

# INNOVATION AND BUSINESS GROWTH

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## INTRODUCTION

Innovation and the pursuit of new business opportunities is essential for growth at the firm level; moreover, it provides the foundation for an economy to achieve new levels of technological prowess, productivity, and ultimately prosperity. This chapter describes recent work in economics and management scholarship on how firms grow. Given the other contributions in this collection, we focus specifically on questions surrounding the types of innovations that large and small firms pursue and how it impacts their relative growth rates. Developing evidence suggests that as firms become larger they have trouble maintaining the external innovations that are most powerful for growth, instead focusing increasingly on internal work and enhancements. Section two outlines a theoretical model about these dynamics to fix ideas and highlight some key economic considerations. In some cases the growing internal focus with firm size is optimal, but in most cases it is not and reflects struggles of larger companies to maintain dynamic capabilities that they otherwise desire. Section 3 then provides a case study of IBM, how it observed these limitations within itself in the late 1990s, and then the actions it took to correct the gaps. We use the IBM story to highlight in section four several emerging best practices on how firms can best structure themselves to maintain the innovations that are important for their growth.

## THEORETICAL BACKGROUND

One model of corporate choices toward innovation and the underlying heterogeneity in these processes is depicted by Ufuk Akçığit and William Kerr (2015), who build upon prior micro-macro work like Klette and Kortum (2004) and Lentz and Mortensen

(2008). The model considers why types of corporate venturing and innovation vary along the firm size distribution; this provides an important input to understanding the relationships between innovation and business growth for firms. The Akçığıt-Kerr model draws a distinction between two types of innovation that companies may perform – internal innovation vs. external innovation. Internal innovation, sometimes called ‘exploitation’ innovation by organizational behavior scholars, concentrates on improvements to a company’s existing product lines, enhancing the capabilities and offerings that the company already has to increase profits. External innovation, sometimes referred to as ‘exploration’ innovation, focuses on creating new ideas to add to the company’s product range. In the Akçığıt-Kerr model, this exploration process can be understood as improving upon and taking ownership of product lines belonging to other companies.

Figure 1 below depicts an illustrative firm in this model, that we label  $f$ , and how this firm engages in these two types of innovation. Each product line is represented by one of the vertical lines on the graph, and every possible product line in the economy falls somewhere on the 0-to-1 continuum. There are infinitely many possible product lines, and each firm owns some finite subset of these lines. The ‘quality’ of the underlying technology for each product line is represented by the height of the line in this figure, following classic ‘quality ladder’ depictions for studying technological progress (e.g. Aghion/Howitt, 1992). A higher quality product line brings in more profit than a lower quality one.

To the right of the figure are the four product lines originally owned by the firm (i.e. the lines shown in black and with  $z_j$  at their base). The firm can engage in internal R&D and innovation to improve the quality of the lines it holds. Firms have profit incentives to improve these technologies but they also face costs for doing R&D. The rate at which they make these investments is  $z_j$ , with some probability of success in each period thus determined (innovation outcomes are stochastic). A firm will invest

money up until the costs outweigh the expected benefits. If an innovation is realized, the quality of the product line is incremented by an amount  $\lambda$ , and the company gains more profits from the improved line. In the figure, two of firm  $f$ ’s internal R&D attempts have been successful as an example.

Companies may also undertake external R&D to ‘capture’ a product line owned by another company. As with internal R&D, exploration R&D efforts succeed with a probability that depends upon the amount of the investment being made. The firm will spend an amount of money  $x$  on exploration R&D up to the point that costs equal expected gains. If a company’s attempt is successful, then it acquires a new product line, chosen at random along the 0-to-1 interval, at the quality level that said product line has reached prior to this acquisition. The firm then increments the quality of this product line by an amount  $s_k$ . This is shown in the figure by the line on the left, with the  $x$  at the base. The black section represents the quality of the product line at the time that firm  $f$  ‘captured’ it, and its quality is then incremented by  $s_k$  as a result of the innovation undertaken by firm  $f$ . The magnitude of  $s_k$  is determined in the model by a number of factors, including technology waves, how long a product line has existed, and various other inputs that are beyond the scope of this note. This form of innovation is also sometimes called ‘horizontal innovation’ and closely relates to the frequently discussed concept of ‘creative destruction.’

Firms are constantly pursuing both forms of innovation, thus competing with each other on two fronts: trying to improve the quality of the product lines that they already own, and trying to capture product lines away from other companies. The model also takes into account entrepreneurs or new entrants by modelling individuals who own no product lines but wish to enter the industry by engaging in this creative destruction. The ability to consider both internal and external innovations and jointly model them in a fully-specified, general equilibrium setting is one of the major theoretical contributions of this model. This is an important step as it begins to allow economic

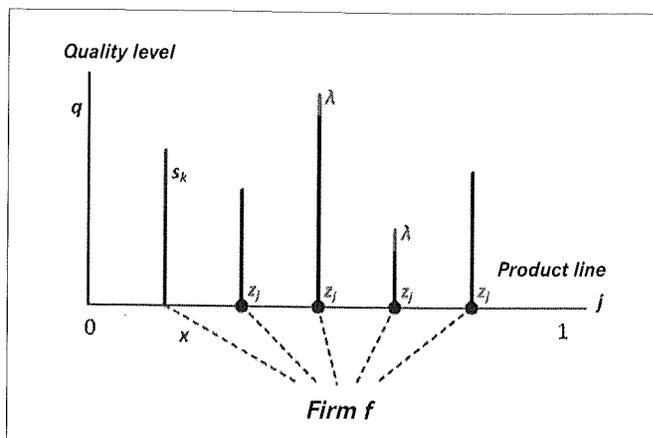


FIGURE 1

Internal and external innovation: the Akçığit-Kerr Model (2015)

models to take better account of why differences in the number of small firms vs. big firms might matter for the types of innovations undertaken and the economic impact observed.

The key feature of this model is the manner in which the different types of innovation scale up as firm size increases. In particular, the model predicts that *internal* innovation scales with firm size much more than external innovation does. As firms grow larger, the proportion of their R&D budget that they allocate to internal R&D will scale in a linear fashion as more product lines are added. However, external R&D does not scale up with company size as completely. This observation has been made at times in the empirical literature regarding innovation and is being applied here to theory; the full version of the model also undertakes a more complicated quantification analysis to formally measure these properties.

As an example, consider the extremes of firm size: a new entrant or entrepreneur starts with zero existing product lines, so they cannot, by definition, engage in internal R&D – the entire budget will therefore be allocated to external innovation. Similarly, a

very small firm with only one or two product lines still has a very limited opportunity to spend money on internal innovation, but there is considerable opportunity for external R&D. At the other end of the scale, a firm with 1,000 product lines has a much greater opportunity to spend money on internal efforts, and we see the proportions shift in that direction. It is important to note that this does not reflect the absolute amounts of money spent – a large firm may spend more in aggregate on external R&D than a small firm does, but these exploratory expenditures will account for a smaller proportion of their budget than at a small firm.

Data collected from the US Census Bureau and the NBER Patent Database on firm R&D and patenting behavior exhibits the scaling that the model predicts. For example, using the 2008 Business R&D and Innovation Survey, there is a -0.16 correlation between firm size, and the share of R&D that the firm reports is directed towards business areas and products where the company does not have existing revenues. Similar negative correlations are found for questions about the share of firm R&D being directed to technologies new to markets. Similarly, using the citations that firms make on the patents they file, there is a 0.11 correlation between firm size and the share of backward citations that are made to a firm's own prior work. Firms with larger past patent portfolios are mechanically more likely to self-cite, and the paper shows that larger firms are more likely to exhibit abnormal rates of self-citations compared to Monte Carlo simulations of their expected self-citation rate. Other evidence is also provided.

By itself, these differences in innovation behavior over the firm size distribution might not result in important economic outcomes, but the study by Akçığit and Kerr (2015) goes further and shows how external innovation is associated with greater employment growth than internal innovation. That is, the average firm growth impact that comes from exploratory work is larger than when firms focus on just enhancing their existing product lines, and moreover the growth spillovers into the broader economy

are larger. The data thus indicate that firm growth rates depend on the kinds of innovation undertaken, and that firms that engage in greater proportions of internal innovation have slower growth rates than firms that spend proportionately more on external efforts. Thus we often see larger firms growing at a slower rate than smaller firms or new entrants, and we also find that these smaller, newer firms make disproportionately large contributions to major innovations. This again connects back to allowing for a model that can link firms of different sizes to different types of innovation investments and ultimately to growth consequences, for the firm and the economy as a whole. This is where the academic literature is currently pushing and starting to make substantial traction.

With this model in mind, the sensible next step is to examine the choices that firms make to see why they engage in the types of innovation that they do. The fact that larger firms devote less resources to external work can have both 'efficient' and 'inefficient' underlying reasons. The model can operate the same in both cases, but the business and policy prescriptions would be different. Why might larger firms engage efficiently in less external R&D? The paper describes several reasons, with the most intuitive one being limits on the effectively used manager time. If a skilled CEO does not have the time or resources to add another product line to their workload, it would be a reasonable decision to focus on the existing lines rather than trying to add new ones. In this setting, because new entrants and small firms have fewer product lines, they have competitive advantages for pursuing external-oriented work.

On the other hand, many management scholars have noted inefficient reasons for why larger companies do less external R&D or are generally less successful at achieving external innovations. Among the issues discussed in the paper are overly bureaucratic organizations and short-term stock market pressures. In these settings, the CEO of the large company may in fact want to obtain more product lines and the associated growth but struggles to do so. This is the scenario in which IBM found itself in the late

1990s, and we will use this case study to describe the setting further. After a successful turnaround following a near bankruptcy at the beginning of the decade, IBM's new CEO was horrified to find that the innovation initiatives that he had set up at the company were failing because IBM's culture and organization were not conducive to that sort of exploratory R&D. We will use this case study to describe some reasons why large companies can struggle with external innovation and also identify how one firm sought to change itself to allow for better innovation outcomes and dynamic growth.

#### THE IBM EBO STORY<sup>1</sup>

Founded in 1911, IBM focused for most of the second half of the twentieth century on creating and selling computer mainframes and minicomputers. In the 1960s and 1970s, it controlled 70% of the market share for the mainframe industry, and by the 1980s it was the most profitable company in the world. However, by the end of the decade the company had begun to decline, and by 1991 it was losing money. Between 1991 and 1993, IBM had lost approximately US\$ 16 billion, and its market share had dropped from 76% to 26%. This happened for several reasons. When smaller, upstart companies began to make personal computers more easily available to individual consumers, IBM leadership believed – based on past success – that they could enter and easily control the PC market. They did not recognize soon enough they needed to continue to innovate their PC platform and its marketing, and they did not realize until too late that the PC would bring about a seismic shift. While IBM's senior executives recognized that they were heading into trouble, they were unable to fix the problem. Hoping to stop their slide and turn the company around, IBM brought in Lou Gerstner in 1993 to be the new CEO. Gerstner had led American Express and had been CEO

<sup>1</sup> This section and the next draw extensively from Applegate and Kerr (2015). The IBM story is described in detail in Garvin and Levesque (2004) and Applegate et al. (2008), upon which this section also pulls material.

of RJR Nabisco, and he was the first outside CEO to lead IBM. When he arrived, he found that IBM had fallen victim to what Donald Sull termed 'active inertia', in which a company's set of assumptions about its core business become blinders to new ways of thinking that will promote growth.

IBM had spent the past several years focusing on existing products and short-term goals, with little attention paid to customers and their changing needs. In addition to 'mainframe blindness', Gerstner found that the processes for managing each of the individual 39 business units had continued to follow unproductive routines that rewarded existing product offerings and short-term results. Processes for starting new ventures were unclear and without a supportive infrastructure. The business units had their own profit and loss statements, but sales, manufacturing, and distribution were spread across the company. This organizational structure and the fact that there was no formal process for acquiring funding or strategy for development, made starting a new venture within the company haphazard at best. Missed opportunities were many. Finally, the culture at IBM fostered relationships that had, in some instances, become shackles that were maintained by a powerful bureaucracy, inflexible hierarchy, and interdivisional rivalries.

Gerstner's first move was to stop the steady losses of money and customers before he could start thinking about how to restart company growth. He decided to keep most of senior management on board, and strove to create a sense of urgency by requiring them to write memos describing steps to fix their department and the company as a whole. He also took steps to cut US\$7 billion in costs, shutting down underperforming departments and units, and established the 'One IBM' philosophy, setting a vision for the company as a global information business, not just a computer company, and allowing them to strategize around new opportunities like the internet. The company focused its new IBM Global Services business on value partnerships with clients and on eBusiness consulting.

### IBM's Setbacks to Innovation

Gerstner's changes brought almost immediate improvement, and by 1999 IBM was on stable financial footing and looking to position itself to be able to grow and make its way back to the top of the industry. A large part of the plan to do so involved IBM being able to identify promising new ideas and directions in which to take the company, but the company was having trouble in that direction. IBM researchers were coming up with plenty of promising new ideas but Gerstner was horrified to learn that, rather than giving them the opportunity to grow, some managers seemed to be obstructing progress or allowing new initiatives to fail. After learning on a Sunday morning that funding had been cut for a promising life sciences initiative due to short-term pressures, Gerstner demanded action be taken.

Gerstner turned to Bruce Harreld, IBM's Vice President of Corporate Strategy, to investigate why things were going wrong. Harreld and his team discovered that this life science example was part of a very consistent pattern across the company, and that IBM's organizational structure was still fairly hostile to corporate venturing and the creation of new businesses, despite intentions otherwise. IBM's business units were having difficulty integrating new products and ideas that came out of R&D efforts, and managers frequently reduced budgets of growth initiatives, or, having failed to commercialize the results of research, even cut the programs altogether.

After interviewing individuals within the company who had been involved in several dozen missed opportunities and failed and struggling new venture startups, and documenting their findings in detailed case studies, Harrell and his team identified a number of high-level problems that were leading to the failure of new ventures. First, the company was mainly focused on serving the needs of existing customers, and managers were usually under considerable short-term pressures that restricted the amount of time that they could dedicate to exploring and supporting new ideas. IBM also had no useful approaches to learning about new ideas or identifying strategic

needs, and no processes in place for selecting projects or funding them. The company used a complex 'matrix' organizational structure that was focused on existing brands and on geographies and industries for sales and marketing, and new ventures that did not fit well into the rigid matrix were frequently abandoned. IBM also tended to rely on profit-oriented metrics to evaluate projects and business units which were ill-suited for measuring the progress of early-stage ventures that might not have reached the revenue-generating stage. This meant that R&D efforts were easy targets and often the first to be cut when a unit was having budget issues. And, the new ventures that IBM did undertake tended to be contained in separate 'silos', away from the rest of the company, which meant that it was difficult to effectively integrate new developments into the core business.

**The Rise of Emerging Business Opportunities**

In a very real sense, IBM had become too good at executing, reducing costs, and achieving short-term success. While each of these outcomes is desirable, they placed the company in a position where it struggled to undertake the longer-term exploratory innovation that would be necessary for the company's sustained success. In short, IBM found itself in a position similar to that described by the Akçığıt-Kerr model but did not want to be there! Harreld and the rest of the IBM executive team addressed this issue by suggesting the creation of an 'Emerging Business Opportunity' (EBO) initiative. It was based on a framework from the influential book on management *The Alchemy of Growth* (Baghai et al., 1999), which describes a three horizon model that classifies business ventures and innovations according to the length of time until expected impact, return potential and level of uncertainty, as shown in Figure 2. The book posits that a company's sustained growth rests on what the authors call a continuous pipeline of business-building initiatives that is attained balancing short-term pressures for results with creating the space to conduct long-term and external innovation.

In the *Alchemy of Growth* conceptual model, horizons are managed concurrently within an organization, and each horizon requires its own separate management strategy. Horizon 1 (H1), situated at the lower left (low impact, low uncertainty), covers a company's core business, the one around which a company has formed its identity, organized, and profited. H1 innovations extend or incrementally improve this business (e.g., the development of a new type of bumper by a car manufacturer for an existing line of sales). These efforts connect very closely to the *lambda* internal innovations we described earlier. While necessary to generate cash and provide resources for growth, H1 businesses – where most companies focus the bulk of their attention – will eventually flatten or become disrupted.

Horizon 2 (H2) encompasses emerging, fast-rising businesses that have the capacity to eventually transform the company and become an H1 business – for example, the development and scaling up of a new type of engine that will be the basis of a new model of car. These innovations and business opportunities often have exhibited already some signs that they will work out well, but much investment remains to be done to prove out the opportunities and place them into positions for long-term

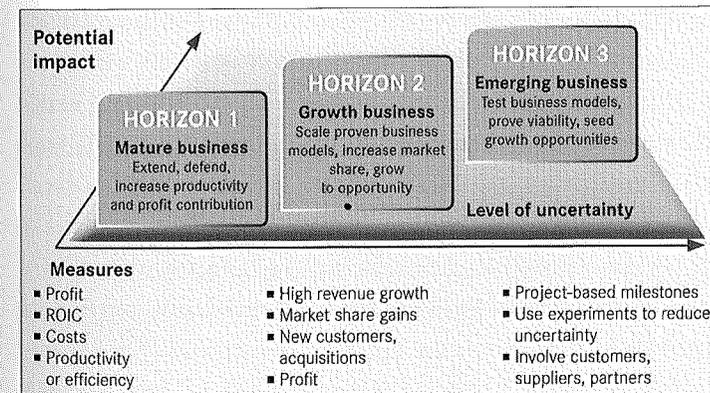


FIGURE 2

Horizons model to classify innovations; adapted from *The Alchemy of Growth* by Baghai, Coley, and White (1999)

profitability. Located in the middle of the figure, these ventures are medium-term and have a potential for medium amounts of growth or transformation but also come with an associated level of risk.

Horizon 3 (H3) is where the seeds of totally new ideas and business concepts are created in initiatives such as research projects and pilot programs (for example, experimentation with rechargeable batteries for the purpose of developing an electronic car in the future). H3 initiatives carry with them a high risk of failure, and are often not completely aligned with a company's existing goals or product lines (and in some cases may even cannibalize current operations if ultimately launched), but they also have the highest growth potential. These are the businesses that can potentially transform a company and provide it a long-term platform for growth. Although not all of the new H3 ventures will mature to become H1 businesses, nourishing them is necessary for a company's long-term future.

Measurements, expectations, and leadership needs differ for each of the horizons. If the three horizons are managed concurrently to ensure healthy and continuous growth they 'cascade' through an organization. IBM was already well set up to handle Horizon 1 ideas and projects, which returned reliable, short-term gains and could be managed within existing business units. There was never a misalignment of incentives between the managers and these profitable investments. By contrast, Horizon 3 businesses was where IBM was struggling, as they usually required extensive experimentation or research and took a long time to realize their potential, which did not fit well with IBM's current short-term focus. These were the ideas that IBM was most interested in cultivating and were the ideas that the EBO initiative targeted. This is very common for larger companies (and very fast growing smaller companies) where the core of the company's operations can limit the ability for other ventures to take root around them. It connects to and reflects the limited scaling built in the Akçığit-Kerr framework.

IBM quickly moved from investigation to action. To begin, Corporate Strategy and managers of individual business units worked together to identify Horizon 3 businesses. They decided upon seven EBOs that met their inclusion criteria, which included: the need for cross-business cooperation and resources; the maturity of the business plan and strategy (e.g., key market and technology risks appeared manageable, expertise was available to build the first offering and take it to market); the forecasted size of the market; and the potential for generating over US\$1 billion in three to five years. Gerstner selected John Thompson, a 34-year veteran of the company, to oversee and coordinate the EBO initiative. He was highly respected at IBM, which gave the program instant credibility. Thompson and Gerstner began rigorous monthly reviews of each of the seven initial EBOs, focusing on project milestones and developing business plans rather than meeting strict financial goals. Corporate Strategy also worked with Finance to identify expenses and revenue for each EBO, and Harreld set a goal of two points annual incremental revenue growth from EBOs. Gerstner also began using the 'horizons of growth' terminology in his speeches to the company. This helped to send the message that EBOs were not just a fad but were something that IBM was taking seriously. By 2002, 18 EBOs had been identified and shepherded through the program. One of the first challenges that the EBO group encountered was the question of where to place EBOs organizationally. If innovation was to be the foundation for success in IBM's future, it could not be delegated to a 'corporate incubator' that received separate funding and was left on its own to build businesses that would later be thrown 'over the wall' to IBM's business unit leaders, who were relentlessly focused on meeting the projections promised to Wall Street. Nor did the IBM team believe that accountability could be delegated to IBM's Research Labs. While the labs' contributions were a significant component of the company's innovation culture and brand, executives wanted to ensure that EBOs were integrated into IBM operating businesses that interacted with the marketplace on a daily basis.

After much debate, IBM determined that both the business units and Corporate Strategy should share accountability for EBO efforts. Placement of the EBO teams within the business units facilitated the effective transition to high growth. Simultaneous oversight by Corporate Strategy, insured that the EBO initiative would secure significant senior management attention. Corporate Strategy also facilitated initial startup funding and, with business unit leaders, approved additional funding on an ongoing basis. A second challenge involved managing risk. Horizon 3 ventures, like all new business ideas, came with an inherent uncertainty and a high chance of failure. To help mitigate the risk, IBM began by first thoroughly monitoring customers' use of technology. By understanding how clients were using (or struggling with) current technology, IBM could better predict what future breakthroughs were needed and hence determine where best to place its research bets. To ensure customer involvement, IBM also introduced its 'First of a Kind' program that required that IBM researchers identify a customer willing to partner on research projects and provide minimal financing of the project. IBM also managed the uncertainty risk inherent in breakthrough research by borrowing an approach used by oil companies when prospecting for oil (i.e. 'test wells') and staging financial and other resource commitments based on specific timelines and goals for each project (Kerr et al., 2014). Finally, in 2004, IBM launched a venture capital group to help it monitor breakthrough innovations outside of the firm and serve as a technology transfer unit facilitating the commercialization of discoveries and technologies developed in IBM's research labs and businesses.

By mid-2002, most of the initial EBO efforts had made considerable progress and revenues were up sharply. Equally important, there was considerable enthusiasm for the program. However, processes remained informal and success depended on Thompson and Harreld's personal interventions and networks. Financial and tracking systems, reporting relationships, review meetings, leader-selection criteria, and incentive mechanisms remained loosely defined. While this had worked for a small

number of EBO projects, the informality and intensive hands-on management could not be effectively scaled. EBO leaders differed on when to move out from under the EBO umbrella and into an H2 business. Some were concerned about how they would weather the transition from qualitative measurements such as milestones, while others argued that the tough financial goals expected of an H2 were healthy and necessary for the EBO system to be taken seriously within the company.

By now, Sam Palmisano, another IBM veteran, was CEO and he challenged Harreld and his team to come up with a way to scale and systematize the EBO program so that it did not require constant hands-on help. Harreld and the Corporate Strategy group assumed formal responsibility for the EBO process. They recognized that different categories of innovation had different risk profiles and, as a result, different approaches were needed to manage risk during implementation. The type of risk and the approach to implementation were based on the size of the opportunity and the timing and level of resources required to exploit the opportunity. These parameters defined different categories of innovation with different risk profiles. Each category of innovation also required a different leadership and organization model.

By the end of the decade, IBM's adjustments to their EBO scheme had proven their effectiveness. By 2011, the company was making US\$19 billion in revenues – 20% of their top line – from businesses that started as EBOs, and IBM seemed to have successfully positioned themselves for further growth and innovation.

#### **Lessons from IBM and Corporate Innovation for Growth**

IBM's story provides a useful example of the importance of establishing an innovative structure within large existing companies. Companies need to have the capabilities to engender dynamic growth. A number of lessons and best practices can be drawn from the successful efforts of others to jump start innovation and new business pursuit (Applegate/Kerr, 2015):



to the same overall strategy. The goal here is building new capabilities to deliver against the strategy.

- Horizon 3 ventures, by contrast, do not (necessarily) address strategy or execution gaps, but are attempts to expand into new businesses within a corporation or create new capabilities, possibly even creating entirely new strategic elements.
- One of the first and most important decisions encountered by IBM and other companies seeking to innovate is where to locate the new initiatives within the company. There is no 'one size fits all' solution. If there is a risk of cannibalization of time or resources by core businesses, it may be beneficial to keep a new venture separate from the rest of the company – but this risks a situation in which an innovation is not well-aligned with the company's goals and is difficult to integrate and move to an H2 business. On the other hand, while integrating new ventures into existing business units from the very start can afford them better access to funding and resources, it can also position them under managers who do not have the time or know-how to properly nurture them.
- Senior management must create a sense of 'urgency' around the changes and new initiatives, and it is responsible for ensuring that there is buy-in at all levels of the company and that innovation and new ventures are taken very seriously. It is also important to staff new ventures with some of the firm's best talent – although it is tempting to reserve the most capable workers for existing businesses with guaranteed returns, innovation efforts cannot succeed without skilled and dedicated workers.
- Although hands-on involvement from the CEO and senior management can be helpful in the early days of innovation initiatives, this may not be sustainable for the largest companies, like IBM, and it is necessary at some point to formalize the process of shepherding early-stage ideas through the stages up to Horizon 1. This includes financial and tracking systems, leader selection, processes for meetings

and reviews, and incentive mechanisms. For other organizations, the CEO may retain more direct control over the moving parts.

- Companies should involve outside parties in the ideation and innovative process to minimize risk. In particular, firms can use customers and other outsiders as 'early discovery systems' by monitoring customers' use of existing products, which can provide clues to their needs and generate likely ideas for new ventures.
- Perhaps most importantly, failure must be an option. Just as venture capital firms rely on their ability to terminate investments in projects that are not working out, large firms like IBM must be able to halt work on ideas that are not panning out and reallocate their resources elsewhere. This can be difficult for large firms: the relative availability of funding may lead to allowing struggling ventures to flounder for much too long, and managers are likely incentivized to avoid or mask failures. Proper continuation choices are essential, and some of the best companies use outsiders to obtain objective opinions about which projects to push forward vs. terminate.

In summary, the development of new businesses and innovations helps drive firm growth and that of the economy as a whole. Recent academic work is pushing the boundaries to understand better how firms differ in this regard, and we have collected empirical and case evidence of the challenges that large companies face in maintaining the pursuit of exploratory powers. In some cases, the shift towards an internal focus is warranted; in other cases, such as the IBM story depicts, it is inefficient and may ironically be an outcome of attributes that makes the organization otherwise successful. In managerial research, we are discerning a set of best practices about how to keep organizations more dynamic. These ideas need to be customized to each company and situation, and not all apply to every firm, but corporations should be learning from others as they discern how to best foster new business opportunities in their companies to provide growth for tomorrow.

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