1940, in a seminal work by Colin Clark. Clark described the transition that economies undergo over time from a pre-industrial stage to an industrial and then a post-industrial stage. In each period, one sector predominates: the primary or agricultural sector during the pre-industrial stage, the secondary or manufacturing sector during the industrial stage, and the tertiary or services sector during the post-industrial stage. Starting in the early 1970s, management scholars and economists began to document the shift from manufacturing to services and describe the emergence of the post-industrial stage. The shift was heralded by many in the 1970s as a true "postindustrial revolution" (Bell, 1973) because services quickly gained importance in the economy: "In 1929, services accounted for 40% of total employment, in 1947, shortly after the end of World War II, for 46 percent, and by 1976, for roughly 61 percent" (Stanback et. al., 1981). The trend continued, and by the mid 2000s services account for more than three-quarters of total employment and gross domestic product in the US. Recent research has also shown that services are currently the engine of growth in the economy, fueling the post-1995 expansion of US labor productivity (Triplett and Bosworth, 2004).

A second focus of the services literature has been the definition and classification of services, with particular emphasis on how services differ from products. In general, services are thought of as anything that is not a tangible, manufactured good (Bell, 1973; Berry, 1980; see Mansharamani, 2005 for a review). This basic classification has been often questioned due to the "goods-like" nature of many services, such as health care, and the "service-like" functions performed within non-service organizations, such as legal

counseling (Stanback, 1979). Nevertheless, despite the criticisms, it is still widely used today. In addition to their intangible nature, the literature has emphasized that services differ from manufactured goods in that they cannot be stockpiled and are generally consumed at the point of production (Heskett, 1986; Organ and Grover, 1987). Services also imply the active participation of the customer in the delivery process (Mills, 1986) and tend to have a non-standardized output. Chase and Aquilano (1977), for instance, following the "contact approach" classified services in three categories: pure services, mixed services and quasi manufacturing services.

A third focus of services literature has been the design of service operations and organizations for more effective functioning. Heskett (1986) and Nayyar (1992) propose a customer- and marketing-driven approach to organizing service operations. Levitt (1976) and Northcraft and Chase (1985) focused on increasing efficiency through the "industrialization" and "de-professionalization" of service operations – that is, greater standardization, mechanization and less reliance on the expert service professional (a movement away from pure services to mixed and quasi manufacturing services). Ingle and Ingle (1983) and Rosander (1989) focused on using a total quality management approach in services industries. Mills (1986) looked at the organizational and human aspects of service operations, and emphasized the importance of carefully managing the "service encounter," the moment where the customer interacts with the service organization. Several studies looked at different aspects of the effect of human factors in service performance (e.g. Schlesinger and Zornitsky, 1991; Schneider, 1991)

## EXTENDING THEORY: SERVICES IN THE INDUSTRY LIFECYCLE

Proponents of services have considered the rise of services as an overall trend in the economy. The advent of the post-industrial economy has resulted in an increased importance of services in most sectors of the economy over time, even in manufacturing sectors (Quinn, 1992). Services are increasingly representing a larger proportion of gross domestic product in all advanced economies. While this general trend is indisputable, we argue here that the role of services within an industry can be better understood by applying the lenses of industry lifecycle (Abernathy & Utterback, 1978). Industry lifecycle theory has long postulated that industries evolve through distinct phases and that each phase is associated with different basis of competition at the firm level. However, the industry lifecycle literature has focused on products and processes and has largely ignored services. Introducing services into the industry lifecycle model requires an understanding of how services relate to the different stages of industry evolution, and to potential shifts in the basis of competition as an industry evolves.

A starting point is the relationship between industry lifecycle stages and the technology of service operations. During the early phase of an industry, customer preferences are not well developed and the product and process technology is in flux (Utterback, 1994). Crude versions of the product are rapidly replaced by improved versions based on technological advances, and customer demand constantly switches to newer products with more advanced features. This "era of ferment" (Anderson & Tushman, 1990) creates enormous complexity for the provision of services, which could range from product customization to technical advice and support. Given the unstable customer preferences and rapid technological change, the provision of services require a

high level of interaction with the customer – what the services literature labels "high-encounter" service situations (Mills, 1986; Skaggs and Huffman, 2003). In such situations, the service provider "will be required to secure and process copious amounts of information in order to address complex issues, and much of this information will be equivocal" (Mills, 1986). The services literature has long noted that the complexity of service operations increases substantially when high customer involvement is required. High-encounter service situations are not conducive to a high level of services, as they make the production of services non-linear and hard to predict (Mills & Moberg, 1982).

In contrast, in industries that reach a mature stage, customer preferences should be more known and stable[1]. Technology generally coalesces around a dominant variation which allows for high levels of standardization (Abernathy & Utterback, 1978). Services can flourish in this environment of low uncertainty. Clearer and more stable customer requirements and predictable technology change allows for companies to write specific contracts, which in turn reduces the need for customers' direct interaction with the service provider (Mills, 1986). Companies can design systems and processes to provide relatively standardized services, which in turn helps the replication of service routines in different organizations. In addition, customer organizations themselves seek system-wide compatibility and integration in the mature stage, as these aspects become crucial for competitive advantage (Farrell and Saloner, 1985). This change in the basis of competition tends to increase the value of services during the mature stage.

[1] For example, Klepper specifically models market convergence into his product lifecycle model (Klepper, 1996). New customers only enter the market when there is a product innovation. The innovator gets monopoly rents for one period, but then the customer becomes part of the "standard market".

Complementarities between products and services are a second line of argument that points toward an increasing importance of services as an industry matures. We can think of products and services as complementary activities (Teece, 1986). Two activities are complementary when an increase in one raises the marginal return of the other (Milgrom and Roberts 1990, Brandenburger and Nalebuff, 1996). The activities are synergistic in the sense that one benefits from the other. The synergies tend to run from products to services insofar as service activity tends to follow the installed base of products: the larger the product installed base, the larger the potential service activity.[2] In a variety of industries, the additional sale of a product often generates service opportunities in the form or warranty agreements, maintenance, training, implementation, and after-sale technical support. As the cumulative product installed base (net of product decay) is directly related to the potential for services, it follows that services revenues will tend to peak after the peak in product revenues and will tend to last longer than product revenues (Potts, 1988). This built-in lag in service activity with respect to product activity is another reason to expect the importance of services to rise as the industry matures. This is reinforced by the fact that, during the mature stage, product prices often suffer a sharp and irreversible decline – product prices stay low even when industry growth shrinks or disappears (Utterback, 1994). Firms are then naturally inclined to explore service opportunities as sources or revenue and profits as the industry matures (Oliva & Kallenberg, 2003; Davies, 2004; Wise & Baumgartner, 1999).

From our discussion above, two propositions follow. One is that *the importance of services in a given industry should be associated with the stages of the industry*

[2] Note that the complementarity can potentially go the other way. Additional sale of services could generate product opportunities as the firm gets exposed to and learns a particular customer's requirements and how the customer uses the product (Rosenberg 1983; Von Hippel and Tyre 1995).

*lifecycle.* A second is that *the importance of services in a given industry should be largest in the mature stage of the industry lifecycle.*

Industry lifecycle theory also argues that a discontinuous technological change may interrupt the mature phase (Anderson and Tushman, 1990; Christensen, 1992) based on a significant change in technical components or architectural design (Henderson and Clark 1990). According to existing theory, a discontinuous change re-starts the industry cycle (Anderson and Tushman, 1990). New firms can enter the market based on the discontinuous technology. As it occurred in the early period of industry evolution before the discontinuity, existing lifecycle theory predicts that firms in the early post-discontinuity phase will focus on product innovation and functional performance. As before, processes will be relatively unimportant in the early phase because changing customer requirements and product characteristics do not allow for economies of scale.

Existing theory does not shed light, however, on the effect of a discontinuity on the level and importance of services in an industry. While the arguments for an increased role of product innovation and reduced role of process innovation are well understood and accepted in existing literature (Utterback, 1994; Suarez, 2004), the impact of discontinuities on the level and importance of services is not straightforward. Due to the nature of services and the role of the installed base of the previous technology, we argue that the importance of services after a discontinuity is largely determined by the level of integration required between the existing and new (discontinuous) technology.

Two of the most prominent frameworks used today to understand industry discontinuities, that of Christensen (1992) and Anderson and Tushman (1990), borrow directly from the pioneering work of Abernathy and Clark (1985), and provide a starting

point for our argument. Abernathy and Clark proposed a matrix that they labeled the "transilience map". Innovations are classified depending on their impact on existing technological competences (the X-axis in the matrix), and existing market/customers (the Y-axis). A new technology can "preserve" or "destroy" existing links with customers and can "preserve" or "destroy" existing technological capabilities. Anderson and Tushman's framework focuses on the X-axis of the transilience map to propose that discontinuities can either be "competence-destroying" (that is, they destroy or render obsolete existing technological capabilities) or "competence-enhancing" (that is, they preserve existing technological capabilities). Christensen's framework focuses instead on the Y-axis of the transilience map to propose that discontinuous technologies often create new markets that are out of the radar screen of incumbents and their customers (that is, a discontinuity "destroys" or renders of little value the links with existing customers). In both Christensen's and Anderson and Tushman's frameworks, discontinuities that "destroy" linkages with existing markets or competences, respectively, are significantly more difficult to handle by incumbents than those that preserve the linkages.

In short, existing frameworks to understand the effect of technological discontinuities have focused on the impact of a new technology on existing customers, or existing competences. We argue that there is a third dimension that needs to be brought forward if we are to better understand the impact of discontinuities on services: the impact of new technologies on the need for backward integration with the previous technology. To use a similar terminology, a new technology can "destroy" linkages with the existing technology's installed base (low need for backward integration), or "preserve" those linkages (high need for backward integration). The level of required

backward compatibility determines whether the assets from the existing technology lose or retain their value after the discontinuity. Note that the required level of backward integration relates to the extent to which a new technology interacts with an existing technology, and not to the type of competences needed to master the new technology or the type of markets and customers involved. In other words, the level of required backward integration is a third, "Z-axis", independent from the X- and Y-axes described above.

Table 1 presents two matrices to classify several examples according to their position along the three axes used to understand technological discontinuities. Matrix 1a is composed of our proposed backward integration dimension and the market/customer (Y-axis) dimension. Matrix 1b is composed of our proposed backward integration measure and the technological competence (X-axis) dimension. As the examples suggest, the three dimensions do not necessarily move in the same direction. For instance, DSL (a technological discontinuity that allows broadband connections using standard telephone copper wires) preserves customer links as DSL services are sold to the same telephone customers. DSL also preserves the links to the installed base of the old technology -- indeed, the new technology runs on the old technology's existing infrastructure. DSL can also be said to be competence-enhancing. Telephone companies were quick to adopt DSL as their core broadband strategy, and they integrated it smoothly with their existing technological base and customer offerings. Satellite TV, in particular the modern version known as DBS, "direct broadcast satellite" or "mini-dish technology," represents a discontinuous departure from terrestrial TV technology and requires the mastery of a very different set of skills and knowledge (for instance, DBS

systems typically require proprietary reception equipment and are based on proprietary transport stream encoding). In addition to being competence-destroying, satellite TV also destroyed the links with the existing customer base. For instance, satellite TV could reach remote areas where regular TV service was poor or non-existent with no additional cost. However, satellite TV preserves the links to the existing installed base, as it still uses much of the terrestrial TV's installed base, including the large number of television sets in homes and offices. Ballpoint pens preserve the links with customers (they basically replaced fountain pens as the main handwriting tool), preserve existing competences (most fountain pen makers could make a smooth transition to ballpoint pens ), but destroy the links to the existing installed base (no need for compatibility with fountain pens' ink cartridges, steel nibs, etc.). The photocopy machine, our last example in Table 1, destroy links in all three dimensions: it creates a whole new market, it requires a very different set of skills and knowledge than those required before, and it does away with the old copying-technology's installed base (mimeographs, carbon paper).

We argue that a high level of required backward integration will tend to uphold the importance of services after a discontinuity and, conversely, a low level of required backward integration will tend to undermine the importance of services. This is due to the fact that when links to an existing installed base are preserved, integration between the products and systems from the existing (old) and new technologies is crucial. In situations like these, existing customers considering switching to the new technology require a transition path that is compatible with their cumulative investment in the old technology. This will typically imply the need for a significant level of services to ensure

continuity in existing operations and a smooth migration toward the new technology. The discontinuity itself brings new service opportunities to the industry.

Take for instance, the case of enterprise software, where the internet discontinuity translated into high demand for services to "convert" different parts of the firm to the new technology (e.g. online sales). At the same time, however, the new systems had to "talk" to the existing systems. The result was a very high level of service activity for consultants and "integrators" that could not only provide the new technology to a firm, but ensure the correct interaction with existing systems.

In situations where a low level of backward integration is required, the importance of services diminishes at the speed that the existing installed base is written off or obsolesces. In such situations, there is no need to create bridges from the new to the existing technology, and therefore services only revolve around the existing, and now shrinking, installed base. Every new adopter of the new technology implies less use of the old technology. The value of the existing installed base disappears as the use of the new technology spreads, and services tied to the old technology also disappear in the process. The new technology will eventually reach its mature stage and, as discussed above, services will most likely become important at that late stage for the new technology. But in the period immediately following a discontinuity, services are likely to be less important if the discontinuity requires low levels of backward integration.

The emergence of such discontinuity will typically mark the end of a period of steady growth in the importance of services during the mature stage of the previous industry cycle. Services linked to the established installed base will begin an irreversible decline, while services in the emergent market will start at a low level and will gradually

increase in importance as the industry matures. This is, for instance, the case of the digital photography discontinuity. Services linked to the old installed base of chemistry-based photography have been now for years on a steady decline (Kodak's serious problems in the last decade testify to this), while the digital photography industry – particularly during the early years – has been mainly focused on product innovation and features as opposed to servicing the increasing installed base.

Figure 2 below depicts the different impact on services of each type of discontinuity (for simplicity, we have omitted the product and process curves in the figure). The fist part of the figure (2a) shows the case of a discontinuity that destroys links to the existing installed base. The second part of the figure (2b) represents the case of a discontinuity that preserves the links to the existing installed base. From Figure 2 and our discussion above, two additional propositions follow. One is that *the emergence of discontinuities that do not require high levels of integration with the existing technology should be followed by a reduced importance of services in an industry.* Another is that *the emergence of discontinuities that require high levels of integration with the existing technology will not have an adverse effect on the importance of services in an industry.*

A final proposition relates to the survival and performance implications of our proposed service phase. Existing literature on discontinuities has postulated that specific types of discontinuities can make it harder or easier for existing firms to survive and, conversely, for new entrants to make inroads in a market. For instance, Tushman and Anderson (1986) argue that "Competence-enhancing discontinuities tend to consolidate industry leadership. The rich are likely to get richer" and that "Competence-destroying discontinuities, in contrast, disrupt industry structure" (p. 444). Similarly, Christensen

(1992) suggests that incumbents are most challenged in the presence of technological discontinuities that start in a remote, emerging market. When it comes to services and the value of the existing installed base during discontinuities, we would expect firms related to the existing technology to perform better when the discontinuity preserves the value of the installed base. The requirements for backward integration with the existing technology increases the value of the incumbent's existing assets, forcing new entrants (based on the new technology) to ensure their access to or compatibility with the existing installed base. As incumbents often have greater resources and complementary assets than new entrants (Teece, 1985), this situation creates opportunities for incumbents to play a larger role in the post-discontinuity period than it would be the case with no backward integration requirements. A final proposition then follows: *in the presence of a discontinuity, incumbents will tend to perform better if the discontinuity requires high levels of integration with the existing technology.*

**Conclusions and Further Research**

Industry lifecycle theory is one of the more influential frameworks in the literature on technology management and has prompted much research in the related areas of strategy, organizational behavior, and operations. In particular, researchers have used lifecycle theory to highlight how the basis for competition might change as an industry evolves. Prevailing theory argues that firms should shift their focus from product differentiation to cost-based competition as their industry matures. In this model, successful firms are those that can transition from a focus on R&D and product

innovation to a focus on operational efficiency and production processes (Abernathy & Utterback and Abernathy, 1975; Anderson & Tushman, 1990).

The industry lifecycle model was first proposed in the late 1970s. Since then, management scholars and practitioners have identified services as a key source of growth and revenues for firms, in addition to or as a complement to their products business. The rising importance of services has been corroborated by macro-economic studies that track the increasing share of services at the national economy level. Services have also been shown to be the engine of growth in our economy. Yet industry lifecycle theory has remained basically silent about the role of services. In this paper, we have provided an extension to the lifecycle model that incorporates the potential role of services at different stages. We have reviewed and built upon the literatures on service management and industry lifecycle in order to come up with a parsimonious representation of the phenomenon. We have focused on the early, mature and post-discontinuity phases and, supported by existing theory, have developed propositions regarding the role of services in each of these phases. As with the existing industry lifecycle theory itself, we do not claim that our propositions will be true in all cases and industries. Nevertheless, as with existing theory, we argue that our propositions are more likely to be true in industries where the products business matures or becomes commoditized to the point where services can becomes a substitute or complementary source of revenues and profits.

As previous studies have argued, a change of strategic focus toward services implies an important change in organizational capabilities (Nambisan 2001, Oliva & Kallenberg, 2003). This change is far from trivial. Growing the service part of a business often requires careful attention to efficiency and process because services tend to be

intensive in skilled labor and hard to scale. Emphasis on efficiency is often paramount to having a profitable service business, although some firms may be able to charge high prices for highly specialized services that rely on unique skills. On the other hand, and unlike what happens in the process stage of the industry lifecycle, the service stage can extend beyond a discontinuity. Many services derive from the need to integrate new products with a customer's legacy technology, or to train customer personnel with different skill levels. We bring forward another dimension to classify discontinuities -- that of the level of required integration with the existing installed base -- and argue that this dimension is key to understanding the role of services in a post-discontinuity phase.

Our effort to incorporate services into industry lifecycle theory is timely. In recent years, we have seen services become important in many mature industries. In the automobile industry, for instance, General Motors and Ford, as well as other automakers, generate the vast majority of their profits from a service activity -- loans and leasing. The automobile industry overall generates a large portion of its profits not only from financing but from other service activities as well, such as insurance and repairs (Gadiesh and Gilbert, 1998). Likewise, software product companies may begin by emphasizing product sales but, as the industry matures, most of them end up with more revenues from services and maintenance rather than from new product sales (Cusumano, 2004). As with the previous two phases, the advent of a service phase gives firms a new dimension to establish their competitive position. Services-related revenue and profits can even mask deficiencies in product development or process innovation; the troubles of the U.S. automakers in the mid 2000s would have probably manifested much earlier had it not been for the rising importance of services in this mature industry.

The rise in services may also prompt a rise in minor product innovation during the industry's mature stage. This possibility, which other scholars have described as "de-maturity" (Abernathy & Clark, 1983), was not considered in the original lifecycle model. Indeed, the original model suggests that the shift from one stage of the industry lifecycle to the next is irreversible (Agarwal, Sarkar & Echambadi, 2002). In particular, product innovation during the mature stage is treated as a discontinuous exogenous event. The incorporation of services in the model allows for the possibility that the shift away from product innovation that comes with the onset of maturity is not irreversible. Most services are provided through close contact with customers. Service providers are then in an excellent position to detect problems with the existing products or services and gather feedback on how to improve them, a fact that has often been emphasized in the services literature (e.g. Quinn, 1992). In such cases, the introduction of a new product design during the mature stage is not exogenous but occurs as a result of the firms' efforts to provide additional customer value in an increasingly cost-competitive environment. In addition, customers do not just enact prescribed uses of a given product or technology, but over time (even in the mature stage) they discover new uses or change their use patterns (Kahl, 2006), giving rise to additional opportunities for improving existing products or creating new ones.

In conclusion, firms should want to manage the transitions in their industry lifecycles or their specific business models as strategically as possible. If appropriate, they should want to pursue new service opportunities, rather than simply allowing product revenues to deteriorate as market competition and commoditization increases. A better understanding of the theoretical underpinnings for the importance of services at

different stages can be instrumental in developing successful strategies to compete at different stages of the industry life cycle.

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Table 1. Types of Technological Discontinuities

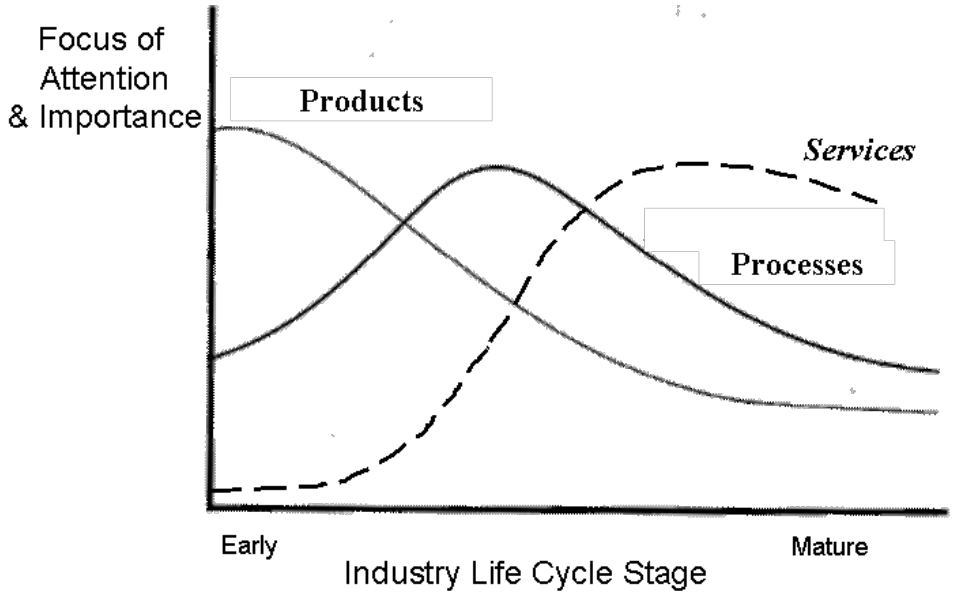
1a. Impact on the value of the installed base and type of customer

| | | Impact on the Type of Customers | |
|---|---|---|---|
| | | Preserves existing customer links | Destroys existing customer links |
| Impact on the value of the installed base | Preserves links to existing installed base | **DSL** | **Satellite TV** |
| | Destroys links to existing installed base | **Ballpoint pens** | **Photocopy Machine** |

1b. Impact on the value of the installed base and firms' technological capabilities

| | | Impact on Firms' Technological Competences | |
|---|---|---|---|
| | | Preserves existing competences | Destroys existing competences |
| Impact on the value of the installed base | Preserves links to existing installed base | **DSL** | **Satellite TV** |
| | Destroys links to existing installed base | **Ballpoint pens** | **Photocopy Machine** |

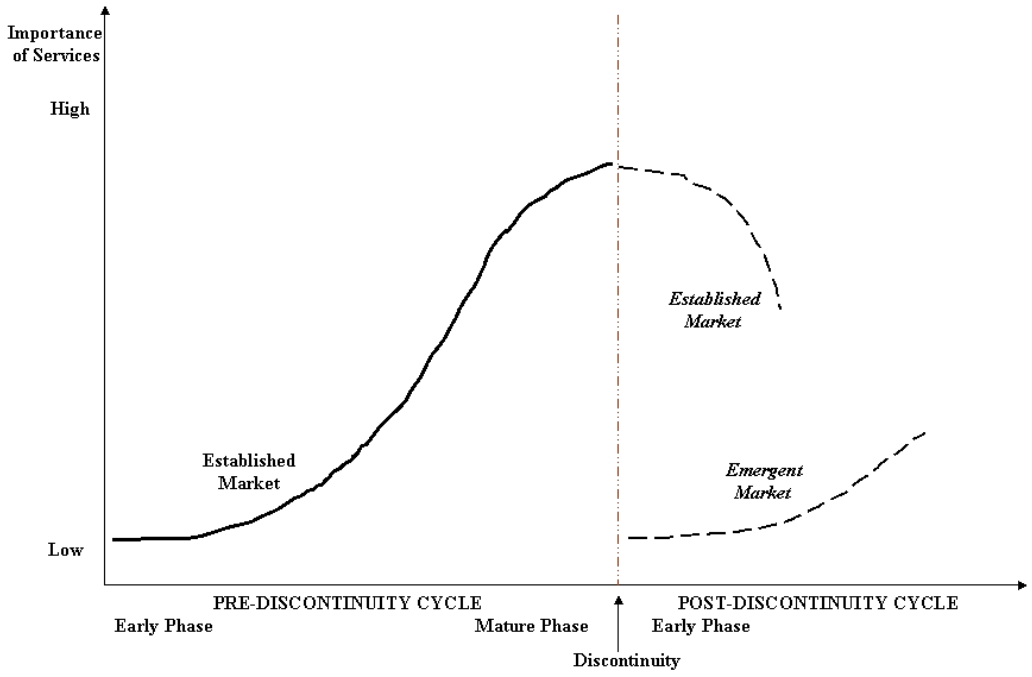
Figure 1: Enhanced Product-Process Industry Evolution Model




Source: Adapted from Abernathy and Utterback 1978.

Figure 2. The Impact of Discontinuities on the Role of Services in an Industry.

2a. Discontinuity that destroys links to existing installed base




2b. Discontinuity that preserves links to existing installed base