

Making Waves:

The Interplay between Market Incentives and Organizational Capabilities in the Evolution of Industries.

Timothy Bresnahan, Shane Greenstein, Rebecca Henderson¹

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Abstract

Schumpeterian “waves of creative destruction” are periodic bursts of innovative activity that threaten to overwhelm entrenched firms and established businesses. What factors make such a wave more likely to arise, or to arise earlier or later? What makes a wave more severe for an incumbent firm? We argue that any framework for answering these questions must examine the *interplay* between strategic interaction in markets and the endogenous development of organizational capability. We illustrate our argument by focusing on two important historical cases: IBM’s response to the PC and Microsoft’s to the Internet. In both cases we highlight the ways in which the intersection between a firm’s market position and its organizational assets lead incumbents and entrants to respond quite differently to potential “waves”. We also explore the ways in which the incumbent firms in both cases suffered from ‘organizational diseconomies of scope’ – so that the realignment of organizational capabilities to serve both an existing market and a new market were costly and time-consuming. In both cases we suggest that explanations that focus only on market-based or only on organizational explanations are incomplete.

¹ We are affiliated with, respectively, the Department of Economics, Stanford University; the Kellogg School of Management, Northwestern University; and the Sloan School of Management, Massachusetts Institute of Technology. We thank James Cortada, Kristina Steffensen McElheran, Scott Stern, Catherine Tucker and several seminar audiences for comments. We are responsible for any errors.

I. Introduction

Schumpeterian “waves of creative destruction” are periodic bursts of innovative activity that threaten to overwhelm entrenched firms and established businesses. Schumpeter argued that such waves renew markets and strike fear in even the most entrenched monopolists, motivating them to innovate. These ideas have influence beyond academic circles, and have taken deep hold in the business press and in the popular imagination.

What factors make a Schumpeterian wave more likely? What makes such a wave arrive sooner rather than later? Why do some waves generate a severe crisis for incumbents while others do not? We draw on two traditions of explanation for a market leader’s persistence and replacement: the economics of markets and the economics of organizations. We argue that understanding a wave’s key features must blend these two traditions into a single framework that examines the *interplay* between strategic interaction in markets and organizational differentiation. Explanations that focus only on market factors or only on organizational factors will be importantly incomplete.

Theories of market equilibrium focus on the ways in which market leaders and entrants may have very different incentives to invest in potential innovations because of their different market positions.² Yet they ignore organizational issues, typically modeling entrant and incumbent as equally capable. They usefully identify features of the stochastic structure of innovation that directly impact incentives, such as whether a new innovation opportunity is drastic or incremental. Yet they [market theories] treat only one moment in the history of innovation, examining the difference between incumbent and entrant that arises within a given race to exploit a technical opportunity. This leaves unanalyzed issues such as why (or in what circumstances) a foresighted incumbent might leave open opportunities for drastic innovation or when an entrant might already have the capabilities to attempt it.

A complementary body of theories of organizational equilibrium highlights the factors that might lead different kinds of firms to develop different kinds of capabilities.³ These theories permit a gap between an incumbent’s capabilities and market circumstances to arise, but do not explore the ways in which they might evolve as a rational response to anticipated competition. In these theories, opportunities for entrant invention appear as an exogenous shock to the environment of the incumbent dominant firm, rather than as an endogenous response to the incumbent’s actions.

² Here we are using “position” as a shorthand for a range of firm characteristics vis-à-vis each other -- beyond efficiency, such as existing distribution with customers, technological leadership, etc. -- identified by a large body of theory of strategic interaction as determinants of the industrial organization of supply. Of course, in our analysis “positional” advantages of different degrees and of different kinds will matter.

³ We will use “capabilities” as a shorthand for a large range of ways in which firms might differ, including investments in human or physical capital, vision, resources (e.g., from retained earnings) knowledge of the market, knowledge, viewpoints, or complementary assets.

The lack of an integrated framework for examining the interplay between positional advantages in markets and organizational capabilities is troubling, since even casual empiricism would suggest that in practice both competitive and organizational forces play a major role in shaping Schumpeterian waves. It is also puzzling, since the two streams of explanation traditions have a common root – sunk costs at the firm level. Without sunk costs, industry structure cannot have strategic effects (including either positional advantages or disadvantages.) Without sunk costs, organizational capabilities cannot create lasting advantage or form the roots of future disadvantage for a firm.

Our framework follows the organizational literature in emphasizing the specificity of the assets that define an incumbent’s capabilities. “Specificity” has long been a core concept in equilibrium organizational economics. The idea of “relationship-specific assets,” for example, speaks to the investments a firm makes when it enters into a relationship with a particular partner. Here we use a slightly broader definition of specificity. We suggest that incumbents develop organizational assets – including decision-making processes, incentive structures and/or core beliefs that are specific to the firm and to the firm’s market, that these represent important sunk costs, and, relatedly, that incumbents incur adjustment costs when trying to change these assets and to build new ones.

We offer a framework where changes over time in a dynamic high-tech industry can (rationally) cause the incumbent firms’ capabilities to drift out of alignment with market demand – even if an incumbent is active and wise in learning about new market and technological opportunities.⁴ Understanding the causes of this drift is part of our task; indeed, understanding why the drift accumulates until there is a period of rapid change is essential to our explanation for the timing of Schumpeterian waves. In saying that, we are taking on two analytical challenges. The first is to understand why a rational, forward-looking firm does not change its capabilities to keep them in alignment as drift accumulates. To tackle this we draw heavily on theories of competition. The second is to explore why incumbents cannot quickly realign their capabilities once a wave has begun, and to tackle this we draw from emerging ideas in the economics of organization.

Our framework has three key parts. The first part draws on our understanding of competition in markets to explore why incumbents might make very different investments in organizational capabilities than entrants, and why these differential investments might lead incumbents and entrants to respond quite differently to potential waves in making. We seek to examine a wave-in-making from both a strategic and an information-processing perspective. Why do incumbents and entrants often have incentives to invest in very different things? Why do some kinds of technical progress make it difficult for incumbents to “see” a coming wave? Once they are upon the incumbent, are all new threats of entry the same, or do they vary in the nature of the challenges they offer an incumbent’s existing organization? We argue that leading incumbents can make different assessments (than entrants and their financial backers)

⁴ Our framework is not dependent on the assumption of complete rationality. Indeed,, the dynamics that we describe could reflect a combination of local learning and selection dynamics. We return to this point below.

because incumbent organizations have strong incentives to invest in knowledge that is closely aligned with prior market opportunities. We further argue that differences in assessment shape the likelihood of a wave, and that its probability declines when all parties tend towards similar assessments.

We next focus our attention on the interface between an organization's capabilities and the market position of a leading firm. When, how, and why entrants seek to enter against a strong incumbent position is a critical question. Focusing just on the industry being entered (in the market-based tradition) or just on the incumbent firm (in the organizational tradition) leaves out half of the story. Concerns about sunk investments lead incumbents to abandon existing market processes and operations with resistance, and this resistance can shape the timing of an incumbent's response to new opportunities so that the speed with which the incumbent adjusts depends crucially on the relationship between pre-existing investments and the needs of the new opportunity. In the right circumstances, entrants can thus sometimes find it in their interest to innovate even against a highly capable incumbent with strong positional advantages.

The third feature of our framework builds on this last observation. We stress the additional challenges uniquely faced by incumbent firms when responding to new opportunities, or on the importance of organizational "diseconomies of scope." In focusing on this concept we are not suggesting that highly decentralized firms (such as large holding companies, for example) cannot contain two radically different organizational structures within the confines of a single financial entity. Instead, we focus on the allocation of shared assets between existing markets and those created by new opportunities when the incumbent must have common management operating *both* kinds of business. We stress that operating in both markets simultaneously may not only generate conflicting claims on these shared assets, leading to significant issues in resource allocation, but may also require the resolution of the conflicting strategic imperatives of both businesses. We suggest that these conflicts may be costly, and that they may shape both the timing and severity of a wave. We label them "diseconomies of scope," though we are mindful that we have a more dynamic definition for scope than is typical in static definitions.

To give all of these abstract notions content, we examine them in the context of two concrete cases: IBM's response to the PC and Microsoft's response to the Internet. These cases are inherently interesting. Both markets were large and important, and the leading firms in both of them, IBM and Microsoft, were remarkably successful in their respective eras. Each case includes episodes that undeniably altered the structure of the computing market and the operations of both the leading firms and new entrants – classic characteristics of a Schumpeterian wave.

In exploring these cases, we seek to demonstrate that the core premise of our framework is plausible: i.e., that it is the interplay between organizational capabilities and market incentives that shaped events, and that neither perspective in isolation can provide an adequate explanation for how the industries unfolded. We do this in two ways. First, we examine the factors that give rise to differences in assessments and actions between incumbents and entrants, to differences in sunk costs, and to diseconomies of scope in both industries, arguing that in both cases these were importantly shaped by the nature of

market competition. Second, we attempt to show that these differences mattered in important ways, i.e., that they shaped the likelihood, timing and severity of observed waves.

Focusing on these particular cases has several other advantages. Because IBM and Microsoft compete in platform industries, many key sunk costs, particularly those related to investments in interface standards, are shared among many firms, including buyers as well as sellers. Unlike many other industries and at many leading firms, these sunk costs are not trade secrets, so we can observe and study them. In addition, the internal organizations of these firms are better documented than in many settings, permitting researchers to analyze the microstructure of decision making and incentives inside these firms before and during a wave.

Using two cases also helps us to explore the strengths and weaknesses of our framework since in important ways they are quite different. During their eras of dominance the two dominant firms – i.e., IBM in the early 1980s and Microsoft in the mid 1990s – served quite distinct customer bases with rather distinct purchase behaviors. Moreover, the two firms employed existing decision making processes for distinctly different strategic purposes prior to and during the midst of crises, and faced waves that differed substantially in the details of their composition, timing and severity.

Yet, there are striking similarities between the two cases that our framework highlights. Both markets display a combination of substantial sunk costs and rapid technological progress. This combination gives rise to observable and powerful technological forces for drift (which is not the same as saying that drift was bound to occur). Both dominant firms tended to employ centralized strategic decision making for regular operations, and both moved away from them during the early phases of a wave, going back to them as the costs of managing the resulting diseconomies of scope became especially high. Both faced Schumpeterian waves with mixed results; both attempted to anticipate future waves and to adjust their capabilities, also with mixed results. Most importantly, both cases suggest that focusing on only one stream of explanation – on organizations or on market incentives – leads to explanations that are incomplete in important ways.

II. Building a framework from two traditions in the existing literature

The Schumpeterian puzzle has attracted attention from generations of scholars interested in the questions posed by Schumpeter in the second chapter of *Capitalism, Socialism and Democracy*. We, too, focus on these core questions: why do incumbents take advantage of technological opportunity sometimes and not others? Why do entrants? If entrants can develop commercial products and services in every potential technological opportunity, does each of those serve as a threat to the incumbent? If not, when does the threat of entry spur reaction from an incumbent and when not? Sometimes incumbents either cannot or will not do the same as entrants do. Why or why not? Is there a systematic explanation for the organizational and market incentives that encourage waves of entrants sometimes and not others?

To make our approach concrete, we attempt to explain three features of Schumpeterian waves – their likelihood, their timing, and their severity. We build our framework in four parts. The first and second present summaries of the existing “market-based” and “organizational” frameworks of innovation on which we build. We then present a tentative synthesis of the two perspectives. We finish with a summary of the key insights of this synthesis for our understanding of observed historical waves.

II.1. Markets

Existing theory suggests one approach to examining the likelihood of a wave (and, in some formulations, its timing). In brief, incumbent players have much stronger incentives than entrants to invest in innovation that is “incremental” – or that extends market power and takes advantage of the incumbent’s current position (Gilbert and Newbery, 1982; others). In the context of platform industries, for example, we can think of this as strong incentives to invest in activities that extend the reach of the existing platform into things such as complementary goods and services and backwardly compatible offerings.

The core ideas of this literature are that (1) holding all else fixed, incumbents have an incentive to avoid cannibalization of their existing profits, but that (2) if cannibalization is inevitable, incumbents would prefer to self-cannibalize rather than to have those profits transfer to another firm.

More recent work extends this insight to argue that the failure of incumbents to recognize a potential source of market value need not be problematic if the firm has a market mechanism to benefit from the innovations of others (see, e.g., Gans, Hsu, and Stern, 2002). Incumbents can choose to position their organization to benefit from others’ innovations by developing assets that entrants find valuable (e.g., marketing or distribution). This type of action gives the dominant incumbent the option to offer entrants a cooperative deal – either through licensing or outright merger – before the entrant goes into direct competition. Such deals eliminate competition between incumbent firms and entrants in a wide set of circumstances where they are economically advantageous to both the entrant and the incumbent. Through such cooperative mechanisms, the identity of the incumbent firm can persist in spite of inventiveness outside the incumbent’s organizational boundaries.

The literature does suggest that under some (very limited) circumstances, incumbents may have less incentive than entrants to invest in “drastic” innovation – or innovation that destroys market power (Arrow, 1962; Reinganum, 1983; others). If investment by the incumbent does not change the probability of the drastic innovation’s success, then the incumbent has the same incentive to invest in it as the entrant. But if investment by the incumbent increases the probability of the drastic innovation’s success, then it may be rational to delay investment (Reinganum, 1983; Henderson, 1993).

In the context of platform industries, this implies that incumbents will be less likely to invest in innovations that a) offer dramatic improvements in price or performance and may replace the existing offering and that b) are sufficiently uncertain of success that incumbent investment might tip the balance in favor of the disruptive technology. In sum, incumbents may have less incentive to invest in innovations that

threaten to replace the existing platform, but that are not yet proven – or in precisely the kinds of innovation that, we argue, lay the foundations for a Schumpeterian wave.

At first glance, this stream of work might seem to provide an adequate theory of the effects of Schumpeterian waves. Waves that are built on “drastic” innovations and whose advent is likely to be triggered by the incumbents investing in them are likely to lead to incumbent replacement: other waves are not. But further reflection suggests that this explanation is importantly incomplete.

Most importantly, it cannot explain why incumbents have difficulty reacting to new opportunities – however drastic – once the innovation is “proven” and the probability of its success is unrelated to any investment that the incumbent might make. As this literature stresses, a clear market and technological opportunity offers incumbents the same incentives to invest in them as everyone else has, especially if it involves a competitive threat. Indeed in such circumstances incumbents may have greater incentives to invest – and significantly greater resources – than entrants.

However this body of theory highlights several dynamics that, when viewed from an organizational perspective, prove to be crucial building blocks of a more comprehensive view of the effects of Schumpeterian waves.

First, the theory suggests why it may be the case that, as several authors have suggested, many entrants introduce products that are markedly inferior to the existing technology, initially taking hold in niche markets, and serving needs that the existing technology does not meet (Christensen, 1997; Adner, 2006). If a direct assault on the main profit centers of an incumbent dominant firm are typically blocked by positional advantages, we should expect foresighted or selected-to-survive entrants to flow into niches and non-strategic complements.

Second, these theories suggest that there is a very high rate of return to incumbent firms from learning about future technical and market opportunities, especially ones that threaten their high profits. In technically intensive markets, forward-looking firms cannot (and *do not*) presume that they are certain about the source of market value. They rationally generate investment in processes for seeking information about the environment and interpreting that information. Such “updating” and “reassessment” tasks never end in technically intensive markets. Moreover, such actions can be quite demanding, because the learning done at an incumbent dominant firm may be idiosyncratic to that firm, shared with no other firm in a similar market position.

Taken together, these incentives suggest that incumbents and entrants are highly likely to invest in significantly different information processing assets – in different people, organizational structures and incentive regimes – and that these different investments are likely to lead incumbents and entrants to make significantly different assessments of the nature and importance of potential “waves in making”, particularly when such waves are surrounded by significant uncertainty.

For our interplay framework we borrow two key generalizations. The managers at leading firms adopt views about the innovative incentives in the market they serve and about what type of activities will contribute to market value in the future, making investments consistent with those incentives. Moreover, especially in technically intensive markets, these assessments about incentives are sensitive to the actions of new entrants or to other market-based actions that reveal a potential change in the appropriate assessment of value in future markets. When incumbents and entrants assess the future in the same manner, these incumbent investments will reduce the likelihood of a Schumpeterian wave. For a variety of reasons, waves become more likely when the assessments behind these investments differ between incumbents and entrants.

II.2. Organizations

Much of the economics of markets assumes that firms have identical capabilities, making it feasible to isolate the effects of market or strategic interaction. This is a useful analytical abstraction but not a fundamental feature of market theory. The assumption about identical capabilities must be abandoned to develop a useful theory of interplay.

The economics of organizations has started from the assumption that private information is valuable to its holder. Indeed, the literature's fundamental modeling assumption has been that internal incentives, the boundaries of the firm, and so on, are set to solve a second-best problem. The firm gains the advantages of the information held by its employees but not at zero cost. However, while the field has taken as a starting premise that firms are different from markets, the idea that firms may be different from each other – and, in particular, that entrants may be different from incumbents -- has emerged only gradually.

One stream of work in this area revolves around the difficulties incumbent firms face in giving adequate incentives to potential entrepreneurs. If, for example, incumbent firms are modeled as hierarchical entities in which a hired CEO has control over agents, while entrants are modeled as entrepreneurial firms in which the agent is the CEO and has control over all residual claims, then a number of papers predict that incumbents and entrants will invest in different kinds of projects. Those projects whose success is primarily driven by their access to existing assets will, in general, be undertaken by incumbents, while projects for which appropriate effort is the primary determinant of success are more likely to be undertaken by free standing entrepreneurs. (See, for example, work by Anand and Galetovic, 2000; Anton and Yao, 1995; Gertner, Scharfstein and Stein, 1994; Gertner, Powers and Scharfstein, 2006; Hellman, 2006 Manso, 2006). This is a type of theory in which waves are likely and the actions of entrants determine the timing of waves.

This literature is less satisfying when it comes to explaining the severity of waves, since it implies that incumbent firms will experience difficulties in the face of Schumpeterian waves solely as a function of their size and their inability to offer adequate incentives. It further suggests that the majority of entrants will be entrepreneurial firms whose founders gained their experience inside the incumbent firms. As we discuss below, one needs more than that to analyze the severity of a wave.

A more promising trajectory, from this perspective, is the recent literature that speaks to the idea that incumbents may develop capabilities that both display important sunk costs and that create conditions under which the realignment of organizational capabilities to a new market opportunity take time. A related idea that is not dealt with explicitly in the literature but that is implicit in much recent work, is that of diseconomies of scope, or of the incremental costs bourn by an incumbent firm that would like to have both the capabilities appropriate to its existing (or old) market opportunity and those appropriate to a new opportunity, at least during a period of transition. By definition, these diseconomies are idiosyncratic to the leading firm, and are largely unknown before the new technological opportunity becomes known.

For example, one stream of work focuses on the difficulties established firms face in replicating the discipline of the external capital markets, suggesting that firms are likely to follow a form of “corporate socialism” in which different projects and/or divisions receive funds as a function of the political structure of the firm rather than as a function of their relative likely profitability (Bolton and Scharfstein, 1998; Marino and Matsusaka, 2002; Scharfstein and Stein, 2000; Stein, 2003). This line of attack suggests that incumbents may experience diseconomies of scope whenever there are significant conflicts over resource allocation between divisions inside the firm.

Another approach has been to explore the conditions under which the need to motivate and reward employees might lead otherwise-identical firms to develop heterogeneous incentive regimes or belief structures that may imply significant sunk costs. Rotemberg and Saloner, for example, show that it may sometimes be optimal to commit the firm to a “narrow” business strategy – one in which it does not pursue the kinds of “high variance” projects characteristic of Schumpeterian entrants. Such firms will hire CEOs with very strong beliefs (Rotemberg and Saloner, 1994, 1995, & 2000), making changes in firm structure and behavior potentially quite expensive. Stein and Scharfsteins’ work on internal capital markets can also be interpreted from this perspective, in the sense that their suggestion that the decision to hire a CEO, rather than to make loans, is a reflection of the fact that there are situations in which the CEO’s “ownership” of assets gives her incentives to gather information about the managers that work for her, and that in some circumstances these investments will lead to superior performance.

Given some plausible assumptions about the limits to a CEO’s ability to collect information, this line of attack suggests both that incumbent firms will hire CEOs whose abilities are aligned with their market positions – leading to further investment in information and assets that are consistent with this position – and that projects that are “different” – in the sense of requiring different kinds of information – will be underfunded by the dominant firm (Stein, 2003). This stream of work thus begins to lay the foundation for a theory of differential investment in organizational capabilities.

Eric Van den Steen’s work provides a particularly compelling set of insights into this issue. He argues that workers will be better motivated when they believe that the CEO of the company shares their beliefs. Thus, firms are likely to sort employees on the basis of their beliefs so that in equilibrium different firms may “believe” quite different things about their environment (Van den Steen, 2005). Relatedly, they may also believe

other things that are fundamentally unverifiable but essential to investment decisions in the present, such as forecasts about the source of value in an evolving technically intensive market.

As it stands, this literature says nothing about interactions between incumbents and waves of entrants and is not focused on explaining such changes as endogenous. Also, with a couple of notable exceptions, it is not focused on the relationship between organizational structure, information processing and the *changing* demands of the market place at a dominant firm.

II.3. Synthesis

It is not much of a stretch to make the connection from prior research to the foundations for a theory of interplay between market incentives and organizational capabilities. We build our framework on elements from existing literature.

The key idea of this framework is that organizational capabilities must be aligned with market opportunities. Our concept of alignment is dynamic and includes perceiving and adapting to incremental changes in technological and market conditions. We focus especially on diseconomies of scope at the firm level. However, rather than emphasizing productive activities that are not efficiently located in the same firm, we focus on managerial decisions or knowledge bases that are not efficiently located in the same firm. Once a firm has aligned its organization's decision making to a particular opportunity, we argue that it may find that the *sunk costs* of that alignment dominate its decision making going forward. Commitment to a particular opportunity may give large strategic advantages while that opportunity is the most important, but does so at the cost of *ex post* flexibility, which is, by definition, inconsistent with commitment.

Finally, in models with limited decision-making capacity on the part of senior management or other sources of scope diseconomies, managing an old opportunity and a new opportunity in the same firm may prove difficult. That is, it is more costly to manage a division devoted to the existing market and to manage another division devoted to the new opportunity than to manage them in two distinct organizations. Realigning an organization to a new opportunity may also prove difficult in the short run.

We describe each of these three elements in turn. Then we discuss their empirical implications.

II.3.a. Aligning Investment in Information with Market Opportunities

Given any model of uncertainty about future opportunities and diseconomies of scope, no rational firm will invest in capabilities to manage all of the different technologies which might emerge in a complex and technologically evolving industry. Some niches and some complementary activities will be left to outsiders. As a broad general proposition, this is unexceptional; what matters for our framework is that the scope of rational incumbent dominant firms will be limited, and that sometimes, *ex post*, the limitations will be ones the firm regrets.

This does not require any assumption that firms differ in their “deep” capabilities: only that dominant firms will make tangible and intangible investments that support its market position and that these may differ from the investments made by entrants.

For example, if senior management has limited information-processing capacity, this capacity will (rationally) be used to understand the market opportunity with which the firm is presently aligned. It will only be expanded to include activities geared toward perceiving and incorporating a wider range of technological opportunities up to the point where diseconomies of scope in decision making grow problematic, so that in practice there will be opportunities that the firm has effectively no capacity to understand or evaluate.

Thus far, the exposition has proceeded under the assumption of a rational actor. However, this is not critical either at the organizational or individual level. Dominant firms may have different capabilities because firms are inherently different in their ideas or beliefs (in which case existing dominant firms may have been selected because they are aligned with the existing market opportunity.) Or dominant firms may hire people who know about the industry’s history of supply and demand, who believe a view of the future that leverages the firm’s position, and who put in place decision-making processes and incentives that support that dominant position. These will be aligned to a specific opportunity and may evolve in parallel with the development of an incumbent’s market position.

As new opportunities arise, an incumbent firm may rationally choose not to explore them – either due to market power or to limited or inappropriate information-processing capacity. For our purposes, the precise cause is less important than the implication. As long as there is some reasonable probability that new technological opportunities will arise for which the incumbent will not undertake innovation, then there must be a divergence between incumbent and entrant activities. Incumbents rationally leverage their existing position, while entrants rationally explore value propositions where incumbent assets provide little insight or competitive advantage. Eventually, almost inexorably, this will lead an incumbent’s capabilities to be out of alignment with the needs of a potential new market identified by entrants, or incumbents will act according to an assessment of the value of the market opportunity that is distinct from that of entrants. Of course as different firms proceed to learn different things, the *ex post* resolution of uncertainty about their distinct capabilities may also change the strategic value of particular information or of investments based on such information.

In a complex and changing technology industries, the most important feature of entrants is their diversity, especially their differentiation from the incumbent. Entrants’ incentives can also matter, either because they direct the investment of particular entrants or because they select among diverse entrants. Three incentives affect entrants when a Schumpeterian wave is still uncertain. As such, these incentives shape the likelihood and timing of a wave.

First, entrants have an incentive to avoid direct competition with the incumbent dominant firm. Supplying niche products or non-strategic complements are attractive strategies for this reason, since the entrant’s incentive is to avoid or delay a competitive breakout. In platform industries, there is typically rich communication between platform-

dominant firms and complementors about future technological direction. This can communicate the dominant firm's perspective not only to complementors but to entrants. That information helps both dominant firms and entrants avoid head-to-head competition in the short run – but also ensures that in the long run entrants and incumbents may develop very different assessments of possible Schumpeterian waves.

Second, to the extent that incumbents have tools to elicit cooperation from innovative entrants, even when innovation takes place outside the organizational boundaries of an incumbent, entrants have an incentive to behave cooperatively (Gans, Hsu and Stern, 2002). Entrants have limited incentive to compete with incumbents except when such tools fail. With these tools in place and similar assessments of market opportunities, incumbents and entrants are likely to jointly pursue these opportunities in a manner which reinforces the incumbent's position. Note that this point turns on the commonality of the assessment of the new technological or market opportunity rather than on the content of that assessment (radical innovation versus incremental one, etc.). Thus, Schumpeterian waves are more likely when the tools for eliciting cooperation fail and/or there is a mismatch between incumbent's and entrants' assessments of where new market opportunities lie.

We do not presume that an entrant who cooperates immediately after entry will always maintain cooperation with incumbents, or that the future change in cooperation is known to all parties at all times. If they are not going to cooperate in the short term, entrants have strong incentives to hide their assessments of the long term from an incumbent, as such hiding provides competitive advantages for a time. Assessments of the future market or technical opportunity are likely to differ because new entrants have incentives to make it that way. Venture capitalists have incentives to fund firms who exploit market opportunities in precisely the ways that incumbents are least likely to recognize as a threat. Or, alternatively, ambitious entrants who anticipate competing with a leading incumbent have incentives to hide their true intentions if doing so will delay strategic retaliation from the leading firm. In contrast, the incumbent has an incentive to create and disseminate a set of ideas in which there is only one future.

This line of reasoning illustrates a general point about the likelihood of a wave. Many models treat competitive threats as two stark extremes: either recognized by all market parties or not. This common simplification mischaracterizes the setting that leads to a potential Schumpeterian wave. Waves are unlikely when all parties have, or should have, the same assessment about where the future leads and what the most valuable investments should be in light of that assessment. Assuming that all parties forecast the same scenarios under all contingencies – a common simplification – assumes away one of the conditions that makes a wave more likely to arise in the first place.

Of course, decision-theoretic studies in the behavioral traditions also argue that firms know or perceive differently and use this premise to explain the different patterns of decision making at firms. In this tradition, researchers argue that dominant firms and entrants take actions that reflect long-standing organizational rules about appropriate practices and their comparative competitive strengths relative to potential rivals – whether or not such perceptions are accurate or not. However we are not convinced that the persistence of decision-making behavior in a changed environment necessarily

involves non-rational actor approaches. For a theory of interplay it is not *necessary* to commit to any particular premise about how dominant firms make decisions. All one needs to believe is that there is persistence in firms' decisions – something that we are convinced is an important empirical phenomenon.

II.3.b. Sunk Costs at the Firm Level

The analysis above is limited to the emergence of Schumpeterian waves as a surprise to the incumbent dominant firm. Differences in assessments and investments by incumbents and entrants offer the initial conditions for a wave. We now turn to a very different question. Once a technological or market possibility is known and catalogued as a threat or opportunity, what do incumbents do?

Standard theory suggests that such recognition alters market incentives dramatically. Potential cannibalization in the marketplace will give incumbents incentives to enter a new market later than entrants, all else equal, but if the incumbent forecasts losing the new market it will have strong incentives to enter. Stated simply, incumbents will aggressively respond to perceived potential threats to the market dominance they possess. If they do not perceive such threats, they will not respond.

Here we emphasize a different point, however. Earlier events determine the initial conditions for competitive interaction between incumbents and entrants, once all parties realize a Schumpeterian wave is in progress. These initial conditions matter.

Ultimately, entrants need to make choices about when to enter, what to reveal to dominant firms, and with what breadth of product line in the short run. A dominant firm, too, needs to make choices over when it should enter a new market, with what breadth of product line, distributing to which customers, cannibalizing which aspects of the existing product line, and at what price. All of these involve developing new capabilities or investing in capabilities which are already in place when active competition breaks out.

If a dominant firm makes a sufficiently early entry directed at the same opportunity pursued by entrants, then all of its advantages come into play. In such situations, Schumpeterian waves are less likely. Schumpeterian waves are more likely, however, when leading incumbents delay commercializing products for new opportunities entrants pursue and delay investing in the related assets. When might such a situation arise as an outcome from the interplay of sunk costs and market incentives?

To address this question we first note that popular reasoning often gets the reasoning wrong about the timing of a wave because it does not distinguish between the timing of its start and the timing of its most severe moments, which can, and often do, come later. Exiting the existing market is often the event that receives the most news coverage because it is the most painful for incumbents. In the popular imagination, it is often the visible event that becomes associated with a Schumpeterian wave. However, it is the *last* event in a Schumpeterian wave, if it arises at all.

In most practical circumstances, market outcomes take time to achieve. That is, a new market usually has not fully blossomed at the time when the dominant firm first assesses information about the potential for the new to cannibalize the existing, still-profitable, market. Exiting the existing market would not be rational in the short run,

even if future cannibalization could be forecast with complete certainty. While entrants may have been building up capabilities aligned with the new market opportunity, the related process at incumbents may be under way when the incumbent considers actions.

Second, and more important, forecasts are not certain. At the time when a dominant firm first recognizes the possibility of market cannibalization of existing market by introducing a new product, existing markets remains profitable under some future scenarios and not under others. Rational-actor models of decision making under sunk costs suggest strategic reasons for not exiting the existing market. If existing processes and markets will continue to have positive value under some future scenarios, then abandoning them too early will necessitate recreating them under some scenarios, an expensive prospect. As in the standard reasoning for environments with sunk costs (e.g., Dixit and Pyndick, 1994), managers at dominant firms will value the option of remaining aligned with the existing market until they are more certain of its demise, if they ever are.

This is the sense in which popular reasoning gets the timing wrong. If an incumbent exits a market, it results from events set in motion earlier, when the incumbent continued with the old market. The most interesting choice is, therefore, between entering the new or not while simultaneously continuing to serve the existing market. Schumpeterian waves are more likely when continuing with the existing negatively shapes the way incumbents enter the new and compete with entrants.

II.3.c. Realignment Need not be Free and Rapid

The key question, in our view, is whether the incumbent firm can quickly realign to the new opportunity. If a transition takes time, can an incumbent align to both the existing and the new within the same organization without scope diseconomies? If not, then a Schumpeterian wave tends to be more severe.

One possible situation is that of economies of scope between two businesses and low-cost realignment. This would lead to a model similar in spirit to Stein's (1997) model of learning for one market and applying the knowledge to another. If an incumbent firm can add divisions and operations to address a new market and face no additional costs beyond those faced by entrants, then the severity of a wave for the dominant incumbent arises from the advantages (disadvantages) associated with early (late) timing of entry, the costs of moving historical investments to new markets (where they may or may not confer competitive advantage), and the operational excellence of incumbents compared to entrants in the face of new uncertainties.

While this is a viable theory of Schumpeterian waves, in practice this approach suggests that most waves will be resolved by an effective counterattack from a successful dominant firm. We argue that Schumpeterian waves are more severe – and thus more likely – when incumbent organizations face diseconomies of scope between existing and new markets or when realigning the organization to a new opportunity takes time.

Slow realignment of the dominant incumbent's existing organization or diseconomies of scope mean a dominant incumbent faces potentially higher costs for serving the new market than a firm who serves only the new. This adds an additional factor that works against an incumbent who competes with unencumbered entrants. In

that sense, this factor can play an important role in shaping the severity of Schumpeterian waves and, as we discuss below, possibly even its timing.

One possibility is that these problems arise *because* an incumbent has had success in the existing market. Its organization has been aligned to the needs of the existing market. This alignment was reinforced over time as the dominant incumbent succeeded in profiting from successive opportunities. Before the arrival of a Schumpeterian wave, the organization has been quite profitable. Indeed, as we argued above, it is best to assume that the existing old business will continue to be profitable for at least a short while as new entrants respond to opportunities in the new market.

A successful incumbent organization contains many features that may interfere with aligning a new organization appropriately to the new market opportunity. Our explanation has two parts. The first part is to argue why a choice appropriate for one type of market circumstances does not have to overlap with the optimal choice for the second type. The second part is much harder. It involves understanding in what sense the lack of overlap *increases* the costs of entering the new market for incumbents or *diminishes* an incumbent's effectiveness in competition with entrants.

In addressing these two issues, we emphasize two points. First, there may be conflicts in organizational design between the divisions of the incumbent organization serving the existing market and those serving the new. If organizational design is difficult to change, realignment to address new markets will be slow. Second, there may be goal conflicts in strategic priorities in competitive environments between priorities for the existing market and priorities for the new. If these conflicts are severe, the costs of perceiving and pursuing both market opportunities may rise.

Conflicts in organizational design can arise in a myriad of mundane organizational activities. We will have numerous illustrations in our cases, so here we sketch a general picture. It can arise from inconsistencies between the incentive systems needed for employees who operate in one market and not another, where, for example, one is salaried and the other is paid on commission. It can also arise when employees in one activity are explicitly rewarded for sales volumes and the other employees are rewarded for accomplishing intermediate milestones that do not affect sales in the short run. Inconsistency can arise from the information requirements of the new opportunity, which might require a distinct set of scientific knowledge or marketing investments by employees who then need to cooperate with one another – although they have disparate assessments about the necessity of such investments in learning. It may also arise from changes in the degree of discretion given divisions and alterations in standards for resolving disputes between divisions, particularly where one needs fast resolution for its competitive priorities and the other serves customers who can tolerate slowness.

Conflict between strategic priorities can also arise in a number of ways. Again, we will illustrate such conflict later, so here we only sketch some examples. It may arise during choices about product design, where the existing market may require reliable products that reside a step back from the frontier. Meanwhile, the strategic priority of the new market may be products that, though they are less reliable, nonetheless come closer to the frontier. Related, the strategic goals of the existing division may focus on a set of products with low-cost after-sale maintenance, while the new market requires exploration

of different designs, some of which will ultimately fail in the market, but which allow designers to learn about consumer valuation of different features. Strategic goals may also shape the incentives to have distinct business partners for existing and new markets, particularly in situations where information must be shared or services delivered cooperatively. The incumbent chooses channels for existing markets in a setting of dominance, yet it may establish policies inappropriate for the requirements of the new.

We are not saying that it is impossible that entirely separate or even conflicting businesses could be owned by the same “firm,” or a holding company. There are multiple examples of that. We are saying, instead, that a firm with common active management of multiple businesses and shared strategic assets will experience very high costs of managing conflicting claims on those shared assets when the strategic imperatives of the different businesses are mutually inconsistent. Deploying the shared strategic assets is not merely a resource allocation problem; it involves resolution of the conflicting strategic imperatives of the distinct businesses.

In rational-actor models, conflicts between organizational design and strategic goals are commonplace. Because the existing division continues to be profitable for some time before the new entrants have grown and matured fully, early in a wave the incumbent must trade off the profitability of serving the existing market with the profitability from serving the new. Such conflicts become framed as trade-offs between profits from existing and new markets, or, what is sometimes equivalent, between the present and future profitability of the firm.

While any one of these conflicts alone may be minor, the totality of them may become quite large. When they are, a Schumpeterian wave is likely to be more severe.

II.4. Ex post analysis of Schumpeterian Waves

We will examine two cases of waves. The first example concerns the emergence of the PC. The second example concerns the emergence of the browser. Before doing this, we summarize the empirical implications of our framework and identify some of the potential issues that arise when performing an ex post analysis of Schumpeterian waves.

Our framing leads to a useful benchmark for analyzing waves: Schumpeterian waves become more likely when the incumbent makes choices that favor the existing market and simultaneously inhibit competitive prospects in the new or enhance the competitive prospects of entrants in the new. Moreover, early in a wave, decisions about trade-offs between the existing and the new market take place when all future scenarios can not be anticipated, so differences in assessment between entrants and incumbents can play a critical role. Different assessments of market opportunities can exacerbate tradeoffs between existing and new markets and organizations. Finally, conflicts between incumbent actions to address existing and new market opportunities will make waves more likely (or more severe) if they hinder an effective incumbent competitive response.

This reasoning will lead us to stress differences in market assessment between entrants and incumbents in our cases. It also leads us to stress disagreements between employees at incumbent organizations about markets assessments early in a wave, especially those that exacerbate any internal conflicts. For example, coordination across

distinct divisions of a firm can become more difficult if employees have disparate assessments about a market's potential and how soon new value will be realized. Waves can become more severe when unanticipated conflicts emerge.

We face a more challenging task linking these assessments to a wave's timing. Managers at leading incumbent firms will be able to anticipate some internal conflicts, but many will arise as entrants and market events expose what types of organizational design best suits demand and competitive needs of the new market. Hence, we are cautious in stressing this link. Almost by definition, a general theory of waves in technically intensive markets cannot fully characterize the costs of organizational realignment *ex ante*, which must be learned over time. Too much is unknowable at the time that crucial decisions are made. These are only observable *ex post*.

Similar reasoning leads to another precaution: observed events do not have to correspond to the perceived counter-factual scenarios that actually shaped the actions of incumbents and entrants decisions. History produces only one event, not the one that corresponds with the most common assessment. Observed realignment costs or scope diseconomies reflect a dominant firm's actions after entering a new market. While it is often possible to trace the sequence of events that led to an *observed* outcome to produce later *observed* outcomes in retrospect, this is not equivalent to explaining how a market and organization might have evolved under a counter-factual scenario had someone acted differently – for example, if the incumbent had entered earlier or later.

We can make this observation another way. Our interplay framework can explain the factors that make Schumpeterian waves more likely and earlier, and make them more severe, but it cannot make deterministic predictions about how an episode would or should end. The very circumstances that make a Schumpeterian wave possible make their outcome inherently unpredictable *ex ante*. By definition, the incumbent firm's and entrants' response to these conflicts will shape events, so, too, will the resolution of uncertain factors and the incumbent's and entrants' actions in light of their resolution. Hence, our analysis will stress the interplay leading to a wave, not its resolution.

This last line of reasoning also motivates the need for closely reasoned empirical study of Schumpeterian waves. As a general matter, many things are possible when organizations and markets interplay, but this very same general theory strongly implies that the timing and severity of actual waves cannot be understood only with general reasoning. Rather, events in any particular Schumpeterian wave only can be understood completely with an analysis of the interplay of incumbent's and entrants' organizations, as well as the market opportunities and incentives enabled by technical advance.

III. First Illustration: Development of the IBM PC

In retrospect, it is clear that the PC launched a revolution – a true Schumpeterian wave that completely reconfigured the competitive dynamics of the industry and ended IBM's period of dominance.⁵

IBM entered in 1981, and demand for the mainframes and PCs grew side-by-side throughout the 1980s. We will argue that IBM had a trying but profitable experience in the early 1980s in the PC business, a result it accomplished by deftly managing the realignment of part of its organization while bearing the costs of managing two distinctly different businesses. After 1985, however, evidence suggests that the realignment costs and (especially) scope diseconomies had grown quite difficult to manage. In saying that, we do not seek to assign managerial responsibility, but only to recognize that managing any PC company in the latter part of the 1980s was challenging. On top of that, IBM's managers face extraordinarily high costs from managing both a large-computing and personal computing business in the same firm.

In discussing this event, we take the view we have argued elsewhere,⁶ that a Schumpeterian wave based around the PC was inevitable, though the details could have taken a variety of forms. The conditions of supply were such that there would have been a large corporation-oriented PC business by the end of the 1980s whether or not IBM had entered the business in 1981 or any other time. This is, dispersed technical leadership over the key components that eventually comprised a client-server platform made it inevitable that such a platform would develop a wide range of applications, competing for a wide range of customers who previously focused on purchasing from suppliers offering platforms specializing in what heretofore had been distinct customers segments.

If IBM had not entered the PC business, other firms could have grown along with the PC business and IBM would have eventually faced a competitive challenge. It might have involved different or the same firms, different or similar alliances, as well as slightly different timing. There is no way to know, but we can be certain that the PC would have been an important corporate technology and a challenge to IBM's core mainframe business by the early 1990s.

Yet, we also recognize that is a statement with twenty-twenty hindsight. We do not presume IBM entered into the PC in anticipation of this wave, or, necessarily, for any strategic purpose related to its managers' anticipation of a wave. We also do not presume that IBM had no chance of successfully negotiating its way through this wave if its organization was aligned to the market demands. Rather, our analysis will focus on understanding the firm's assessment of the opportunity as it appeared *ex ante*. Similarly, we do not presume a static assessment over time. As events unfolded, so did management's assessment of the market opportunity and their organization's place within

⁵ This case study presents only essential highlights from a very long sequence of events. For a full review of all the details, see Bresnahan, Greenstein and Henderson (2006).

⁶ For an elaboration of this argument, see Bresnahan and Greenstein (1999).

the market. Hence, we seek to understand the changing market incentives management faced as well as their changing assessment of those incentives.

We will stress throughout that the ultimate outcome of a PC industry – eventually dominated by firms other than IBM – cannot be adequately explained using either solely market or organizational lenses. In other words, the essence of the Schumpeterian wave here – its timing and severity – is more usefully interpreted as the interplay between organization and market.

III.1. IBM and the Mainframe Business

We begin with a discussion about how IBM aligned itself with the market opportunities in computing before it launched the PC in 1981. It is very difficult to sustain the argument that IBM's strategy, including its limitations, was irrational. IBM held a dominant position in the most lucrative segment of computing, and it faced strong incentives to continue to innovate in that market for its existing customer base. The firm had effective means for gathering information about how technical improvements could serve market needs. Their organization and market position let them repeatedly act on that information. In many respects their behavior was exemplar.

More specifically, IBM dominated the mainframe business for many years. IBM was well-aligned to the market opportunity of supplying enterprise data processing, but in a manner which would make later realignment difficult because of sunk costs.

IBM's long-run strategic goal was to dominate all general-purpose technologies in enterprise data processing, and its strategy was to bring all new technologies with general importance to large enterprises into its platform. This called for successful identification of such technologies – a demanding learning task, since it involved both technology and complex customer demand – and of updating the platform to incorporate them – another demanding technical task. IBM could be extremely persistent and foresighted in attempting to bring new technologies into its products (though outsiders groused that IBM often chose to wait and use only the version of a new technology invented in-house.).

Historically, IBM had dealt with wrenching transitions in the technical basis of its core business. The most important technical revolution in that business, the computer, arrived when IBM was the dominant firm in electromechanical data processing devices, and it left IBM the dominant firm in enterprise computing. This historical example suggests the value of using a more nuanced theory of organizational capabilities than assuming that this old firm was somehow stuck with old technologies or old ideas.

Indeed, not long after IBM shifted to computer technology, it brought forth an innovation, the modular platform, which would support its dominant market position for decades. The IBM System 360 was launched in 1965. It was a multi-million dollar gamble for the firm, but it grew to become the single most profitable product introduction in commercial computing, generating more revenue than any other computer product line

for more than two decades.⁷ Together with senior management, which supported it over the objections of existing product line managers, and the sales organization, which could direct its improvements toward strategic customer needs, the modular platform was well-aligned to IBM's market.

The system 360 was a *system* – an operating system and set of applications that worked across a range of hardware sizes. Its unified and largely proprietary architecture proved to have enormous appeal to commercial users – large corporations, for the most part – because it provided them with the option to upgrade across a family of systems 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: a classic entry barrier rooted in sunk costs.

The dramatic success of the 360-based mainframe business shaped the organizational capabilities of IBM thereafter in very 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 dominant role within the firm. Almost all 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 in the mainframe division.

The incentives facing many employees suited the opportunities in the mainframe market extraordinarily well, but, as it would turn out, would be misaligned to supplying products or services in the PC market or to assessing changing conditions in the PC market. The IBM sales force was divided by region and industry, and even by company in large industries. Compensation emphasized meeting and exceeding quotas for new sales and for keeping customers. This oriented employees towards 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. By the late 60s, no other firm could match this network of relationships, which, in turn, became a classical sunk-cost-based barrier to entry.

Prior to the emergence of the PC market, IBM's managers consistently acted to protect the profitability of serving the large-system market. They tried to keep most of the business for installing upgrades within the IBM product family. They adopted policies for resisting the use of non-proprietary software specifications, and, more broadly, resisted anything offered outside IBM's proprietary designs. They kept the manufacturing of most products in-house, and for most of the 1970s IBM also resisted adopting technical standards put forward by national or international standard-development organizations.⁸ IBM also offered very limited support for plug-compatible competitors and third-party peripheral vendors and tried to limit the information that flowed to them. A number of

⁷ It is beyond our purpose to tell this entire tale. For explanations, see, e.g., Pugh (1995), Fisher, McGowan and Greenwood (1983), Fisher, McKie and McGowan (1983), Katz and Phillips (1983), Brock (1975b), or Watson Jr. and Petre (1990).

⁸ Brock's (1975a) analysis of IBM's policies for EBCDIC is representative of this type of analysis.

antitrust cases arose over these practices, and over time IBM's behavior changed in response.⁹

Inside IBM there were frequent debates about whether (or how) to respond to new technological opportunities and whether (or how) to respond to a large number of outside firms serving different parts of the computing. These debates focused on the scope of their product line, the breadth of customer needs to address, and the technical opportunities to investigate most intensively and those to leave aside to others. Indeed, the debate that led IBM's managers to introduce a PC began in the summer of 1980 just as many of these prior debates had begun. As with many of these prior experiments, an objective observer might conjecture that this one too had a high probability of expending many resources but not fundamentally altering IBM's business.

The decision-making processes inside IBM centralized strategic decisions. Watson Sr., the CEO who built IBM over several decades and began its foray into computing markets, had encouraged contentious debate, ruling through his personal authority (and infamous temper). When Watson Jr. became CEO in 1956, he tried to reduce some of the *ad hoc* features of strategic decision making. He established the "Management Committee" (known as the CMC, for "Corporate Management Committee," to outsiders). By the late 1970s this process touched every aspect of strategy in IBM. "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. While this forum became known for its decisive decisions (especially in the era of Watson Jr.), it also became known for the layers of management below it that decided which disputes received attention.¹⁰ It also became famous for its "task forces," which generated reports aimed at gaining more information in an open dispute.

Using this decision making apparatus, IBM's top managers aggregated a very wide range of customer concerns *and* coordinated large-scale product development strategies for the entire customer base. In the mainframe market this process gave rise to products that were, in general, high quality, backwardly compatible, technically conservative, and highly priced. Introducing products with backward compatibility both kept customers happy – by enabling them to preserve their local investments – and supported IBM's competitive position by renewing and extending the installed base. The technical constraints imposed by respecting backward compatibility meant that IBM's offerings were not always on the technological frontier. In addition, the collection of information and the development of a large-scale project often took time, further putting product introductions behind the ever shifting frontier.

⁹ IBM's resistance to plug-compatible components dated from an antitrust case over selling punch cards. It arose again with the System 360 and its legacy, as IBM sought to compete with third parties and clone makers. This generated a federal antitrust case and a European commission case, resulting in a series of policies for sharing information with other firms.

¹⁰ This process continued to guide the formulation and implementation of strategy for IBM until an outsider, Lou Gerstner, became CEO in the early 1990s. He eliminated the entire process.

This example illustrates a broader feature of IBM product development process at this time. Because mainframe customers were generally willing to wait a short period for the next upgrade – as long as they were not too far from the technical frontier – there was little strategic cost to IBM from focusing primarily on lowering the probabilities of costly error. Thus IBM developed elaborate quality-assurance processes to ensure that they shipped robust products.

It is a cliché of the computer business that managing technical change and market opportunity is difficult and that technologists acting alone are unlikely to choose the most commercially valuable direction of technical progress. IBM's organization empowered the sales function to lead critical decisions about the direction of technical progress. This allowed the organization to pursue a very large number of internal technical initiatives and to choose among them, often to the great unhappiness of the technologists whose projects were not commercialized, in a customer-friendly fashion.

This organization ensured that IBM was 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 serving enterprise customers very well. A high-value example was the strategic response to computer networking. As the PC wave loomed, IBM was engaged in platform improvements for electronic commerce in support of very valuable applications such as the computerized reservation system for airlines and the automatic teller machine network for banks. These adaptations to a new environment were very successful for IBM and its customers. It was with some merit that IBM's employees came to believe that they understood (in a way that others did not) the combination of organizational traits and technological features necessary for commercial success in large-computing systems.

That said, in the late 1970s IBM's management was not excessively smug about the capabilities of its organization. IBM's top management viewed its decision making process through nuanced lenses. In their view sampling widely often raised legitimate issues that required coordination between different parts of IBM. These issues reflected both organizational and market-oriented concerns. However, the process also had some readily apparent drawbacks, such as its slow and inevitably painful movement towards a result. The need to coordinate input from the sales-side with new technological opportunity also put great pressure on senior management's ability to comprehend and select among conflicting opportunities, as well as settle disputes.

Indeed, partly for such reasons management would wane in its commitment to using this process for the PC, choosing to bypass this process at first before committing back to it over time. As we discuss below, these changing commitments would affect the timing and severity of events in the PC market.

Lack of commitment to this process was easy for another reason. IBM's efforts to compete outside its core enterprise computing market had all failed. 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. This called for steady experimentation with new technologies, overwhelmingly done in-house after soliciting heterogeneous voices reflecting a wide array of perspectives and financial incentives. As it would turn out, 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. Yet, the pattern was quite broad. Attempts to make minicomputers and other smaller systems had also had long histories of commercial failure.

One particular and recent failure would cast a long shadow over many early decisions in PCs. The minicomputer market arose outside the mainframe market, generating a crisis within the CMC to initiate a response. The IBM 4300 was designed to compete head-on with DEC's VAX and was introduced in 1976-77. This product line stumbled in the marketplace because the product was forced to align with IBM's existing organization and technology. DEC, whose product was aligned with the emerging midrange market, succeeded admirably.

Many within IBM's management took several lessons from their experience that shaped their decision in PC. Many concluded that the decision making process itself had led the firm to develop an ineffective product. The IBM 4300 was a compromise between many organizational demands and market needs, while the competition simply responded to market needs. For example, the 4300 was a *partially* 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. As another example, IBM's planners also compromised on the pricing, embedding some overhead and service in the standard contract, which cost more than the other general-purpose minicomputer firms but not as much as in a mainframe. Users, however, largely rejected these compromises for competitive alternatives.

Altogether, as the PC revolution began, IBM's organizational capabilities were fully aligned with a very profitable market opportunity in large-systems and had a strategy to remain dominant. The organization was permeated with powerful incentives to serve the existing customer well: the sales organization was the strongest organizational actor, and decision making was slow, contentious, and – in the context of its existing market – very successful. Yet these same strengths would greatly hamper IBM's ability to reposition itself successfully in the face of the next great Schumpeterian wave: the PC.

III.2. The advent of the PC

Why did IBM finally enter the PC market – and in so doing embrace open systems¹¹ business and organizational models that the firm had long rejected? That is the focus of this section. Given that IBM's entry gave enormous impetus to the PC revolution, but that other firms ultimately earned the enormous profits as well, IBM's

¹¹ There is an ongoing controversy over the use of the word "open" in the computer business. We use the definition of an open systems platform as one any firm can improve and no firm controls a bottleneck on improvements. The IBM PC was an open systems platform in the 1980s. The Windows PC is not an open system platform today, as Microsoft maintains a bottleneck. (Some observers would use a different definition of "open" and say the Windows PC is open because there is no proprietary hardware firm with a bottleneck.) Similarly, IBM mainframes were a proprietary system, not an open one, in the 1980s, and the World Wide Web was an open platform in the 1990s.

strategy is difficult to understand either looking forward from their initial behavior or with twenty-twenty hindsight.

Part of the answer about the timing of this decision must lie in the success of the PC before IBM entered the market. This is intimately connected to the question of why IBM at first ignored the PC.

Between 1975 and 1979, when the PC industry first began to emerge, IBM's managers did not have any reason to believe the PC could become a large business opportunity – and certainly no reason to believe that it could be a threat to the profitability of the mainframe business.

The origins of the technology were unprecedented, but, by the same token, initially unthreatening.¹² Many firms with appropriate technical capabilities such as Texas Instruments and Hewlett Packard had stayed away from the product area – like IBM, they did not perceive any commercial opportunity. Instead, a hobbyist (almost amateurish) community had given rise to a “bottom-up” process for invention. The customers were hobbyists and gamers, and the largest market appeared to be in the home. The PC market had its own magazines, such as *Byte*, and also its own social network, such as at the Home Brew Club. As such, the PC market appeared quite distinct from existing computing markets.

The architectures for PCs initially met no technical ideal that a large-systems manager at IBM would have ever articulated in advance. Instead, they met the pragmatic goal of satisfying the individualistic (and somewhat quirky) demands of technically savvy hobbyists, allowing such a user to perform some basic computing functions for very little expense, at their own convenience, and, importantly, without oversight from IS managers (with whom IBM had strong existing relationships).

The identities of the extant PC suppliers were not large established firms with corporate clients (IBM's familiar competitors). Apple and Atari were start-ups, and the hardware suppliers who used another operating system, CP/M, were entrepreneurial as well. Only Tandy had an established business in its Radio Shack chain, but this chain was nothing like any of the mainframe firms. Moreover, while Apple had begun writing its own applications and encouraging others, the CP/M community was uncoordinated, often descended from hobbyist electronics communities. No single supplier provided the lion's share of the proprietary parts. The microchips came from Motorola (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 retailers.

Overall, in relation to the mainframe, the earliest PC firms did not sell a computer that represented a drastic or incremental technological change in any possible meaning of the concept. The PC, such as it was, was not even remotely competitive with the IBM

¹² None of the familiar competitors served this need, not Burroughs, Sperry-Univac, Honeywell, and so on. It also did not come from the places where the typical technological revolution in computing science originates, such as MIT's or Stanford's laboratories, IBM's own labs, or the Department of Defense.

mainframe, and their customers were users that IBM and DEC and Wang and others did not bother with. In short, the product was not targeted at IBM's customers and – arguably – could not meet their needs without changes.

No existing computer firm entered in the early stages, which lasted several years. Indeed, one of the more important sources of supply of PC entrepreneurs was junior engineers from established computer companies who asked their employers if they could work on a PC project in-house and were refused.¹³

All of this began to change in the late 1970s when the existing PC began to find a market inside the corporation. Commercial, rather than hobbyist, users bought application software from third-party vendors such as Visicalc, the most popular application for the Apple II. Word processing started to look like a useful technology in bureaucracies, and the leading word processing program for the time, WordStar, resembled a nascent emerging corporate software vendor. A number of corporate PC efforts were announced, including one from Apple, the Apple III. Suddenly, the PC was being sold to IBM's customers.

Our only point so far is that Apple and others were the “entrant”, as in the standard model of waves. Further, it is not surprising, in retrospect, that forward looking firms would seek to enter the PC market after observing the experience of these “entrants” and recent change in their strategies. All at about the same time a number of established computer firms entered the PC business, including DEC. By far the most successful, however, was IBM.

Once again, it is hard to sustain the argument that IBM's actions in the PC market were irrational. If anything, it is easier to interpret these events simply: IBM's management supported forward looking experimentation in its sub-divisions (and one of those unexpectedly bore fruit). Looking closely, however, this simple interpretation does not hold up. From the outset the situation was more nuanced.

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.¹⁴ After much study and a consideration of a variety of plans, this division arranged for a presentation in front of the CMC. The leader of the Boca Raton group, Bill Lowe, was able to persuade the CMC to make a significant investment in the PC.

This experiment had several puzzling features. Among them, the CMC authorized the division to use an entirely different organizational and business model. Why? And – most importantly for our purposes – why was it destroyed within five years? In answering that question we explain both the timing of the PC and we develop much of the answer for why the wave became more severe thereafter.

¹³ In a canonical story, Wozniak approached his bosses within HP for support to produce the earliest PCs and was rebuffed. Jobs had worked there several summers prior to founding Apple, but by 1976 worked at Atari. He and Wozniak both quit their jobs in order to start Apple.

¹⁴ The contemporary media also shaped perceptions. Atari and Apple computer were the darlings of the business press. See, e.g., Cringely (1992) or Freiburger and Swaine (1984).

There were, apparently, multiple reasons for going ahead. It is unclear which reason was most paramount to the outcome and how much IBM's top managers understood in the summer/fall of 1980. IBM's CMC left few paper records, so most of what is known comes from second-hand interviews from people who recall being remarkably foresighted. Among the salient issues discussed:

- (a) Some technically adept users crossed the line between hobbyist and work use. The PC was about to be marketed to people inside IBM's customers.
- (b) PCs were already easier to use than "green screen" terminals. As an intelligent terminal, the PC potentially threatened peripheral revenues.
- (c) Though the revenues were small, PCs were getting attention from futurists and popular trade magazines. This was especially true of the Apple II and 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.
- (d) The PCs involved a loose collection of entrepreneurial and less-established firms. Bill Lowe argued that the introduction of professional distribution and servicing, IBM's traditional strength, could significantly alter the value proposition of a well-positioned design similar to what was already provided.
- (e) A nightmare scenario was easy to sketch. Futurists had been forecasting 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 others. As in the mini-computer market, the bulk of the revenue would flow elsewhere unless IBM acted to control standards.
- (f) Clarity about the nature of the future market opportunity may have mattered much less than the leadership's (in particular, the CEO of IBM, Frank Carey) desire/obsession to fill a hole in a product line that had defied many prior product development attempts. They were willing to experiment to get it done.¹⁵

This last point is a critical one, because the IBM PC division would gain from the protection of the CEO, permitting it to act in way that did not follow "the IBM-way", as understood by IBM's employees elsewhere within the company. 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. It also shows that IBM's introduction of the PC was not an event determined solely by the competitive dynamics of the marketplace but, rather, a complex interaction of the organizational dynamics within the firm coupled with a reasonably accurate, if indistinct, perception of the PC market's role as opportunity and long-run threat,

¹⁵ See, e.g., the account in Chposky and Leonsis (1988) and Carroll (1993).

III.3. The Organization of Entry into a New Market by an Established Firm: A Firm-within-the-Firm

The 4300 experience had fueled a debate inside IBM. Many blamed a planning process that was unaccustomed to delivering decisions with any sense of urgency, that represented too many voices, (especially those of existing account managers concerned with cannibalizing existing sales), and that allowed for too many technical compromises. There was also a belief that the planning processes had focused too much on internal rivalry within IBM. The experience in the midrange market also illustrated the dangers of letting a firm other than IBM establish, manage, and grow a platform with backwardly compatible features.

IBM's early decisions in the PC market would be shaped by these lessons. It encouraged managers to create an independent division – the term inside the company was an “Independent Business Unit” or IBU – with considerable autonomy.

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. 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, backed the PC group's decision without review – i.e., *without* calling for any presentations at the CMC, sticking to a pre-committed schedule for review every few months.

The PC group was thus given a license to *de facto* “act like an entrant.” And, at least initially, the division did, suggesting that – apparently counter to our central argument – IBM's organizational capabilities were not constraining the firm's response. Looking more closely, however, IBM's managers did not – perhaps *could not* – leave the PC division alone once its business became important. Those later events explain the timing and shape of the Schumpeterian events that followed.

The interplay between the early organizational choices and market events at these early stages would shape many later issues. The Boca design team made many decisions for design, development, and production which departed radically from IBM precedent. Following other early entrants, it used inexpensive (instead of frontier) components, except in a few key places such as the microprocessor.¹⁶ IBM also sourced parts from other 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. IBM also invited other software and peripheral vendors to make compatible software and peripherals for the new PC, another break with precedent. To do so, it made many technical details about its PC available to many other firms, another break with IBM's general practice of secrecy.

¹⁶ This chip design was also off the shelf, since it already existed at Intel and then, at IBM's insistence, a second source, AMD.

A “firm-within-a-firm” like the IBU corresponds to one of the archetypes of the economics of organization. In the early days, IBM appeared to bear no organizational scope diseconomies. On the contrary, the firm appeared to gain large economies of scope from its reputation, as customers in corporations turned to IBM for a PC, and application developers wrote for a platform whose success they forecast.

However, that also would be too simple. There were also some problems that arose from IBM’s established reputation. IBM sought as partners the leading suppliers of key PC complements. They succeeded in signing up the leading microprocessor maker (Intel), the leading maker of programming tools (Microsoft), and the maker of the leading spreadsheet (VisiCalc.) Yet their reputation as a proprietary systems company led to problems negotiating with the maker of the leading operating system (CP/M) and the leading word processor (WordStar).

The operating system came from as motley a company as any of the other software vendors, signaling how far the IBM team was willing to go for the sake of speed. After failing to arrive at a satisfactory arrangement with the market leader in operating systems for CP/M systems, the PC group procured their operating system from a Seattle-based company (Microsoft) which was a 32-employee firm when IBM first called in July of 1980. It 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). Microsoft’s lack of conventional credentials was not unusual in a market where one leading firm (Apple) had co-founders (Jobs and Wozniak) who also were college drop-outs and had once briefly sold “blue-boxes” to hack the telephone system. Microsoft’s sketchiness was exceeded only by the supplier of IBM’s word processor, whose owner’s previous activity had been as “Captain Crunch,” a notorious “phone phreak” (or telephone hacker.)

How did IBM succeed in having a “firm-within-a-firm” with only the (small) reputation disadvantages and (large) reputation advantages of being in IBM? Why was the team allowed to act so differently from the more “normal” modes of operation of the mainframe division? The answer arose from the interplay of the market circumstances and the organization’s capabilities. The failure of the 4300 almost certainly played a major role. So, perhaps, did the extensive history within the firm of separate divisions attacking niche markets. IBM had an active office products division, for example, whose prototypes were state-of-the-art for their time and included variations on some of the best electric typewriters in the business. There was also a social mechanism within the firm to legitimize “different” activities. Both Watson Sr. and Jr. had openly used the term “wild ducks” for unusual activities. Boca Raton applied the label to itself and so did others, giving it social license to differ.¹⁷

Thus Carey and Opel took few risks: they irritated others parts of IBM, but at little cost. Every attempt at IBM in very small systems prior to it had failed, and if this

¹⁷ The term “wild duck” seems mostly to refer to social behavior – e.g., a wild duck does not fly in formation. In IBM, that implied the individual did not wear blue suits and white shirts every day. More broadly, it was a social convention for permitting creative technical talent to contribute to the enterprise in spite of a sometimes awkward social fit with the sales division.

attempt failed too, then any conflicts with other parts of IBM were moot points. If it worked, it would result in the development of a product where none was expected. 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 IBM's most important organizational capabilities. As we shall argue, as soon as that perception began to shift, the division's independence came under attack.

III.4. Problems of Realignment

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 during its launch. The success of the PC division could have led to one of two outcomes. IBM's top managers could have concluded that the success of the division arose from many of its unique features. In that case, the lessons learned in the new division would need to be transported to the rest of IBM, or at least maintained on a second track. Alternatively, they could have concluded that many of the successes at the PC division arose in spite of its unique organizational features. In that case, many of the features of the existing organization would need to be transported to the new. In fact, the latter occurred, and it is those latter events that generated many of the most severe and well-publicized features of the Schumpeterian wave associated with PCs.

In common with many other observers, our interpretation below traces many of the failures at the PC division to the imposition of procedures that are normal for larger systems. We will, however, interpret these procedures in terms of the costs of coordinating 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 is also well-aligned. Forcing the new division to coordinate with the existing imposed costs on the new, and these costs contributed to its decline.

We recount these events in light of many issues popular portrayals missed. IBM's PC troubles attracted considerable press attention after 1988. IBM's financial distress in the 1990s 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 overwhelming evidence of crisis in the early 1990s, which later culminated in a changing of CEOs. While these latter events are certainly engaging illustrations of behavior at a formerly dominant company going through a Schumpeterian wave, they provide little illustration about what made the crisis likely, which is our goal. We accordingly concentrate on earlier events. In doing so, we also shed light on what shaped the timing of some key entry events, which made the latter events so severe.

III.4.a. Scope Diseconomies from Aligning to 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 company was completely brought back to the familiar IBM style of management. How did the interplay of market and organizational incentives bring this about?

Even at the outset, though IBM's PC design was supposed to respond to market needs, it also deferred to some of the existing practices at IBM. For example, the original proposal for the design of the PC explicitly *did not* propose a leading-edge design at the frontier of microprocessors for fear that doing so would get the entire project politically derailed over cannibalizing IBM's (already sputtering) mini-computer product line.¹⁸ Many of the pre-existing parts were also chosen because they had passed marketplace tests and could easily pass internal IBM reliability standards. In effect, the PC group backed into a design with both frontier and conservative features, which some marketers believe helped sell it to business buyers. This gave the strategy an internal organizational logic that might best be described as partly "under the radar." The rapid and incremental design was also reasonably well aligned to the needs of the PC market at that time.

IBM announced the product in August of 1981. It shipped that fall. There was strong demand – something that surprised many within IBM. But even strong demand could not overcome rising tensions with the rest of the organization. One tension arose in the early planning for production. The PC group had avoided using internal supply when their costs were not the lowest, which was not the norm in mainframe production, and the PC group made many enemies at divisions that were turned down. Even when divisions won rights to supply parts, it did not earn the PC group many friends. The PC group attempted to make internal suppliers act like external suppliers, and refused to act like the mainframe group, which throughout the 1970s 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.

Another major source of tension arose from the failure of the PC-jr, which was ostensibly aimed at the home user. IBM had aimed its first PC at the business user and perceived an additional market for a compatible design. This was launched in 1983, and became 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 this market outcome, but two deserve note. First, expectations were out of scale with reality. A small firm with the sales of the PC-jr would have considered it a success. Second, the failure was almost the inevitable byproduct of the PC group's attempt to take market risks like an entrepreneurial company. The failure taught all market participants a great deal about market demand, but most of those lessons would be used by the next generation of products.

The PC group came close to operating according to the norms of an entrepreneurial enterprise, emphasizing quick decisions, resolving disputes through verbal debate, using minimal documentation, and deliberately taking risks. Errors were inevitable in such an operation, especially in forecasting. As long as it succeeded, the group was safe from second-guessing. But publicized errors made it vulnerable to

¹⁸ At the same time, the engineers could not resist pushing the technology edge by choosing a 16-bit input/output channel. 8-bit was the standard prior to the IBM PC.

assessment according to the older norms. For example, when the PC-jr 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.

The internal perception thus began to arise that the 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 Chaplinesque errors at the PC division (especially over the PC-jr's design and the AT's problems in quality control) diminished years of careful image-building, hurting the firm's reputation for reliability – something that was essential to the marketing of large-systems. The publicity that the division received – e.g., the IBM PC made the cover of Time Magazine as “Computer of the Year” – was thought to have interfered with important aspects of IBM's marketing strategy with respect to its traditional customer base.

PC distribution was another major cause for concern. Boca Raton – in keeping with its mission to “act like an entrant” – did not initially depend on IBM's own distribution network, instead arranging for distribution through third-party retailers Sears and Computerland. Channel conflict was inevitable in this arrangement as multiple channels served growing demand, especially because demand grew well beyond what had been forecast when it was first established, and because the external channel worked better than even the PC group had intended. Very quickly, Sears and Computerland grew accustomed to selling and servicing PCs in large volumes. Many businesses then used these outlets for purchase instead of going through IBM's distribution system.

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. That sounds terrific on an organizational level, but it was not success shared with many employees outside the division. A significant fraction of that revenue was not contributing to sales commissions, a factor that was generating conflicts with the established distribution division for IBM. Another, more subtle, form of channel conflict also arose. The PC group was accused of not policing the gray market for PC hardware. The PC group had less incentive to police this than IBM's distribution channel because it brought prices down.¹⁹ It is very unclear whether these petty accusations had any truth to them, but the accusation continued to be raised in Armonk, even after Boca Raton revoked the authorization of a few specific outlets for violating IBM's resale restrictions.²⁰ This example illustrates an essential point: IBM's distribution channel

¹⁹ Evidence for this accusation is ambiguous. The gray market resells PCs. It is operated by vendors who purchase (at a discount) excess inventories from established dealers. See the discussion in Carroll (1993).

²⁰ There were continuing conflicts over channels, especially during the planning for the PC-jr. In one view, the channel for the PC-jr should have been expanded to other mass-market retailers, such as K-

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.

In 1983, less than two years after launching its key product, the division lost its direct reporting relationship to Opel, with Estridge, its director, reporting to a boss who reported to a CMC member who reported to Opel. While the newly renamed division retained its discretion over forecasting, pricing and servicing, this change began the integration of Boca Raton back into normal IBM operating procedures. This change in structure affected daily operations. Rather than running the division directly, Estridge, the head of the PC division, began to spend several days a week in Armonk, taking care of internal political and operational issues. Through much of 1984, he fought attempts to make the PC the server for an office automation strategy and attempts to coordinate distribution of the PC with others 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. Not long thereafter, Estridge was moved to another position.²¹ The original manager for Boca Raton, William Lowe, who had spent the last few years at another location, was moved back. 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.²²

Because the CMC decision was quite controversial with employees in Boca Raton and because few written records were kept, it is not clear why these changes were made. Among the reasons offered by secondary sources:

- This division now accounted for an increasing fraction of IBM's revenue and publicity. Corporate managers wanted division managers who were sensitive to IBM's corporate norms, such as documenting all decisions – something Estridge resisted.
- There was precedent at IBM for tolerating “wild ducks,” as the original Boca Raton group liked to think of itself, in R&D and development activity – but not in a large and profitable operation such as the PC division had become.
- With the antitrust suit behind it, IBM had a banner year in its traditional businesses, mainframe computers. Most employees in sales expected it to only get better if they coordinated distribution of the PC through all channels.

Mart and JC Penny. In another view, which eventually prevailed, such channels could not provide the after-sale service that IBM wanted from outlets selling its products.

²¹ Estridge was given a corporate job involving world-wide 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.

²² 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.

- Most employees with experience in large-systems had little sympathy for the view that the PC group had succeeded by adopting non-standard operating practices. Few of them perceived the costs from imposing normal operating practices on the growing PC operation.
- Lowe's appointment coincided with the promotion of the new chief executive, John Akers, who openly preferred centralization for IBM.

Thus, for all its early alignment to the PC marketplace, the initial organization of the PC within IBM did not leverage initial success as an entrant into success in the era of setting of proprietary PC standards. 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 re-coordinated organization was best or whether it was the outcome of a wasteful internal political fight, or both. The incident does at a minimum show how problems with the "firm-within-a-firm" archetype can lead to its eventual demise.

III.4.b. Long-run problems of realignment

For the next three years the PC division did, in fact, aspire to act like any other division of IBM – in the sense that it aimed to release new PC products only after internal consultation and deliberation, presenting buyers with technically reliable products priced with high margins and later than competitors. Unfortunately for IBM's commercial prospects, most potential buyers did not wait for the results of this coordination because they had access to alternative compatible products with similar functionality priced at low margins. The traditional IBM supply organization was stunningly misaligned to an open systems market environment like the PC.

Though IBM had entered the PC market as an open systems company, the deliberate product introduction process of the PC division after 1985 moved it away from that approach (even more than prior decisions). This movement was inconsistent with the market environment of the mid 1980s (and thereafter). Clone hardware products began to innovate faster than IBM (the first Intel 80386 based PC was a Compaq machine, not an IBM one.). Meanwhile, IBM launched a major long-term initiative: leapfrog redesign of the PC. An important part of this was a joint venture with Microsoft, to have a new operating system for the PC. These initiatives failed dramatically.

Most critically, the PC revision reverted to IBM's historical stress on proprietary products. The firm announced in 1988 a 386-based machine with a proprietary architecture – the IBM PS2 with "micro-channel architecture" (MCA). In an effort to compel the transition, it simultaneously announced that the roll-out of the PS2 would be accompanied by the discontinuance of IBM's best-selling product at the time, the AT-286.²³

²³ Carroll (1993) attributes the decision to remove the 286-AT from the US market to Lowe alone. As evidence, he notes that just before this decision Lowe's former boss received a promotion to head IBM-Europe, where he did not discontinue the 286-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 distribution division (and either party could have objected if they understood the ramifications).

The PS2 might have sold well if it had had new or different features that users actually wanted. MCA was not such a feature. IBM might have kept its margins high if it had had features that could not be replicated. Yet, plenty of firms offered alternatives to an IBM-brand PC. Thus, the introduction was a disaster.

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 which respected backward compatibility with prior IBM designs but without the MCA.²⁴ The announcement openly rejected IBM's stewardship in planning upgrade cycles for the IBM-PC-and-compatibles industry.²⁵

This is 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. To be sure, contemporary observers understood its importance and newspapers commented on it, but we have added an additional element. We have stressed that there had been plenty of other antecedents to a change in commercial leadership prior to the announcement by clone makers. Our framework helps us trace causes to the interplay between markets and incumbent organization.

III.5. Schumpeterian Waves and the Costs of managing both the old and new

Had IBM's managers intended for their actions to be so disconnected from the market environment? Of course not. Yet, many of the contemporary accounts, especially in the early 1990s, discussed the outcomes as if they were intended. Our interplay framework leads to an alternative interpretation. Once IBM decided to enter the new market, it faced a series of largely unanticipated costs. The costs of operating in both markets shaped the ultimate outcome.

As recounted above, IBM's top managers confidently imposed 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. The view of the established business was that this process involved some costs in terms of delay but had an obvious potential coordinating benefit to the PC division. For example, MCA and related technologies could link PCs in organizations to larger computers. Similar links are very valuable today, but in 1988 customers did not value them.

²⁴ It was sponsored by AST Research, Compaq, HP, NEC, Olivetti, Tandy, WYSE, and Zenith Data Systems.

²⁵ 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 later, a new technology called the PCI bus, sponsored by Intel, came into use in combination with the old ISA bus.

An alternative view is 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 of coordinating with the rest of IBM to the challenges at the new division. This did not have to lead inevitably to failure, 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 in this case.

The arrangement also introduced an additional subtle bias into the selection of information shaping the judgment of key decision makers, which IBM's top managers seem not to have anticipated. Sampling opinions from the rest of IBM produced a consensus among top managers from the large-systems division about what they would like IBM to do in PCs. However, this was not necessarily what IBM *should* do in PCs if it tailored its actions to the (PC) market environment because it elicited the opinions of those who experienced another market with very different supply and demand conditions. As we have stressed, those differences could not be learned quickly, and they were not appreciated at a prospering mainframe division in 1985-86.

This bias might have been corrected by immediate and frequent negative feedback from PC marketplace events. However, negative feedback was not immediately visible in PC product revenues.²⁶ There were no IBM actions to generate strong marketplace reactions until the PS2 rolled out in 1988. For a year prior to this, IBM only talked about its benefits, a marketing approach the CMC certainly approved. The baldly negative outcome in the marketplace made all the positive talk look disconnected from reality, as if nobody had anticipated any negative reaction. It was this latter event that received the most attention in contemporary reports, cementing it in popular imagination as the event that brought about the wave of entry. We have argued, in contrast, that this event resulted from myriad of decisions that preceded it, culminating with those in 1985.

This latter part of the epoch became cemented in the popular imagination for another reason. 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 especially received enormous attention at the time. These last set of meetings were the culmination of years of volatile start-and-stop negotiations, mutual misunderstanding, and frequent redirection of IBM's goals.²⁷ They also coincided with the rollout of OS2 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: it either continued contracting for an

²⁶ 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 286-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 286-XT rollout, which went badly, but it had been planned for some time, so the changes post-1985 were not held responsible.

²⁷ 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.

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 competed with Microsoft directly the market's reaction was decidedly negative. Many contemporary papers treated the divorce between Microsoft and IBM as if it were the downfall of IBM and focused on the question of bad-faith bargaining on Microsoft's part.

Our interplay framework offers an alternative interpretation of the likelihood, timing, and severity of these events. Over the late 1980s, IBM lacked an independent manager in the PC division who could make deals with Microsoft in real time. It lacked a focus on the immediate market needs of the PC market. These made the division a sitting duck for a more decisive firm who was better aligned to the market – i.e., a firm with a clear view of the needs of the market place and the capabilities to address those needs quickly – such as Microsoft, which ultimately took control of PC standards.

IBM preserved, for a time, its leadership in mainframes. That would wane later, and it was likely already visible to some at the time. 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.²⁸ Leadership in the proprietary mainframe platform would later be lost, and the firm would choose an open systems approach, becoming a service firm.²⁹

The later failure of the business IBM chose to pursue is not the key fact about the PC wave, and takes the focus away from the deeper lesson. Rather, the IBM example illustrates the critical role of 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 a fundamental strategic asset, 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.

The scope diseconomies and conflict are fundamental to operating two distinct businesses aligned to very different market circumstances. In such circumstances, it is likely that the existing business will win the internal struggle over the new. In the case of IBM, a number of historical circumstances meant that internal political power shifted

²⁸ 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 revolutions' 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.

²⁹ Gerstner, 2004.

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 company came in 1978 (i.e., if the macro-economy of 1985 had looked like it did in 1978.) Meanwhile, the PC division within IBM had a number of startup problems which made its engineering look sloppy and cost it capital.

There was a great irony of 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.³⁰ That internally cooperative view just happened to be entirely inconsistent with the external behavior required of an open systems PC company at this time. Hence, the IBM PC company died slowly in the stranglehold of cooperating with the rest of IBM.

We next turn Microsoft and the browser waves. Despite substantial differences in the details of this market and organization, and ultimately the outcome of Schumpeterian wave, this case will display a surprising set of parallels. Once again, we will see a dominant firm with substantial sunk costs facing rapid technological progress. Once again, it will employ centralized strategic decision making for regular operations, and move away from them during early phases of a wave, only to change course again after facing considerable issues arising from diseconomies of scope.

IV. Second Illustration: Microsoft and the Internet

IV.1. Microsoft and the PC

The development of the Netscape browser launched another revolution; this time it was the Internet. It was an event that one of the dominant firms at the time, Microsoft, considered to be a threat to the existing hierarchy of the industry.³¹

There is a considerable advantage in looking at this illustration because the antitrust case has left behind a deeper written record about organizational structure and decision making than the IBM example has. It allows us to provide a rich explanation of the timing of this particular wave and its causes, as well as partially explain some of its severity. A corresponding disadvantage is that less time has passed, so there is only a short history of the "post-wave" period.

As with IBM and the PC, it is not possible to understand Microsoft and the Internet without an extensive analysis of its alignment with the existing opportunities in the PC market, as Microsoft manager's assessed them. To that, we start with their existing business.

³⁰ See Killen (1988), whose title "IBM: The Making of the Common View" gives away the punchline for in a careful insider history of this cooperative solution.

³¹ As with the prior case study, we present only essential highlights from a very long sequence of events. For a full review, see Bresnahan, Greenstein and Henderson (2006).

Microsoft's long-run strategic goal was to dominate or commoditize all pervasive general-purpose computer technologies, and its strategy was to enter and seek to dominate new component markets when they appeared likely to become pervasive. To achieve high revenue per employee, Microsoft supplied only those components which could not be commoditized, attempting to keep proprietary standards for itself while forcing open standards on complementors.

Microsoft implemented this strategy by having an organization and capabilities which were aligned with it. The firm compensated for rarely innovating in component markets by being an excellent imitator and incremental improver. The firm was well-organized to detect new technologies invented outside and to decide how they fit into the firm's long-run strategic plans. This created considerable tension for senior management, which needed to be responsive both to the existing organization focused on implementing improvements in existing products and to a constant barrage of new information from outside. Much of this tension was resolved by a combination of decentralization of day-to-day authority for existing product lines with centralization of 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 which were its proprietary technology (though others groused that the important inventions came from outside).

Microsoft had been through a number of Schumpeterian waves within the PC business prior to this one. In each case, they had moved forward without losing their then-preexisting positions. For example, they had been the dominant firm in programming tools for PCs from the earliest days of the industry, and survived entry by a firm with a far-superior product to continue as the dominant firm. Microsoft had also remade itself from a tools firm and had frequently acted as the entrant into markets previously dominated by others (OS, Spreadsheet, Word Processor, Presentations.) Like IBM, it was with some experiential justification that they thought of themselves as an extraordinary organization with extraordinary leadership.

Microsoft's organization was aligned with the dynamic opportunity in personal computing through the ability of its managers to aggregate a very wide range of user concerns *and* to coordinate large-scale product development for the entire product line *and* to coordinate application development by many firms other than Microsoft. Over many years it had built a set of capabilities useful in dealing with consumers, assemblers and other software application writers.

The collection of information and the development of a large-scale project often took time. So, too, did the production of large-scale software. But it yielded market-based strategic advantages that others could not match – e.g., the operating system could have a complex design with broad functionality. It also came at a potential strategic cost. No design feature could be considered market-ready until its functionality had encountered a wide range of circumstances. Hence, designs needed to be *planned* far in advance of their market use, which could restrict the final design (e.g., of an operating system) to functionality *identified* far prior to their commercialization – a potential strategic disadvantage in markets where new customer requirements emerged unexpectedly and frequently.

Aware of the value of large-scale projects and their potential strategic drawbacks, Microsoft developed a production process that innovated at the interface between testing and design. By the time the Internet began to emerge, the company's executives had invested considerable resources, energy, and experiments in developing processes that did not rigidly follow what was colloquially termed a "waterfall" development process, which is, in brief, a predetermined sequence of steps between design, development, and testing. Rather, the firm employed development processes where many parts of the design were broken into sub-steps, each tested at incremental stages, before the biggest and final assembly of code. While many facets of the "meta-design" remained constant over the entire development process, many facets of the specific look and feel of particular functions could change until shortly before first release for beta-testing by outsiders. In this way, large projects retained some flexibility to respond to unexpected market needs identified nearer to the time for final release. It was a cumbersome process to manage, and it imposed additional requirements on managers, designers, and programmers, but its strategic importance for the firm was widely appreciated across the organization.³²

One other of the important factors behind this success was Microsoft's extraordinarily strong decision making, an aspect of the organization that was a direct reflection of its history. By the launch of Windows 95, Bill Gates and Steve Ballmer had gained a great deal of personal authority inside the firm. Their status as successful rebels against IBM, the commercial success of Office and Windows 3.0 and 3.1, and the anticipated commercial success of Windows 95 had all given them wide discretion with both their board and their organization. Gates and Ballmer retained the rights to settle disputes about strategy and organizational design. They had also acquired and retained considerable personal authority to monitor activity, intervene when they deemed it necessary, and discontinue investments they deemed wasteful.

This distribution of authority amplified the importance of their views about strategic priorities and their assessments of a market opportunity. Major strategic decisions were not delegated – ever. Employees were instructed to bring their ideas for initiatives as well as their conflicts to this team. Consequently, the top strategists never lacked for technical information or for heterogeneous assessments of the market potential for new technical opportunities.

This feature of the organization – and its interplay with market events – played a key role in raising the likelihood of a Schumpeterian wave by shaping the timing of decision making at the dominant firm. Specifically, while this centralization gave the firm a unified strategic approach to a variety of issues, 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 out-weighted potential costs. However, it played a role in launching the "browser wars" by delaying Microsoft's response to Netscape's entry into this market.

³² For more on the development of these processes in the late 1980s and early 1990s, see Cusumano and Selby (1995).

IV.2. Microsoft as the Internet Revolution Loomed

We can see both of Microsoft's traditional strengths in the period when the Internet loomed on the horizon. The firm was using its existing position to deepen its hold on PC standards and was aggressively seeking new opportunities in mass-market electronic commerce as a "strong second."

First, Microsoft was deploying its ability to undertake large projects, coordinating a large number of developers inside the company, in customer corporations, and in complementor hardware and software firms to excellent effect. The product we now know as Windows 95 encapsulated years of learning at Microsoft about developing, supporting, and distributing operating systems for mass-market products like the PC. Microsoft had been working on this new operating system for years, and had slipped several planned ship dates. Nonetheless, this was a major effort to move PC standards and functionality simultaneously forward. It had backward-looking elements: a series of compatible improvements in DOS and Windows had left some very old technologies in place, and one goal of Windows 95 was to put applications as well as the operating system on a modern foundation. It also had forward-looking elements, such as improving the programming interface for applications developers and the graphical user interface for users. Finally launched in August 1995, the product was an enormous success, cementing Microsoft's position as a leader in PC operating systems and cementing its position in such key applications as word processing and spreadsheets.

As the Internet revolution loomed, Microsoft anticipated widespread electronic commerce, electronic entertainment, and other online applications of a revolutionary nature, as did most other computer firms. Microsoft was engaged in a strategy to develop and exploit the best technologies for mass-market online applications in electronic commerce and content. The best available outside versions to imitate and improve upon came from firms like AOL. Microsoft characteristically set out to improve upon those with a proprietary architecture. Their idea was to have a proprietary Microsoft standard in place long before there was mass-market use of online services. Technologically they forecast those to be after widespread distribution of broadband access. In terms of timing, they predicted it to be early in the new century. In other words, prior to the diffusion of the browser, Microsoft had committed itself to invest in anticipation of a slow user acceptance of its own and everyone else's services, believing this gave their developers enough time to experiment with a new service and position it appropriately by the time demand by mainstream users began to grow.

As it would turn out, Microsoft's online strategy was remarkably unsuccessful. Yet, we do not want to let twenty-twenty hindsight get ahead of our analysis. Microsoft's managers were quite committed to this strategy in 1994.

Two organizational practices reinforced the steadfastness of Gates and Ballmer to this strategy in 1994. Microsoft's solution involved the introduction of proprietary online services, called MSN. MSN imitated AOL, the most mass-market-oriented among the other proprietary online services, with one important difference: it attempted to exploit Microsoft's position as a distributor of mass-market software. Microsoft hoped widespread distribution of its electronic commerce and entertainment software with

Windows 95 would lead to a new mass market of applications built around the MSN service.

Despite their focus on the commercial opportunity associated with online content and e-commerce, Microsoft's senior management decided not to pursue the content and commerce opportunity associated with widespread use of the Internet following the invention of the browser. The reason for this involves an interesting interplay of organizational and market forces.

IV.3. Taking a Pass on the Internet

In reviewing Microsoft's response to Netscape, two features emerge as particularly intriguing. First, Microsoft's response was slow. While IBM's entry into the PC business was early enough for it to play the major role in stimulating the takeoff of the technology in commercial use, Microsoft's browser was not the first to obtain mass-market acceptance. This advantage went to Netscape.

Why was Netscape earlier than the most successful software in the PC market? One logical possibility is that Microsoft was not prepared because the threat 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.³³ The technological origins of the threat also were not standard.³⁴

However, we can rule out this explanation. 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. Microsoft employees were regular participants in the portions of the computer industry organized around open systems lines. Employees summarized support conversations and notified supervisors about important changes. Moreover, the process for triggering changes in the product set 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 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 to gain strategic advantage from investing in Internet applications.

³³ Though, to be sure, once the Internet began to diffuse, it did not take Oracle or Sun long to device 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).

³⁴ 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. 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 first popular browser came from a super-computer lab at the University of Illinois. The operations for the US Internet backbone came from the recently privatized NSFNET. On these origins and their transition into commercial markets, see e.g., Abate (1999), Berners-Lee (2000), Greenstein (2001), and Mowery and Simcoe (2002).

The decision at this stage raised the likelihood of the wave, letting the actions of entrants determine the timing of the wave. At that stage the firm decided to provide only Internet “plumbing” to connect a PC, leaving the browser and other applications to outsiders. Gates and Ballmer insisted that Microsoft keep to the status quo and not invest.

The decision reflected prior assessments that a proprietary on-line service model was the most profitable entry path for Microsoft. In autumn, 1994, Gates restated the then-familiar strategic analysis at another meeting. He expressed considerable skepticism about the profitability of any 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 non-commercial origins of the Mosaic browser potentially reinforced the view that the application lacked profitability. Further, Gates expressed the view that any standards for PC-Internet connection would be decided by Microsoft with its (then) 100 million users. Seeing neither opportunity nor threat, the firm moved forward.

Not everyone at Microsoft agreed with their senior management’s decision. Two disobedient initiatives inside the company emerged, one of which caused ongoing organizational stress.

A small group inside Microsoft worked on a “skunkworks” browser in Autumn 1994. These employees were due to gain internal power and prestige later, but at this time they labored, as a skunkworks often do, under the radar screen of top management. No one paid any attention to them, and, by the same token, they received few resources.

Another group – especially the marketing people in the very influential division preparing Windows 95 for launch – also sought to initiate a wider set of programs inside Microsoft. These programs were designed to make the firm’s products compatible with the Internet and to cooperate with Internet-oriented firms. Senior management, of course, encouraged them to add technologies to Windows 95 for Internet “plumbing” or basic connectivity.

The Windows division, however, also saw a considerable profit opportunity in selling space on the Windows 95 desktop (or providing related distribution services) to Internet Service Providers – a kind of “click here to sign up for the Internet” which would take the user to an advertisement. ISPs were even willing to pay for position, so such a program could become quite profitable. The problem with this initiative is that it involved a conflict with the planned proprietary online service, MSN, which was still quite young at the time. To give MSN its best chance at scale economies would require exclusive distribution with Windows 95. All initiatives with ISPs were, therefore, quashed by senior management. Though potentially extremely profitable, it was quashed in November, December (with alleged finality) and January.

Quashing the effort to cooperate with Internet Service Providers shows a real organizational strength on Microsoft’s part. The firm was protecting a future effort, its (soon-to-be doomed) proprietary online service, from a powerful internal group with a current near-term profit opportunity. Like IBM’s senior management’s protection of the

independent PC company, it is the kind of action taken by a strong organization that is attempting to be forward-looking.

IV.4. Costs of Alignment to the Old Market

Microsoft delayed having its own browser until a last-ditch effort put a very unimpressive project in the box with Windows 95, calling it version 1. This add-on was a hastily modified version of the Mosaic browser, originally developed at the University of Illinois several years earlier, which the university was now licensing out widely through a third party. By this point, August of 1995, this add-on was not sufficient to execute a successful fast-follower strategy. 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 the Microsoft browser.

The delay gave Netscape an extraordinary commercial opportunity, which others would later label an "error" by Microsoft. In retrospect, such an error would not – we might say, *could not* – last forever. Microsoft was and is an organization with administrative processes designed to help it respond to market events, even when the CEO is steadfast in his views. In this sense, the interplay between market events and organizational practices at Microsoft had a key role in shaping the timing of this Schumpeterian wave.

The key change in strategy came in the spring of 1995. By this point, the entire question of the Internet had become increasingly urgent inside Microsoft for a number of reasons:

- (a) Netscape had begun to make money from sales to businesses and employed a unique distribution mode involving "free" downloads by households.
- (b) Netscape's products were getting attention from futurists as being necessary for all computers.
- (c) 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 – practices aimed at controlling the rate and direction of innovation.
- (d) Not long after its founding, Netscape began to expand its product line into networking products.
- (e) The set of uses for the World Wide Web began to mimic the functionality affiliated with the proprietary on-line services.

The latter three arguments turned the browser into an activity more consistent with established modes of analyzing the PC market environment. By the spring of 1995, it was possible to use a commercial browser to surf the earliest attempts at developing applications on the commercial and non-commercial web. This rendered many of the most critical business and strategic issues very concrete, and so in April, 1995, an evening of surfing was arranged for Bill Gates with instructions about where to go and what to look for. This was arranged by some employees who intended to change his mind

about the strategic priorities of the firm. As it turned out, the demonstration succeeded. Gates spent the better part of the night surfing. A month later he issued the memo entitled “The Internet Tidal Wave,” which effectively admitted the prior oversight and announced the realignment of priorities for strategy inside the firm.³⁵

By the spring of 1995, the browser technology obviously held the potential to generate a redesign in the software used by the typical PC, possibly redefining the value chain for PC purchases. Responding to it became a matter of competitive urgency at Microsoft – as a market-based perspective might suggest – but, our main point so far, the *timing* of the response (and hence, the severity of the wave) was deeply shaped by Microsoft’s activities in the prior technological generation, i.e., the PC, and its interplay with its unique internal decision-making structure, which reduced any earlier investments that might have left the firm better prepared. Now we turn to its response to the newly conceived competitive threat. Once again, the *way* in which the firm responded was deeply shaped by the interplay between market events and its experience in the recent past.

IV.5. Strategic Costs of an Incorrect Assessment

“The Internet Tidal Wave” came out in May of 1995. The memo sketches several different scenarios. Gates explicitly outlined a few that lead to large losses in profits at Microsoft by means of a Schumpeterian wave.³⁶ Defending against this was his primary motive for pursuing the Internet opportunity. At the same time, Gates recognized how attractive Netscape’s and others open approach was to developing a new market, and, at least for a period of time, decided to abandon Microsoft’s proprietary online approach. (This ended up costing little, as the proprietary product was headed for a very rocky launch.)

The company did not publicly announce its change in direction until early December, well after the release of Windows 95 and Netscape’s IPO (both in August, 1995). As has been widely documented elsewhere, part of the long delay was understandable, a by-product of desiring not to distract from the launch of Windows 95. But a large part of the silence had a different origin; it could be attributed to the lack of any coherent strategy to announce. After briefly negotiating with Netscape for a cooperative arrangement in the spring/summer of 1995 (and failing to elicit a cooperative

³⁵ A publicly available copy of Gates (1995) is at http://www.usdoj.gov/atr/cases/ms_exhibits.htm, government exhibit 20.

³⁶ Gate’s memo is eight pages, single spaced. It first emphasizes the long-run drivers of market value in computing and Microsoft’s position therein. It then turns to specific broad initiatives the firm should undertake to develop a position over the next few years. Before doing that, it stresses several different ways in which an independent browser might ultimately lead to “commodification” of the operating system. First, Gates is concerned about a browser and its extensions accumulating 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, Gates is concerned that the browser enabled something “far cheaper than a PC” – such as a network device – that might achieve sufficient capability to compete with Windows PCs.

response), Microsoft began internal development of Internet-based technologies over a very wide range of products.³⁷

The firm's earlier mis-assessment of the value to developing Internet applications was extremely costly in the short run. To begin, Microsoft had done little Internet-related development up to this point. Its 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. This was far from ideal for Microsoft. 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.

More critically for understanding why this wave became severe, perhaps, the organizational capabilities developed by the firm during its experience prior to 1995 made it difficult to respond to the Internet threat with any speed. The firm had a long history of taking several years to commercialize software. It was also demonstrably good at commercializing software that required coordinating large teams of designers, programmers and distributors, inside and outside the firm, again something that took a long time. It was also demonstrably good at reviewing the market experience, generating lessons, and incorporating them into later actions. For short commercial episodes, it was also demonstrably good at responding to incremental innovations invented elsewhere with fast-second capabilities, particularly when these could be integrated into pre-existing Microsoft products and distribution channels.

Those organizational capabilities were magnificently aligned to being the dominant firm in the PC operating system market and in the market for major applications like Word and Excel. As the Schumpeterian wave began, however, they had limited value.

The firm was far behind in development and design in comparison to Netscape's Navigator. Merely adding a browser to Windows 95 and pushing it down existing channels did not induce new adoption. The first version of IE was not as good as Netscape's, and there were also problems in the support network. Merely announcing support for Internet applications was not sufficient to motivate third-party developers to write software compatible with Microsoft's, particularly when superior technologies existed elsewhere.

Moreover, Microsoft's recent history of controlling Windows motivated many third-party software firms to seek less-constraining alternatives for their software development projects. This was particularly so for the largest among them who could afford to hire a large team of programmers and develop broad arrays of products. A similar dynamic emerged among the PC assemblers, since by 1994 Microsoft's managers were going to great lengths to enhance the firm's bargaining power with assemblers, and were introducing a wide range of non-monetary terms into contracts with assemblers,

³⁷ The negotiations with Netscape ultimately acquired a controversial flavor, as they were prime evidence used in the antitrust case. For an account of these early negotiations, see Cusumano and Yoffie (2000).

such as those preventing assemblers from adding things to the “first screen” that came up after a boot up sequence.

In summary, at the outset of the “browser wars”, there was a misalignment between Microsoft’s competitive strengths and the needs of the market environment. As our interplay framework predicts, this helped make a Schumpeterian crisis more likely and, in this case, more severe. That is, there were many links between the causes of the crisis, its timing, and, to some extent, its eventual severity – i.e., the factors that shaped the delayed response also made it more costly to address when the strategic direction at Microsoft changed.

IV.6. Realignment Costs

The Internet wave brought many challenges to Microsoft, even with its abundance of resources, deliberately flexible organization, and history of competitive success. Some of these challenges came immediately, others in the near short run and still others in the long term. We will use a few selective examples to illustrate the main theme – that managing two businesses, an operating system business and a browser business, increased the costs of operating either one and, hence, shaped the choices the incumbent made.

In contrast with many other observers, however, our interpretation will trace many of Microsoft’s successes in blocking the competitive threat from the browser to the ways in which its top managers handled issues regarding scope diseconomies. We will, therefore, interpret these decisions in terms of the costs of coordinating the activities of two divisions in two distinct market environments, where one division is well-suited to the established market while the other serves the new. We will also stress the costs of adjusting the alignment of the existing organization. Forcing the new division to coordinate with the existing imposed costs on both, and those costs made the crisis more severe.

IV.6.a. Realignment Problems and scope diseconomies in the short run

Achieving Microsoft’s competitive goals created a number of organizational problems. First among them was the simple complexity of organizing a response to this competitor *while* the firm was also supporting Windows 95. Supporting Windows 95 had taken years of preparation and had involved large numbers of personnel assignments that could not easily change. The firm had been organized to support products and services affiliated with a market in which users bought a PC operating system, some applications, and, if the buyer was a business, a network operating system and related applications (e.g., SQL). Even in a firm stacked with talent and loaded with resources, these were demanding activities to operate and execute, requiring the attention of the top managers.

Managers wanted to redeploy employees, but no major redeployment of the responsibilities of many employees was possible until Windows 95 was successfully launched. Even after the launch, such plans for redeployment would generate resistance. Many sunk assets had been developed for that launch. Many employees had accepted responsibilities and had significant investments in them, with the anticipation about the

long-term responsibilities their jobs engendered. Altering the priorities of the firm around the Internet necessarily altered the anticipated costs and benefits that employees foresaw, as well as potentially sacrificed success with Windows 95. More subtly, altering the priorities for the company required bringing employees to agree with management's analysis of the anticipated competitive threat. Despite Gates's and Ballmer's credibility with employees, this common agreement was not necessarily easy to generate in the summer of 1995. The firm's launch of Windows 95 went spectacularly well, showing all the signs of reaching profitability as anticipated. Such commercial success had demanded years of sacrifice and hard effort.

This success was incongruous with top management calling for a dramatic change in firm direction in response to an anticipated but (largely) unseen future threat. Particularly prior to Netscape's IPO, which occurred in August, an employee looking at the contemporaneous success of Microsoft had an understandable case for complacency. Netscape's spectacular success (and especially the publicity that followed that fall) eventually broke through this complacency, but its role in slowing Microsoft's response illustrates the power of common belief systems in organizations.

Netscape was lucky in the timing of its launch – finding Microsoft tied up in the Windows 95 rollout. Netscape was also skillful in the way it took advantage of the situation. Netscape sought to introduce a browser which was “cross platform,” meaning it ran on all kinds of PCs. Since almost all PCs were Windows PCs, running Microsoft operating systems, this might seem like a small point. After all, neither Apple Macintosh or desktop Linux was likely to grow very rapidly, so in the short run, the PC was a Microsoft-dominated PC. There is, however, one very important distinction here. Microsoft was attempting to move the Windows standard from the obsolete Windows 3.x (3.0, 3.1) to the modern Windows 95. As Netscape launched its browser, almost all PCs were the older standard Windows 3.x.

Thus, as Microsoft sought to introduce its own browser to blunt the outside threat, there were numerous goal conflicts between success with the browser and success with the operating system. For example, the Windows group did not want its browser, Internet Explorer (IE), to be compatible with old versions of Windows (3.0, 3.1 and the like) so as to preserve users' and application developers' incentives to upgrade to Windows 95. However, those supporting IE's battle with Netscape Navigator wanted to foster adoption by more users by making IE compatible with as many PCs as possible, including old versions of Windows. Left alone, Microsoft had no incentive to support older versions of Windows, because doing so reduced user incentives to upgrade to Windows95. Netscape, on the other hand, had incentives to sell browsers to user of Windows 3.0 because it helped build the installed base. A similar fight arose over compatibility with the Apple Macintosh systems.

This is a conflict we have seen in different clothing (the PC market) and with a different dominant firm (IBM) – a conflict between a new product whose strategic imperative is connected to open systems (a browser), and an existing product whose fundamental strategic imperative is proprietary (Windows 95). In this case, as in our prior example at IBM, in the absence of entry a dominant firm would act one way, but the actions of those entrants alter the assessments made by managers and, in time, their

actions. In the short run these fights were resolved in favor of the new product group's competitive needs (i.e., the browser group's needs). Versions of IE initially were available for all personal computers, including old versions of Windows plus Macintosh, matching Netscape's compatibility.³⁸

Microsoft's strategy team also tried to exploit its indispensable position in the PC value chain for the benefit of its browser. At first, they sought to delay some of the terrible Schumpeterian effects of not having a competitive browser. For example, Microsoft requested (or demanded) specific actions out of its distributors and assemblers, such as carrying its web browser and displaying it, even if users did not ask for it.

This strategy had immediate costs. Those who were handling the negotiations with PC assemblers over Windows 95 did not like compelling the use of IE because it was resisted by customers, and hence by many assemblers. In the absence of full cooperation from willing partners, Microsoft's position would eventually evolve, leading it to retaliate against partners who cooperated with Netscape, such as Compaq, HP and IBM. However, even Microsoft's own managers believed that such actions would meet with resistance.³⁹

The resistance would not fade soon, so these short-run issues in distribution became attached to long-run strategic issues as well. We turn to those next, which also illustrate why this crisis became so costly.

IV.6.b. Long-Run Realignment Issues

In his first book, Bill Gates summarized that "Both timing and marketing are key to acceptance with technology markets."⁴⁰ The relative strength of distribution and first-mover advantages vary over time, as the mass market develops, leaving a finite window of time when a second-mover can act strategically to interrupt the activities of a first-mover. Microsoft's own analyses of the "browser wars" assumed they had a short window of time to move both users and developers to their browser.⁴¹ They hoped to move into the market early enough to precede most user and developer decisions and make a browser attractive enough to be adopted by later adopters. In this sense, Microsoft's long-run actions during the "browser wars" *followed* from their analysis of anticipated demand and distribution conditions, leading to additional unanticipated internal conflict.

Long-time participants in the PC industry, such as Gates and many others, believed that individual users choose systems which had the most or best applications provided by developers. That choice was also based, in part, on their expectations of future applications availability. Yet, this behavior is not set in stone: any particular user

³⁸ Eventually Apple agreed to make IE the default browser as part of a much larger deal involving patent disputes and financial remuneration.

³⁹ For more detail see Bresnahan (2002).

⁴⁰ Gates, Myhrvold, Rinearson (1995), p. 135.

⁴¹ 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).

will trade off the number and variety of developer applications on a system against other considerations, such as the price of that system or the difficulty of connecting to it.

Gates and others also believed that developers tend to provide for systems which have the most users (or the most profitable users for their particular application). If developers sink costs into a system (for example, by learning how it works or how to make their application work well on it) then they will base their choice at least in part on expectations about similar demand. If the incremental costs of developing for a second system are positive (“porting costs” in the language of developers) then there will be an incentive to supply first (or only) to the system with the most or most profitable users. Once again, this is not set in stone: developers will trade off the number and variety of users against other system features, such as its technical quality of a development environment, and will sometimes need to act based on expectations.

Microsoft’s long run strategy then followed from this belief about how the market operated and a sober assessment of Microsoft’s position in it. Microsoft had entered a market where the users and developers had so far chosen Netscape’s browser, and not its own. Yet, Microsoft also believed that there was inertia – but not irreversibility – behind those choices. Microsoft’s intermediate goals for contributing to its core strategy emerged quite plainly as two tactical goals: (1) find ways to compel a sufficiently large number of users and developers to adopt Internet Explorer; and (2) find ways to compel a sufficiently large number of users and developers to abandon Netscape altogether. Of course, the first goal supported the second one, so most of the energy in the short run focused on it.

Ultimately, the strategy team decided that the mass market was just developing in 1995 and was nowhere near cresting in 1996. Hence, Microsoft’s long-run strategy was to take advantage of this growing demand over the next several years and undercut Netscape’s initial advantage. How does a leading firm take advantage of changes in the market over time? An installed base of adopters will find it costly to switch between browsers, but the rapid growth in demand presents an opportunity for an alternative browser to capture the newest adopters in numbers that swamp the size of the early installed base. Another way in which markets for new technologies change over time is in the composition of demand. The early adopters of a technology tend to be different from the mass-market adopters, who tend to be more responsive to convenience of adoption than they are to the technical capability of the technology. Many later adopters are waiting for complete, ready-to-go systems. Once again, that presents an opportunity to capture the later adopters in large numbers if an alternative plays to their distinct needs.

These demand factors enhanced the strategic importance of Microsoft’s control over distribution channels for new browsers. While supply-side factors, such as taking control of distribution, were not sufficient to compel users to stop adopting Netscape’s browser, it could contribute to building up the number of users and developers dedicated to Internet Explorer. Specifically, distributing only one browser (i.e., Internet Explorer and not the Netscape Browser) to some mass-market adopters could: (1) generate some adoption among users who prefer the browser they initially use; and (2) generate some adoption by developers who wanted to serve the users of Internet Explorer.

Microsoft simultaneously began investing in browser technologies and the services related to supporting developers, intending to build a large organization that played to its strategic advantage as a large software developer. It also let developers know about its investments and about its intention to support a mass-market browser technology. These actions let developers plan for more complex applications as well as for applications that suited later users, which emphasize ease-of-use instead of frontier features.

Microsoft's managers initially attempted another familiar strategy: proprietary standards. For example, they attempted to advance their own proprietary version of HTML.⁴² This met with such developer and market resistance that the IE group managed to get top management to change this practice, eventually employing pre-existing non-proprietary Internet standards. We only recount this as a symptom of the extent to which the firm's development efforts began with familiar operating practices, slowing its ability to shift towards the requirements for fast *catch-up*.

Other parts of the organization sought to compel a switch to their improved (closer-to-competitive) browser. Microsoft's managers continually let every assembler and distributor hear about Microsoft's desire to not see alternative browsers displayed. These actions generated the allegations that led to the antitrust case.⁴³

This competition did not end quickly. As it continued, a large organizational problem arose that had not been anticipated in 1995 – when the long run strategy for the browser wars was first sketched. IE began as an application and was originally situated outside the operating system group. Indeed, Microsoft set up a new division, the Internet Platform and Tools Division (IPTD), to press forward with its mandate. This was the classic “firm-within-a-firm” strategy, and for a while it succeeded admirably. Impressively, Microsoft eventually built the IPTD up to 4500 people (there are considerable strategic advantages affiliated with eventually being able to deploy resources on a vast scale, as a dominant firm can do). Equally impressively, the IPTD rapidly chased Netscape in browser quality and features, and, using a variety of distributional advantages, effectively pushed its browser out to all kinds of PCs, not just new versions of Windows.

From the perspective of the Windows group, there were two benefits from this action. First, it brought the browser in-house, where they could manage the competitive threat directly. Second, it gave it the benefit of Microsoft's control of the distribution channel. Though beneficial in a number of respects, this also led to enormous internal conflict.

The internal conflict reflected the interplay between Microsoft's position as a leading operating system company and a competitive threat that resided in the market place as an application. The browser has elements of an application and elements of

⁴² Microsoft's effort, as well as Netscape's, collapsed quickly after opposition from W3C and IETF.

⁴³ For longer discussion, see Rubinfeld (2004), Bresnahan (2002), and Fisher and Rubinfeld (2002).

being a platform for the development of other, network-oriented, applications. It has its own APIs for the purposes of permitting such applications. It did not much matter to the internal conflict that the Microsoft browser's APIs were a direct response to the competition with Netscape's support network. Until the browser wars, inside Microsoft the development of API's had been the domain of the operating system division. Conflict over the design, function, purpose and support of many APIs was inevitable, since almost every API on the browser served a strategic purpose on the dominant OS, Windows, and also on the multi-OS applications support browser, and these purposes were not necessarily congruent with one another.

This is an example where market needs necessitated two inconsistent organizational responses and the organization's manager bore a high cost. The evolving strategic response of the firm under competition eventually necessitated placing the browser in one division – in this case, in the operating systems group. This change generated considerable acrimony and rivalry inside Microsoft. The operating systems group complained about having to take in such a buggy mess as a browser developed in a competitive race. The browser- and Internet-oriented group felt that the firm was slighting their priorities, and broadly abandoning the needs for the firm in the future. Much of these costs played out *during* and *after* Microsoft ostensibly won the “browser wars.”⁴⁴

We must end by noting that this internal conflict eventually would lead to the end of the independent Internet Platform and Tools Division, especially after the browser wars ended. Once the prospect of a Netscape browser standard began to recede, there was little justification for the firm-within-a-firm. It created enormous internal discord, consumed massive amounts of the top management's attention. As its independence was reduced, these organizational changes eventually induced quite a few employee exits, largely among the pro-Internet forces who lost out.

IV.6.c. Microsoft Networks and Strategic Priorities

The issues that Microsoft eventually faced with its online efforts offer further evidence of the innate long-run problems the firm faced adjusting its existing organizational practices and goals to the new environment. This is the second example we offer, and this one is quite illustrative of Microsoft's challenges adjusting its strategic priorities to the new market environment with their existing organization's other businesses in tow.

Netscape understood the importance of distributing their product to make adoption as easy as possible for new users. Netscape signed contracts to distribute its browser through Internet Service Providers (ISPs) and along with new PCs. This service and hardware provided a strong complement to the browser: a user had to have both in order to access Internet content, along with the browser. Netscape employed these distribution channels to overcome the adoption costs for their browser.

⁴⁴ After Netscape lost viability as a competitor, the firm moved Windows to the center of its business. Eventually Silverberg and Slivka and others affiliated with promoting the Internet quit. See the discussion in Banks (2001).

As noted, Microsoft had been slow to initiate a similar program with ISPs at the end of 1994, when the competitive necessity for it was less urgent. Now that the top management had altered priorities, it set about initiating deals with ISPs as a competitive response to Netscape's initiatives.

By early 1996, a wave of new ISPs offered Internet service throughout the US. Online leader AOL switched strategies, very publicly, 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, it was introducing new Internet users to facets of the Internet. As an entrant into home-based electronic commerce, it was becoming a very real threat to Microsoft's online content and e-commerce strategy.

As did all the proprietary and non-proprietary information services at this time, MSN reconsidered its operations and business value for users. But this ran into special problems. MSN had been founded by Microsoft employees, many working there 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 the distribution of their operating system. Microsoft protected this position with contracting restrictions requiring PC assemblers not to alter the prominent placement of MSN's symbol on the first screen of a PC. These restrictions angered assemblers (who could not tailor the PC to user requests) and those who also wanted a prominent place on the operating system, such as AOL, but Microsoft was unwavering.

The competition with Netscape over browser standards put MSN's special status under pressure. Microsoft failed to generate adoption of its browser, IE 1.0 and 2.0. Given the resources devoted to development, IE 3.0 was anticipated to be much better and equal to the Navigator in some basic features, giving Microsoft the "realistic" option to push hard for its adoption without getting as much push-back. At this point, however, the protection of MSN came into conflict with a strategic action aimed at aiding the adoption of Microsoft's browser. Microsoft wanted to strike a deal with AOL to make Internet Explorer the default browser of AOL. In exchange for making IE the default browser, AOL requested lifting the first-screen restriction on AOL's symbol. Microsoft initially refused this request and attempted to bargain for other things, such as money.

Microsoft's initial refusal was understandable, since capitulating to AOL's request would be breaking the promise to MSN employees and giving up on Microsoft's standing online effort. After considerable negotiation, however, 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. AOL made IE the default browser, and, in exchange, AOL received the right not to be subject to first-screen restrictions. Further deals over time supported AOL's marketing interest on the desktop and promoted Microsoft's interest in generating the use of Internet explorer by AOL's

users.⁴⁵ As anticipated, over the next year many MSN employees left, as MSN lost ground to AOL, setting back MSN's development for some time.⁴⁶

The AOL deal moved a large fraction of Internet users – over one third by some estimates – to IE as their default browser. Among other deals affiliated with increasing default use, in retrospect one can see that this one especially was the beginning of the end of the “browser wars”. It contributed to the general thrust of Microsoft's distribution strategy at this time, which was to make other deals that altered the distribution of Netscape's products, limiting its availability on many ISPs and PCs.⁴⁷

Internal conflicts between the open systems browser and both the proprietary MSN and the proprietary Windows group were deep and very difficult to resolve. They involved conflicts over one of the firm's most important shared assets, control of the PC distribution channel. These conflicts were closely linked to fundamental differences in strategic necessity between the browser and the proprietary businesses. Further, they involved deep disagreements over what the firms' reputation for steadfastness and decisiveness, one of its most important intangible assets, meant for new decisions. Repeated attention from senior management could keep these deep conflicts under control for a period of time, but ultimately they had to be resolved as the costs in senior management time and attention grew.

IV.7. Scope Diseconomies: the Costs of Managing Both old and new

Had Microsoft's managers intended for their actions for the Internet to conflict in so many ways with its goals for Windows 95? Of course not. Yet, many of the contemporary accounts discussed the outcomes as if Bill Gates had had a grand plan. This is false. Once the Schumpeterian wave was upon Microsoft, it faced a series of anticipated and largely unanticipated costs associated with the new business. The central determinant of the severity of the crisis was the combination of the late entry and the unanticipated high costs of running the existing business in the same firm as the new.

As our framework suggests, management worked through the costs of operating both businesses as the unanticipated costs became apparent. Senior management initially tried to address the new opportunity without paying much cost for coordinating the initiative with the established business. After it was apparent there would be substantial costs, they tried to minimize them with a firm-within-a-firm organization.

⁴⁵ A copy of AOL's contract with Netscape, dated March 11, 1996, is at http://www.usdoj.gov/atr/cases/ms_exhibits.htm, government exhibit 824. AOL's deal with Microsoft, dated March 12, is exhibit 804. Further cross-promotional deals were made over the next year and a half. See, e.g., exhibit 1019 for a deal in October, 1996, and exhibit 1022 for a deal in December, 1996, and exhibit 1175 for one in September, 1997. According to exhibit 1480, Internet Explorers' percentage of hits from AOL and Compuserve went from 22% in January, 1997 to 76% in October, 1997.

⁴⁶ Banks (2001).

⁴⁷ For a list of these deals, and a discussion of their controversy, see Rubinfeld, 2004, Bresnahan, 2002, Fisher and Rubinfeld, 2002.

The firm bore the costs of managing two internal businesses, each aligned to an entirely distinct market reality, for a brief period of time when it perceived a real possibility of losing the existing business to new competition during the wave. As it turned out, their competition eventually collapsed under the assault, getting a result perhaps better than Microsoft had expected.⁴⁸

What did the managers at Microsoft do then? A final anecdote from this large epoch is perhaps the most telling. After the immediate threat from the wave fell aside, Microsoft's managers faced questions about what to do with all they had built for this competitive situation. The firm's management considered two distinctly different options: (a) expanding Internet tools and applications into all aspects of the firm's business, as had been planned under competitive pressure; and (b) returning to the strategies devised for Windows, a plan that Netscape's entry disrupted considerably.

As in the IBM case, management's choices depended on management's assessments of the reason for the browser division's market success. Microsoft's top managers could have concluded that the division's success arose from many of its unique features. In that case, the lessons learned in the new division needed to be transported to the rest of Microsoft. Alternatively, Microsoft's managers could have concluded that many of the successes at the browser division arose in spite of its unique features. In that case, many of the features of the old needed to be transported to the new.

Microsoft's managers did not choose all at once. First, they reorganized development of Internet technologies, giving Windows centrality in its strategic priorities. After the removal of competitive pressures, however, most organizational decisions became disconnected from outside pressures. Gradually, actions began to follow internal power struggles, motivated by a variety of rent-seeking, career-oriented, and personal motives, unguided by competitive checks.⁴⁹

As we have already indicated, the Windows group continued to win virtually every internal fight for supremacy over strategic direction. Top management reduced the organizational independence of the Internet platform and tools division. General internal commitments to eventually make IE compatible with other PCs or other software on other platforms, and so on, also were allowed to lose momentum and disappear. These actions induced a large number of exits by employees who had been committed to developing new Internet businesses, but the decisions stuck in spite of the exits. In this sense, once competitive pressures lifted, the firm's top managers could not resist returning to organizational practices and strategic priorities that they had favored many years earlier, and which had proven profitable prior to the diffusion of the Internet.

How should we understand this embrace of the future and then reversal? A central part of this story is the disparate alignment of core firm strategic assets called for by the two businesses. The result was large scope diseconomies. The firm was willing to bear the costs for a transitory period. Certainly the benefits of bearing the scope diseconomy costs were highest at the height of the competitive wave, offering the dual

⁴⁸ See, e.g., Cusumano and Yoffie (2000).

⁴⁹ Banks (2001) provides an exhaustive chronicling of these events.

value of exploring a new growth opportunity and preserving the profits of Windows and Office. The costs may also have been lowest during the crisis, the authority to coordinate is easily transferred to senior management. Once the crisis was past, however the scope diseconomies forced a choice, which, in this case, went in favor of the old business and the older practices aligned to it.

This internal triumph of the old over the new left the firm with serious long-run market challenges. Dominating Internet clients (browser, email, etc.) for individual users without focusing on communications applications brought serious headaches, many of them in the security area. The existing strategy of extending Windows into low-end servers (file, print, email, etc.) while reinforcing outsiders' views that Microsoft sought excessive control over complementors created a market opportunity for open-source projects, such as uncontrollable, Linux. Focus on the OS platform (and on defensive strategies such as game boxes) rather than on the Internet opportunity left opportunities on the server side with mass-market appeal, including search, directory, hosting of retail stores, social-network sharing of a myriad of user-generated content, and so on. As these pervasive computing opportunities appeared, Microsoft remained committed to its old sources of income, and passed up new opportunities. Only time will tell whether these were profitable strategic moves, or actions that invited another round of Schumpeterian entrants.

V. Overview

What factors make a Schumpeterian wave more likely? What factors shape its timing? Why are some crises more severe than others? We argued that answering such questions requires a framework that examines the *interplay* between market context and organizational capabilities. To give all of those abstract notions content, we examined them in the context of two concrete cases: IBM's response to the PC and Microsoft's to the Internet.

Our illustration and framework contains three elements: (1) different types of organizations invest in different types of knowledge aligned with current market opportunities; (2) concerns about sunk investments lead incumbents to abandon existing market processes and operations with resistance; (3) realignment costs and diseconomies of scope limit an incumbent's options during the transition from the existing market to the new.

Illustrating our framework and demonstrating its usefulness was our primary purpose in presenting these cases. A cautionary note, however, is required. Many would draw their conclusions from the case of Microsoft – the newer firm which has so far successfully survived its wave. This is too hasty, however, as the two waves have as many similarities as differences.

Both dominant firms faced Schumpeterian waves, each with mixed results. Before each wave, each firm aggressively pursued new technological advances. Coincidentally, each had just undertaken a major electronic commerce initiative: IBM's to great success for enterprise customers in the late 1970s, and Microsoft's without

impact on the online world of the mid-1990s. In other words, even prior to these observed waves, both firms attempted to anticipate future waves and adjust their capabilities.

In each case, there was a substantial internal conflict between management of the old (Mainframes, Windows) and management of the new (PC, Internet.) Each firm solved this in the short run by creating a separate internal organization (a “firm-within-a-firm”), and protecting it from internal attacks by the application of senior management time and attention. As the amount of senior management effort needed to control those conflicts grew out of control, each firm resolved the internal conflict – in each case favoring the old over the new.

Each firm enjoyed considerable interim success by taking advantage of assets it had built up in the old market: IBM for a time dominating PC standards-setting and Microsoft winning the browser war and setting other key standards such as email. Neither, however, turned this into lasting advantage in a range of applications tailored to new market opportunities. Enough historical time has passed to see IBM’s loss of PC market standards and eventual exit; Microsoft’s future in the Internet age is also unclear at this juncture. Both firms avoided any short-run threat to their existing position; again, in the case of IBM, sufficient time has passed to see long-run threats come to fruition, while Microsoft today continues to dominate its historical markets, but few of the new Internet ones.

In both cases the Schumpeterian wave arose out of the market behavior of dominant firms and their rivals and the incentives of the market circumstances. An observer would commit analytical errors by assuming that exogenous forces solely determined either the timing of events or the margins on which dominant firms and entrants competed.

More concretely, it would be impossible to explain IBM’s actions and the actions of entrants without understanding IBM’s history in mainframes and its continued interest in producing for both the mainframe and PC markets. It also would be impossible to explain the both Microsoft’s and its competitors’ actions in the browser wars without understanding Microsoft’s history in the operating-system market and its continued interest in producing Windows 95 and a browser. A deep understanding of the unusual circumstances and market value for PCs and the browser requires a deep understanding of IBM’s and Microsoft’s successes and travails in the marketplace at that time.

We conclude that the essence of competitive events in both cases – the timing of entry, the pricing of products, the distribution of market share, or even the realized changes of market leadership – would be misinterpreted if viewed as solely determined by technology, solely by the actions of a single organization or solely by the incentives of market circumstances. Both Schumpeterian waves are more completely understood as the outcomes of the interplay between strategic market interaction and organizational forces at the incumbent dominant firm.

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