How the Best Firms Balance Competing Forms of R&D-based Innovation

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Abstract

A recent study found that the odds of firm failure increase significantly after a firm attempts to transition between exploiting current innovations and exploring for new forms of innovation. This is because the skills required to perform one type of innovation differ from those required to perform the other. I look at two firms that failed to make the perilous leap between R&D-based exploration and exploitation, and consider what might have saved them. Firms that make the leap successfully to R&D-based exploration have a history of R&D-based learning, and firms that make the leap to exploitation are not manipulating earnings.

Creating Value with Opposing Forms of Innovation

Corporate innovation experts know that R&D-based exploitation is valuable. Exploitation occurs when firms create commercial value by making modest, incremental refinements to prior innovations in order to extend product lifecycles. For decades, Eastman Kodak exploited its proprietary innovations in amateur film-based photography, and Xerox exploited its capabilities within photocopying. These firms issued hundreds of closely related products based on their core technologies, and both firms created substantial value in the process.

R&D-based exploration is also important. When firms explore, they discover new forms of innovation that are relatively distant from the firm's prior areas of innovation. R&D-based exploration has created blockbuster innovations such as statin drugs that lower blood cholesterol[1]; the statin drug *Lipitor* was the first prescription drug to generate over $10 billion in annual sales.[2] New smart phones that emphasized advanced software over traditional hardware-based features have changed the way we interact with the world, and has created an industry worth $432 billion in only 10 years.[3,4]

Since both R&D-based exploration and exploitation are critically important, it follows that prior research has shown that firms possessing *sustainable* competitive advantage must conduct both forms of R&D. Firms conducting too much exploitative R&D eventually deplete their stock of proprietary knowledge (which may be said about Eastman Kodak and Xerox) as the market overtakes them.[5] Firms conducting too much exploratory R&D never create the commercial value necessary to sustain profitable operations. Firms that are "ambidextrous," possessing the ability to conduct both R&D-based exploration and exploitation, have been shown to be superior performers in a wide variety of contexts.[6]

Here we encounter one of the fundamental challenges of corporate innovation. R&D-based exploration and exploitation require fundamentally orthogonal skill sets, organizational processes and incentives. In fact, these innovation practices are in such conflict that many firms specialize in either R&D-based exploration or exploitation, and partner with other firms specializing in the opposite form of innovation.[7]

This raises two practical questions. Many researchers have observed that practicing R&D-based ambidexterity creates organizational benefits, and have quantified those benefits in a wide variety of contexts. But few to none have quantified the difficulty of practicing ambidexterity; just how just how serious is this ambidexterity challenge for innovative firms? In addition, if it is serious, how do the best firms overcome these difficulties?

Sizing up the Challenge

Firms that are effective at R&D-based exploration have created an environment that is conducive to this type of innovation. R&D-based exploration is uncertain, and we cannot predict reasonably the likelihood of success. Firms engaging in exploratory R&D have attracted risk-seeking investors that are motivated to invest by the high-returns available in such high-risk endeavors. R&D scientists concerned with job security will not undertake uncertain exploratory R&D without appropriate incentives, such as employment guarantees.[8] Finally, R&D scientists who value the notoriety and fame associated with making breakthrough discoveries are attracted to firms engaging in exploratory R&D.[9]

When market conditions call for exploitative R&D, all of those attributes that are essential for exploratory R&D now stand in the way of success. Exploitative R&D generates more predictable, lower investment returns, which may antagonize corporate investors. R&D scientists who are excited to engage in exploratory R&D may become frustrated with the tedious, routine work associated with exploitative R&D. Employment guarantees to R&D

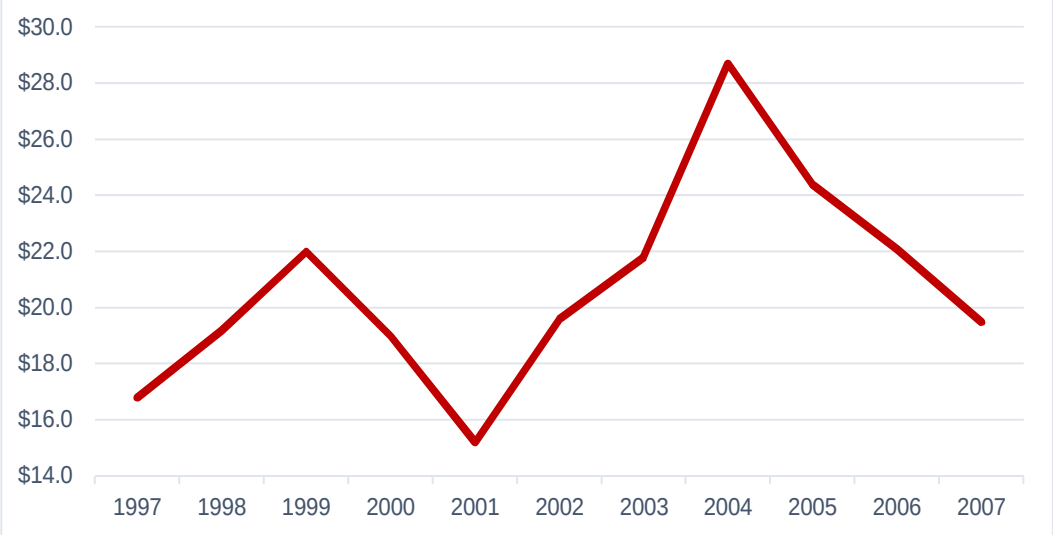
scientists no longer drive the appropriate behavior in the face of rather mundane exploitative innovation.

In a study recently published in *Strategic Management Journal*, I found that the challenge of moving between R&D-based exploitation and exploration is quite profound.[10] After controlling for firm-specific characteristics, including financial distress, my analysis shows that the odds of firm failure (i.e. liquidation, bankruptcy, or de-listing from stock exchanges) significantly increase as a firm attempts to move between these opposing forms of innovation. The leap from exploration to exploitation is not merely difficult; it threatens the very survival of the firm.

The Perilous Leap into Exploration

In general, firms ramp up R&D spending, transiting into more expensive exploratory R&D when prior innovations lose commercial value because competitors have imitated them, or when environmental changes demand new forms of innovation from incumbents. The abrupt and sustained increase in fuel prices prompted one industry titan to make a perilous leap into exploration in the early 21st century.

Figure 1. Fleetwood Enterprises Inc. R&D Expenditure, 1997-2007 ($millions)



Data Source: Compustat North America

Fleetwood Enterprises Inc. was once the largest manufacturer of recreational vehicles (RV's) in the United States. Founded in the 1950's, the firm entered the *Fortune 500* in 1973 and topped $1 billion in sales in the late 1980's.[11] Early in the 21st century, rapidly increasing gasoline prices threatened the RV industry, whose vehicles are notoriously fuel-hungry. In 2004, Fleetwood increased research and development expenditure by 31.6%, raising

the firm's R&D spending from 0.8% of sales to 1.2% - a sizable increase. This increase was attributed to the development of diesel powered vehicles with superior fuel economy.[12]

The new diesel RV's failed to produce enough benefit to save the company. Fleetwood was delisted in 2008, and broken up shortly thereafter.

The Perilous Leap into Exploitation

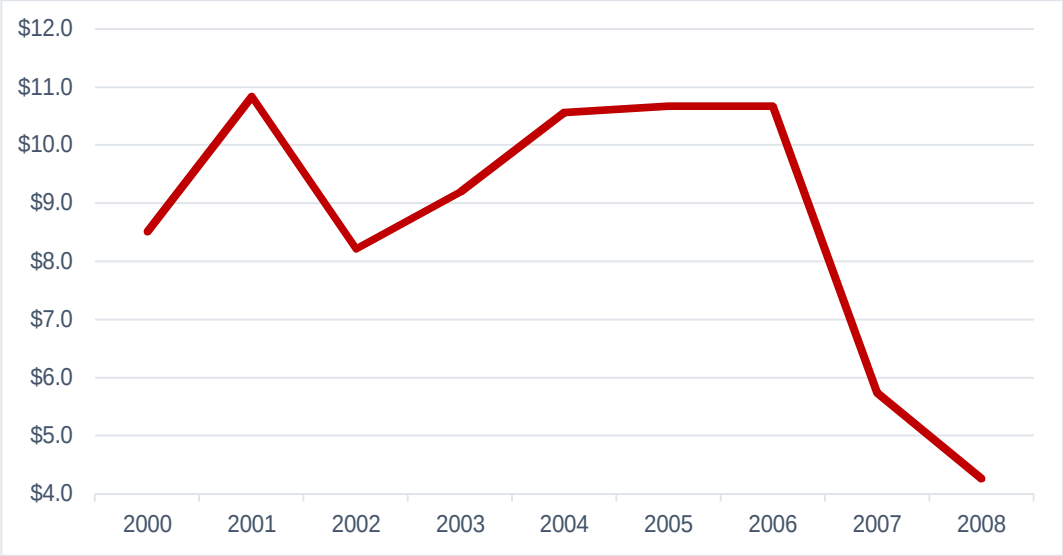
In general, firms cut R&D expenditure for two reasons. One reason is to improve near term earnings. In a recent survey, 80% of Chief Financial Officers (CFOs) said they would cut R&D expenditures in order to meet earnings targets.[13] This has serious negative consequences; if a firm reduces funding to an R&D project at a time when the project is nearing a major accomplishment, then the opportunity cost to the firm can be enormous. The other reason that firms reduce R&D expenditure is when they transit from exploratory R&D to exploitative R&D, because exploitative R&D is less expensive than exploratory.[14]

When firms reduce R&D spending for the right reasons, they generate a relatively high number of incremental innovations over a short period of time, which generate significant commercial value. Pharmaceutical companies are notorious for such activity. Pharma firms generate multiple modifications of an original drug (e.g. an "extended release" version of an original blockbuster drug) that the FDA terms "efficacy supplements." [15] These efficacy supplements extend the product lifecycle of highly profitable drugs.

Advanced Research Technologies (ART) developed optical medical imaging products for medical imaging, medical diagnostics, disease research, and drug discovery. In 2007, after many years of exploratory product development, ART implemented a major reduction in R&D spending. The firm stated that this R&D reduction was due to an increased focus on "commercializing" all of its products (i.e. exploiting its current product portfolio).[16] While ART did witness a modest increase in sales after this move towards exploitation, it saw an even greater reduction in its operating losses.

ART's move into exploitation proved unsuccessful. While the reduction in R&D spending resulted in a 16% reduction in operating losses, which reduced the firm's cash burn rate, it failed to produce the increase in profitable revenue that the firm needed after commercializing its product line. The R&D spending cut bought a little time but failed to produce the benefits that we expect from successful R&D-based exploitation. The firm went bankrupt in 2009.

Figure 2. Advanced Research Technologies R&D Expenditure, 2000-2008 ($millions)



Data source: Compustat North America

How the Best Firms Meet the Challenge

Despite the perils facing ambidextrous firms, most firms do survive these transitions between exploration and exploitation, and many firms generate significant benefits from the practice. This prompted me to investigate further how the best firms cope with these challenges.

My first insight is that firms with more experience in R&D-based "learning" are more likely to survive the leap from R&D-based exploitation to exploration. Scholars call the benefit that firms gain from R&D-based learning "absorptive capacity." [17] Firms with this enhanced learning ability have conducted a relatively large amount of R&D over time. This experience increases the firm's ability to identify valuable bits of information in the firm's environment, and to combine that information with the firm's proprietary knowledge base to create something even better.

Unfortunately, Fleetwood lacked the history of R&D-based learning that is an important prerequisite of a successful leap from R&D-based exploitation to exploration. Historically, Fleetwood's R&D expenditure hovered between $15 to $20 million, or 0.5% to 0.8% of sales. This is a good deal below the transportation equipment manufacturing industry average R&D intensity of 4.5%. This transition into exploratory R&D, which was an unfamiliar task for Fleetwood, was one more stressor on the firm.

My second finding was that firms that use R&D expenditure reductions to prop up earnings are more likely to fail after the R&D spending cut. This finding is rather surprising; a firm that shows an *improvement* in earnings

relative to peers after an R&D expenditure reduction is more likely to fail than a firm that does *not* show such an improvement.

This indicates that firms transiting into R&D-based exploitation should not do so to alleviate earnings pressure; new product launches are quite expensive, and the financial payoff to such releases may be years away. Instead, firms that reduce R&D expenditure because the market is calling for a period of exploitation, which requires significant marketing and advertising expenditure in its own right, are more likely to survive the leap.

The policy implications of these findings are enormous. First, firms with inherent skills in R&D-based exploitation must invest in absorptive capacity. That is, they must invest in R&D that may not be related directly to the commercialization of their product or service lines. They must invest in R&D that creates the opportunity for their R&D scientists to *learn*. Innovative firms with a culture of learning are more adept at discovering the new information in the external environment that will become the basis of breakthrough innovation. Firms that dive into exploratory R&D without the prerequisite skills in firm-level learning greatly increase the odds of firm failure.

The second insight is more intuitive. Firms must resist the temptation to reduce R&D spending merely to meet earnings targets. Healthy R&D expenditure reductions come about in the natural course of business. Once firms discover new forms of commercially valuable innovation, they move into a period of lower-cost, exploitative innovation that is devoted towards improving the product's marketability and extending its shelf-life. R&D cuts that are motivated by a desire to improve short-term earnings are jeopardizing the long-term competitive position of the firm, and increasing the odds of firm failure.

Author

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Endnotes

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