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Chapter Authors: Timothy F. Bresnahan, Shane Greenstein, Rebecca M. Henderson

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Schumpeterian Competition and Diseconomies of Scope
Illustrations from the Histories of Microsoft and IBM

Timothy F. Bresnahan, Shane Greenstein, and Rebecca M. Henderson

4.1 Introduction

Schumpeterian "waves of creative destruction" are bursts of innovative activity that threaten to overwhelm established dominant firms. Schumpeter argued that such waves renew markets and strike fear in even the most entrenched monopolists, motivating them to innovate. Despite the strength of that incentive, established dominant firms often fail to dominate in the new technological era. This fact has had great influence on the literature in organizational theory and technology management, and has also taken deep hold in the business press and in the popular imagination.[1]

Within economics the theoretical basis for explaining an incumbent's difficulty in responding to radical or discontinuous innovation focuses on the potential for cannibalization as drag on incumbent investment in the new

Timothy F. Bresnahan is the Landau Professor in Technology and the Economy and professor, by courtesy, of economics in the Graduate School of Business at Stanford University and a research associate of the National Bureau of Economic Research. Shane Greenstein is the Elinor and Wendell Hobbs Professor of Management and Strategy at the Kellogg School of Management, Northwestern University, and a research associate of the National Bureau of Economic Research. Rebecca M. Henderson is the Senator John Heinz Professor of Environmental Management at Harvard Business School and a research associate of the National Bureau of Economic Research.

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1. See, for example, Dosi and Mazzucato (2006), Gerstner (2004), Henderson and Clark (1990), Utterback (1994), Christensen (1993, 1997), among many others. A related literature in evolutionary economics has also taken up this problem, summarized in Dosi and Nelson (2010).

technology, and more broadly on the ways in which potential for strategic interaction between the old and new businesses constrains the incumbent's response to new opportunities.[2] When cannibalization does not constrain the incumbent, however, the mainstream economics literature remains underdeveloped. Economics crashes up against two puzzles. It has little to say about why incumbents should not be able to simply duplicate the behavior of successful entrants—or even to do much better. Incumbent firms, after all, usually have important sources of advantage through existing assets that might yield economies of scope. In those cases in which incumbents responding to creative destruction can take advantage of existing assets—assets such as brands, channels, manufacturing capability, knowledge of the market, and so forth—why should incumbents not have an advantage over entrants? Indeed, antitrust and innovation policy often implicitly assumes that "anything an entrant can do an incumbent can do better."[3]

One possibility is that radical technological change generates uncertainty and thus produces discontinuities.[4] If any single firm, including the incumbent, has only a probability of introducing the right product or having the right capabilities in the midst of a Schumpeterian wave, incumbents might be replaced simply because they are unlucky. Such an argument, while clearly compelling in some cases, does not explain why incumbents do not more often become successful strong seconds—duplicating the successful entrant's technology and leveraging their existing assets to gain the market. Indeed, Schumpeter himself leaves open the question about whether incumbent and entrant firms face similar costs in a new market, treating it as one of several unknown factors that market events will reveal as circumstances unfold.[5]

Another possibility that has been extensively explored by organizational scholars is that the firm's existing incentives, organizational routines and ways of seeing the world, or embedded cognitive frames, may be inappropriately imposed on new units, leading them to act in suboptimal ways.[6] This literature suggests that senior management at incumbent firms may become complacent and inward looking, leading them to neglect new opportunities or to frame them as extensions of the existing business, and that even when senior management understands the nature of the new market they may be forced to rely on organizational competencies developed to serve the old business that are ill suited to the new.

2. See, for example, Arrow (1962), Gilbert and Newberry (1982), Henderson (1993, 1995), Gawer and Henderson (2007). One key question is whether the incumbent should see through to the equilibrium outcome and thus cannibalize rather than be replaced by an entrant.

3. For example, see Davis, MacCrisken, and Murphy (2002).

4. See Klepper (1997), Stein (1997), Jovanovic (1982), Adner and Zemsky (2005), or Cassiman and Ueda (2006).

5. See Schumpeter (1942) for a number of the arguments we have cited.

6. Henderson and Clark (1990), Henderson (1993), O'Reilly and Tushman (2008), Tripsas and Gavetti (2000), Kaplan and Henderson (2005), Daft and Weick (1984), and Kaplan (2008).

Even accepting its premises, this line of research seems in many circumstances too restrictive in its assumptions about what is possible in an organization. One question for any model based on the limitations of organizational process or cognition is why firms cannot simply create a firm within a firm that replicates the organizational structure and competences of a new entrant. Moreover, we have several examples of firms that have succeeded in recreating themselves quite effectively, even in circumstances where existing ideas were quite strong and senior management felt the powerful temptation to complacency.

While this stream of research is compelling as one potential explanation of incumbent difficulties, the view that it is the explanation has led to a false dichotomy. Continued success by a firm is identified with an outbreak of foresight and good judgment, while declines of a formerly dominant firm are identified with suboptimal choices.[7] Our goal in this chapter is to break out of this identification of the explanation with the phenomenon to be explained.

Here we propose a third source for the difficulty incumbents experience in mimicking entrant behavior, stressing that the replacement of the old by the new never occurs instantaneously. We argue that *diseconomies of scope* may play an essential role during the interval when old still thrives and new first appears. We suggest that such diseconomies are not a function of any market distortion or any disequilibrium, but are, rather, a systematic factor in many Schumpeterian waves.

In broad outline, we argue that diseconomies of scope may arise from the presence of necessarily shared assets. These are assets—such as a firm's reputation for reliability or for conforming to closed or open standards—that inevitably adhere to the firm, rather than to the operating units, no matter how organizationally distinct the units may be, whenever two businesses are sufficiently close. It is the necessity of sharing the asset across business units that leads to the possibility of scope diseconomies.

Of course, the most usual case is that assets shared between related businesses will be useful in both. However, it need not always be so. First, there is the possibility that specific features of the asset built up in the old business will be mismatched to the market reality of the new one. When the features of the shared asset that would be desirable in each business are adequately distinct, sharing creates diseconomies of scope. If the asset is necessarily shared, no reorganization short of divestiture permits the firm

7. See, for example, Teece et al. (2000) who argue the goal of research is to "understand how firms get to be good, how they sometimes stay that way, why and how they improve, and why they sometimes decline" or Dosi and Nelson (2010) who relate that "In these and other cases when a radically new technology has replaced an older mature one, as we have noted, old dominant firms often have difficulty in making the adjustments. In such circumstances, technological change has been what Tushman and Anderson (1986) have called 'competence destroying.' The industry may experience a renewal of energy and progress, but often under the drive of a new set of firms." The latter definition captures the idea of a competence that works in a particular market environment.

to escape the scope diseconomies. Further, any such mismatch also creates costly organizational conflict between the two lines of business. We know from recent research in organizational economics that it is not possible to give conflict-free incentives to the managers of potentially competing divisions, in the sense of giving them both incentives to simply maximize firm value, and that, in our application, the managers of the established division will therefore fight with the management of the new division over how best to use or develop shared assets or both.[8]

Scope diseconomies can offer the incumbent firm a difficult choice. In the extreme, particularly if there are also significant strategic interdependences between the businesses, the firm may have to choose between not supplying the new business at all or assigning control rights over the shared asset either to the old or to the new business. If either the control rights are assigned to the old business (which, after all, built the asset) or there is joint control of the asset, the new business will be managed very differently from the entrants with whom it must compete. We do not argue that such an outcome represents suboptimal behavior on the part of the firm. Rather, we suggest that these kinds of organizational diseconomies of scope explain why the investments and behavior of the incumbent firm are likely to be very different from those of entrants in the new markets.

We do not suggest that operating two lines of business when an asset must be shared presents problems in every circumstance, or inevitably leads to failure at incumbent firms. Instead, we suggest that it makes failure more likely if the costs of organizational conflict are considerable and if the marketplace does not value the benefits of increased coordination.

Our analysis also highlights the consequences of those cases in which the firm *chooses* to share an asset across the old and new line of business. We show that this decision can also lead to significant organizational conflict and can impose real costs on one or both of the businesses—but that since choosing to share an asset implies avoiding the added cost of duplicating it for the new business, it is difficult to assert that this is a plausible cause of incumbent replacement at times of technological transition.

We focus on two well-known cases of incumbent firms attempting to react to major Schumpeterian waves, International Business Machines (IBM) to the Personal computer (PC) in the early 1980s and Microsoft to the widespread use of the Internet in the late 1990s, in order to make the case that diseconomies of scope have competitive implications during Schumpeterian competition. In each case we present a detailed historical account that both explores the changing strategic incentives facing each firm and the organizational conflicts that emerged within each firm.

While many economists think of Microsoft and IBM as highly distinct, we

8. See, for example, Hart and Holmstrom (2002), Baker, Gibbons, and Murphy (2002), Anand and Galetovic (2000), and Anton and Yao (1995).

shall see that looking at each of them at the height of its dominance reveals firms that were far more similar than different. Each was a highly successful established dominant firm with powerful technology marketing capabilities and proven ability as a strong second. Each used vertical integration to some degree as a structure to limit entry into its core markets. Faced with a new wave of potentially transformative importance, each firm at first missed but soon saw the importance. Both set up separate units within the firm to invest in the new technology—IBM created an entirely new operating division, while Microsoft created a separate engineering group that eventually grew to more than 4,000 people. Both firms eventually rolled these new units back into the existing organization, effectively ending the effort to be a dynamic competitor in the new area. There are, of course, important differences, which we shall revisit in detail in the history.

In both cases, we shall show that the firm encountered difficulties in attempting to respond to the Schumpeterian wave in both old and new business. In IBM's case, they forced the firm to exit the competition for control over standard setting in PC business and, years later, to effectively exit the business. In Microsoft's case, while they left the firm as dominant in one new Internet technology, the browser, they forced the firm to pursue a very different strategy with respect to the Internet than those pursued by successful new entrants—at, we believe, significant long-run cost to the firm.

We pick these two examples with three broad methodological points in mind. First, their market circumstances and their internal organization are well documented in the key eras. We are convinced historical methods revolving around the deep investigation of the specifics of organization and market alignment in specific examples are the right way to pursue an initial investigation of theories like these. The depth of our account allows us to explore the complex interplay that unfolded between the strategic incentives facing the firms and the need to share assets across businesses and the internal organizational dynamics that resulted and that in turn shaped investment decisions.

Second, both firms were extremely well managed. It is a common anachronistic error to think of Microsoft as better managed than IBM: rather, both were excellently managed firms at the moment we study them. Neither was inert, neither was a "dinosaur," neither failed to come to an understanding of what was required for market success in the new era, and neither lacked the implementation skills needed for the new market. In neither case did the established firm lack the necessary technical skills nor did it fail to (if not immediately, soon enough) recognize the importance of the oncoming wave or fail to make substantial investments in response. Indeed, IBM built a $4 billion PC business—one that had it been a freestanding firm would have been the third largest computer company in the world. While there are undoubtedly cases in which incumbents were unable to build the organizational capabilities required to address the new market, this is not the case

here. In both cases, outside innovators demonstrated a market opportunity that appeared attractive to many entrants, including the leading firm. In both cases, the leading firm was a commercial organization contemporaries regarded as an extraordinarily effective strong second. There is something deeper to explain here.

Perhaps most importantly, each of these firms appears to have had the kind of well-developed firm level assets that could create tremendous scope *economies* between its old and its new business. That each was unable to achieve this, instead bearing large scope *diseconomies,* speaks to the importance of looking at the details of the economics of the organization.

Finally, these are very important firms and very important transitions, linked not only to shareholders' wealth but to the growth of the national and world economies. Studying Schumpeterian waves in such cases gets us closer to the ultimate purpose of Schumpeterian economics.

Our analysis also stresses that diseconomies of scope are not the same as cannibalization. In both cases there were (eventually, in the case of IBM and immediately, in the case of Microsoft) important strategic interdependencies between the old and new businesses that created very significant tension between the managers of the two units. In both cases there were also critical, necessarily shared firm-wide assets whose forced use imposed costs on both businesses and that also created organizational tension. In IBM's case this forced sharing created significant costs even before the strategic interdependencies between the old and new businesses emerged, and we suspect that this is a general result.

We also depart from a large strand of prior writing about Schumpeterian waves in which competitors take advantage of an established firm's weakness. Rather, in our view organizational diseconomies of scope arise in the area of the greatest strength of established firms, not in any area of weakness. These firms can deploy their inherited strengths; however, a problem can arise when the inherited strength has uses in both the old and the new market and the two market settings call for very different deployments, so much so that realizing goals in one market impedes realizing them in the other.

Finally, we provide an explanation that avoids a common error in methodology. There is a strong but erroneous tradition of seeking to classify firm organizations as good or bad and of discovering that the most recently successful firm in an industry has good organizations. We emphasize that instead organizational diseconomies of scope explain a large number of events. We are most careful to discuss outcomes, since the anachronistic error is often linked to outcomes data like profits or market share. In the case of the IBM PC, we argue that organizational diseconomies not only *could,* but, in fact, *did* shape the market outcome in the PC market. IBM's loss of standard-setting leadership in that market followed, in the context of that difficult competitive market, from strategic errors forced upon the

IBM PC division as a result of internal conflicts with mainframe divisions. Nonetheless, IBM remained well-organized for its existing mainframe business, and stayed, for a time, the world's largest and most profitable computer and software company. In the case of Microsoft and the browser, we note that Microsoft is still the leading firm in its old businesses and is also the leading market share firm in the browser market. Nonetheless, Microsoft gave up real opportunities for profitable business in Internet-based industries at the end of the browser war. Microsoft remained well-organized to be the dominant PC software firm, an extremely profitable business, but scope economies have left the firm with little role in the development of mass market computing on the Internet. In short, rather than effectively pursuing the new business, in both cases long-run decisions led the firm to focus on its old business.

Section 4.2 provides a review of our framework. Section 4.3 illustrates its application to IBM's behavior in the PC markets. Section 4.4 explores Microsoft's behavior in the browser markets. Section 4.5 identifies a number of implications and outlines some directions for further research.

Our analysis is of the firm, but of the firm faced with a challenge from the market. On the policy front, our analysis lends further credence to the idea that incumbent firms, alone, are unlikely to be able to duplicate the technological diversity characteristic of the market. That suggests that vigorous entry, and not only incumbent dominant firms' incentives in response to entry, may be a key contributor to the innovativeness of an industry or an economy.

4.2 Sketching a Model

Here we outline a brief presentation of our framework. A more complete explanation lies in our companion paper (Bresnahan, Greenstein, and Henderson 2009).

Our analysis will not assume that economies or diseconomies of scope are automatic or that, when diseconomies arise, market transition is a foregone conclusion. Instead, we consider the question open ex ante before the diffusion of a new technology. This model has four stages, labeled as: (1) Search; (2) Institute investment; (3) Organizational Experiment; and (4) Assess and Resolve.

We model stage (1) minimally, and say that an outside entrant opens a new market at that time. We take the technical and marketing aspects of this new market as exogenous. Incumbent firms enter the new market in stage (2) with assets that possess attributes already determined in their established markets. While the incumbent firm can create new assets at this stage, our key assumption (borne out in our examples) is that some existing assets must be shared with the new business. Since we are writing about industries with rapid technical change, we endow firms at stage (2) with rational expecta-

tions but not perfect foresight. A firm might, for example, enter a new market not fully knowing its costs in that market. Stage (3) serves to inform managers about (unanticipated) conflicts, or, what will often be equivalent, about (unanticipated) costs from attributes of inherited and necessarily shared assets. We also model stage (4) minimally, arguing that incumbent firms then invest in firm assets and in the division of organizational responsibilities in an attempt to obtain resolution to prior conflicts.

4.2.1 Modeling Shared Assets

Consider two markets: an established market, "A" and a new market "B." In market A customers place a high value on product attributes a_1, a_2, while in market B customers place a high value on attributes b_1 and b_2. As a first step, assume that firms can choose whether to serve the two markets with a single shared asset, F, or with two separate assets, F_1 and F_2. Under these circumstances the firm's decision as to whether to use a single asset to serve both markets or to develop an entirely new asset to serve the new market is, of course, a function of the cost of the asset and the degree to which a single asset can serve both markets.

In general, firms will choose to use a single asset the more the preferences across the two markets are similar and the more flexible the asset. Thus, for example, Coca Cola's reputation for quality and excitement is valuable in many markets, so the firm uses a single brand to serve many niches, despite the fact that in each niche the nature of the drink—sweet, fruity, low calorie, and so forth—is quite different. Similarly, Unilever uses a single distribution channel to sell both a wide range of food products (ice cream, tea, rice) and a wide range of personal and home care products (deodorants, laundry soap). These are examples of the classic economies of scope identified by scholars such as Sutton (1991, 1998) as so central to long-term incumbent advantage and by those exploring diversification as central to related diversification; for example, Wernerfelt (1988).

Notice that choosing to share an asset may not be costless. Sharing an asset that may not be optimally matched to either market may create conflict between divisional management, and may put either or both divisions at a disadvantage. But since in many cases it is likely to be considerably cheaper than recreating the asset, it may nonetheless be rational and may lead to significant economies of scope.

Of course when preferences across the two markets are sufficiently different, firms may choose to invest in two assets rather than attempting to share a single asset across markets. In the extreme, the assets supporting General Electric (GE)'s locomotive business are almost entirely different from those supporting GE's financial service or media businesses, for example.[9] A less

9. Whether this type of "unrelated" diversification ever makes sense if the two businesses share no assets at all is a long-standing topic of debate in the literature. The argument has been made, for example, that GE shares assets such as access to the credit markets and a unique ability to develop managerial talent across its businesses.

extreme example would be that of Corning Glass's medical equipment and visual display businesses. Both rely on highly sophisticated glass technology and they both make use of the same advanced research and development (R&D) facilities, but they also rely on quite different manufacturing plants and sales and distribution channels.

This line of analysis is standard in the literature, and is the source of the intuition that, in general, incumbents should be advantaged in entering new markets. In the best case they can make use of existing assets and take advantage of economies of scope; in the worst they can build new assets and compete with entrants on their own terms. Here we argue, however, that if the incumbent firm *cannot* choose to develop a new asset to serve the new market—if an asset is "necessarily shared," then the incumbent may be at a significant disadvantage in serving new markets or at the very least constrained to act in very different ways from de novo entrants.

What kinds of assets might be necessarily shared? What attributes adhere to the firm, per se, rather than to the operating units? Here we do not attempt to develop a comprehensive theory of the *causes* of necessary sharing, focusing instead on its consequences. However we suspect them to be relatively common, and in our empirical analysis we begin to sketch out some possible explanations for the existence. One plausible candidate, for example, is the firm's credit rating.[10] As the recent financial crisis so vividly demonstrated, the divisions of a firm cannot isolate themselves from other divisions in accessing the capital markets. American International Group (AIG), for example, was effectively destroyed by the actions of a single (small) unit. Until that unit was sold the other divisions, no matter how profitable and well run, could not access credit of any kind.

Another plausible candidate is the firm's reputation, or in some circumstances the reputation of the firm's senior management. In the case of IBM, for example, before the advent of the PC the mainframe business had an enviably strong reputation for quality and reliability and for close engagement with its customers. It also had a reputation for being a strong second—the firm was very rarely first to market with a new technology—and for developing closed proprietary systems. The PC business, in contrast, initially developed a reputation for speed and for using an open system approach, and was simultaneously able to take advantage of IBM's historical reputation for quality and reliability to develop a very strong position in the market place. It was a very successful business—if it had been freestanding it would have been the third largest computer company in the world—and it appeared that the company had been able to take advantage of classic economies of scope.

As the PC market developed, however, this "separation of reputations" became increasingly problematic. In our discussion we explore the reasons for this in some detail, but in essence it appears to have been the case that

10. We are indebted to Claudine Madras for this example.

as the PC business grew, and as PCs were increasingly sold to traditional mainframe customers, these customers became increasingly concerned that the design and quality problems that emerged in the PC business were indicative of design and quality problems in IBM as a whole. Increasingly IBM's reputation across the two markets could not be differentiated, and as a result it became increasingly mismatched with both.

In both IBM's and Microsoft's cases, the firm's reputation for supporting proprietary standards also became an asset that was necessarily shared, largely became of the potential for strategic interaction between the two businesses. In the case of IBM, the management of the mainframe business came to believe that a PC business based on proprietary standards could be a powerful strategic complement to the mainframe business.[11] In the case of Microsoft, the managers of the Windows business not only wished to manage the browser as a strategic asset to the Windows business, but also early on became aware that a browser based on open standards might weaken Window's proprietary position substantially. In both cases managers of the existing, legacy business thus had strong incentives to manage the new business *in the interests of* the existing business. We cannot assert that ex ante these managers were mistaken—indeed in the Microsoft case it is not at all clear that they were wrong. But what we can say is that the existence of these incentives made it impossible for the new businesses to develop a credible reputation for "openness." Such a reputation was of considerable value in both markets, but in both cases customers and eco system partners were very much aware that IBM's and Microsoft's strategic incentives were not—and *could not*—be the same as those of a de novo entrant.

This necessary sharing imposes two costs. The first order cost is the obvious one: the firm is forced to use a single asset in two markets that is not ideally suited to either. In IBM's case the value of IBM's reputation in the mainframe business was severely impacted, and in Microsoft's case the firm's ability to compete effectively in the Internet space was greatly compromised. The second order cost is more subtle and may be both longer lasting and most costly. As assets must be shared between divisions, very considerable organizational conflict emerges. This is illustrated in figure 4.1.

In the figure, the vertical axis is a common sense of product quality, like performance on a set task. The horizontal axis is the distinction between speed and engagement. We show the indifference curves of two sets of customers; while both like quality, those in one market like "engagement" and those in the other market like "speed." As a result, the manager of the old business prefers one product market reputation and the manager of the new business prefers another. There is divisional concord about the quality part

11. Another potential source of strategic interaction—namely that a PC industry based on open standards could trigger substitutability away from IBM's mainframe business—did not become clear until considerably later in our period.

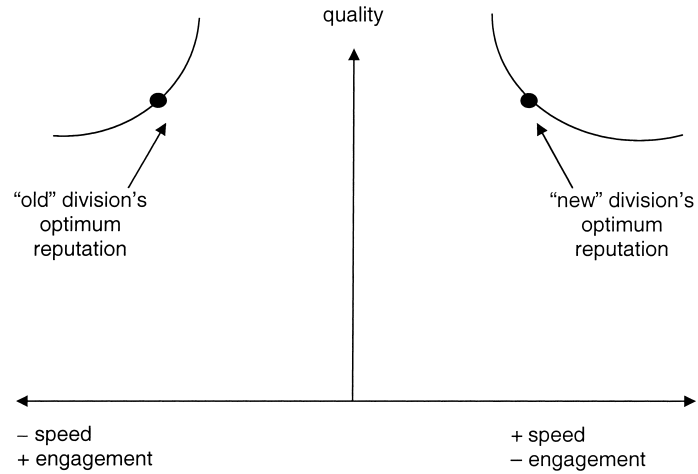

Fig. 4.1 Divisional concord and conflict: Product development reputation optima

of the fixed asset, but potential divisional conflict over its speed/engagement attributes. One can imagine a similar diagram for the attributes of "open" and "proprietary."

This potential for conflict may not be apparent at the earliest stages of experimentation with a new business. The optimum attributes for *F* are presumably known for the old business at stage (2), but may very well be unknown for the new business at that stage, and only learned after experience with stage (3). In this model *F* is chosen at stage (2) for one set of reasons and at stage 4 after experiencing competition.

The presence of conflict arises from the combination of (a) the indivisibility of *F* with (b) the inability of senior managers to write a contract that can give the managers of the two businesses "perfect" incentives to maximize total firm value. Conflict will arise both if the attributes of *F* are a choice variable and if the determination of *F*'s attributes is something that is endogenously determined by operational decisions. A reputation for speedy product introductions, for example, could arise from investment by one division, while a reputation for engagement with customers to determine product design could arise from investment from the other division. In this model, stages (1) and (2) take place in the shadow of precedent and stages (3) and (4) may take place in anticipation of future conflict. The manager of product A will then care about the operational behavior of division B and vice versa.

Standard principles in organizational economics suggest that this conflict cannot be costlessly resolved since within a firm, effective action involves effort that cannot be effectively monitored and outcomes that cannot be specified in such a way that top management could write enforceable con-

tracts around them. In the absence of contractible measures, managers must rely on second-best contracts. Said another way, under many circumstances top managers cannot give perfect high-powered incentives that maximize the value of the entire firm to everyone in an organization at once. In essence, even when managers can put in place "relational contracts," incentive issues cannot be perfectly resolved. See, for example, Hart and Holmstrom (2002), Baker, Gibbons, and Murphy (2002), Anand and Galetovic (2000), and Anton and Yao (1995). Thus, even under optimally designed incentive contracts the incentives of the two divisions will differ, and as a result both will advocate for different characteristics of the shared asset.

An emerging literature considers the problem of optimal organizational design when there are dependencies of a form related to this between business units. These show the circumstances, in stylized models somewhat related to the problem we model, in which there will be a control structure that then gives operational and strategic control over one business to the managers of another business, to centralize control, or to create a firm within a firm.[12] These models are quite interesting in that they show that none of these structures is costless; that is, show that scope diseconomies can persist even after the optimal organizational form is adopted.

This does not imply that firms will (or should) give up on all the innovative opportunities in stage (2). Rather, for a wide set of plausible circumstances firms will rationally attempt to innovate inside their boundaries, choosing to share a single asset rather than to duplicate the asset entirely, despite the fact that the asset will not be ideally suited to either market and the organizational conflict that will inevitably result. We are agnostic about which of many types of conflicts arise, since that depends on the specifics of the shared asset and the allocation of decision rights within the firm. For example, if F has been at A's preferred point and the firm enters market B, the situation will not be entirely positive from manager A's perspective. He will be asked to compromise in the interest of the broader firm.

We are also agnostic about the allocation of control over the asset that will emerge as the two markets develop and the conflict between the managers assigned to both becomes increasingly costly. As the literature has emphasized, a variety of governance structures and incentive regimes may be optimally chosen by senior management, depending on the characteristics of the asset, the markets the firm wishes to serve, and the information structure of the problem. What is important from our perspective is that all solutions to the problem of a shared asset will lead to at least some conflict between units and to decisions that are necessarily different than those that would be made by the managers of an equivalent but freestanding business.

12. Alonso, Dessein, and Matouschek (2008) and Rantakari (2008) both explore the consequences of this incontractability for the locus of control within the firm when decisions taken by the managers of one operational unit have implications for the other.

The form of the conflict matters less than its consequences for stage (4). Conflict can take any number of forms: the managers of old and new businesses might spend time lobbying for a change in the characteristics of *F*, they may make investments in *F* that are not optimally suited to the interests of the firm as a whole, senior management may find it impossible to elicit truthful information about the benefits of different attributes for *F*, and so forth. In the case of an established firm with an established business, the costs of conflict can be so great that it may choose to spin off the new business entirely: or it may focus on its longstanding success and retreat from wholehearted competition in the new area.

In the case of both IBM and Microsoft, conflicts between the old and new units triggered both by strategic interdependencies and by the need to share key firm-level assets became so expensive that the firm chose to give control rights over the new business to the old business, and in both cases the old business—the mainframe business in IBM's case, and the Windows business in Microsoft's—began to make decisions that managed the new business as a strategic asset to the old. It is very hard to make the case, of course, that ex ante this was irrational. What we can say is that in both cases each firm faced quite different benefits and costs in entering and in operating in the new market than a de novo entrant. We now turn to our illustrations.

4.3 IBM and Personal Computing

The competitive and innovative history of the PC industry in the 1980s has a rich literature, to which we have contributed in the past.[13] The industry was a difficult environment for firm success because of rapid innovation, divided technical leadership, and frequent episodes of competition for market dominance. It is against the test posed by that difficult environment that we examine IBM's entry and later events.[14]

Following our theoretical frame, we focus on three areas of inquiry. How did the organizational sources of IBM's success in enterprise computing contribute to success in the young PC market with the participation of senior management? How did the assignment of decision making at the firm level and within the PC division contribute to IBM's success as an entrant? What were the sources of IBM's later difficulties in the PC business? It is only in this third part of our historical enquiry that the notion of scope diseconomies will emerge.

Our explanation of initial success and later problems turns on the changing role of IBM's key firm-wide assets, and its reputation with customers. At first, the existence of the firm-wide asset provided scope economies. IBM's

13. See, for example, Freiberger and Swaine (1984), Cringley (1992), Langlois (1992), Carroll (1993), Bresnahan and Greenstein (1999).

14. This case study presents only highlights from a very long sequence of events.

reputation with corporate customers aided its entry into the PC business. As the PC business grew, however, scope diseconomies emerged. The specific attributes of IBM's customer reputation became a major source of conflict between the IBM PC division and the long-established IBM mainframe business. That conflict was resolved by organizational changes that removed the conflict, and the firm choosing a high level of alignment in the old business. This necessarily implied a low level of alignment to market opportunity in the PC business.

To make this explanation plausible we need to examine the idea of alignment to a market opportunity in some detail. That detail is necessarily specific to the computer industry, even if the general idea is not. A detailed examination is also useful in discarding other theories of IBM's ultimate failure in the PC business. Some of these, including cannibalization and stupidity or inattentiveness on the part of IBM's management, are simple to discard. We take rather more time with other theories in the literature, which fall into two main classes: (a) IBM was too backward looking, focusing on hardware rather than on software, and (b) IBM was too forward looking, leaving the supply of key PC components to outside firms like Intel and Microsoft. Both of these views turn out to be wrong in interesting and productive ways.

4.3.1 IBM before the PC

IBM's capabilities and organization were aligned to a specific market opportunity, the changing and evolving enterprise computer market. IBM had dominated enterprise computing for many years.[15] The firm's long-run strategic goal was to dominate all general-purpose technologies, whether hardware, software, or networking, in enterprise computing. That had been going very well for IBM, in the first instance because of its command of distribution channels, its excellence in marketing, and its ability to incorporate innovations first made by others into its products as a strong second. Critics of IBM sometimes doubt the firm's technological innovativeness in its long era of dominance, but there is no doubt about its marketing capabilities.

While technologist-critics sometimes think of IBM's strengths as mere marketing, IBM's enterprise customers did not see it that way. IBM's emphasis on product design responding to customer concerns rather than to technologists' concerns and IBM's fabulous field support for customers gave it great advantages. Above all, IBM's field sales force dominated distribution and the flow of information to and from customers. These marketing strengths were central to IBM's emergence as the dominant supplier for enterprise computing.

15. Enterprise computing refers to the business systems, typically used in large organizations, which support key enterprise-wide functions in finance, operations, and the like. The most important technologies used in enterprise computing historically were IBM mainframes, so this segment is sometimes labeled "mainframe computing." We avoid that label because it is unhelpful for discussing the use of smaller computers, like the PC, in enterprise computing.

Having an informational link to customers through IBM's field sales force gave the firm opportunities. IBM's organization empowered the sales function to make critical decisions about the direction of technical progress. This in turn enabled the organization to pursue numerous internal technical initiatives and choose among them—commercializing some in a customer-friendly fashion, often to the great unhappiness of the technologists whose projects were not chosen. Customers came to rely on this, to IBM's tremendous competitive advantage. IBM's reputation was so strong that "nobody was ever fired for choosing IBM" became a cliché.

The Strengths Were Aligned to a Dynamic Opportunity and Were Sunk Costs

At the time of the launch of PC, IBM's strengths were not tied to a specific technology. Indeed, historically speaking, IBM had already dealt successfully with wrenching transitions in the technical basis of its core business. Among all such historical examples one stood out, the modular platform. This would support its dominant market position for decades. Introduced in 1964, the System 360 modular platform was a unified and largely proprietary architecture. It provided customers with the opportunity to mix and match larger and smaller computers, disk drives, and so forth, as long as these were within the IBM 360 compatibility sphere. This was very valuable to enterprise customers, particularly as it gave them an option to upgrade across a compatible family of computers as their needs changed and thus to preserve their investments in applications programs, data, and so on. The installed base that grew around the 360 architecture and its backward-compatible descendents provided IBM with a substantial competitive advantage. The System 360 grew to become the single-most profitable product introduction in computing, generating more revenue than any other computer product line for more than two decades.

The decision to launch the System 360 illustrates that the firm was exploiting a *dynamic* market opportunity.[16] It was a multimillion-dollar gamble for the firm, opposed by all existing computer product line managers. The firm's senior management supported the modular platform over their objections, and the sales organization directed its improvements toward strategic customer needs. The dramatic success of the 360-based mainframe business shaped the organizational capabilities of IBM thereafter in profound ways. As a direct reflection of the market-driven incentives to maintain and extend the installed base, the sales and service organization assumed a particularly strong role within the firm. Ambitious executives tried to get extensive sales experience, and in the 1970s and 1980s all the CEOs after Watson Jr. and the majority of top management had extensive sales experience.

16. It is beyond our purpose to tell this entire tale. For explanations, see, for example, Pugh (1995), Fisher, McGowan, and Greenwood (1983), Fisher, McKie, and Mancke (1983), Katz and Phillips (1982), Brock (1975), or Watson Jr. and Petre (1990).

While IBM's marketing strengths were a competitive advantage, they were also sunk costs tightly linked to the requirements of enterprise computing. The IBM sales force was structured around the existing body of customers. Compensation emphasized keeping customers and meeting and exceeding quotas for new sales. This oriented employees toward knowing their (typically corporate) customer well. In this case, customers were the information systems (IS) employees at customer firms, who operated systems, and corporate vice presidents, who controlled budgets for purchases. The sales organization was very well informed about the growth prospects in the existing enterprise computing market.

The decision-making processes inside IBM were also aligned to the dynamic market opportunity in enterprise computing. It centralized strategic decisions. A key structure was the CMC (Corporate Management Committee). By the late 1970s this process touched every aspect of strategy in IBM. This centralization shaped many incentives. "Escalating a dispute" to the CMC became a known tactic throughout IBM. Professional reputations at IBM were made or ruined from presenting well to the CMC or from wasting its time. Known for its decisive decisions (especially in the era of Watson Jr.), the CMC would spawn layers of management below it. These layers decided which disputes received attention.[17] It also became famous for its "task forces," which generated reports aimed at gaining more information in an open dispute. These structures were essential to exploiting economies of scope across multiple product lines by coordination from the center.

Consequently, IBM's top managers, in general, aggregated a wide range of customer concerns *and* coordinated large-scale product development strategies for the entire customer base. In the mainframe market, more specifically, this process gave rise to products that were, broadly speaking, high quality, backwardly compatible, technically conservative, and highly priced. Introducing products with backward compatibility (a) supported IBM's competitive position by renewing and extending the installed base and (b) kept customers happy by enabling them to preserve their large local investments.

Though IBM dominated enterprise computing, there were a large number of outside inventors of computer technologies generally. Part of IBM's strategy was to bring all new technologies with general importance to large enterprises into its platform. This called for successfully identifying such technologies and updating the platform to incorporate them. Both tasks were demanding—the first a difficult learning task as it involved both technology and complex customer demand and the second a demanding technical task. IBM could be extremely persistent and foresighted in attempting to bring new technologies into its products (though outsiders groused that IBM

17. This process continued to guide the formulation and implementation of strategy for IBM until an outsider, Lou Gerstner, became CEO in the early 1990s and eliminated it.

often chose to wait and use only the version of a new technology invented in-house).

Success at many difficult tasks contributed to IBM being serially effective at exploiting new market opportunities in enterprise computing. Major technical advances, whether invented inside the firm or not, ultimately became part of an increasingly capable IBM platform that served enterprise customers well. At least one important example arises in computer networking: As the PC wave loomed, IBM was engaged in platform improvements for electronic commerce at enterprise in support of highly valuable applications (e.g., the computerized reservation system for airlines, the automatic teller machine network for banks). These adaptations to a new environment were successful for IBM and its customers. It was with some merit, then, that IBM's employees believed they understood—in ways that others did not—the combination of organizational traits and technological features necessary for commercial success in enterprise computing.

IBM's efforts to compete *outside* its core enterprise computing market had a rather mixed record, with a substantial number of failures. This was not due to lack of experimentation. In practice, IBM relied on its own executives' judgment and its own task forces to decide what to do on the basis of steady experimentation with new technologies, overwhelmingly done in-house after soliciting heterogeneous voices reflecting a wide array of perspectives and financial incentives. Ultimately, some of these initiatives may have failed because the technology was challenging or the customer not well connected to IBM. For example, there was even a single-user computer—not remotely a PC—that did not find much of a market in the mid 1970s. Attempts to make minicomputers and other smaller systems also had long histories of commercial failure.[18]

One particular failure cast a long shadow over many early decisions regarding PCs. The minicomputer market arose outside enterprise computing, and the possibility of future entry and competition from minicomputers against IBM mainframes raised by the Digital Equipment Corporation (DEC) VAX generated a crisis within the CMC. Many in IBM forecasted, correctly, that DEC would move from its dominant position of selling to engineers to competing for IBM's primary enterprise customer base.

The IBM 4300 was the competitive response, which stumbled in the marketplace because its design and marketing were forced to partially align with IBM's existing organization and technology.[19] The IBM 4300 was a compromise between many organizational demands and market needs,

18. We will discuss some of these experiments later, but notable successful experiments included early word processors and some early small computers, such as the 1620. However, IBM's competitive difficulties responding to Wang and other providers of words processors were well known. We will also discuss some of its difficulties with general purpose minicomputers later. See Haigh (2006) for an analysis of IBM's position compared to various initiatives from other firms in office computing.

19. See, for example, Fisher, McKie, and Mancke (1983).

while DEC and other competitors simply responded to market needs. For example, the 4300 was a *partially* IBM-compatible system. At the insistence of the Mainframe Division, it respected some of IBM's existing mainframe technologies. Yet its designers gave up on full compatibility in order to embed technical advances in the system. Pricing was also a compromise, with 4300s below mainframe prices but above competitors' prices, including VAX's prices. Users largely rejected these compromises for competitive alternatives.

Many in IBM's management learned lessons from the 4300's failure that would shape future decisions about scope economies and diseconomies, particularly with regard to the PC. They concluded that IBM's decision-making process itself had led the firm to develop an ineffective product through internal compromise rather than market alignment.

This experience, and others like it, would shape the organizational response to the rise of the PC. IBM's management continued to believe that there often were legitimate issues that required coordination between different parts of IBM, but this centralized coordination process also had some readily apparent drawbacks, notably slow decisions, and the potential for influence costs. Hence, at the dawn of the PC market, there was an ongoing debate inside IBM about relying on centralized coordination for every new opportunity.

4.3.2 New Opportunities That (Soon) Appeared to Play to These Strengths

The technical and market direction of the early PC industry followed an indirect path, which at first obscured its salience to enterprise computing. Perhaps this is systematic. Every Schumpeterian wave begins with something that creates an opportunity for entrants. The PC industry was created by entrepreneurial firms exploiting unserved niches that, at first, were very far from IBM's markets and its strengths. IBM, for its part, at first ignored the PC. After a period of time, the PC began to be attractive to IBM's customers, and IBM then came quickly to view the PC as within the ambit of its long-run strategic market goals.

Before that time, however, the PC industry developed, separately from the rest of computing, a set of rapidly improving technologies and standards and a pronounced industrial organization. The PC markets were organized overwhelmingly along open-systems lines. The most important PC operating system was CP/M, which came from a vertically disintegrated supplier. While Apple produced both computers and operating systems, it encouraged outsiders to write applications. The CP/M community and the community of Apple applications developers was uncoordinated, often descended from hobbyist electronics communities. No single supplier provided the lion's share of proprietary hardware. The microchips came from Motorola, Intel, and others, while the other parts, such as disk drives and monitors, came from an assortment of low-cost standardized suppliers. There were

few proprietary parts or designs. Moreover, the PC was distributed through catalogues and (at that stage) a limited number of independent retailers.

From the founding of the PC industry through 1979, IBM's managers did not have any reason to believe the PC would become a business opportunity within their enterprise computing market goals—and certainly no reason to believe that it could be a threat to the profitability of the mainframe business. Instead of corporations, the customers were hobbyists and gamers, and the largest market appeared to be in the home. From a strategic marketing perspective—as we have seen, the key perspective for long-run planning at IBM—the PC was not relevant to IBM's existing customers and thus represented, at this early stage, neither an opportunity nor a threat.

All of this changed toward the end of the 1970s as personal computers began to find a substantial market inside corporations. Suddenly, the PC was being sold to IBM's customers. This brought the PC within the scope of IBM's strategic marketing goals and raised the question of how to deal with an important, and now salient, new technology.

Just as entrepreneurs had founded the PC industry, other entrepreneurs seeing a new opportunity converted the PC from a hobbyist toy into a corporate, white-collar worker tool. Corporate users bought third-party application software such as VisiCalc, the most popular commercial application for the Apple II. Word processing started to look like a useful technology in bureaucracies, and the leading word processing supplier, WordStar, began improving itself so it resembled an emerging corporate software vendor. The PC attracted attention from programmers with a variety of backgrounds and interests, even some inside IBM.[20] The upshot was that IBM's most important firm-level asset, its marketing reputation, was now salient to the PC. The entrepreneurial creation of the corporate PC, not the earlier creation of raw PC technologies, marked the beginning of the Schumpeterian wave for IBM.

4.3.3 Seeing the New Opportunity

This is when IBM's organizational structures for perceiving new opportunities and challenges cut in. IBM's management supported forward-looking experimentation and outlook, as any firm that seeks to be a strong second should do.

IBM had a group based in Boca Raton whose primary goal was to follow small-system developments and propose responses. In the late 1970s, the managers in Boca Raton took notice of the PC industry.[21] Deliberate

20. Indeed, Lowe and Sherburne (2009, 43) note that eventually IBM CEO Frank Cary expressed concern that the creeping encroachment of the PC into corporate organizations had also infected IBM, and the Apple II has "captured the hearts and minds of IBM programmers."

21. The contemporary media also shaped perceptions. Atari and Apple computer were the darlings of the business press. See, for example, Cringley (1992) or Freiberger and Swaine (1984).

in its activities, the group became intimately familiar with the workings of every available PC, studying the technical foundations of each project and its marketing strategies, such as they were. While Boca's activities were not secret within IBM, they were also not of any importance to managers in any other existing division. Boca's was precisely the type of activity expected of a major firm that was attempting to monitor commercial activity in related markets, and, of course, most of that activity is of limited relevance most of the time.

After considering a variety of actions, Boca arranged for a presentation in front of the CMC with the active support of the CEO, Frank Carey. The leader of the Boca Raton group, Bill Lowe, made one of the most fateful presentations in the history of computing. He was able to persuade the CMC to consider making a significant investment in the PC. Because the group was already intimately familiar with the workings of every small system, both IBM's prior attempts and the PC industry, Lowe's group was able to develop a fully viable plan in a very short time, including detailed estimates for costs and time to completion.[22]

IBM saw multiple reasons for going ahead. IBM's CMC left few paper records, so most of what is known comes from many contemporary second-hand accounts[23] and one retrospective first-hand account from Bill Lowe.[24] These are among the salient issues discussed:

- The PC was about to be marketed to IBM's customers.
- PCs were already easier to use than "green screen" terminals. As an intelligent terminal, the PC potentially threatened IBM's substantial terminal revenues.
- Although PC revenues were still small, PCs were getting attention from futurists and popular trade magazines. This was especially true of the Apple II and the plans for the Apple III. Apple and others were loudly pursuing business users, gaining a hearing if not yet much in the way of sales.
- The PC industry involved a loose collection of entrepreneurial and less-established firms. Lowe argued that the introduction of professional distribution and servicing, which was IBM's traditional strength, could significantly alter the value proposition of a well-positioned design similar to what was already provided.

22. At this time Lowe was systems manager for what was called "Entry Level Systems" and he was later appointed to lab director for the site in November of 1981, before his departure. The account comes from chapter 2 of the book. Hereafter we refer to this as Lowe and Sherburne (2009).

23. This episode has been reported widely, but not the details behind managerial decision making. See, in particular, the accounts found in Chposky and Leonsis (1988) and Carroll (1993).

24. Lowe and Sherburne (2009). We thank Lowe for showing us his original presentation notes at the CMC that reveal much about IBM's thinking at the time of entry.

- Futurists forecast a computing market based on microprocessors. Left unchecked, IBM's own customers might soon ask IBM to design products that worked closely with technical standards from outsiders. As in the minicomputer market, the bulk of the revenue would flow elsewhere unless IBM acted to control standards.

We report these points as if there was significantly more clarity about the future than was possible at the time. There was clearly an element of experimentation in a very uncertain and rapidly changing area. One thing does stand out. IBM clearly understood that there was a strategic choice, not a strategic necessity, to enter the PC industry. There was no then-current competitive threat to its existing business from the PC. The competitive challenge IBM faced in its core mainframe business arose (a) a decade later and (b) much more from firms in the minicomputer or workstation markets than from PC firms.[25] Nor was there any immediate prospect of complementarity between PCs and corporate computing in 1980. Today, one of the many functions of PCs in large organizations is to access enterprise applications. Many observers, including IBM, could see that coming, and, while the timing of that complementarity relationship was uncertain, in 1980 it was clearly not in the immediate future. Instead of representing either an immediate complement to IBM mainframes or a near-term threat, the PC represented a long-run growth opportunity for IBM. Few at the time forecast as rapid growth for the PC as it has in fact had, but many observers saw that this was going to be an important technology in enterprise computing and a sizable revenue opportunity.[26]

4.3.4 New Opportunity Called for Open-Systems Approach

While entry into the PC industry was attractive to IBM, it involved important changes in strategy, enough so that there would be important organizational implications as well. In introducing the PC, IBM moved away from established processes supporting supply of existing products, making the IBM PC Division into an effective open-systems supplier. To understand why this move ultimately created scope diseconomies with the rest of IBM's business, we first examine what it called for in the PC business.

There were established standards in the PC market, like CP/M, VisiCalc, and the Intel 8088 microprocessor, but there was also clearly a window of time during which a new standard could be set for a corporate PC. As IBM began to consider entry, that window was clearly beginning to close. A number of corporate PC efforts were announced, including one from Apple

25. For an elaboration of this argument, see Bresnahan and Greenstein (1999).

26. In short, precisely because the attempt was not seen as directly related to the future success of IBM's core business, it was shielded from influence by existing organization and structure. As we argue, as soon as this perception began to shift, the division's independence came under attack, and that attack illustrates the organizational limits of economies of scope.

(the Apple III) and a new version of CP/M. Too long a delay could mean that even IBM's formidable reputation with corporate customers would be insufficient to overturn a newly established standard for a corporate PC. Timely entry would give IBM the opportunity to draw on the marketing advantage of its formidable reputation in setting an IBM PC standard.

There are a number of general observations about open-systems standard setting that mattered for IBM's entry that we shall reuse in our second case study as well, so it is worth stating them generally. First, entrepreneurial innovators are drawn to the vertical disintegration at the heart of open systems organization because (a) it permits them to specialize in one or a few technical areas, levering their resources by using technologies supplied by complementors, and (b) because the flexibility and modularity of open systems permit rapid, uncontrolled exploration to learn by market experiment which product features matter most to customers. These two features are, of course, radically different from IBM's use of a vertically integrated structure to implement a strategy of managing and controlling product improvements.

Second, while entry into a particular component market of an open system can be quite easy if done during a narrow window of time, it can also be prohibitively difficult if attempted earlier or later. This is particularly true of the "platform" components around which standards are set. At ordinary times, users and developers will tend to choose the old standards, but narrow windows of time appear in which new standards can be set. An entrant who can attract a large volume of business quickly will be particularly well favored in an effort to set a new standard. In his first book, Bill Gates summarized this part of standard-setting analysis, saying, "Both timing and marketing are key to acceptance with technology markets."[27] His analysis followed from leading industry participants' analysis of standard-setting situations, which closely parallels the economic theory of standards.[28]

Entry into a particular component market in an open system is possible at particular times. Nonetheless, even open systems can have high entry barriers for an entire de novo system, just as proprietary systems do. The difference arises because a systems entrant also needs to replace all the complementary components. Whether IBM or entrepreneur, an entrant must work with the best suppliers in all the component markets. Once again, this supply behavior contrasts sharply with IBM's traditional vertical integrated structure.

Finally, uncontrolled outside technical progress is inevitable for any firm in an open-systems industry. Rather than attempting to manage technical progress and innovation with a control system, an open-systems firm will see constant outside innovation whose form, timing, or direction it would

27. Gates, Myhrvold, Rinearson (1995, 135).
28. See David and Greenstein (1990) and Bresnahan and Yin (2006).

not necessarily have chosen. To accommodate that outside technical change, an open-systems firm makes public the information outsiders need to work with its products, cooperating with all comers without prior vetting. This, too, is in sharp contrast with IBM's traditional model of consultation with customers long in advance of bringing new technologies into its platform.

This set of market principles applied to IBM's potential entry as a strong second. Famously, IBM aligned the strategy of PC unit with the market competitive situation by adopting an open-systems strategy and organization. This had important implications for the PC's subsequent history that we return to next.

4.3.5 A Firm within a Firm

The IBM PC experiment had several novel—to IBM!—features. Among them, the CMC authorized the division in Boca Raton to use an entirely different organizational and business model than other IBM divisions, one much more aligned to open-systems industries. In addition to formal approval from the CMC, the PC group had the CEO's protection for acting in ways that did not follow "the IBM-way," as understood by IBM employees elsewhere within the company.[29] This made the IBM PC Division into a highly separate firm within a firm.

The CEO created an independent division—the term inside the company was an *independent business unit*, or IBU—with considerable autonomy. Boca Raton's managers were also given a direct reporting line to the CEO. When others in IBM tried to challenge the PC group, Carey and then Opel both backed the PC group's decision *without* calling for any presentations at the CMC, and remained committed to the schedule of review every few months.[30]

This structure also departed from a core social and procedural norm at IBM, one that supported transparent and ubiquitous internal accountability. IBM was a company where everything was inspected or potentially subject to inspection, formally and informally, at all times. Said another way, all employees expected to be held accountable for achieving targets, and

29. The protection even continued after Frank Carey stepped down as CEO in January of 1981, but remained as Chairman of the Board. John Opel became CEO and continued with the policy, though, as we shall see, after major diseconomies of scope between the division and other parts of IBM could not be controlled, began to modify it.

30. How was this commitment communicated? With a normal initiative other senior managers within IBM were allowed to raise objections and, in so doing, initiate a process to bring issues to the CMC. Frank Carey let it be known in advance that this procedure would be modified for the PC initiative—ostensibly in light of its tight deadline and importance of the initiative to the senior management. The rule was thus changed: As always, any IBM senior manager was allowed to raise an objection about the PC initiative. However, as a new condition, they would be required to travel immediately to headquarters in Armonk (potentially even the next day) to explain or defend their objection or both. Consequently, and in sharp contrast to all other major initiatives at IBM at the time, not a single objection was brought to the CMC for consideration regarding the PC over the next year. See Lowe and Sherburne (2009).

managers anticipated inspecting and controlling processes with the intent of reaching targets. Against that history, the protection for the IBU was a dramatic departure. No division had ever been given discretion to make decisions over a time period of medium length without the potential for immediate review.[31] Hence, the PC group was given a license to de facto "act like an entrant."

IBM's senior management gave the IBM PC Division time-to-market direction that departed strongly from IBM norms but was entirely aligned to the problem of a PC market entrant. Most dramatically, the managers in Boca Raton were given an executive mandate to produce a design for commercialization in less than a year—by the summer of 1981. There was no precedent for such speed at IBM: Some observers speculated that designing a PC using IBM's normal engineering approaches would involve a two- to three-year decision-making cycle.

The Boca design team made many decisions for design, development, and production that departed radically from IBM norms. Following other early PC industry firms, it used inexpensive (instead of frontier) components, even in key places such as the microprocessor.[32] IBM also sourced parts from outside suppliers for things such as memory, disk drives, and printers and, in general, used off-the-shelf parts, except in a few key places such as the ROM-BIOS, which was a proprietary IBM design. Breaking with precedent, IBM also invited other vendors to make compatible software and peripherals for the new PC. To do so, it made many technical details about its PC available to numerous other firms, which was yet another break with IBM's general practice of secrecy.[33] In short, the IBM PC Division was acting like an open-systems company, not like IBM.

Many of the preexisting parts were also chosen because they had passed marketplace tests and could easily pass internal IBM reliability standards. The rapid and incremental design was also reasonably well aligned to the needs of the PC market at that time, since it meant that the IBM PC was compatible with, or easily made compatible with, many leading components in the PC industry.

One tension arose in the early planning for production. The PC group had avoided using internal supply if the costs were not the lowest. The PC group

31. We thank Jim Cortada for pointing out how important was this particular departure from norms.

32. IBM chose the Intel 8088 over the superior and already existing 8086. It came off the shelf and permitted hardware components from existing CP/M machines to be used in IBM PCs.

33. They key word in that sentence is *invited.* By this point there was also a third-party software industry for IBM mainframes, but the relationship between those firms and IBM had emerged after numerous ups and downs in cooperation. The relationships with PC software firms looked quite different. Though IBM attempted to supply some application software, IBM took actions, such as releasing technical specifications, to overcome some of the existing mistrust. These differences were widely recognized at the time. See the accounts in Chposky and Leonsis (1988) and Carroll (1993), for example.

made many enemies at the divisions that were turned down. Even when divisions won rights to supply parts, it did not earn the PC group many friends because the group chose between internal suppliers and external suppliers based on speed and technical merit.[34]

Boca Raton—in keeping with its mission to "act like an entrant"—also did not depend on IBM's own distribution network, instead arranging for distribution through third-party retailers, Sears and Computerland. This brought the IBM PC into a distribution mode suitable for the individual end user, rather than the corporate computer department, which was closely linked to the IBM field sales force. This decision was aligned to the PC marketplace but once again departed significantly from IBM past practice.

(Unimportant) Diseconomies of Scope Emerged Quickly

Our theory is one in which shared assets can create either scope economies or scope diseconomies. At least initially, the key asset of market reputation provided considerable scope economies to IBM's PC Division. Customers in corporations turned to IBM for a PC, and application developers wrote for a platform whose success they forecast.

Meanwhile, at this early stage there were few costs—and few benefits—for existing IBM divisions from the success of the IBM PC. This followed from two things. The PC was, in the short run, neither a complement nor a substitute for IBM mainframes. Second, any internal impact was minimized by the choice to structure the PC business as an operationally distinct unit; its doings were not apparent *to other divisions* in the short run, particularly while the division was small. It appeared to the other divisions as either an irritating departure from norms or a firm-wide success or both.

What little diseconomies of scope arose were, at first, primarily a problem for the new division. Any forward-looking organization must be prepared to bear some transitory costs and these particular costs were small compared to the reputation benefit. They did, however, forecast some of the larger costs to follow. The few costs of being inside IBM that struck the new IBM PC Division were reputational costs associated with the parent companies long-time commitment to proprietary systems and to exploitation of outsiders' inventions as a strong second.

IBM sought as partners the leading suppliers of key PC complements. They succeeded in signing up the foremost makers of the microprocessor (Intel), programming tools (Microsoft), and spreadsheet (VisiCalc.) Yet IBM's reputation as a proprietary systems company led to problems negotiating with the foremost makers of the leading operating system (CP/M) and

34. This was not the norm in mainframe production: Throughout the 1970s, the mainframe group had covered everyone else's variable expenses, overhead, and cost overruns in a single company-wide profit statement. When the PC group eventually enjoyed enormous profits, several of these component groups raised questions about whether the PC Division profited by not accepting standard practice for allocating the overhead of other manufacturing units.

word processor (WordStar). The entrepreneur selling CP/M was concerned that working with IBM would simply lead to the divulgence of proprietary knowledge to IBM. The entrepreneur at WordStar saw a conflict between an IBM PC standard and a standard for writing corporate applications (much like the modern standard around Microsoft Office) that would be set by his firm. Negotiating around these conflicts, even if it were possible, would have delayed introduction of the IBM PC, which was in a race to the market.

Failing with its first choice for an operating system partner, the team from Boca Raton turned to its next choice, a clone of CP/M from Microsoft (which bought the clone for the occasion). At this stage, IBM was partnering with a motley group of PC entrepreneurs, drawn, like many firms in the industry, from the margins of the broad computer and communications industries. By traditional IBM corporate-marketing standards, Microsoft was a sketchy partner.[35] Yet this was nothing next to IBM's other second-choice compromise: the supplier of IBM's initial PC word processor was not market leader WordStar, but a quickly written (and later quickly forgotten) product from an entrepreneur previously known as "Captain Crunch," a notorious "phone phreak" (or telephone hacker).

4.3.6 Problem Was Not Not Knowing How to Enter New Markets

IBM's entry into the PC market shows that the firm—or at least the firm-within-a-firm—knew how to enter this new market. Rather than displaying the behavior of a backward-looking firm that only understood its old market, IBM adapted to the strategic requirements of its new market.

Many observers, using an ex post perspective, have said that IBM was unwise to source key components, like the OS and the microprocessor, from outsiders. To be sure, the vertically disintegrated and open PC industry was highly competitive, and IBM's participation exposed them to that competition. Yet their decision to enter as an open-systems company was essential to aligning to the new opportunity. As we shall see, IBM's competitive problems in the PC industry arose partially because it was a highly competitive environment and partially because IBM's organization retreated from the independence and alignment of the PC Division after diseconomies of scope emerged.

4.3.7 Success, Later Reversed

The launch of the IBM PC and its sales for the next few years went spectacularly well, far better than any official prediction had dared to state

35. The PC group procured their operating system from a Seattle-based company (Microsoft) consisting of a thirty-two-employee firm when IBM first called in July of 1980. Microsoft was managed by a young Harvard dropout from a local family (Bill Gates), his teenage techie buddy who would soon quit for health reasons (Paul Allen), and a Harvard friend and Stanford MBA dropout (Steve Ballmer).

prior to its launch.[36] This was an enormous accomplishment. The IBM PC became the standard design for personal computers. Complementary investment from many, many, companies flooded to the IBM PC, giving it new software, new compatible hardware components, new programming tools, a new retail sector, and a set of information institutions, from magazines to custom software houses, help users take advantage of it. That kind of complementary investment is the great benefit of open systems, and it led IBM, the dominant firm in the older segment of the computer industry, to build what would have been (if it were a stand-alone firm) the world's third-largest computer company, the "IBM PC company," in just a few years.

IBM also faced the difficulties associated with an open-systems business. There were a number of firms selling clones of the IBM PC. Since the industry had open systems, these clones could take advantage of all the complementary investments. Thus, to make its initial market success permanent, IBM would need to, at a minimum, maintain its role as the dominant firm in making the PCs themselves. Had this been accomplished, it would have given IBM a market position like Intel in microprocessors today; that is, subject to some competition from clones but continuing to earn large returns from controlling hardware architecture. IBM also could aspire to eventually making the PC less of an open-systems market; that is; taking a position where it could dictate the direction of technical and market progress to its complementors. Had *this* been accomplished, it would have given IBM a market position like Microsoft in operating systems today; controlling standards for the entire PC industry and earning enormous returns on that.

IBM did not accomplish either of those goals, as is well known. Both contemporary observers and later scholars have correctly attributed that failure to IBM's management decisions in the PC industry. IBM did not have a "market orientation"—in the language of important industry complementors. This led to a series of missteps that led to a series of setbacks. Hardware technical leadership in computer design was taken from IBM by clone manufacturers beginning in 1986. IBM attempted to move the industry to a new, superior, hardware design with proprietary elements in 1988, but could not get market acceptance. Finally, there was a successful effort to redefine the PC industry around a proprietary standard. So that goal was possible, but it is Microsoft Windows, not any IBM product, which defines the PC industry standard today and has since the early 1990s.

A natural conclusion would be that IBM was simply an old-style firm and

36. Even at this early stage, existing organizational perceptions shaped forecasting. Boca Raton's managers believed the market potential was large, but dared not say so in their first presentations to the CMC in deference to the prevailing sensibilities. The division's official forecast for sales was deliberately chosen to not exceed the total number of IBM worldwide installations at the time, just over two hundred thousand. In fact, sales of the first models eventually exceeded several million units. See Lowe and Sherburne (2009).

could not manage in this new environment. That turns out to be incorrect. IBM was, as we have seen, capable of managing in the new environment. We now turn to the sources of IBM's retreat from that competence. They lie in powerful scope diseconomies between the longstanding mainframe business and the new PC business in IBM. They created severe problems of misalignment between the IBM PC Division and the PC marketplace long before the success of the clones or the failure of IBM's efforts to install a proprietary standard. IBM's tremendous lead in the PC market after its initial introduction carried the firm for a while, but the conflict that shortly emerged between the mainframe and the new effort left it doomed.

4.3.8 Problems of Alignment to Both Old and New Business

IBM's senior management would retreat from the idea of having a division organized along open-system lines. Understanding why is the key to understanding IBM's later troubles in the industry.

We will interpret events in terms of a firm-wide problem, in light of unavoidable diseconomies of scope. Senior management faced the firm-wide costs of coordinating the use of shared assets in two divisions in two distinct market environments, where one division is well aligned to the established market, while the other serves the new market—to which it also seeks to become well aligned. Forcing the new division to coordinate with the existing imposed costs on the new, and these costs contributed to the new division's decline.[37]

We recount these events in light of many prior portrayals. IBM's PC troubles attracted considerable press attention after 1988. IBM's financial distress in the 1990s attracted attention and had huge implications for the computing marketplace. In addition, there were many arresting stories written about the seeming absurdity of IBM's managers' actions in the face of the overwhelming evidence of crisis in the early 1990s, which later culminated in a changing of CEOs. In comparison, we focus on earlier events between 1985 and 1988, which did not receive as much attention.

While the later events are certainly engaging illustrations of behavior at a formerly dominant company going through a crisis, they provide little illustration about the foundations for the organizational limits of economies of scope, which is our goal. We accordingly concentrate on earlier events. In doing so, we also shed light on what later observers missed and misunder-

37. Notice here the crucial importance of the distinction between assets that are *necessarily* shared and those that are optionally shared. Two divisions could conceivably choose to share an asset—say, a manufacturing facility—despite the fact that the decision creates organizational costs, because the benefits of sharing outweigh the costs of duplicating the asset. But we argue here that there are some assets that are necessarily shared—in the IBM case the reputation of the firm—and that the existence of these assets forces the firm to incur the costs of organizational diseconomies of scope.

stood as irrational behavior, and on the factors that made the latter events so severe.

Tensions from Aligning with Two Opportunities

The firm-within-a-firm came to an end in early 1985. Less than five years after agreeing to initiate the project, the IBM PC Division was completely brought back to the familiar IBM style of management, with no independent decision making and limited discretion for the division. How did that come about? We have already noted some small tensions within IBM over the structure and independence of the IBM PC Division. Those could easily have been overcome in the interest of having a new ongoing success in a growing market. But as the IBM PC Division grew, its behavior as an open-systems company began to influence IBM's market reputation. This led to severe scope diseconomies.

An example of the market reputation tension arose from the failure of the IBM PCjr, a smaller machine than other early IBM PCs that was aimed at the home user in an effort to increase the size of the market beyond corporations with a compatible design. This was launched in 1983, and the focus of many news stories throughout 1984. The product did not sell well and a great deal of inventory had to be written off. It was also a source of much public embarrassment for IBM.

There were many causes behind the PCjr's failure, both immediate and deep. The immediate causes included a poorly designed keyboard. Known as the "chiclet keyboard" for its diminutive size, it was ridiculed inside and outside the company. While cheaper than other IBM PCs, the PCjr was expensive for a home machine, and IBM's brand name mattered less there. To gain some market segmentation, the PCjr was not fully technically compatible with the regular IBM PC for business; both IBM and others learned a valuable lesson about open standards and universal compatibility from it.

The specifics of these product problems are less important than the inevitability of some problems given the IBM PC Division's open-systems supply stance. Like any firm in an industry like the PC, this one experimented with balancing new designs, new choices for suppliers of parts, educated guesses about the nature of demand, and compromises between cost-saving goals and desirability-enhancing features.[38] The PC group also came close to operating according to the norms of an entrepreneurial open-systems enterprise by emphasizing quick decisions, resolving disputes through verbal debate, using minimal documentation, and deliberately taking risks. Thus, *some* failure was inevitable, a byproduct of the PC group's attempt to take market risks in an open-systems market.

38. IBM was hardly alone in having some failed experiments. Apple was watching chips pop out of the Apple III's unhappy, overheating, hardware design, Microsoft's effort to write (rather than buy) an operating system flopped in the market, and so on.

The PCjr was more important as a source of internal trouble for IBM's PC group than as a marketing failure. To put it in perspective, expectations were out of scale with reality. A small firm, like most in the PC industry, with the sales of the PCjr would have considered it a success. Yet the highly publicized failure was important in creating arguments against the independence of the IBU.

As long as it succeeded, Boca Raton was safe from second-guessing. But publicized errors made it vulnerable to assessment according to established IBM norms. For example, when the PCjr did not generate large home sales, the PC group was accused of not studying and understanding its market using appropriate marketing techniques. A couple of years later, when quality problems arose at the (sole) supplier of hard drives for the PC/AT, which affected the quality of the whole product, the division was accused of violating company norms for having second sources for key components.

These disputes went beyond corporate political infighting to become a question about the key shared assets at IBM, and its reputation for reliability. The internal perception began to arise that the PC Division's failure to use IBM's existing organizational competencies was hurting its performance. At the same time, others inside IBM began to believe that the PC Division risked actively harming the core mainframe business.

In the view of the established divisions of IBM, the well-publicized errors at the PC Division diminished years of careful image building for all of IBM, hurting the firm's reputation for reliability—something that was essential to the marketing of large systems.

The specifics of these examples are less essential than their general feature. Once the division had any failures that threatened the reputation of the larger organization, senior management heard about it from other parts of the organization, including notably the profit-heavy mainframe division. Although the failures and the subsequent backlash do not make change inevitable, they do make senior management aware of the organizational costs. This meant that the management would have to (at a minimum) consider changes to the formal assignment of authority or other actions to protect its asset—its reputation.

A second set of problems arose with regard to distribution. With IBM's field sales force and the PC Division's distribution partners (Sears and Computerland) selling to the same customers, channel conflict was inevitable. It was also new. No IBM division had ever before been given the autonomy the PC Division possessed. Before this, the field sales force had been responsible for "account control."

Models of channel conflict often portray it as a form of cannibalization. In this case, cannibalization played little role at a firm-wide level. Rather, channel conflict was a grubby contest about the flow of money. By 1984, the PC Division had revenues of more than four billion dollars—making it the third-largest computer company in the world, had it been a stand-alone

company. The issue arose because a significant fraction of that revenue was not contributing to sales commissions. Both the Sales Division and Sears could sell PCs, the internal IBM divisions received the PCs at a discount. The large accounts were held by the Sales Division, but smaller firms and independent buyers could purchase from Sears. Thus, IBM had an internal division competing with an external company for the sale of its product. A complex set of rules determined who could make a sale, who would get credit (and commissions) for a sale, and so on. There was even conflict over "grey market" sales; that is, authorized dealers reselling machines. To an open-systems company, to first order a sale is a sale; to a proprietary systems company, a sale without connection to the customer involves loss of control.

Once again, the specific feature of each aspect of channel conflict is less important than the general lesson behind it. IBM's distribution channel relationships were a key firm-wide asset, and the PC business and the rest of the company had powerful and misaligned incentives regarding how to use it. That does not make change inevitable, but it puts the costs in front of management, this time with the powerful Sales Division in conflict with the PC Division.

In brief, issues about changing the structure of formal authority over the firm's market reputation and over distribution were inevitable once the PC Division demonstrated any significant commercial success. The PC Division, to be an open-systems success, had used IBM's core firm-wide assets in novel ways. When that activity grew, it began to impose costs on established divisions. The situation could not persist unresolved. The scope diseconomies between old business and new did not compel any particular resolution, but they did compel some resolution.

4.3.9 Avoiding Scope Diseconomies

Senior management did react to these costs, and rather quickly. In 1983, less than two years after launching its first product, the PC Division was reformed and renamed the Entry Systems Division (ESD), and it lost its direct reporting relationship with CEO Opel. Estridge, the group's director now reported to a supervisor who reported to a CMC member who reported to Opel. While the division retained its discretion over forecasting, pricing, and servicing, this change began the integration of Boca Raton back into normal IBM operating procedures.

This was not just window dressing. It affected daily operations. Rather than running the division directly, Estridge began to spend several days a week in Armonk, taking care of internal political and operational issues, gaining approval for actions, leaving others in charge in Boca Raton of many details. He was appointed IBM vice president in 1984. Through much of 1984, he fought attempts to make the PC a part of an office automation strategy and attempts to coordinate distribution of the PC with other parts of the company.

In January of 1985, a little over three years after first selling an IBM PC, Estridge lost this broad fight, and the National Distribution Division gained control over retail dealer sales of all PC products. That officially ended the experiment with the IBU, though, as noted, many aspects of the IBU had ended some time earlier.

These formal changes involved more than just assignment of divisional responsibilities. Key personnel and geographic proximity were altered. Not long thereafter, Estridge was moved to another position.[39] The original manager for Boca Raton, William Lowe, was moved back as president of ESD.[40] Along with Lowe's reappointment came a reporting structure for the PC Division similar to those used with other IBM divisions. In June, two hundred of the top executives were moved out of Florida and to a facility near Armonk.[41]

While few written records about the CMC decision were kept, it was clearly quite controversial with employees in Boca Raton. As with the decision to initiate the project, there are several contemporary secondary sources and one primary source for understanding its change. It is clear that the conflicts among divisions were a major reason for these organizational changes, and that making them reduced scope diseconomies.

History does not record whether this was a hard-headed calculation by IBM's senior management that costs would be lower and revenues higher because the recoordinated organization was optimal for their strategic goals or whether it was the outcome of a wasteful internal political fight, or both.[42] And a counterfactual assessment of what would have happened had IBM gone down another path would be extremely difficult. Our core point is that scope diseconomies compelled some sort of compromise between IBM's new and old businesses in order to avoid internally inconsistent uses of investments in the firm's key assets.

39. Estridge was given the title Vice President, Manufacturing, and a job involving worldwide manufacturing. Most employees within the company and IBM-watchers outside the company viewed it as a demotion, though, characteristically, Estridge was good natured about it. Tragically, several months later, on their way to their first vacation in years, he and his wife were killed in an air crash at Dallas airport.

40. Lowe had spent the last few years as a General Manager of IBM's facility in Rochester, Minnesota, and then as Vice President, Systems, and later, Development, for the System Products Division in White Plains, N.Y. Prior to moving back to Boca he was Assistant Group Executive for the Information Systems and Communications Group, a position he assumed in August 1983.

41. Lowe never bought a house in Florida after arriving in March. Later, most observers inferred that Lowe took the position in Florida knowing an announcement about a move might come soon thereafter.

42. In this case, a number of historical circumstances meant that internal political power shifted to the existing business. By the mid-1980s, thanks to the macroeconomy, the mainframe business was booming and the disaster of minicomputer entry was forgotten. The mainframe organization looked great; we further note that it would have looked far worse if the conflict with the PC division came in 1978 (i.e., if the macroeconomy of 1985 had looked like it did in 1978).

4.3.10 Smothered by Support from the Parent Company

IBM's top managers imposed a structure and a planning process on the PC Division in 1985 that coordinated its decisions with other parts of the firm. As desired, it resulted in decisions screened by the CMC and fostered a consensus-building process aimed at sampling the opinions and judgments of the other parts of the company and of customers.

In this section, we shall see how the traditional IBM supply organization was stunningly misaligned to an open-systems environment like the PC market. For the next three years, from 1985 to 1987, the PC Division acted like any other division of IBM in several senses associated with preserving key firm-wide assets. New PC products were released only after internal consultation and deliberation. New products were technically reliable, priced with high margins, and introduced later than competitors. Langlois (1997) suggests that this reflected classic cognitive framing problems on the part of IBM's managers and the fact that strategic models derived from the mainframe business were inappropriately applied to the PC business. Another possibility is that the PC business suffered from exactly the kinds of costs identified by Rantakari (2008), and was simply subordinated to the strategic needs of the mainframe business. Whatever the cause, the results were dramatic.

To some degree, IBM could get away with this in the PC market. It had a very valuable brand name, and was able to sell many PCs even though there were alternative IBM PC compatible products at lower prices. As a result, initially there was only weak negative market feedback about the changes in IBM's practices, and certainly this feedback was not at all visible in PC product revenues.[43] There were no IBM actions to generate strong negative marketplace reactions until the PS/2 rolled out in 1988.

However, unfortunately for IBM's commercial prospects, potential buyers did not *need* to wait for the results of all this internal coordination because they had access to alternative compatible products with similar functionality priced at low margins. Thus, IBM could not *compel* customers to follow its technical lead. Clone hardware products began to innovate faster than IBM could (the first Intel 80386-based PC was a Compaq machine, not an IBM one).

Despite its lack of a mechanism to impose leadership on the PC industry, and despite its inability to, IBM launched a major long-term initiative: the leapfrog redesign of the PC. An important part of this was a joint venture

43. As it turned out, immediately after the changes in 1985 there were not many negative revenue events with clear association with the new strategy. The PC/AT did well in 1985 and 1986. The negotiations with Microsoft also went according to plan in 1985, and its problems later were thought to be a symptom of Bill Gate's savvy, not problems with IBM's strategy for coordination. There was one negative market event. It was the PC/XT rollout, which went badly, but it had been planned for some time, so the changes post-1985 were not held responsible.

with Microsoft for a new operating system. These initiatives failed dramatically.

The PC organization suffered under the concerns of the rest of IBM. Most critically, meeting demand elsewhere in the firm, the PC revision reverted to IBM's historical stress on proprietary products, a design decision that met with approval from senior management. The firm announced in 1988 a 386-based machine with a proprietary architecture—the IBM PS/2 with microchannel architecture (MCA). In an effort to compel the transition, it simultaneously announced that the roll out of the PS/2 would be accompanied by the discontinuance of IBM's best-selling product at the time, the PC/AT, which was based on the 80286.[44]

The PS/2 might have sold well if it had had new or different features that *users* actually wanted; MCA was not such a feature. The MCA was seen as highly valuable by internal managers from the Large Systems Division. With MCA, and related software changes, PCs could be used to access data on large systems. The use of PCs for that purpose, however, was still in the future, and not an immediate market need. Rather than undertaking changes that were aligned to the *distinct* needs of the PC market, IBM undertook changes suitable to a new vision of an all-computing market, which, unfortunately, did not yet exist. What was lost was the urgency of the competitive situation of the open-systems PC: that was something that could not be learned quickly, as we have pointed out, and it was not appreciated by an IBM with a prospering mainframe division in 1985 to 1986.

The introduction of IBM's ground-up redesigned and proprietary PC was far out of sync with the open-systems PC market. Open systems markets absorb incremental improvements in components very well, but leapfrog designs to a proprietary architecture impose switching costs on customers. By 1988, IBM's actions had fostered the perception that IBM's managers just did not understand the situation. In the summer of 1988 the clones declared independence from IBM's designs by combining to form the EISA, a 32-bit architecture that respected backward compatibility with prior IBM designs but without the MCA.[45] The announcement openly rejected IBM's stewardship in planning upgrade cycles for the IBM-PC-and-compatibles industry.[46]

44. Carroll (1993) attributes the decision to remove the PC/AT from the US market to Lowe alone. As evidence for this interpretation, he notes that just before this decision, Lowe's former boss received a promotion to head IBM-Europe, where he did not discontinue the PC/AT and it continued to sell well. Carroll's interpretation must be an overstatement. Keeping with standard practice at IBM at the time, this decision must have been reviewed by the CMC and the divisions related to distribution of products (and either party could have objected if they understood the ramifications).

45. It was sponsored by AST Research, Compaq, HP, NEC, Olivetti, Tandy, WYSE, and Zenith Data Systems.

46. The principal difference between EISA and MCA was that EISA is backward compatible with the previous bus, while MCA was not. Computers with the EISA bus could use new EISA expansion cards as well as old expansion cards. Computers with an MCA bus could use only MCA expansion cards. Ironically, this fight was largely symbolic and short-lived. A few years

The market events of the summer of 1988 are a long story and one that has been told often in the press and many books. We do not disagree with the generally well-known facts about the severity of the crisis at IBM after 1988. Contemporary observers understood its importance and newspapers commented on it. And the rise to market prominence by other PC manufacturing firms, those whose strategies were consistent with the PC market environment, is correct.

Our point is that IBM's loss of leadership in PC technology, if not its exact timing, was rendered inevitable by earlier changes in organization. IBM's earlier success in the PC industry had been contingent on the independence of its PC Division. Once that independence was gone, IBM was overtly sharing key firm assets between PC and mainframe divisions in an effort to achieve economies of scope. But this was extremely difficult; indeed, despite the close connection between the two related divisions, the effort to gain cooperation between large systems and the PC made the firm entirely misaligned to the burgeoning PC market.

It takes nothing away from the market success of the PC industry to point out that, after 1985, IBM imposed extra costs on the PC business by structuring it in a way that altered the new business to suit the established one. Managing the challenges of the market environment in PCs was already hard, as IBM's own experiences prior to 1985 illustrated. The changes after 1985 added an additional cost to the challenges at the new division—that of coordinating with the rest of IBM. This did not have to lead to failure with regard to any particular decision, but it made failure more likely if the delays caused problems and if the marketplace did not value the benefits of increased coordination. Both happened rather quickly in the event.

Recognizing the early loss of IBM's alignment to the PC industry helps understand the history in another important way. The latter part of this epoch became cemented in the popular imagination, because, for their sheer drama, there is nothing equal to the events surrounding the divorce between IBM and Microsoft—embodied in meetings between Gates and Lowe, then Gates and Cannavino, Lowe's successor. The latter meetings received enormous attention at the time.[47] They also coincided with the rollout of OS/2 and Windows 3.0, two products that would compete directly. The outcome reinforced the perception that IBM was caught between a rock and hard place.[48] Many contemporary papers treated the divorce between Microsoft

later, a new technology called the PCI bus, sponsored by Intel, came into use in combination with the old EISA bus.

47. For *all* the details, see the latter half of Carroll's (1993) book, which is a full account of what he followed in detail as the *Wall Street Journal*'s reporter.

48. That is, IBM either continued contracting for an operating system from Microsoft or it organized its own software project in-house. No option looked attractive or free from large risks. The firm's managers had vacillated for years between these options before the divorce settled it, and when it compared with Microsoft directly the market's reaction was decidedly negative.

and IBM as if it were the downfall of IBM. Many focused on the question of bad-faith bargaining on Microsoft's part.

One important implication of the IBM/Microsoft dispute is that Microsoft, unlike IBM, was ultimately able to impose a proprietary standard on the PC industry. Microsoft, unlike IBM, did not assume that it could act like a firm managing a proprietary standard until after it had succeeded in imposing one. In the 1980s, Microsoft's decision making remained attuned to the (then) open-systems nature of the PC industry.

In summary, popular reports date the beginning of the crisis to events after the clones declared their independence. We think that popular account is misleading. We see many antecedents in earlier events. Our framework offers an alternative interpretation of the likelihood, timing, and severity of these events. First, many issues had appeared far earlier than 1988.[49] Second, over the late 1980s, IBM lacked an independent manager in the PC Division who could make deals with Microsoft in real time. It also lacked a focus on the immediate market needs of the PC market. These made the division a sitting duck for a more decisive firm that was better aligned to the market (i.e., a firm with a clear view of the needs of the marketplace and the capabilities to address those needs quickly), such as Microsoft, which ultimately took control of PC standards.

IBM retained its leadership in mainframes throughout the early period we emphasize. Late in the 1980s, it began to be clear to some market participants that that position would weaken. As smaller systems began cutting into large-system demand in the early 1990s, this competition became apparent to the large-systems managers at IBM who had denied the possibility throughout the 1980s.[50] Leadership in the proprietary mainframe platform would not be lost, but it would be much less valuable. Over the years, IBM would choose an open-systems approach even for enterprise computing, becoming a leader in a profitable though inherently limited niche, providing very expensive servers, and becoming a leader in the growing and much more profitable activity of being a service firm.[51]

The later decline of IBM's traditional business takes the focus away from

49. Aside from those already mentioned, Lowe's own accounts make it clear there were tensions before 1988. For example, Lowe and Sherburne (2009) highlight initiatives by the Mainframe Division to support an open UNIX platform in an alliance with DEC, which were initiated for political appearances. These were understandably greeted by Microsoft as contrary to their interests, fomenting mistrust between Lowe and Gates in particular. They are another example of the misalignment between the PC Division's strategic interests and the strategic interests of other parts of IBM.

50. Contemporary reports that emphasize technical advance have a tendency to observe the coming of an event before commercial markets actually act on it, dating the revolution's arrival by a technology's arrival instead of a market's activity. The profitability of a company is much more sensitive to the latter. Our dating of the *actual* change in market demand is in keeping with our prior empirical studies of the competition between legacy large-system users and the emerging client-server technologies. See Bresnahan and Greenstein (1996).

51. Gerstner (2004).

the deeper lesson. The IBM example illustrates the critical role of organizational scope diseconomies in fostering misalignment. It was ultimately impossible for the firm to manage both the PC business and its existing large-system business within the same organization. Conflicts arose over the deployment of fundamental strategic assets, IBM's reputation as a firm, and its relationship to its corporate customers. The conflicts were fundamental, entailing not only the marketing, distribution, and sales functions in a narrow sense, but the engineering and product design functions of the two businesses. Where the open-systems PC business called for quick, "good enough" new products compatible with PC-market competition and innovation, the existing proprietary large-system business needed predictable product upgrades, compatibility in connection between large-systems and small-systems, and high reliability. There was no resolving this conflict.

More to the point, the scope diseconomies inside IBM reflected a fundamental conflict over key firm-level marketing assets. The PC Division's optimum arose from the pressing competitive needs of an open-standards marketplace, while the enterprise division groups' optimum arose from the pursuit of a highly profitable and dynamic proprietary standard. The optimal form of firm-wide asset differed between the old business and the new so completely that neither business could easily accommodate the other's preferred form of firm-wide asset.

There was a great irony to IBM's internal organizational resolution of this conflict. It was not that the PC business was crushed in a fight, but rather that a highly attractive companywide cooperative solution was found.[52] That internally cooperative view just happened to be entirely inconsistent with the external behavior required of an open-systems PC division at this time. Hence, the IBM PC Division died slowly in the stranglehold of cooperating with the rest of IBM.

4.4 Microsoft and Mass-Market Internet Computing

Our second example explores Microsoft's response to Netscape's introduction of the browser and the challenge posed by widespread use of the Internet. Though it appeared as an entrepreneurial entrant in our first example, by the mid-1990s Microsoft had come to dominate the most profitable and strategic segments of the PC software markets, when the widespread use of the Internet threatened a new Schumpeterian wave. As we shall see, many of the same analytical themes about old firms entering new markets arise in this history—even though the same firm changes roles.[53]

Parts of the history of this example are well known. Microsoft fended

52. See Killen (1988), whose title "IBM: The Making of the Common View" gives away the punch line for a careful insider history of this cooperative solution.

53. As with the prior case study, we present only essential highlights from a very long sequence of events.

off a threat of creative destruction by entering the web-browser market as a strong second, eventually prevailing in the "browser war." Microsoft's browser is the most widely used browser even today, although the firm is not dominant, or even particularly important, in the most innovative and profitable software markets of the mass market Internet, such as search, e-commerce, or social networking.

Less well known, but well documented in the Microsoft internal e-mails and memos brought to light by the antitrust suit, are the radical organizational changes Microsoft made in the course of responding to this wave. Finding its existing PC software development and marketing organization misaligned to the new opportunity, Microsoft created a new organizational unit to supply its browser and related software. This was a partial success, as the new organization was well-aligned to the open-systems Internet. Nonetheless, fundamental conflicts with the existing PC software business over the appropriate use of shared assets and the degree to which the browser business should support an open-standards model both caused significant organizational turmoil and imposed real costs on the Windows business. These conflicts were ultimately resolved—as they were within IBM—by ending the independence of the new, Internet-oriented, unit and managing it instead as an integral part of the legacy business.

We organize our analysis around three main eras. The first era falls before the mass-market Internet opportunity became apparent to Microsoft. We show that the firm developed organizational capabilities that were well aligned with its strategy of being the dominant firm in PC software and of being a strong second in the introduction of new technology. We also suggest that it had particularly effective strategic decision making and resource allocation processes, and that although the firm was late to enter the browser market, the timing of Microsoft's entry cannot reasonably be construed as suggesting that the firm was an unaware or incompetent or backward-looking organization.

Our second main era is the browser war, when the wave threatened to overturn Microsoft's dominance in its traditional markets. The development of the Netscape browser launched the pervasive use of the Internet and for the first time brought a widely used network to mass-market computing. Microsoft at first viewed this development as innocuous. Once the firm came to see it as a threat to the existing hierarchy of the industry, it quickly entered the browser market as a strong second, creating an independent unit within the firm and giving it both considerable strategic freedom and access to the PC distribution channel that Windows' success had secured. Microsoft had great initial success in winning the browser war.

Nonetheless, during this same era, fundamental and seemingly irreconcilable conflicts between the old and new businesses emerged. These conflicts centered on the use of the firm's most important firm-wide assets, its reputation with outsiders and its control of distribution channels, and on the

strategic direction of the browser business. Managers focused on the browser as a stand-alone business wished to pursue an open-systems strategy and to distribute the browser as widely as possible. Managers focused on the Windows business wished initially to restrict sales of the browser to new PCs in order to stimulate sales of Windows and then, as the potential for the browser to become a Windows-threatening platform became apparent, to minimize this threat. In contrast with the IBM example, these conflicts emerged almost immediately upon Microsoft's entry into the browser business. In our treatment of this era, therefore, we pass back and forth repeatedly between the firm's urgent need for market and strategic alignment with the mass Internet and the equally urgent need for market and strategic alignment for the proprietary Windows business, outlining the organizational problems and very real costs that this conflict created.

Our third era covers the resolution of these conflicts. Managing both businesses simultaneously according to their own logic was imposing considerable costs on the old business, and senior management had been drawn into not only conflict resolution but also the direction of detailed operational activities. Senior management decided to deal with these costs by imposing (yet another) reorganization, this time granting control of the new business to the managers of the old. This led to cessation of conflicts and to the management of the browser business as a strategic adjunct to Windows, but it also meant, from the perspective of the pro-Internet managers in the new business, the end of the effort to exploit the new opportunity in the most effective way possible. Many of the pro-Internet managers most committed to growing the new business left Microsoft. Since our second example is more recent, we lack the long historical period after the Schumpeterian wave we could observe with IBM. Nonetheless, Microsoft's former Internet radicals appear, so far, to have been right that the organizational decision of ceding power to the old business has limited the firm's ability to compete in the most profitable and innovative new markets in mass-market computing.

4.4.1 Microsoft before the Browser

As with IBM, we start with Microsoft's existing business. Microsoft's long-run strategic goal was to either dominate or commoditize all mass-market, general purpose computer technologies, and its strategy was to enter and seek to dominate new component markets when they appeared likely to become pervasive.

Microsoft's position and strategies has similarities and differences to the IBM case. Where IBM vertically integrated into a wide variety of mainframe hardware and software technologies, Microsoft had a partial vertical integration strategy, and was the dominant supplier only of the most widely used strategic software technologies, notably the operating system (Windows) and such key business applications as word processing, spreadsheet, and

presentation. Hardware and most applications software came from other firms.

Nonetheless, the "Windows PC" was a proprietary platform. The divided technical leadership of 1985 had been replaced by a proprietary dominant platform, Microsoft Windows.[54] To achieve high revenue per employee, Microsoft sought to be the dominant supplier of only those general purpose components that could not be commoditized. It sought to keep proprietary standards for itself while forcing open standards on complementors, such as hardware manufacturers. Microsoft's central position let it dictate terms to other industry suppliers, including hardware manufacturers and applications software vendors.

Microsoft's organizational strengths were not tied to a specific technology. This does not mean that the firm's capabilities were infinitely fungible to meet any new opportunity. Instead, the firm had optimized its marketing and product development capabilities, as well as its strategic information gathering and decision-making capabilities, to two aspects of its market position as the PC industry's dominant software firm. First, it was well set up to exploit the extremely profitable dynamic of improvements to the PC, and to keep the PC on a proprietary and backward-compatible Microsoft standard as technology advanced. Second, it was well set up to perceive software technical progress from outside firms and to quickly assess its strategic importance. That is, Microsoft would decide to leave the inventor to exploit its invention or to enter as a strong second.

The history of Microsoft's rise to a dominant position in the PC industry has been written frequently, and we will not reproduce it in detail here (Cusumano and Selby 1995; Cringley 1992). For our purposes, the important thing is that Microsoft had been through a number of wrenching organizational changes before this time. In each case, it had moved forward without losing its then-preexisting positions.[55]

The causes of Microsoft's success are controversial, with some authors putting more weight than others on the firm's technical capabilities. For our purposes, what is important is that there is little controversy about Microsoft's abilities as an imitator, an incremental improver of existing designs, and most especially, about Microsoft's abilities and position in marketing

54. Microsoft was in a position to dictate behavior to firms supplying complementary products. Dictating terms was not costless, but a strategic dispute Microsoft deemed important would lead it to dictate. The browser war demonstrated that Microsoft was in a position to compel many firms to take actions different from their own self-interest, including the manufacturers of PCs, the developers of software applications, microprocessor dominant firm Intel and non-Windows-PC supplier Apple.

55. For example, Microsoft had been the dominant firm in programming tools for PCs from the earliest days of the industry, and it survived entry by Borland, a firm with a far-superior product, to continue as the dominant firm. Microsoft had also moved beyond its tools business, and had frequently acted as the entrant into markets previously dominated by others (including Operating Systems, Spreadsheets, Word Processors, and Presentations).

and distributing mass-market software. Like IBM in an earlier era, Microsoft was an impressive strong second moving forward into dominance of the most strategic and profitable new technologies.

There are many historical examples of Microsoft's effectiveness as a strong second. For our analytical purposes, the key question is whether the firm still had those skills as the Internet revolution loomed. The answer to that is a resounding "yes."

By the mid-1990s many firms, including Microsoft, anticipated widespread electronic commerce, electronic entertainment, and other new mass-market online applications. Microsoft engaged in a strategy to imitate and exploit the best technologies for mass-market online applications in electronic commerce and content. The best available outside versions to imitate came from firms like AOL. Microsoft characteristically set out to enter as a strong second with a proprietary architecture. The idea was to have a proprietary Microsoft standard in place long before there was mass-market use of online services. This effort would eventually be given the name MSN, for Microsoft Network.

Microsoft expected mass-market online applications to follow the widespread distribution of broadband access, which, like many others, Microsoft predicted to be early in the new century. In other words, prior to the diffusion of the browser, Microsoft had committed itself to invest in online applications in the patient anticipation of slow user acceptance of its own and others' services, believing this gave its developers enough time to experiment with a new service and position it appropriately by the time demand by mainstream users began to grow.

In seeking to set a standard for mass-market online applications, Microsoft sought to take advantage of its dominant position in existing mass market computing; that is, the PC. At this time, almost all of mass-market computing was PCs. There were approximately 100 million users of Windows, for example, versus (they are harder to count) 4 to 6 million users connected to any wide-area network, and the networked users included very many, possibly a majority, of technical users (scientists and engineers in government, universities, etc.) rather than the kind of home and ordinary business users who would be the growth segment for mass-market online applications. To exploit its installed base advantage, Microsoft sought to distribute the user software for MSN with new PCs, beginning with Windows 95. This would immediately put the MSN user software in front of nearly two orders of magnitude more users than AOL had.

We shall return to MSN a number of times, as it played a number of different roles in our three eras of Microsoft's relationship to the Internet. For now, we note only that, while Microsoft's managers did not see the mass Internet coming, they were, nonetheless, within their information set, forward looking. They were committed to a proprietary mass-market

e-commerce and content strategy in 1994, and a commitment to the future. This was not an old firm resting on its old products.

In summary, Microsoft was well organized to detect new technologies invented outside, and to quickly decide how they fit into the firm's long-run strategic plans, and ultimately to ship new products or amended products in response. The firm was an excellent imitator, incremental improver, and executor of its commercial goals. It implemented a strategy of partial vertical integration, and of proprietary standard-setting dominance. This supported profitable exploitation of noncommoditized PC technologies using a set of organizational capabilities aligned with the strategy.

Microsoft's strategies put extraordinary demands on the firm's ability to perceive outside developments and act on them. Leaving much technical development to outside firms meant that Microsoft faced the constant risk of outside invention of either strategically threatening or potentially valuable technologies. The development and success of an outside technology standard would undercut the extent to which the entire PC industry was organized around the proprietary Windows standard.[56] Senior management needed to be responsive both to a constant barrage of new information from outside and to the need to focus on implementing improvements in existing products. Much of this tension was resolved by a combination of decentralizing day-to-day authority for existing product lines and centralizing strategic direction and decision making about new initiatives, including remarkably small ones. Microsoft could be extremely patient and foresighted in the effort to expand the range of products that were its proprietary technology (though others groused that the important inventions came from outside).[57]

Microsoft was, in some very positive ways, highly centralized. The senior management team was very effective at gaining information about developments both inside and outside the company and at acting on them. Major strategic decisions were not delegated. All employees were instructed to bring their ideas for initiatives as well as their conflicts to the Strategy Team, which consisted of Gates, Ballmer, and several other high-level executives. The firm demonstrated extraordinary discipline in this, and as a result the top strategists never lacked for technical information or for heterogeneous assessments of the market potential for new technical directions. In contrast, management of the major product lines was highly decentralized. This included management of the development of new products or new versions of existing products. This combination of centralized strategic authority and decentralized implementation was quite well aligned to Microsoft's existing

56. The historical example used within the company to evoke this situation was the local area network communication standard that grew up around Netware.

57. For example, it was nearly a decade behind Apple in making a Graphical User Interface (GUI) a centerpiece of its operating system, but today by order of magnitude, more people use the Windows GUI than the Apple Macintosh GUI.

dynamic market opportunities but it also imposed a serious bottleneck on decision making. Historically, this had not been a critical issue since decision making occurred quickly, and the strategic benefits of centralization had outweighed potential costs. Nevertheless, as we shall see, it played a role in the browser wars by delaying Microsoft's response to Netscape's browser.

4.4.2 A New Opportunity, a New Schumpeterian Wave

The mass use of the Internet, triggered by the invention of the World Wide Web (WWW) and the web browser, was one of the most important technical advances of the twentieth century. However, despite the firm's strengths in perceiving outside innovations and reaching strategic decisions about them, Microsoft's decision to enter the browser market—its key strategic reaction to the Internet—was slow. Netscape's browser, not Microsoft's, was the first to obtain mass-market acceptance. Why? The established dominant firm was not ignorant of the new opportunity. Instead, it rationally (if ex post incorrectly) *decided* not to take it up.

Why did Microsoft at first leave the browser opportunity to Netscape? One logical possibility is that Microsoft did not even notice the outside developments. After all, those developments did not come from one of the many firms whose actions Microsoft monitored closely, such as Sun, IBM, Lotus, Compaq, HP, Oracle, and so on.[58] The technological and noncommercial origins of the threat also were not standard.[59]

As is the case with IBM's decision with respect to the PC, this explanation is contradicted by both broad and specific facts. Microsoft's organization was very effective at competitive intelligence. Support for third-party software firms gave its employees regular insight into the plans of other firms in the personal computer industry. Further, Microsoft employees were regular participants in the institutions of the computer industry that supported its open systems and noncommercial segments. Moreover, the process for triggering changes in response to outside developments was well-known within the firm. Requests to alter designs climbed a (comparatively flat) hierarchy directly to the Strategy Team.

In fact, Microsoft's organization functioned excellently in bringing the widespread use of the Internet and the opportunity associated with the browser to the attention of senior management. A formal presentation of

58. Though, to be sure, once the Internet began to diffuse, it did not take Oracle or Sun long to devise a strategy for "thin client and fat server," which served their interests in relation to Microsoft's. It did not commercially succeed. That is a longer story. See Bresnahan (1999).

59. The building blocks of the technology—TCP/IP, HTML, and the parts endorsed by the World Wide Web Consortium—did not come from the places where prior technological revolutions in computing science originated. The HTML came from an employee at a high-energy physics lab in Switzerland, Tim Berners-Lee, who later founded the World Wide Web Consortium. The operations for the US Internet backbone came from the recently privatized NSFNET. On these origins and their transition into commercial markets, see Abate (1999), Berners-Lee (2000), Greenstein (2008), and Mowery and Simcoe (2002).

the suggestion that Microsoft should produce a browser and other mass-market Internet technologies was made to the senior team in April of 1994. This was still early enough that the firm could have gained strategic advantage from investing in Internet applications. At that stage, however, Microsoft decided to provide only Internet "plumbing" to connect a PC—tools and processes inside the operating system to support Internet protocols, leaving the browser and other applications to outsiders.

The plumbing decision was entirely consistent with the long-run goals of the existing Windows division, who sought to encourage the adoption of Windows. Windows marketing staff saw the advantage of making it possible to connect a Windows PC to the Internet. The plumbing made it possible to connect Windows to the Internet, while leaving Microsoft cooperating with Internet-oriented firms.

The decision not to enter the browser or related applications markets reflected the assessment that a proprietary online service model a more profitable approach to the same market opportunity. In the autumn of 1994, Gates restated the then-familiar strategic analysis. He expressed considerable doubt about the potential profitability of any open-systems Internet application—for Microsoft or any another firm. Internet applications had previously been catalogued as the domain of third-party vendors and of little potential business or strategic value to Microsoft. The noncommercial and open-systems origins of the most popular browser reinforced the view that the application lacked profitability.[60] Further, Gates expressed the view that standards for PC-Internet connection would be decided by Microsoft with its (then) 100 million users. Internet plumbing connections could remain open so that data transport would be a commodity. In brief, seeing neither opportunity nor threat, the firm did not change course.

Not everyone at Microsoft agreed with management's decision. A disobedient and secret initiative was organized by Brad Silverberg in the summer and autumn of 1994. Silverberg was a comparatively senior manager who reported to members of the Strategy Team.[61] These employees ostensibly did something that was not unusual at Microsoft; examining trends aimed toward taking new initiatives after Windows 95 shipped. They were due to gain internal power and prestige later. For example, one member who reported to Silverberg, Ben Slivka, would later lead the team that built Internet Explorer (IE) 1.0, 2.0, and 3.0. At this time, however, they labored in obscurity, as do most skunk works that lack senior executive support. No one paid much attention to them, and, by the same token, they received few resources.

Their lack of status and resources was an unintended drawback to the suc-

60. The first popular browser, Mosaic, came from a team of undergraduate and staff programmers at the University of Illinois, Urbana/Champaign.

61. Ben Slivka, private communication, October 2008.

cessful execution of a centralized strategic allocation of resources—Gates and his advisors saw no value in investing in employees understanding all the various aspects of Internet technology, so deliberately none was made. Thus, Microsoft's late development of the browser began—when it did begin—without a developed internal group with intimate knowledge about all aspects of the existing capabilities for the Internet.

Just as IBM had done with the PC, Microsoft, for a time, deliberately chose not to pursue the new opportunity. For each firm, the moment of entry and changed assessment, was, of course, a time when it would have been valuable to see the new opportunity more clearly and earlier. Consideration of that value has shaped the normative business literature on firm design, with many calls for foresight and flexibility at the firm level. That is misguided, at least in the case of excellently managed firms like the ones we study here. It is inherent to high-tech industry that information changes over time, and that some new opportunities appear more important (or less!) later than they did earlier. One point of this section is that Microsoft, like IBM, made an informed deliberate decision not to enter the new business early on.

That is not to say that the decision to eschew early entry into the new market was not based on Microsoft's existing business. Indeed, the main point of this section is that the early decision to delay entry into the browser market (and hence, the severity of the competitive events hereafter) arose because Microsoft was the proprietary standards-setter in the pre-Internet PC. This, too, is parallel to the IBM case in the early stages. Each case gives us an important lesson about the incentives at early stages of Schumpeterian waves. The same new opportunities appeared profitable to entrepreneurs and unprofitable to the existing dominant firms in both cases. This interim information period left the existing dominant firm with sunk investments in firm-wide shared assets and an internal decision-making structure that were consistent with the old opportunity. It later proved to be inconsistent with the new one.

Microsoft's delay in entry gave Netscape an extraordinary commercial opportunity, which others would label an error by Microsoft. In retrospect, such an error would not—we might say, *could not*—last for very long. Microsoft was and is an organization with administrative processes designed to help it respond to market events, and to reverse past decisions by the CEO. Once it became clear that using the browser to access the Internet was as salient to mass-market computing as everyone realizes today, Microsoft reversed course.

The salience of the browser and the Internet as a threat and opportunity in mass-market computing was clear to Microsoft by the spring of 1995. Several external events had changed internal perceptions.

First, Netscape began to act like an important commercial firm in the mass-market software business. Netscape had begun to make money from

sales to businesses and employed a unique distribution mode involving free downloads by households and students, anticipating revenue from business licensees.[62] Netscape had begun a program to invite third-party vendors to make applications compatible with the Netscape browser, mimicking Microsoft's practice of supporting APIs (application programming interface)—practices aimed at influencing the rate and direction of innovation. Netscape had also begun to expand its product line into complements to browsers, such as products for servers and areas of related networking.[63] This market-development activity would bring the browser and the Internet into play as an effective way to achieve mass-market e-commerce and content.

All of these developments were bolstered by an effort on Netscape's part to take advantage of the open-systems nature of the Internet. Many developers flocked to the Internet building commercial applications. While some griped that Netscape was not as committed to open systems as noncommercial entities, the reality was that mass use of the Internet was developing at the extremely rapid pace permitted by open systems. Rather than waiting for the widespread deployment of Broadband Access as under Microsoft's proprietary MSN, the market for widely used online content and commerce could (and did) develop very rapidly using dial-up capabilities.

Perhaps most importantly, the rapid rate of adoption of Netscape browsers meant that there would soon be a pervasive and strategically important software complement to Windows under the control of another firm. This marked a return to the Industrial Organization of the PC business of the 1980s. A sequel to the 1980s might have the same plot, but the roles had changed. Like IBM before it, the mature Microsoft was cast in the role of incumbent, while Netscape was playing the role of the young upstart, like Microsoft in the past.

These developments changed the outside strategic situation radically and Microsoft then quickly changed its assessment.

The Silverberg group gained attention, and conducted many wide-ranging conversations with existing stakeholders inside the firm. They established and refined a vision about the future of the marketplace and Microsoft's potential role in it, and internally publicized its views and efforts.[64] In April 1995, they organized an evening of surfing for Bill Gates, with instructions about where to go and what to look for. The demonstration succeeded in changing Gates's views. Gates spent the better part of the night surfing. A month later he issued the memo entitled "The Internet Tidal Wave," which

62. The browser was free, technically only for evaluation and educational purposes. This was a variant on a well-known practice among shareware vendors to let out software for trial use and attempt to follow up with registration during service or upgrades.

63. Cusumano and Yoffie (2000) have an extensive description of how Netscape explored the commercial potential of many complementary service markets through site visitation of lead users and interaction with many user and vendor experiments.

64. See Slivka (1995) for the fourth and final draft of this vision statement.

effectively admitted the prior oversight and announced the realignment of priorities for strategy inside the firm. The next day the skunk works issued its fourth and final version of its vision, written by Ben Slivka, entitled "The Web is the Next Platform."[65] Both Gates's and Slivka's memos show that Microsoft was now the old firm in a Schumpeterian wave. Both writers explicitly outlined scenarios that led to the loss of Microsoft's market position as a result of new competition.[66] Each also saw the potential profitability of many new long-term commercial opportunities.

The widespread use of the Internet, and the breakthrough PC software that permitted it, the browser, had three implications for Microsoft. Two of these arose immediately, an important difference from IBM's entry to the PC market. They are: (1) The browser (and the Internet resources it brought to users) was a close complement in the short run for Microsoft's PC software. Demand for PCs, and thus for Windows and Office, was about to grow very rapidly thanks to this outside innovation; (2) The browser posed an immediate threat to the established positions of Windows and Office; a Netscape browser standard could enable competition against Microsoft in much the same way a Microsoft operating system standard contributed to enabling competition against IBM earlier; and (3) In the long run, the growth of mass-market computing was going to have a strong Internet component; if Microsoft were to participate in the growth over the long haul, the firm would need an active strategy for supporting or providing new, network-oriented applications.

By far the most urgent of these three was the defensive (2); the Microsoft internal analyses recognized that the browser technology obviously held the potential to radically change the way a mass-market of users used the PC, possibly redefining the PC value chain and leaving Microsoft outside its central standard-setting position. Responding to it became a matter of competitive urgency at Microsoft. However, the delay in reaching the realization of a Schumpeterian wave was going to make dealing with the urgent competitive situation all the more difficult, and heavily influence the way the firm responded to the wave.

65. A publicly available copy of Gates (1995) is at http://www.usdoj.gov/atr/cases/ms_exhibits.htm, government exhibit 20. A publicly available copy of Slivka (1995) is government exhibit 21.

66. Gate's memo is eight pages, single spaced. Among its many themes, it stresses several different ways in which an independent browser might ultimately lead to "commodification" of the operating system. First, a browser and its extensions could accumulate the same functionality as the operating system, directly reducing the latter's market value. Second, an independent browser, combined with new technologies from Sun Microsystems called "Java," might lower entry barriers into the operating system business for Netscape or others. Third, the browser enabled something "far cheaper than a PC"—such as a network device—that might achieve sufficient capability to compete with Windows PCs. Slivka's memo, at nearly fifteen pages of text, includes many of these same scenarios, but places particular emphasis on the third.

Late Entry Proves Costly

Microsoft's early underassessment of the Internet applications platform was extremely costly in the short run. Over 1994 and most of 1995, Microsoft did little Internet-related development or marketing. As both Gates's and Slivka's memos made abundantly clear, there was no shortage of Internet-related activities relevant to Microsoft's existing businesses. Microsoft's legions of programmers had not explored the possibility of redesigning any applications, tools, or operating systems to emphasize the World Wide Web and its standards. The absence of advanced development work was a symptom of how unanticipated this threat was and how late top managers were (in comparison to entrants) in recognizing the potential.

Things got worse before they got better for Microsoft. Having recognized the possibility of a Schumpeterian wave in the Spring of 1995, Microsoft saw the importance of entering the browser market itself as a strong second. However, for the next several months (until August) the firm's first (if not only) priority would have to be the launch of Windows 95, key to ongoing dominance in its core business.

Netscape had a very substantial lead on Microsoft in a race to establish a browser standard. Microsoft's answer was to attempt to enter the browser market at the same time it launched Windows 95. Internet Explorer (IE) 1 was a hastily modified version of the Mosaic browser, originally developed at the University of Illinois, which the university was now widely licensing out through a third party.[67] However, IE 1 was not nearly as good as Netscape's browser, and there were also problems in the support network.

Users had little reason to choose IE 1. Any technical observer of both browsers could see why. While both browsers were based in noncommercial versions, the team at Netscape had reprogrammed the entire browser from scratch, tested a beta version with many users, and made numerous improvements to the browser and other programs that worked with it. Netscape's browser had nearly a year's lead time over Microsoft's. The quality gap was so large that Netscape dominated in browser usage.

Internet-oriented applications developers also had little reason to work with Microsoft's browser. Announcing support for Internet applications was not sufficient to motivate third-party developers to write software to run in Microsoft's browser when superior technologies existed elsewhere. Even developers who would have supported a Microsoft strategy in the early going did not have an opportunity to do so. Microsoft simply did not have an Internet strategy for outside developers to follow. The company did not publicly announce its strategy until early December, well after the release of Windows 95 and Netscape's IPO (both in August 1995).

67. See an account from the viewpoint of the licensor in Sink (2003). Slivka and company had arranged for the license at the end of 1994, and had only limited time to make changes oriented toward their perceptions about user needs.

The theoretically relevant conclusions we draw from the early period in which Microsoft struggled to respond to the threat posed by the Internet are necessarily limited. To state the conclusion first: Like many established dominant firms, Microsoft was not the first to see a new opportunity, and, like many other established dominant firms, bore considerable adjustment costs in the short run as it moved to enter a new business. These costs were made all the larger by the delay in perceiving the threat, by a substantial gap between its existing capabilities and those that would be aligned to the new business, and by a temporary but severe need to devote all attention, and the key asset of reputation with outside developers, to the existing business. These problems are general to established dominant firms and they were severe in this instance: they left Microsoft with no legal way to win the browser war.

Yet any such conclusion is necessarily limited by its focus on the early phase. In Microsoft's case, these adjustment costs were severe but transitory. In a few pages, we shall turn to the firm's rapid and decisive shift of attention and resources to the new business that served, over time, to reduce the importance of the short-run adjustment costs. To undertake that analysis, we first look at the details of the new business opportunity Microsoft was entering, so that we can see the goals to which it needed to realign and why these imposed nontransitory, scope diseconomies on the firm.

4.4.3 The New Opportunity

Microsoft faced a narrow window of time to enter before a Netscape browser standard would be set. Microsoft's own analyses of the browser market concluded they had a short window of time to move both users and developers over to their browser.[68] Microsoft concluded that an immediate and powerful move as a strong second might switch standard setting to its product, but a move that was either not immediate or not powerful would fail.

The decision to enter the browser market brought Microsoft into direct competition with a firm seeking to establish its own standard, Netscape. Netscape had been skillful in the way it took advantage of its long lead, working to make the browser war into an open-system, standard-setting race in which Microsoft's strengths would be devalued.

One open-systems strategy from Netscape was introducing a browser that ran on all kinds of PCs. Since almost all PCs were Windows PCs running Microsoft operating systems, this might seem like a small point. Neither the Apple Macintosh, nor desktop UNIX, nor any of the potential "thin clients" discussed at this time was likely to grow very rapidly, so in the short run, the PC was a Microsoft-dominated PC. However, Microsoft was attempting to move the Windows standard from the obsolete Windows 3.x (3.0, 3.1) to the

68. For a fully developed analysis of many market-oriented factors and their role in setting de facto standards in this case and more generally, see Bresnahan and Yin (2006).

modern Windows 95. As Netscape launched its browser, almost all PCs in use were the older standard Windows 3.x.

The effect of this was to compel Microsoft to adopt a parallel open-systems strategy for its own business, a strategy that immediately placed the browser effort in strategic tension with the Windows business, the core of the existing firm. Thus Microsoft found itself, just as IBM had earlier, a proprietary-standards company entering an open-systems market.

A second problem along the same lines arose because Netscape, like other entrepreneurial Internet firms, had developed organizational capabilities that allowed it to bring out new products rapidly and effectively. If Microsoft were to compete effectively, they would have to move away from the organizational capabilities developed by the firm during its experience prior to 1995. The firm had a long history of taking several years to commercialize software: It was demonstrably good at commercializing software that required coordinating large teams of designers, programmers, and distributors, inside and outside the firm. It was also successful at reviewing the market experience, generating lessons, and incorporating them into later versions. Those organizational capabilities were magnificently aligned to being the dominant firm in the PC industry. In a speed-based browser war, however, these capabilities had limited value.

As IBM before it, Microsoft therefore set up a firm within a firm. It was given a mandate to be fast. Most importantly, the team developing IE was situated outside the operating system group. Microsoft set up a new division, the Internet Platform and Tools Division (IPTD).

The parallel with IBM's PC Division is not complete. Microsoft's Internet division never had as much autonomy: Gates and the Strategy Team retained rights to monitor and intervene in decisions, and, from the outset, they used it frequently.[69] The IPTD did, however, have considerable independence from the existing operating systems business in Microsoft, which gave it freedom to act like an open-systems company.

The IPTD's development process, motivated by an urgent need to catch up to technological leader Netscape, departed from Microsoft norms. Rather than slowly and carefully consulting with a wide range of stakeholders in order to define users' and developers' migration path to the next major release years from now, the IPTD was quickly chasing a market leader and adding features in response to competition.

Impressively, Microsoft built the IPTD up to 4,500 people (there are considerable strategic advantages affiliated with eventually being able to deploy resources on a vast scale, as a rich dominant firm can do). Equally impressive, an elite team of programmers within the IPTD worked to improve

69. Indeed, that monitoring and intervention activity left an impressive trail of e-mail communications between various managers of this division and top management at Microsoft. For a lengthy review of much of it, see Bank (2001).

Microsoft's technology, rapidly chasing Netscape in browser quality and features. The quality gap with Netscape narrowed with each major release. By the release of IE 3 in August 1996, there was only a modest gap. The IE 4, released in September of 1997 and, for all computers, winter of 1998, had nearly caught up to the market leader. Taking two and a half years to catch up in quality was not sufficient for moving the browser standard away from Netscape, but this impressive technical effort was certainly necessary.[70]

Intending to build a large organization that played to its strategic advantage as a large software developer, Microsoft began investing simultaneously in browser technologies and the services related to supporting developers. It also let developers know about its investments and its intention to support a mass-market browser technology. These actions let developers plan for more complex applications as well as for mass-market applications for the Internet of the future, suiting users who value ease-of-use as well as network access.

The successes of the IPTD have a great deal of theoretical salience. As in the IBM example, there was no lack of learning, nor any deficiency in key capabilities. This established dominant firm learned what was necessary for success in the new market and executed its strategy. Also, we see a number of conventional scope economies here, though they were limited. The large number of extremely talented technical people inside Microsoft together with management's ability to quickly redirect resources provided a benefit in the new market, while the existing product development process and the associated reputation for slowness would be problematic. Microsoft solved this by putting great people in a new organization exempt from existing processes.

Since its technical efforts were only necessary but not sufficient for strategic success, the browser group also sought to draw on Microsoft's most important firm-wide assets in marketing and distribution. Although access to these assets gave Microsoft's browser business considerable initial advantages, they also quickly led to the imposition of significant costs on the core Windows business, tremendous organizational conflict, and increasing pressure to manage the browser business as a strategic complement to Windows. These pressures made it increasingly difficult for the browser business to "act like an entrant" and eventually led to a fundamental shift in control, just as they had done inside IBM.

Microsoft's control of the PC distribution channel and its reputation with developers were key firm-wide assets. The channel was not a necessarily shared asset—Microsoft's new browser business could and did take advantage of the channels that Netscape was using—but its availability presented the browser business with perhaps its only possible means of catching Netscape, and thus created a positive classic economy of scope for

70. See Cusumano and Yoffie (2000), Bresnahan and Yin (2006).

Microsoft. The firm's reputation with developers, in contrast, was necessarily shared—actions taken by the browser group in this regard would have immediate reverberations across the entire community, and vice versa, and the use of this asset proved to be much more problematic.

Microsoft's long-run strategy was to take advantage of growing demand over several years and undercut Netscape's initial advantage. The simplest part of this strategy was arithmetical. The existing stock of browser users overwhelmingly used Netscape. But, partly fueled by the tremendous attractiveness of Internet access, people were buying new computers at a record pace, often to get on the Internet for the first time. If Microsoft's browser were used by most new computer buyers, the rapid growth in demand meant new adopters of IE would soon outnumber the existing stock of Netscape users. Microsoft took advantage of this arithmetic—and of its control of the distribution channel—by contractually compelling computer manufacturers to distribute IE with new computers and informally banning them from distributing Netscape.[71]

This distribution strategy could not compel users who had already chosen it to stop using Netscape's browser. But it could contribute to increasing the number of users and developers dedicated to IE. Specifically, distributing only one browser to some mass-market adopters could (a) generate some adoption among users who continue with the browser that came with their computer, and (b) generate some adoption by developers who wanted to serve the users of IE. After a period of time, as the arithmetic played out, a majority and then an overwhelming majority of users would be using IE, and the standard would shift to Microsoft.

Since control of the PC distribution channel, a company-wide asset, followed from Windows' market position, control was held by the Windows division. Senior Microsoft management directed the Windows marketing organization to use this control to benefit the Microsoft browser strongly. The Windows marketing organization complied. They contractually required distribution of IE with Windows by all PC original equipment manufacturers (OEMs) whenever they shipped a new computer. Further, the Windows marketers continually let every OEM hear about Microsoft's desire not to see alternative browsers distributed with new computers, and threatened retaliation against those OEMs who did distribute Netscape. These efforts were effective, in that Netscape largely disappeared from new computers in favor of IE.[72]

71. See Fisher and Rubinfeld (2001), Rubinfeld (2004), Bresnahan and Yin (2006).

72. A parallel effort, to compel developers to favor IE over Netscape, was also implemented by the Windows organization. This was less important. The Windows organization would only give information about the next version of Windows to developers who agreed to favor IE, but in the relevant time period new versions of Windows were minor improvements like Windows 98. For longer discussion, see Rubinfeld (2004), Bresnahan (2002), and Fisher and Rubinfeld (2001).

This strategy was not without costs. Scope diseconomies connected to reputation quickly emerged.

The first problem arose in the old business. The Windows marketing organization was in a position to make take it or leave it offers to the OEMs. That did not mean the strategy was costless. The OEMs were in a competitive business and the browser their customers wanted was Netscape, not IE. This led to continuing conflicts between the Windows marketers and their primary customers, the OEMs. As the OEMs invented new ways to give their customers a choice of browsers, the Windows marketing organization in response invented more and more inefficient and constraining contractual features to prevent it. While bearing these costs was necessary for a firm-wide strategy, the Windows organization—looking narrowly at its own business—saw this as forcing increasing restrictive and inefficient contracts on their customers.

This strategy also had reputation costs for Microsoft's nascent Internet business. By foregrounding the willingness and ability of Microsoft, the dominant firm in the existing PC industry, to unilaterally force conditions on its trading partners, this strategy could only heighten the outside community's awareness that in the long run the firm might have strong incentives to move away from the browser group's claim to be an open-systems company, particularly given the close complementarity between browser and Operating System.

4.4.4 Seizing Control of Distribution in New Channels

Because Netscape was so far ahead in the browser war, and had such an effective strategy of distribution to existing PC users, Microsoft's browser division would lose if it relied only on the "arithmetic" mechanism of waiting for the stock of PCs to turn over. Thus, Microsoft was compelled to seek emergency control of the new distribution channel that emerged as the Internet developed. We cover this part of the Schumpeterian competition in this section, not so much because of its competitive logic, but because the compromises Microsoft was compelled to make in its foray into the new distribution channel—its very success in acting like a particularly effective entrant—led to tremendous internal conflicts, illuminating the depth and strength of the organizational scope diseconomies between its new and old businesses.

In 1995 most PC users, and therefore most potential browser users, were using older versions of Windows (like 3.0 or 3.1). A small minority of users wanted to access the Internet from a UNIX computer (typically in a University setting) or a Macintosh. Netscape had an open-systems strategy. It sought to distribute browsers to all existing computer users to build a mass-market quickly and turned to Internet Service Providers (ISPs) as a result.

The conversion of the Internet to a mass-market called for an industry to sell access. The rapid growth of the Internet Service Provider industry

filled this need.[73] By early 1996, a wave of new ISPs offered Internet service throughout the United States. Many were local businesses organized around a bank of modems. There were also national firms: Online leader AOL (America Online) publicly switched strategies to embrace the Internet; with Web-friendly software, acquisitions, and a new pricing strategy, AOL was becoming the largest ISP in the country. As with other ISPs, AOL was introducing new Internet users to many facets of the Internet.

Netscape initially signed contracts to distribute its browser with ISPs as well as with OEMs selling new PCs. Thus, even as Microsoft cut off distribution of the Netscape browser with new PCs, people signing up for Internet access could get a Netscape browser from their ISP. This, plus Netscape's long lead time, left Microsoft with a problem: waiting for the arithmetic of exclusive distribution with new PCs would be too slow to prevent a Netscape browser standard.

Microsoft sought to plug this gap in its control of distribution by seeking exclusive distribution of IE rather than Netscape when a customer signed up for Internet access. The ISPs responded differently than OEMs to Microsoft's approach. Where Microsoft was in a position to put OEMs out of business if they did not comply, ISPs saw Microsoft as largely irrelevant to the widespread use of the Internet. With most ISPs, who were small, Microsoft overcame this problem by paying them for exclusive distribution.[74] While that sounds like a classically positive scope economy—existing dominant firms will typically have cash—the leading ISP, AOL, held out for nonmonetary and strategically important terms, which as we shall see in a moment, imposed significant costs on Microsoft's existing businesses and thus implied real scope diseconomies. However the exclusive distribution arrangements were obtained, they solved the distribution problem for Microsoft. When users signed up for Internet access, they would be given a copy of IE, not of the Netscape browser. This strategy filled the loophole: now the two effective distribution channels for browsers would both be all-IE. This distribution dominance ultimately led to the end of the browser war in Microsoft's favor.

The same strategy also dramatically increased scope diseconomies between Microsoft's new Internet business and its existing Windows business. These scope diseconomies were fundamental, a conflict between the Windows business's essential need to manage transitions in the Windows standard and the browser division's need for universal open-systems distribution.

73. Greenstein (2008) describes the regulatory and economic origins of these suppliers.

74. At this point the next largest ISPs after AOL were players with national aspirations, such as CompuServe, AT&T WorldNet, and several others. A large number of players had small market shares, but aspired to national prominence, such as MindSpring, EarthLink, and Erols. Deals with several dozen ISPs could, therefore, account for somewhere between 80 percent and 90 percent of US market share. See Greenstein (2008).

Microsoft initially distributed its new browser only with new PCs running the new Windows 95—a strategy that avoided these diseconomies of scope. The browser business gained a distribution advantage, and the Windows business gained a valuable complement for a new PC. This win-win world for Microsoft's new and old businesses would not survive the use of ISP browser distribution strategy aimed at getting Microsoft's browser into the hands of people who were *not* buying a new computer.

The ISP deals gave Microsoft's browser distribution not only to buyers of new computers but also to the users of the stock of existing computers. This was critical from a browser-market perspective, since the browser group needed distribution to the existing stock of computer users to avoid a Netscape standard, but it imposed a significant cost on the Windows business. The Windows group did not want the browser to be compatible with old versions of Windows (3.0, 3.1, and the like) so as to preserve Internet-oriented users' and application developers' incentives to upgrade to Windows 95. The Windows division sought to manage the slow backward-compatible transition from one proprietary standard (Windows 3.x) to another (Windows 95), and thus needed to ensure that the new version of Windows, rather than the old, appealed to most consumers. From this proprietary-systems perspective, all efforts should be made to have valuable new software work only with the newest version of Windows. The browser division sought to *compete* for all customers immediately, whether they used a new or an old computer. Thus the browser division was in the business of offering highly attractive Microsoft software to customers of the old operating system, creating tension between the open-systems Internet business and the proprietary standards Windows PC business.

A variant of this tension between proprietary standards and open systems showed up in connection with Microsoft's proprietary online service, MSN. Microsoft Network had been founded by Microsoft employees, many working on it as early as 1992, and they had had the commitment of top management that their effort was the future of pervasive e-commerce and online content. For many years Microsoft's strategic team had made good on its commitments: it had nurtured MSN with favored status in distribution. Microsoft had required OEMs not to alter the prominent placement of MSN's symbol on a PC's desktop. These unilateral restrictions angered assembler OEMs, who could not tailor PCs to user requests, and also firms such as AOL, who would be willing to pay considerably for a prominent place on the desktop. Microsoft's top management was unwavering in its support for MSN.

The competition with Netscape over browser distribution put MSN's special status under pressure. Microsoft wanted to strike a deal with AOL, the largest ISP, for exclusive distribution of IE. Unlike smaller ISPs, AOL would not offer an exclusive distribution deal for money but instead demanded lifting the desktop restriction on AOL's symbol—so that it could negotiate

with some OEMs to have the AOL symbol visible to consumers on the Windows desktop. This would be an effective nationwide distribution strategy for AOL.

AOL's demand highlights the conflict between a proprietary strategy and Microsoft's open-source strategy in browser distribution and the degree to which the presence of Microsoft's legacy businesses implied that Microsoft faced significantly different incentives in entering the new business than de novo entrants. Microsoft's deal with AOL is arguably one that a de novo entrant would have considered, and it brought very significant benefits to the browser business, but in imposing real costs on MSN and on the Windows business it caused considerable tension within the highest managerial ranks. Indeed, Microsoft initially refused AOL's demand and attempted to bargain with other things, such as money. This initial refusal was understandable, since capitulating to AOL's demand would be reneging on the promise to MSN employees and would grievously hurt Microsoft's existing, proprietary, online effort.

The urgency of competitive events in the browser market forced a decision in favor of striking a deal with AOL.[75] AOL made IE the default browser to distribute to its ISP customers, and, in exchange, AOL was exempted from the desktop restrictions. Further deals over time supported AOL's marketing interest on the desktop and promoted Microsoft's interest in generating the use of IE by AOL's users.

The AOL deal moved many Internet users to IE. The deal was a critical part of filling loopholes in Microsoft's distribution strategy, ensuring that IE and not Netscape had widespread distribution to new users with new PCs and to existing PC users new to the Internet at the time of ISP sign-ups. This distribution strategy, together with Microsoft's eventual success at catching up to Netscape in browser quality, led to a Microsoft victory in the browser war.[76]

As anticipated, this deal's benefits came with considerable cost for Microsoft. Over the next year, many MSN employees quit as MSN lost ground to AOL, setting back MSN's development for some time.[77] It is not possible to know whether MSN would have ever achieved any of its goals without the deals with AOL, but with those deals it did not achieve much. Proprietary MSN has been relaunched as an Internet "portal" and has not achieved anything like its original goals.[78]

75. Specifically, after considerable negotiation, AOL negotiated a deal with Netscape to support Navigator for several years, but left open questions about the default browser. The contract with Netscape placed pressure on Microsoft to fish or cut bait, pressure to which Bill Gates and Steve Ballmer relented.

76. For a list of these deals, and a discussion of their controversy, see Rubinfeld (2004), Bresnahan (2002), and Fisher and Rubinfeld (2001).

77. Bank (2001).

78. While MSN has typically been number two or three in the portal and online service markets, MSN has always been a distant second or third to the leading portal in a given year,

The scope diseconomies were not limited to a conflict between Microsoft's browser and MSN. Microsoft was compelled to permit a competitor, AOL, to make use of the Windows desktop, one of Microsoft's key assets as a firm. This uncomfortable open-systems behavior was essential to buy distribution for IE from AOL, distribution that was only necessary because of the Microsoft browser's open-systems distribution problem. Microsoft, heretofore able to dictate terms about the distribution of PCs, was forced to accept the terms proposed by AOL, only because AOL had turned somewhat quicker to embrace the new Internet opportunity. Used to defining the terms of unilateral bargaining with every partner, Microsoft here was forced by the emergency period of the Schumpeterian Wave to accept an outside firm's proposed terms. While obtaining widespread exclusive distribution for its browser in an open-systems way was a strategic goal for Microsoft, the costs in the proprietary-standards parts of the company were not trivial.

4.5 Applications Software Running in the Browser

Another source of scope diseconomies arose from conflicts about the role of Microsoft as a setter of standards for applications developers. Here we see—as we did with IBM—that the existence of the legacy, proprietary business means that the incumbent may have quite different strategic incentives with respect to the new business than a de novo entrant concerned only with success in the new market. The problem began when Netscape designed its browser to permit developers to write new, network-oriented, applications that would run "in the browser." Parts of the application might also run on a server computer on the Internet, including possibly a server computer owned by an online commerce, search, or entertainment firm. This technical possibility was deeply troubling to the Windows group. The PC part of the application, by running in the browser could run on any kind of PC, not just a Windows machine.

To counter the Netscape threat, the Microsoft browser needed to provide similar facilities. New, network-oriented applications had to be able to run in the browser. With the Microsoft browser being distributed not only to new Windows computers, but also to old Windows computers and to Macintosh, the Windows group saw this open-systems strategy as highly problematic.

Meanwhile, the browser division at Microsoft needed to act like an open-systems company in achieving rapid time to market for its products and having its products work with outside technologies, whether other Microsoft businesses such as Windows were benefitted strategically or not. Thus, in

whether that is Netscape, AOL, Yahoo, or Google. It has done better than most niche businesses, but never has had a dominant position, nor have analysts ever forecast that it was imminent. MSN also has not achieved another Microsoft aspiration; that is, any notable profitability in comparison to online leaders.

December 1995, Bill Gates announced a number of different collaborative arrangements with Internet firms.

The end of divided technical leadership on the personal computer and the control of the standards for PC applications development meant that "Windows is the platform" defined the strategic view of the Windows group even as an internal technology, Microsoft IE, came more and more to embody the alternative and deeply contradictory vision, "the web is the next platform." It is hardly surprising that the conflict over platform control shifted from Windows versus outside rivals such as IBM to Windows versus IE. These were powerful internal conflicts driven by the inconsistency of the Windows proprietary standard strategy and the open-systems approach of the browser and the Internet. As we shall see, these conflicts were resolved by senior management in favor of IE for the duration of the browser war and in a very different way after the browser war ended—very much as IBM had permitted the PC business to run an open systems-strategy initially but then, as the PC became increasingly perceived as a strategic threat to the mainframe business, forced a significant change in the new unit's strategy.

4.4.6 Diseconomies of Scope Issues Resolved

The specifics of the events inside Microsoft during the Schumpeterian emergency posed by the browser war are engaging, but we do not want them to distract from the more general points they illustrate: internal conflicts between the new business and the old were deep and difficult to resolve.[79] They involved conflicts over one of the firm's most important shared assets, control of the distribution channel. These conflicts were closely linked to fundamental differences in strategic alignment to the browser versus to the proprietary businesses. In the context of the computer and software industries, this was a conflict that revolved about the open-systems browser versus proprietary MSN and proprietary Windows, but our point is the more general one that the outside market environments of the two groups made the conflict fundamental.

Furthermore, these conflicts involved deep disagreements over what the firm's reputation for steadfastness and decisiveness, one of its most important intangible assets in negotiations, meant for new decisions. Repeated attention from senior management could keep these conflicts under control for a period of time, especially with an immediate competitive threat, but ultimately they had to be resolved as the costs in senior management time and attention grew. Initially these conflicts were overwhelmingly re-

79. Our approach to a complex history has necessarily been selective; one important set of conflicts we left out was those between the open-systems browser and proprietary-standards Office (i.e., Word, Excel, etc.) applications. *These* conflicts flared up when the Office unit was enlisted in the browser war. In order to compel Apple to distribute Microsoft's browser with Macintosh computers, Microsoft threatened to end the supply of Office for Macintosh, a product highly valuable to both companies.

solved in favor of IE. This was strategically necessary; the browser war represented a competitive crisis for Microsoft, which could have lost its extremely valuable position in Windows and Office if there were an independent browser firm.

Indeed, using the variety of distributional advantages described previously, Microsoft effectively pushed its browser out to all kinds of PCs, not just new versions of Windows, and blocked similar widespread distribution of Netscape. This gave IE a growing numerical edge in usage over Netscape. Indeed, after it became clear that IE 4.0 would come close to Netscape's browser in quality and after distribution restrictions created a great deal of market momentum for IE over Netscape, contemporaries began to forecast that Microsoft's strategy would succeed. However, the end of the browser war meant that the firm could step back and make long-term decisions. We now turn to these.

The Third Era: Putting the Legacy Business in Charge

At the end of the browser war senior management faced three distinct options. Critically, only one of these would have been available to an entrant: the other two flowed from the firm's strong incumbent position. They might have (a) continued to manage the browser business as a stand-alone entity, pursuing an Internet-oriented growth business inside the firm, using the capabilities of the IPTD, the newly formed Microsoft browser standard, and the enormous growth opportunities of mass-market online content and commerce, while maintaining their position in Windows and Office and potentially using the assets of Windows and Office to advance the browser business. This is the two-business, "firm within a firm," best of both worlds, option. Alternatively, they might have (b) expanded Internet tools and applications into all aspects of the firm's business, as had been planned under competitive pressure, and for which there was considerable internal enthusiasm (especially in the IPTD). This is the "conversion to the new world" option. Or they might have (c) returned to the strategies devised for Windows years before, a continuation in the old world option.

Microsoft's managers chose option (c), continuation in the old world. Our scope-diseconomies framework explains why they chose (c) the old world, over (a) pursuing both old and new. The choice between (c) continuation in the old market, and (b) conversion to the new world, falls outside the scope of what our theory can explain. We raise it to show how a theory of diseconomies of scope sharpens questions about the choices management faced.

Absent diseconomies of scope, pursuing option (a), the best of both worlds, would have been a highly profitable one for Microsoft. With the benefit of hindsight, it is obvious why. First, there has been a great deal of profit in mass-market computing in the Internet area. Firms who have taken up Internet-oriented growth businesses, such as Google, eBay, Facebook,

and many others, have made enormous fortunes. Of course, others have lost money, but that is not relevant to Microsoft's circumstances. Microsoft would have entered this era as the browser-dominant firm, and as an important maker of tools for exploiting the capabilities of the web. This would have meant expanded control over distribution of mass-market applications. It also would have reflected Microsoft's ability to enter the most profitable or strategically important markets as a strong second. Had Microsoft pursued option (a), it would have been able to expropriate the returns to some or all of the invention we have seen in mass-market computing on the Internet in the last decade, just as it expropriated many of the most valuable inventions in PC computing over the previous era.

Management made a foray into the new business, a very significant foray measured either by costs or capabilities created, but then Microsoft retreated and chose option (c). Option (c) could be denigrated as the most conservative, but what it conserved was the two largest profit streams ever created.[80] This makes it difficult to criticize as wrong. Our key point is that there was no free choice of strategy without consideration of the costs imposed (and benefits created) by both the new and the legacy business. While the firm was capable, division by division, of pursuing both the old—Windows PC, goals—and the new—Internet, goals—pursuit of multiple goals would have clearly brought substantial diseconomies of scope. An independently managed browser business might well have accelerated a "browser is the platform" or, indeed a "the web is the platform" strategy, potentially dramatically undercutting the value of the existing operating and applications businesses. It would also have meant a continuation of very high levels of organizational conflict. We cannot know whether it would have been more profitable—but we can understand why Microsoft's senior team was reluctant to try it.

The choice of option (c) was not immediate but it was final. After the browser war's outcomes began to be clear, the Windows group's standing objections to the browser effort led to proposals to restructure the organization. In this case, as it worked out, management would act rather quickly, changing the formal organizational structure not long after the release of IE 3.0. The IPTD came to an end as a separate organization, and responsibility for the browser's further development fell to the Windows group.[81]

Over time the Windows Division, managed by Jim Allchin, continued to win virtually every internal fight for supremacy over strategic direction. A number of initiatives that might be understood as bringing Microsoft into

80. Option (c) would also come with a number of proprietary strategies for the new growth opportunities, such as Microsoft operating systems for cell phones and for server computers and an online presence for Microsoft through MSN. These were ideas in place before the widespread use of the Internet.

81. Bank (2001) provides an exhaustive chronicling of these events. He emphasizes a variety of rent-seeking, career-oriented, and personally guided motives.

the new, Internet era were reversed. General internal commitments to make IE run on many other PCs or other (non-Microsoft) software and so on were also allowed to lose momentum and disappear. In short, in spite of having the capability to pursue option (a), Microsoft chose quickly and decisively not to do so.

Of course, choosing to pursue (c) implied not choosing (b) as well. Option (b) would have represented even more of a commitment to Internet-driven growth, though we also note that it would have had some advantages. It would have let Microsoft take advantage of its new opportunities (e.g., for social interaction) while deftly avoiding its new challenges (e.g., computer security.) Option (b) would, in essence, have begun a pattern of migration within mass-market computing from the PC to the Internet, with all that implied for the length of time over which revenues would continue to grow.

The decision to pursue (a) was, of course, not without costs, especially the unification of the IPTD into the Windows group. This change generated considerable acrimony and rivalry inside Microsoft. The Operating Systems Division complained about having to take in IE. The IE had been developed in a competitive race, and, out of competitive necessity, was far from elegantly designed, difficult to modify, and fraught with the potential for intentionally coding "bugs," which are unanticipated inconsistencies between different parts of the code. The browser- and Internet-oriented IPTD felt that the firm was slighting their priorities, broadly abandoning the needs for the firm in the future, and potentially giving managerial discretion to the Windows Division over many potential market opportunities in markets for web applications. This induced a large number of exits by employees who had been committed to developing new Internet businesses.[82] The direction held firm in spite of the exits. Over time, once immediate competitive pressures had lifted, the firm returned to the strategic direction and organizational practices and strategic priorities they had favored many years earlier and had proven profitable prior to the diffusion of the Internet.

It is important to understand Microsoft's decision first to act like a future-dominant firm that believed "the web is the next platform" and then to retreat from that goal in light of changing information and incentives. Senior management worked through the costs of operating both businesses as the unanticipated scope diseconomies became apparent, and apparently large. Senior management initially tried to coordinate the new opportunity with the established business. After it was apparent there would be substantial costs, management tried to minimize them with a firm-within-a-firm organization.

That organizational form was very costly because of diseconomies of

82. Eventually Silverberg and Slivka and others affiliated with promoting the Internet quit. See the extensive discussion in Bank (2001).

scope. With the dual value of exploring a new growth opportunity and preserving the profits of Windows and Office, Microsoft's management was willing to bear the organizational and opportunity costs for a transitory period.[83] But once the competitive crisis was past, one of these two values fell away and the organizational scope diseconomies led to pushing the conflict away from senior management and into a division, where it was resolved in favor of the old, familiar strategy.

The internal conflicts Microsoft encountered with its online efforts highlights the firm's innate long-run problems exploiting economies of scope within a new environment. The tension between adjusting strategic priorities and keeping existing businesses in tow is yet another example we offer of the conflict between organizational diseconomies and achieving conventional economies of scope. This outcome had important long run implications. It left the firm with serious long-run market challenges. Numerous talented programmers and managers left the firm to pursue projects and commercial opportunities more closely oriented with their interest in Internet and web technologies. Dominating Internet clients (browser, e-mail, etc.) for individual users without focusing on the Internet brought serious headaches, many of them in the security area. The existing strategy of extending Windows into low-end servers (file, print, e-mail, etc.) while reinforcing outsiders' views that Microsoft sought excessive control over complementors created a market opportunity for open source projects, such as Linux, Apache, MySQL, and others. Focus on the OS platform (and on defensive strategies such as game boxes) rather than on the Internet left vacant opportunities on the server side with mass-market appeal, including search, directory services, hosting of retail stores, social-network sharing of user-generated content, mobile electronic communication (BlackBerries and smart phones), and virtually every other notable lucrative online opportunity after the recovery from the dot-com bust except gaming.

4.4.7 Like IBM

The scope diseconomies inside Microsoft had the same root cause as those inside IBM in our earlier examples. In each case, there was fundamental conflict over key firm-level assets. In each case, the optimal form of firm-wide asset differed between the old business and the new so completely that investments by one business raised, not lowered, costs in the other. Nor could either business easily accommodate the other's preferred form of firm-wide asset. The Microsoft browser division's optimum arose from the pressing competitive needs of an open-standards marketplace, the mass-market Internet, while the Windows and other proprietary groups' optimum arose from the highly profitable logic of customer and developer migration within

83. The coordination costs may have been lowest during the height of a competitive crisis as the authority to coordinate shifted to senior management.

a dynamic proprietary standard. An important difference between the two cases arose because the browser and Windows were close complements in the late 1990s, while the PC and the mainframe were only potential future complements in demand in the 1980s. One impact of this was that Microsoft was able to use its position in Windows (and Office) to win the browser war. The market outcome was, in the short run, victory for Microsoft in holding a browser standard.

The close complementarity between browser and OS also meant that the scope diseconomies were present in the routine operations of both divisions. The Windows Group's control of the traditional distribution channel aided accommodating the needs of the browser division. However, the browser division's open-systems strategy (of widespread availability on old versions of Windows and on the Macintosh) and of innovative programming (of new applications to run in the browser) brought it into immediate and direct conflict with the main strategic goal of the Windows Division, which wanted a managed migration within the Windows standard. Strategic success for the Microsoft browser and strategic problems for Microsoft Windows were tightly linked. In contrast, the IBM divisions' conflicts, while equally irreconcilable, lacked this immediacy and strength. As a result, Microsoft had much less room to maneuver in organizational design. Where IBM might have spun off a PC company—after taking years to think about whether it was wise—Microsoft needed to resolve conflicts quickly and within the firm.

Both IBM and Microsoft, by trying to accommodate an open-systems and a proprietary-systems business selling to the same customers, had tried to build a team of horses but, once the distinctions between the old and the new markets became clear, found it had built a Pushmi-Pullyu. Neither kept that organizational form; both went back to pulling in the old direction. The scope diseconomies between old and new businesses ruled out successful pursuit of both businesses, because sharing key firm-wide assets between the two businesses (in these cases marketing reputations) led to fundamental strategic conflict (in these cases between open- and proprietary-systems market strategies).

Enough historical time has passed to see IBM's loss of PC market standards and eventual exit, not to mention the competitive crash in enterprise computing that followed later; Microsoft's future in the Internet age is unclear at this juncture, even though it staved off this first threat. Both firms avoided any short-run threat to their existing position. Again, with IBM, sufficient time has passed to see long-run threats come to fruition, whereas Microsoft today continues to dominate its historical markets, but few of the new Internet ones. Notably, it has already lost many opportunities it aspired to exploit, namely, the proprietary electronic commerce businesses it anticipated dominating as pervasive broadband and small devices diffused.

We make a broader and more general methodological point here, buttressed by our choice to use the same firm, Microsoft, first as part of the

new market and then as the old dominant firm, and to use the same industry, PC hardware and software, first as the new market and then as the old. Many scholars would be tempted to conclude that Microsoft is the better organized firm by comparing it to IBM in a snapshot. Better to compare the Microsoft of today to the IBM of the 1980s, to avoid the anachronistic error of concluding that the firm organized to serve yesterday's market will also be organized to serve tomorrow's.

4.5 Conclusions: Implications and Directions for Further Research

This chapter has explored a persistent finding in the empirical literature—the observation that at moments of technological discontinuities, incumbent firms, rather than being able to take advantage of scope economies, often find themselves at a significant disadvantage relative to de novo entrants. Through detailed case of histories of IBM's response to the invention of the PC and Microsoft's response to the invention of the browser we have suggested that scope diseconomies created by the presence of necessarily shared assets have an important role to play in explaining this phenomenon.

We showed that—at least in these two cases—the two incumbent firms had no difficulty building the raw organizational capabilities necessary to compete in the new markets. Each initially created the equivalent of a firm-within-a-firm and was able to mobilize internal and external talent very effectively. However, as strategic interdependencies between the new and old markets became increasingly salient, the need to share key firm-level assets became both more critical and more difficult. Both firms saw very considerable organizational conflict emerge—and at both firms it was resolved by the decision to give the managers of the legacy business control over the new. Although we cannot say that this was per se economically irrational on an ex ante basis, in both cases it led to decisions that were quite different from those made by entrants and that, at least in retrospect, placed the new business at a considerable disadvantage.

More generally, our results suggest that organizations face limits to the exploitation of economies of scope, even where there are powerful firm-wide shared assets. Collectively these limits can add up to more than just a series of managerial inconveniences. Conflict over the optimal structure of shared assets, and conflict inherent in the difference between old and new businesses, interferes with the pursuit of new opportunities and raises their costs. While sharing existing assets with a new business seems an obvious source of scope economies, our examples show that the resulting conflict can be so costly as to reverse the gains.

Our analysis, if supported by further research, has immediate implications for both policy and managerial practice. On the policy front it lends further credence to the idea that incumbent firms, alone, are unlikely to be able to

duplicate the technological diversity characteristic of the market and thus to the belief that vigorous entry may be a key contributor to the innovativeness of an industry or an economy. On the managerial front it highlights the subtle nature of the interaction between strategic and organizational conflict, suggesting that organizational conflict is often as much symptom as cause, and should be managed as such. Certainly the suggestion that an established firm should simply seek to duplicate the structure and behavior of entrants should be treated with skepticism.

We have also opened up a number of avenues for further research. Most obviously it would be useful to know if the concept of necessarily shared assets is a useful one in understanding the history of other industries and other significant discontinuities. Both IBM and Microsoft, for example, have a history of entering new markets with great success. Our preliminary analysis suggests that this was because they were able to take advantage of conventional economies of scope and because there was relatively little conflict over how necessarily shared assets should be deployed. In the case of IBM's entry into electronic computing, for example, or into software services, assets such as the firm's reputation and distribution channels could be managed to serve both assets with minimal conflict. Microsoft's early entry into applications programming or more recent entry into gaming were similarly relatively free from this particular kind of conflict.

Another important question is that of the factors that cause an asset to be necessarily shared. In the case of IBM and Microsoft, we suggested that an asset such as reputation might be necessarily shared because the firm's customers simply did not believe that the firm could develop distinctly different capabilities (reputation) or because they understood the ways in which the strategic priorities of the existing business were likely to overcome the new (open versus closed). But we suspect that the universe of necessarily shared assets is much wider than this and the range of causes correspondingly greater. We suspect, for example, that it is difficult for a firm to develop two entirely different reputations for the way in which it rewards its workforce, and that this may be another shared asset that may make it difficult to do entirely new things.[84]

Lastly, our analysis suggests that the line of research recently opened by Alonso, Dessein, and Matouschek (2008) and Rantakari (2008) is a particularly promising one that would merit much further exploration. For many years economists have dismissed accounts of organizational conflict as merely epiphenomenal, despite sustained research by organizational scholars suggesting that it has very real effects. It would be impossible to explain IBM's or Microsoft's actions without understanding the role scope diseconomies played. It would also be impossible without understanding each company's interest in continuing in one market while pursuing another.

84. On this point see Kaplan and Henderson (2005).

The essence of competitive events in both cases—timing of entry, pricing of products, distribution of market share, or even realized changes of market leadership—would be misinterpreted if viewed as solely determined by the diffusion of technology or solely by the incentives of market circumstances. It would be equally misinterpreted if seen as arising from something inherent and unchanging in the firms' capabilities or organization. Rather, the interplay between market needs and organizational diseconomies of scope shaped incumbent firm behavior and the salient features of outcomes. Our analysis thus highlights the ways in which the interaction between strategy conflict, necessarily shared assets, and conflict over the locus of control within a firm have significant economic implications. (To the degree that managers are, indeed, constrained in their decision making by cognitive frames developed through experience this problem becomes very interesting indeed.) Further empirical and theoretical research in this area is thus likely to yield significant returns.

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Comment Giovanni Dosi

The chapter insightfully analyzes two instances of "Schumpeterian transitions" across different technological trajectories, and the vicissitudes of the firms that were market leaders on the "old" ones. As such, it makes fascinating reading in its own right. But it is also a revealing illustration of some of the major advances made over the last half century, since the early Rate and Direction Conference, in the understanding of the nature and dynamics of technological knowledge and the conditions under which it is generated and economically exploited.[1] It is from this angle that I will offer the comments that follow.

In fact, together with the understanding of the determinants of the rates and directions of accumulation of technological knowledge, a lot of progress has been made in the understanding of business firms as major repositories

Giovanni Dosi is professor of economics at Sant'Anna School of Advanced Studies, Pisa, Italy.

1. For an overview of the state-of-the-art in the field, let me refer to Dosi and Nelson (2010).