A Guide for Manufacturing and Technology Organizations

OVERCOMING INVENTORITIS

THE SILENT KILLER OF INNOVATION

"At Apple, Steve and I were successful because we followed the path outlined by Peter and Tats in this book and didn't fall prey, at least not too often, to inventoritis."

Steve Wozniak, Wheels of Zeus, CTO
Inventor of the personal computer and co-founder of Apple

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The Silent Killer of Innovation

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Overcoming Inventoritis:
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Warning and Disclaimer

"As a tinkerer and inventor my whole life, this book addresses a topic that is near and dear to my heart. At Apple, Steve and I were successful because we followed the path outlined by Peter and Tats in this book and didn't fall prey, at least not too often, to inventoritis. I've learned over time that getting inventions to the marketplace is at least as important as the product itself. It was much harder to get people to accept the concept of a computer into their homes and lives than to design it. Too many inventors fall prey to the 'field of dreams' syndrome. This book will drill home the importance of getting your product to market. It's a must read for any inventor."

Steve Wozniak, Wheels of Zeus, CTO
Inventor of the personal computer and co-founder of Apple

From the Back Cover

If You Are in Love with Your Product or Innovation, Your Company will Fail.

Innovation is a perilous process with unreasonably low odds of achieving commercial success with a new product or invention. Corporate innovators get it right only about 1 in 4 times, a deplorably low figure. To achieve commercial success, follow the lead of famous inventor Thomas Edison, the World's Greatest Product Marketer, who got it right almost 100% of the time. He ran a great organization, much of which became global giant General Electric. He maintained a healthy perspective, built an empire from his ideas, lived long and prospered.

Manufacturers must overcome the natural tendency to become emotionally attached to their products and innovations. Organizations of all types can benefit from training their people to be vigilant for inventoritis since it will allow them to improve their commercial success rates while simplifying the innovation processes. Toyota got it at least partly right and has become the world's greatest manufacturer while Ford Motor is on the verge of bankruptcy.

Learn how to identify, manage and overcome the debilitating inventoritis condition, so that you can dramatically improve your results while becoming a great product marketer!

Dedication

To Anne, a great leader, teacher and friend.

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Gerard and Anne were each tremendous sources of insight and inspiration. We benefited greatly from their amazing abilities to quickly analyze a business or commercial situation, separating the good from the bad and the ugly. We are saddened that Anne passed away after a heroic struggle with cancer as we were undergoing the publishing process. This work is dedicated to her.

We also owe a debt of gratitude to those pioneers who have come before us and who have contributed immensely to the field of product marketing.

Peter Roosen & Tatsuya Nakagawa

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  http://happyabout.info/homerun-fundraising.php

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Introduction

Are you about to embark on a venture based on an idea for a new product? Preparing to launch a product that has just come out of the development process? Or is it time to do a post mortem on one that has undergone the full cycle without becoming a commercial success? These can be very uncertain and painful times. We know and understand the pain because we have felt it - often. We have also experienced the joys of successful ventures - a much better sensation. Most innovators don't experience as much joy as they would like to. We're here to help change that. The process involves getting into the right mind set, maintaining perspective and avoiding the numerous pitfalls along the way to achieving commercial success.

So whether you're a venture capitalist, a strategic marketer, an R&D manager… or that indefatigable and solitary inventor… we all have much to gain from learning about why innovation fails. Successful outcomes require avoiding the numerous landmines and obstacles found along the journey. Only a small percentage of innovations meet expectations and we want to increase the percentage that do. We would all like to concentrate our resources on those innovations that are likely to succeed. This book is intended for those whose goal is to profit from these activities. It contains hard-earned wisdom that will save you some serious grief, no matter how you're involved in the business of invention.

“Inventoritis” is a term that we found bubbling up in various places among inventors and managers alike. We need to overcome it to achieve successful outcomes in innovation. We didn't find any explicit references to a definition but we did find numerous references to its core meaning. One example stems from famous inventor Thomas Edison's protégé and long-time friend Henry Ford. Ford made excellent observations and expounded on his experiences en route to his status as a legendary car maker.

We've learned that those who exhibit inventoritis are far less likely to achieve commercial success than those who don't. This is not confined to inventors. Sales people with little or no technical expertise can just as easily fall in love with their products and lose perspective. Steve Jobs is a recent example of someone who did but managed to get back on track with a stream of winning products.

So why go through this exercise? To help people and companies get out of their own way and become more effective innovators. There is a need to protect companies and individuals from tainting their own ideas with unhealthy biases. Our core message for company managers is simply that organizations must identify and treat their people to become inventoritis-free to enable greater return on their innovation investments, while simplifying the innovation process.

We are experiencing less uncertainty and pain in our product marketing practice as we continue to develop a better understanding of what works and what doesn't. We hope your innovation process too will improve. As your success rates go up, the pain you experience should go down. That means that our efforts will have been a step toward changing the world to make it a better place.

Chapter 1

Inventoritis Exposed

The Origins of Inventoritis – The Light Bulb as the Symbol of Ideas and Innovation

Thomas Edison is an American hero. He is credited with the invention of the light bulb, and he played a tremendous role in ushering in modern industry worldwide based on his advancements in electrical energy. Electric light greatly changed the way people lived and worked by turning night into day so that offices and factories could operate effectively without being limited to daylight hours. Edison is widely credited with having over 1,000 patents in his name and is often given the moniker: "World's Greatest Inventor."

What is not as well known, perhaps, is that Edison's penchant for invention was rivaled only by his effectiveness as a marketer. He was in the habit of working backward from the market and doing whatever was needed to most expeditiously fill what he found to be the real or actual need. He was known to always be actively researching what everyone else was doing and had done. He sometimes bought and on occasion stole technology from others.

Few people today know or appreciate that Edison did not invent the light bulb. Joseph Swan was installing them in homes and landmarks in England before Edison's first successful test was completed on October 21, 1879, when Edison's carbon filament lamp successfully operated for only 13.5 hours. Additionally, Edison had bought the Canadian and US patent rights filed in 1874 for a carbon filament lamp by a Canadian medical electrician named Henry Woodward and his colleague Mathew Evans. What Edison did was to create the first *commercially viable* filament lamp which, incidentally, did not occur until more than six months after Edison filed his patent. Edison understood the importance and power of a good public relations and media strategy and was able to capture media attention while others were busy working in relative obscurity. He developed his prototype lamps to the degree they could last over 1,200 hours using a carbonized bamboo filament; however, this advancement was not made until several months after he filed his patent application and made the front pages with his early announcements. Edison then developed Direct Current (DC) electrical power systems to energize the light bulbs. Swan sued Edison for patent infringement and eventually won, resulting in Edison having to take Swan in as a partner in the British company.

In his 1930 book, 'Edison As I Know Him,' legendary car maker Henry Ford, a close friend of Edison, described inventoritis without giving it a name. Ford described an inventor as one who "frequently wastes his time and his money trying to extend his invention to uses for which it is not at all suitable." Ford asserted "Edison has never done this." The context and meaning of the term "uses" should not be limited only to technical feasibility but should include commercial viability as well. Edison and Ford always considered commercial viability a requirement for anything they were involved with. Ford built a massively successful enterprise because he understood thoroughly the importance of this principle.

Many inventors who file patents, including the inventors of the zipper (sewing machine inventor Elias Howe in 1851, Whitcomb Judson in 1893, and much later again electrical engineer Gideon Sundback in 1917), fall into the trap of being too far ahead of their time or otherwise being out of tune with the market. The zipper finally started getting good market acceptance around 1930 and has since become one of the world's best known products – almost a century later. It did little good for its early inventors. Judson showed his version of the zipper to 20 million (20,000,000) people and sold only 20.

Better known among inventors is Nikola Tesla, inventor of Alternating Current (AC) electrical systems. After some great successes, Tesla lost touch with the market and was later pursuing visions that generated much interest and debate but did not yield marketable products. This is one of the worst outcomes people with inventoritis can experience since their monetary gains never equal the strength of their innovative ideas. Tesla experienced this fully.

On the other hand, Edison, through an extensive network, was able to learn the crucial lesson of not misunderstanding the market with his first patented invention. The following story told by Henry Ford[1] shows that he was obviously quite aware of the typical outcome of inventoritis:

In Common With All Inventors

Mr. Edison, in his first patented device concentrated on something which he *thought* was needed, but which, in fact, was of no use to anyone. In 1868, he took out a patent for an arrangement that would quickly and accurately record the vote of a legislative body. He had the impression that Congress in particular needed his invention so that time taken in voting might be used for more valuable purposes. He still laughs about the reception which this, his first child, received in Washington:

> It was exhibited before a committee that had something to do with the Capitol. The chairman of the committee, after seeing how quickly and perfectly it worked, said: 'Young man, if there is any invention on earth that we don't want down here, it is this. One of the greatest weapons in the hands of a minority to prevent bad legislation is filibustering on votes, and this instrument would prevent it.'
>
> I saw the truth in this, because as a press operator I had taken miles of Congressional proceedings, and to this day an enormous amount of time is wasted during each session of the House in

1. Ford, H. & Crowther, S. (1930). Edison As I Know Him. New York: Cosmopolitan Book Corporation. (pp. 56-57).

> foolishly calling the members' names and recording and then adding their votes, when the whole operation could be done in almost a moment by merely pressing a particular button at each desk. For filibustering purposes, however, the present methods are admirable."

That *cured* Edison of inventing things which he *thought ought to be wanted*. Thereafter he kept to things he *knew were wanted* and which would have widespread application.

Congress still does its voting the same way it did in 1868 but Edison was treated by the committee chairman and overcame his early onset of inventoritis. Once thus inoculated, Edison had a lifelong winning streak with almost 100% of his 1,093 lifetime U.S. patents having been tied to commercial successes. The last part of Appendix B focuses on quantifying his success, and Appendix C lists his patents.

Tesla however, went in the other direction. After some breathtaking early successes, he alienated himself from the marketplace and everyone in it. Tesla was the inventor of Alternating Current (AC) electrical systems and technology, which is continually and widely used throughout the world today. He was in direct competition with Edison's Direct Current (DC) technology. Tesla had the superior technology for many electrical power applications, but Edison's technology held the market for some time even after George Westinghouse, inventor of the railway air brake system, backed Tesla. Edison actively resisted changing from his established DC to the superior AC technology but eventually did make the wholesale change based on market demand.

There are many books written about both Edison and Tesla, their lives, inventions, personal and professional successes and failures. The vast majority of these books fall short in encapsulating a common feature, especially in the case of Edison. They generally have missed the point that, although Edison had taken ownership of the term "inventor", he was the best *product marketer* the world had ever known. After his death, Tesla was eventually credited with the invention of radio communication to add to an already impressive list of accomplishments and today, many scientists agree that Tesla was actually the greater inventor of the two. Yet he lacked the marketing skills of Thomas Edison, forcing his utter brilliance to be remembered only after his death.

A detailed discussion of Edison's lasting rise to prominence, Tesla's early rise then long fall from grace and the “War of the Currents” battle between their rival DC versus AC electrical systems is provided as a case study in Appendix A. Appendix B contains lessons from these historical references while Appendices C & D contain complete lists of Edison and Tesla's respective U.S. patents. The main difference between these two famous inventors is that Edison was a far greater leader than Tesla, while being free from inventoritis. Edison tended to recruit experts while Tesla generally worked alone. Edison had developed sound marketing processes whereas Tesla had not. Had Tesla been free of inventoritis, he might have won the battle of the competing DC and AC electrical power systems without destroying himself in the process.

What Led These Two Prominent Individuals to Such Vastly Different Outcomes? Inventoritis.

Tesla is the poster boy for this disease, arguably being a greater inventor and scientist than Edison, while self-educated Edison was effectively treated by the congressional committee chairman who rejected his first patented invention, the “Electrographic Vote-Recorder.” Edison lived the rest of his life mostly free of inventoritis and still has the reputation of being the World’s Greatest Inventor. Edison understood and consistently applied sound principles of marketing whereas Tesla did not.

Since Edison’s death, the light bulb has become universally recognized as the symbol of ideas and innovation. Many of the current books and web sites on innovation include a picture of a light bulb.

Why is Inventoritis a Big Issue?

Development and testing activities have been modeled on Thomas Edison's famed Menlo Park laboratory example. This was done on the premise that by establishing systems and processes toward the objective of coming up with winning products through technical research and development activities (R&D), a company would gain a competitive advantage. Vast amounts of money are spent in this area and many companies still pride themselves on the money they spend each year on these activities, usually expressed as a percentage of sales, and typically in the 1% to 15% range. An endless series of winning products is not the normal result. A 2005 Booz Allen Hamilton study[2] of the global top 1,000 R&D spenders found no direct correlation between R&D spending and sales growth, operating profit or shareholder return.

It seems that few companies properly interpreted Edison's example. Microsoft is one that has come quite close, at least in terms of having its marketing strategy properly leading its R&D activities, rather than the other way around. Toyota is also getting it at least partly right by virtue of its lean manufacturing approach. Central to Toyota's lean approach is constant improvement, respect for people and the elimination of all types of waste, including misdirected R&D spending and initiatives.

Innovation giants 3M, HP and Procter and Gamble have been making big publicity splashes with their slogans about innovation and inventiveness while they too have all sorts of problems trying to achieve good results from their R&D spending. 3M had a big hit with its Post-it notes but that had more to do with the tenacity of the inventor than the effectiveness of the company's innovation.process. HP has done quite well overall but not everyone agrees, especially numerous shareholders who got burned from time to time. Consumer products giant Procter and Gamble is revamping its entire R&D process to an open innovation model because spending in the area has been exceeding sales growth with no end in sight.

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2. Jaruzelski, B., Dehoff, K., & Bordia, R. (2005). The Booz Allen Hamilton global innovation 1000: Money isn't everything. Strategy + business magazine issue 41, Winter 2005 Reprint No. 05406. New York: Booz Allen Hamilton.

Ford Motor was the world's biggest R&D spender in 2005 while Microsoft was the biggest one in the previous year. Microsoft seems to be moving forward while Ford seems unable to spend its way out of the innovation rut it is presently stuck in - having lost $12.6 billion in 2006 with few exciting innovations to brag about. Steve Jobs got himself into problems and even got thrown out of his own company. Jobs has since managed to get back on track and is having some great innovation successes at Apple.

Clearly, inventoritis is a big issue where such vast R&D spending produces such unreliable results.

Why We Need to Deal with Issues Caused by Inventoritis

Obtaining more predictable and better results from these substantial R&D investments would lead to competitive advantages. An important metric would be an increase in the percentage or number of innovations that are successfully deployed. Hundreds of thousands of new products are launched worldwide every year, with only a small percentage of the products remaining on the market a couple of years after the launch. Companies that can increase their success rate even a little bit will be able to capture greater market share from their competitors.

How to Identify Inventoritis

An industry metric first introduced in 1992 called the M/E or Grabowski ratio[3] can be used as a measure or at least an indicator of the extent to which organizations are likely exhibiting collective inventoritis.

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3. Grabowski, R.E. (1995). Who is going to buy the darn thing? Proceedings of the IEEE Electro International, June 21, 1995, 69-97.

The M/E ratio was developed by engineer turned marketing consultant Ralph E. Grabowski and is the ratio of marketing to engineering investment. The main component of the marketing investment is the often undervalued discipline of “front-end marketing” that includes conducting market research, gathering competitive intelligence, building the business model and analyzing the payback. Marketing investment for the purposes of the M/E ratio does not include sales and promotion expenses.

Grabowski found that the most successful companies had ratios greater than 1.0, spending more in front-end marketing than in engineering. Failures had ratios often well below that. Copier manufacturer Xerox had a ratio of 0.1 and large computer companies Digital and Wang, that were impacted by the advent of the personal computer, had ratios of 0.004 and 0.001 respectively. Personal computer maker Dell and software company Intuit had ratios of 1.5 based on his comparison. Grabowski found that companies with low ratios tended to have inwardly focused engineering cultures.

Other researchers, such as Robert G. Cooper and Elko J. Kleinschmidt, have been investigating the relative amounts of resources applied toward front-end marketing. They have done considerable research work throughout the past 20 years in the product development field. In one study, they found that only small amounts of money (7%) and work (16%) go into the front-end marketing homework. These findings were presented and discussed by Bill Dean in a case study article he prepared for a direct marketing association. Dean[4] stressed the importance of incorporating focus group testing in the product development process. For Dean's article, he also found research revealing that solid up front marketing homework can increase new product success rates by a whopping 43.2%.

To help develop a clearer picture of where an organization stands relative to its inventoritis issues, a careful examination should be made of the budgeting processes, reward and incentive systems, human resources policies and activities, training programs, innovation recognition systems and strategic planning methodologies.

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4. Dean, B. (2005, March 28). Case study: Incorporating focus group research into the product development process. DM News, Article 32310. Retrieved March 31, 2007, from the World Wide Web: http://tinyurl.com/2gh29w

It is also important to be able to identify inventoritis issues at the personal level. Human resources people need to have at least a basic understanding of how it impacts various functions. They must also be able to screen and qualify it within individuals to minimize adverse impacts. Managers should be able to determine suitable methods of identifying these issues within their respective enterprises.

Inventoritis should not be much of a problem in large hierarchical companies where the innovation activities are tightly managed and people work in carefully defined jobs that are not entrepreneurial in nature. But then again, a scientist or engineer working deep within a large R&D organization with some of these tendencies could have substantial, albeit hidden influences on the product. The following comments made recently to the authors by Ashton Udall, a professional working in product development and manufacturing suggests this:

> “Taken from a product development and manufacturing perspective, I watch companies and inventors make their way through the trade-off process in which they select their optimal combinations of features, costs, materials, and so forth for a product. We've recently worked on a product requiring a rather simple component as simple and as common as a button for a TV remote product or a shoulder strap for a carrying case. With a common component like this, it's probably a good idea to see if one is already being produced out there that might fit with what you had in mind. Avoid the need to spend thousands on tooling for a new component for your product! Take that money and put it in marketing, or keep it as profit, or put it all on Black in the nearest casino. Why design and build a new TV button?
>
> We sourced a nice alternative component, but the specs weren't quite a match (slightly wider than needed). Rather than modify the designs for this (which would only have been an aesthetic modification), the client is still interested in tooling to maintain exactly what was envisioned. This is where inventoritis and its evil

> cousin 'designeritis' smack into reality. Multiply this approach a few times within one product development process and you're looking at a surefire way to decrease your profits.”

Being able to identify inventoritis in individuals and companies or organizations is a prerequisite to being able to apply solutions. The degree to which symptoms appear may vary, but there is no individual or organization that has not at one time or another experienced the consequences of innovations inflicted by the shortcomings of inventoritis. Better tools are being developed to ascertain the extent to which organizations are at risk of squandering resources applied to innovation.

The objective of this chapter was to expose this silent killer of innovation. Strategies for overcoming it for organizational and individual innovators will be covered in later chapters.

Chapter

2 Running the Numbers: Most Innovations Prove Worthless

The number of lone inventors who are able to successfully market their first invention is difficult to know, although it is widely believed by most industry professionals to be very low. There does not seem to be consensus as to how low the success rates are, nor has there been much research done in this area. Fortunately, there are enough data available from corporate innovation processes that some reasonable estimates can be made. Few inventors know what they are up against before they go out and apply for their first patent. The goal of this chapter is to estimate the likelihood of commercial success and suggest why individuals are usually at a severe disadvantage relative to well established corporate or institutional innovators.

For the world's largest and most sophisticated companies, including those with corporate research and development centers, the success rates are certainly much better than for the typical lone inventor. However, the numbers are still poor, with the rate being well below 50% - certainly below what most managers and owners would like.

Companies stay afloat because the products they sell, including new products, rarely rely on patented subject matter. Across a range of industries, companies derive about a quarter of their sales and profits from new products, only some of which are patented. The other three quarters of a company's sales and profits come from yesterday's breadwinners that still have years left in their product life cycles.

So what happens if a company stops innovating? In most cases, it will slowly die. Companies operating in a competitive marketplace need to continually introduce new products or products that are better, faster or cheaper in order to stay in business. They don't need to overdo it with innovations, but there is a need to have something in the works. Companies that are leaders in innovation become the pacesetters for the rest of the industry. The other players are forced to keep up or get knocked out of the never-ending race.

Besides a basic need to constantly introduce new and improved products, another factor that stimulates the corporate innovation process is the tantalizing prospect of huge profits from world-beater innovations. For the few innovations that become blockbuster commercial hits, the rewards can be great. Companies that come up with such innovations and exploit them well can end up dominating their industry categories and raking in huge profits.

There are several references that give the failure rates for new product introductions. The normal range is typically from 70 to 80%. These sources include:

1. Various studies cited by Advertising Age.[5]
2. A study[6] by Linton, Matysiak & Wilkes, Inc. of the top 20 food companies reviewing 1935 new products.
3. A Booz Allen Hamilton study[7] on new product management claiming that one out of seven product ideas yields a successful product.

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5. Brock, D. (1997). Getting the most out of your new product introductions. Partners in Excellence. Retrieved April 27, 2007, from the World Wide Web: http://www.excellenc.com/articles.htm

6. Linton, D.B. (1997, July 1). Market study results released: new product introduction success, failure rates analyzed. Frozen Food Digest 12(5), 76.

4. Boston Consulting Group vice presidents and directors James Andrew and Kermit King claiming 60% to 85% in an article[8] titled 'Boosting Innovation Productivity'
5. Some college textbooks[9] claim 80%.

A study by the Product Development and Management Association titled 'The PDMA Foundation's 2004 Comparative Performance Assessment Study (CPAS)' shows 40% rather than the higher 70-80%. The PDMA figure appears to be based just on the post-commercialization or post-launch failure rate. It does not include all products that go into the development pipeline, rather just those that make it to the launch pad. If one includes all the steps from idea generation, the PDMA study failure rate is over 80%.

From this data, it is quite clear that only about one quarter (1/4) of the products that go into the development process end up being successful. This is a deplorably low figure that applies across a wide range of industries. The data comes mainly from well-established companies, typically the top ones in the various industries. In other words, a success ratio of one in four is currently accepted as the best that can be done in terms of converting ideas introduced to the development process into successful products.

What Happens in the Case of Start-Up Companies?

For these companies which are usually quite small, there is a whole other set of failure rate data involved. U.S. and Canadian statistics reveal that only about one third (1/3) to one half (1/2) of new companies remain in business for at least 3 to 5 years. [10,11]About a third of them

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7. Dean, B. (2005, March 28). Case study: Incorporating focus group research into the product development process. DM News, Article 32310. Retrieved March 31, 2007, from the World Wide Web: http://tinyurl.com/yuzzzp

8. Andrew, J.P. & King, K. (2003, April). Boosting innovation productivity. BCG opportunities for action, April 2003. Retrieved April 27, 2007, from World Wide Web: http://tinyurl.com/23y3cp

9. Friedman, H.H. (2000). Product policy; new product development. Retrieved March 31, 2007, from City University of New York, Brooklyn College Economics Department web site: http://tinyurl.com/22jgv8

10. Knaup, A.E. (2005, May 1). Survival and longevity in the business employment dynamics data. Monthly Labour Review 128:5, 50-57.

make a profit during that time, another third break even and the remaining third lose money. Many of the companies that close their doors within the first few years do so because of business failures. Running a profitable business is obviously not easy.

Multiplying the survival probability for a start-up company with the new product success probability makes the overall likelihood of success for a start-up company to develop and commercialize an invention or new product seem fairly dismal. The math looks like (1/3 to 1/2) x 1/4 = 1/12 to 1/8 overall likelihood of success. Since the probabilities are not entirely mutually exclusive, the more forgiving 1/8 figure will be used. Determining what influence one of these variables might have over the other is beyond the scope of this book. In any event, a 1 in 8 or 12.5% chance of success seems somewhat risky, which is why venture capitalists and finance people generally have a hard time dealing with start-up companies based on a new product idea. However, a well managed start-up company with a highly successful product can generate a phenomenal return.

So, for large and well established companies that have developed sophisticated R&D operations, the odds of a successful new product launch is about 1/4, dropping to about 1/8 for start-up companies. What about the lone inventor? There are no readily available statistics for this. Anecdotally, the number is very low.

Throughout industry, the informal consensus for individual inventors is that 95% of the granted patents issued to them do not return the out of pocket costs that went into the patenting process. It typically costs $5,000 to $20,000 to obtain a U.S. patent. The costs depend mainly on the complexity of the subject matter and the number of rounds in the examination process, with two rounds being the normal minimum. Among these same individuals, those who experience true “commercial success” with their first patented idea, appear to number less than one in a thousand.

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11. Baldwin, J., Bian, L., Dupuy, R., Gellatly, G., Statistics Canada (2000, February). Failure rates for new Canadian firms: New perspectives on entry and exit. Minister of Industry / Statistics Canada Catalog no. 61-526-XIE. Retrieved March 31, 2007 from Statistics Canada web site: www.statcan.ca/cgi-bin/downpub/freepub.cgi

Inventions for the purposes of this discussion are limited to those covered by patents. Commercial success is defined as receiving enough money from the sale of the patented subject matter or sale of the patent itself such that all the costs, including the applicable overhead costs over time, are adequately compensated, plus a reasonable rate of return. Also included in the costs are the market value costs of all materials, products and services used in each step of the process from the initial idea generation through to the sale or deployment of the patented products or technology. Depending on the invention, these costs will vary from a low in the $50,000 to $100,000 range to millions or tens of millions for a serious full scale product launch.

The very low success numbers for lone inventors seem quite reasonable when three additional variables are taken into account:

1. Experience
2. Resources and
3. Contacts

These are tied together under the umbrella of leadership abilities and expertise. Suppose that each of the three variables has a rating from 1 to 10, with 1 being the lowest and 10 being the highest. A lone inventor with no experience, no money and no contacts would score one out of 10 or 1/10 in each area. Multiplying these three probabilities together would yield 1/10 x 1/10 x 1/10 = 1/1,000. On the other hand, someone who is a great leader with tremendous relevant expertise and experience, has adequate resources to fund and otherwise support the development and commercialization of the new product, and has all the necessary contacts to make it work, would score 10 out of 10 in each of the three areas. Multiplying those probabilities together would yield 10/10 x 10/10 x 10/10 = 1,000/1,000 or 1. This set of probabilities multiplied together can be called the individual's 'capability factor' or “CF.”

Continuing the exercise, assuming the lone inventor doesn't own a well established company, take the start-up company probability of successfully launching a new product at 1/8 and multiply it by the individual's CF. In the worst case, that would yield 1/1,000 x 1/8 = 1/8,000 and in the best case, the yield would be 1/1 x 1/8 = 1/8. This gives a wide range, from a one in eight (1/8) chance at one end to one in eight thousand (1/8,000) at the other. This fits well with the "one in a thousand" notion.

A typical case might be an inventor working on his or her 3rd or 4th commercialization project. With some experience (say a rating of 5 out of 10 or a 5/10 ratio), half the resources needed to get through the development and launch process (5/10), and half of the contact score (5/10) for a total CF of 5/10 x 5/10 x 5/10 = 125/1,000 or 1/8. That means this person would have a likelihood of 1/8 x 1/8 = 1/64 or a 1 to 2% chance of making it work. These are still not great odds.

Now, how would world famous inventor Thomas Edison have scored in one of his later years after he was well established? He certainly had all the experience, resources and contacts needed to make it a success. He also had a family of well-established companies in operation. In that case, his capability factor or CF of 1 would be multiplied against the large company successful launch probability of 1/4. For Edison the overall probability of a successful product launch based on this model would be 1/1 x 1/4 = 1/4, the same as for a big and well established company with all the necessary R&D infrastructure in place, which is exactly what he had. Edison actually did much better than this.

The vast majority of Edison's projects were commercial successes. An example of a very expensive one that did not do well (he lost millions of dollars) involved developing iron processing technologies and building facilities to extract iron from low-grade ore. While he was in the midst of the development process, a large high-grade ore body was discovered by a competitor that made his developments designed for low-grade ore bodies largely moot. Edison was able to offset the losses by applying the important new technologies he developed to other areas such as pioneering the manufacture of cement. He eventually managed to turn the failure into a success. Virtually all the world's cement is now made in rotary kilns based on those Edison patented. Furthermore, the high-grade iron ore body did not last forever and modern ore-processing systems and methods have been built on Edison's developments.

Edison's commercial success rates were much higher than 1 in 4 or 25%, mainly because his inventoritis-free approach to innovation was radically different and better than the ones now in use by most corporate innovators. There is a large inventoritis variable in the current corporate model that Edison managed to overcome. His overall number was closer to 100%. The last section of Appendix B looks at Edison's historical success rates and contrasts them with those of Nikola Tesla. Edison achieved an almost perfect 100% lifetime success rate that has never been matched by any company or individual since, even over a large number of innovations. Tesla's rates were similarly excellent while he was involved with Westinghouse after leaving Edison's employ. But once he went out on his own in around 1900, they dropped to about 20%, matching those of the typical modern corporation a century later. The numbers clearly suggest that modern industry has adopted the Tesla approach to innovation rather than the extremely successful one employed by Edison with its less than 1% failure rate.

This simple model was designed to quantify the probability of success for lone inventors relative to both new and well established companies. It is intended to be taken as a starting point for further work and to give rough estimates of the chances of success for various types of inventors. It highlights the fact that inexperienced individuals with few resources and no networks of contacts have a very slim chance of successfully commercializing their first ideas or inventions. This model can be used to help guide these individuals toward improving their chances of achieving commercial success.

One of the main reasons most lone inventors (also referred to as independent inventors) fare so poorly relative to corporate innovators is that inventoritis seems to be more of a problem with them. The corporate innovators also fare as badly as they do due to inventoritis issues. Lone inventors and corporate innovators alike all need to overcome it. Lone inventors also need to strive to develop relevant experience, amass sufficient resources, and build a suitable network of contacts in order to achieve commercial success with their ideas.

Developing great leadership skills along with a good understanding and appreciation of the innovation process is also essential for an individual working on achieving commercial success through innovation. Fortunately, most of these factors are well within an individual's control. Individuals can work on each of the key areas, dramatically improving their chances of success. For individuals with severe inventoritis, their ideas are almost always worth less than zero when the financial results are tallied.

Do Patents Count?

Most inventors have a portfolio containing granted patents and other forms of intellectual property including trade secrets. There are also other types of intellectual property. Copyrights and trademarks are among them. For example, computer software is usually protected by copyrights rather than patents. The focus on patents in this book helps to simplify the discussion. There is a large body of detailed data available on patents and since this form of intellectual property is most closely associated with inventors and manufacturing innovations, it will be used throughout the ensuing discussion.

A patent is not a complicated thing in and of itself. It is basically a contract between a national government and one or more inventors in which the government grants the owner of the patent a limited period of exclusivity (usually between 15 and 20 years) to exploit the invention. The inventors are often not the owners because patents can be rented out (licensed), donated or otherwise pledged to a company (assigned), and generally bought, sold or otherwise transferred like other types of property. In exchange for granting a patent, the government gets a full public disclosure of the invention. The public benefits by having access to a comprehensive permanent record of all the inventions disclosed in the numerous patents over the years. The patent owners have a time-limited opportunity to legally monopolize the invention. That is really all there is to a patent.

To obtain and maintain patents, there are numerous fees paid by inventors or patent owners to the various involved government patent offices, patent agents and attorneys. Unless the fees become a problem, obtaining a patent is usually easy except when an application is for a broad patent. Once the patent term has elapsed and the patent therefore becomes void or extinct, anyone else may also go ahead and make or use the invention with impunity.

During the term of the patent, a patent owner may sue any infringers in federal courts for damages caused by the competing sales. They may also seek legal injunctions and Court Orders to restrain the infringers from carrying on the infringing activities. That litigation can become very expensive and complicated and the one doing the suing usually pays substantial court costs, even if they win.

In practice, most patents are relatively worthless because they cost between $5,000 and $20,000 to obtain and apply to things that do not become commercial successes. Furthermore, they are often narrowly defined and relatively easy to circumvent. Litigation costs for infringement lawsuits can run up into hundreds of thousands or millions of dollars - more than most commercially successful patents are worth.

Since the vast majority of issued patents are not worth the paper they are printed on, it is reasonable to assume that someone with a patent might have an inventoritis problem. This is also true for many companies that get carried away with filing patent applications for almost everything they possibly can.

Chapter

3 Inventoritis is Disruptive

In recent years, there has been much debate and discussion of the rapidly increasing rate of change in the context of globalization and the threats posed to established businesses, entire industries and the entire industrial sector of several countries. The most popular example is the present shift of manufacturing activities and related jobs from the United States to China and to other countries where labor costs are a fraction of those in the United States. This perceived threat is not new, although the numbers of affected industries and involved jobs are much higher and the rate of change is much faster now than in the past. These and other types of threats are now commonly referred to as being “disruptive.”

This differs little from the debate throughout the 1970s and 1980s when Japan's advances in industrialization were seen as a similar threat although the term “disruptive” was not used to describe it. At that time, there was the additional threat to jobs posed by a great increase in the level of automation replacing traditional methods of manufacturing. Throughout the developed world, very large R&D investments were made in robotics, computers, artificial intelligence and other technologies that led to increased productivity and quality improvements in all sectors of the manufacturing economy. These investments were generally aimed at areas that would improve gross profit margins and were largely successful. A good example was the market rewarding automakers for quality improvements - led by Japanese producers. Japan, a small country, became a global powerhouse.

The current shift of industries and jobs to China and other lower cost countries seems much broader and is not yet based on competing through margin-improving technologies aimed at increased quality and productivity. Producers operating in such countries have been increasingly exporting high volume, low cost 'knock-off' products to developed countries. The world's most populated countries, including China and India, are simultaneously undergoing rapid industrialization as part of this process. Like Japan before its big quality improvement push, these countries are competing by exporting as many goods as they can to mainly western markets, especially the United States. The massive margin-improving R&D investments will likely follow, as they did in Japan's case. China, the world's most populous country with a quarter of the global population, is leading the charge and has recently become a global player. This shift appears to be very large compared to Japan's earlier rise.

To keep up with these greater and more rapid changes, a company's typical knee-jerk reaction and blind, illogical practice has been in many cases to arbitrarily increase its spending on technical R&D activities to remain competitive and to attempt to protect itself against competing technologies that could undercut existing business. Harvard Business School professor Clayton Christensen in his 1997 book 'Innovator's Dilemma'[12] outlines and discusses the concept he called “disruptive technology” that now forms part of the business vernacular. The term “disruptive” applied to the globalization developments mentioned at the beginning of the chapter came about after Christensen's work was popularized.

The main conclusion of Christensen's analysis is that in the face of potentially disruptive technologies, even well-managed companies are bound to fail because sound management decisions will take these

12. Christensen, C. M. (1997). The innovator's dilemma: when new technologies cause great firms to fail. The management of innovation and change series. Boston, Mass: Harvard Business School Press.

companies up market in a one-way direction, making them unable to respond in time to disruptive innovations that encroach from the bottom of the market with unique and disruptive value propositions.

Little consideration has been given to the psychological aspects of the decision-making process that can prevent companies from properly addressing potentially disruptive technologies in time. The idea that company management can place blame for their companies' failure to address changes in the marketplace on such externalities as apparent “disruptive technologies” is outrageous. Fortunately, this and other academic arguments for failure are overcome simply enough when proper consideration has been made for inventoritis. However, to do so effectively, there needs to be a clear understanding of marketing objectives, what the term “marketing” really means and what a product marketer should be doing.

Definition of Product Marketer

So, what exactly is a “product marketer” and what is the definition of “product marketing?” The answers are not as obvious as they should be. In fact, there are conflicting definitions of “marketing” that can lead to considerable confusion. The definition of marketing used herein - the process of anticipating, identifying and satisfying customer requirements profitably - suggests it is the core of what a business is all about and therefore a clear leadership role. That differs greatly from the opinion held by many that marketing is or ought to be primarily a support or management function rather than a key strategic leadership issue. This confusion surrounding the various definitions of marketing and the related roles is a serious problem in modern industry. Thomas Edison was never one to be confused in regard to this topic.

The confusion on what marketing means has been further confounded by the creation of the concept of “product management” and the role of a “product manager” in 1931 by consumer products giant Procter and Gamble. Since then, product management and product managers have become standard throughout industry. Linda Gorchels, author of 'The Product Manager's Handbook'[13] is an authority on the subject of product management. She defines it as “a matrix organizational structure in which a product manager is charged with the success of a product or product line, but has no direct authority over the individuals producing and selling the product. Much of the work of a product manager is through various departments and cross-functional teams, almost as if the product manager were operating a business within a business." She notes various limitations of the product manager role that often serves as a "training ground for young executives." From her description, it is not perceived as very important role in most companies.

Another marketing expert who has considered the definitions of marketing roles is Steve Johnson at Pragmatic Marketing (www.pragmaticmarketing.com) which mainly serves high-tech companies. He observed that product management, product marketing, program management and other titles in high-tech companies are poorly understood and are defined differently in various firms. He recommends a three-person product management team as an ideal solution for many companies with a technical product manager and a product marketing manager reporting to a director of product strategy or product line manager.

The consensus is that product managers are more internally-focused while product marketing managers are more externally-focused. There is considerable overlap of responsibilities, as there is on names, so this becomes fuzzy. Gorchels, Johnson and others seem to confirm, yet decry as problematic, the widely-held view that marketing is more a supporting function and not a top level leadership role.

Rather than placing and enforcing marketing as important above all else, most companies place innovation or R&D activities at the same level as marketing or sales with marketing and sales often combined under a single vice president and R&D under a different vice president. Structurally, in most companies, by default, the CEO is responsible for anticipating, identifying and satisfying customer requirements profitably. This should not be the case unless the CEO is an expert in this domain. The traditional marketing vice president does not lead the product marketing or govern the strategy unless he or she has

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13. Gorchels, L. (2006). The product manager's handbook (3rd ed.). New York: McGraw Hill (pp. 305 & 325)

sufficient expertise plus direct control over the R&D function. Microsoft, the world's largest R&D spender in 2004, appears to have taken a lead in correcting the misalignment of roles.

Herein, the definition of product marketer is a person with the authority and responsibility for leading the process of anticipation, identification and satisfaction of customer requirements in a profitable manner. If that requires the CEO to become involved and lead the way, then so be it. This is a leadership, not a managerial, role. The word manager should never appear in such a title because managing as opposed to leadership is generally viewed as an efficiency process. Peter Drucker and many other authorities have written about the differences between managing and leading and the point here is that product marketing needs to be run by a leader. Thomas Edison's key characteristic was that of a leader.

Perhaps the most revealing source of Edison's greatness as a product marketer is his former employee, protégé and long time friend, Henry Ford, who's Ford Motor Company, is currently the world's fourth largest automobile manufacturing company. Henry Ford has been credited with pioneering the mass production assembly line, fixing sales prices on future anticipated costs and then forcing the costs down through volume production. This strategy is known today as a 'loss leader' strategy. But Ford himself largely credited Edison with having pioneered and developed these and other marketing strategies. Ford's attempts to credit Edison with these developments have gone largely unnoticed.

The examples that follow show that companies that properly assess and manage potentially disruptive technologies from an inventoritis-free vantage point do not become subject to the gloomy predictions made by academics such as Christensen.

Since Christensen's work became popular, almost anything that came along and knocked a business off course was labeled by management as “disruptive.” These managers have been using this as an excuse for poor performance, especially in the area of corporate innovation. Such an excuse is not necessary since businesses that are free of inventoritis can always anticipate and identify new market opportunities without them becoming disruptive.

The remainder of this chapter considers how some companies addressed potentially disruptive changes. It also sets the stage for applying various solutions including those presented in later chapters that can help a company avoid or manage these challenges to its advantage.

Were Minimills the Destroyers or the Saviors of Integrated Steel Mills?

One example of a potentially disruptive technology was the advent of minimill steel-making technology that encroached and severely undercut the business of large, integrated steel producers such as U.S. Steel since the 1980s.

Traditionally, steel is made in large plants where iron ore, coke and limestone are converted into finished steel shapes in large integrated mills. These plants need to be large to take advantage of the required economies of scale to cost-effectively create steel products from raw materials. Gigantic furnaces are required. The mills that process the molten steel into finished shapes are huge complex facilities. They are integrated with the iron conversion operation so that the freshly molten steel from these huge furnaces can all be efficiently converted into marketable products.

The minimill businesses, developed mainly by Nucor and Chaparrel, operate using scrap steel rather than iron ore as the main input material. Furthermore, minimills use much smaller electric arc furnaces to melt the scrap into steel so the scale of the operation is about one-tenth that of the integrated mill. These smaller quantities are continuously cast into nearly finished shapes requiring far less downstream processing. At first thought this “recycling” solution would seem to offer an alternative with great potential for marketing steel products.

It is true that the costs of producing steel products using minimills is substantially lower than with integrated mills. However, minimills tended to produce lower quality finished steel. As a result, minimills were initially able to only compete in the bottom end of the steel business, making concrete reinforcement steel bar, also known as rebar. The integrated producers were happy to be out of this part of the business because there was no profit in it and they could concentrate on higher margin products. The minimills viewed the business differently, making a profit in this low end of the market.

Over time, through effective R&D investments and equipment upgrades, the minimills were able to improve the metallurgical quality and consistency of their products. They were able to move into the next higher market area, that of simple structural steel products including bars, rods and angle irons. Again, the integrated producers allowed this to occur as they concentrated on their higher margin business at the upper end of the market. The market shift was rapid. By 1980, the minimills had captured 90% of the rebar and 30% of the bar, rod and angle iron market. They took the whole market by the mid 1980s. Similarly, the structural beams market went to the minimills unchallenged by the early 1990s.

Throughout the 1980s, the integrated producers made much greater profits as they were concentrating their business on high-quality rolled steel sheet used to make cars, cans and appliances. They were able to target the bulk of their investments at these areas while closing many of their unprofitable operations. Share values of these integrated producers increased dramatically during this period.

But the minimills did not stop their advance once they had captured the entire structural steel market. They invested in new, small, cost-competitive, continuous thin-slab casting and rolling technology that could be fed from the electric arc furnaces. There was an expected 20% total cost reduction for using this approach to making sheet steel. The quality was not high enough to reach the car, can and appliance market so they were left with markets like construction decking and corrugated steel for culverts. Nucor captured 7% of the large North American sheet steel market by 1996 and was working on improving its quality to continue encroaching on the market, as it has continued to do during the past 10 years.

But were the minimills really a disruptive technology? The minimill and integrated mill approaches involved completely different types of input raw materials. Scrap steel used to feed the minimills needs to come from somewhere. Minimills can be viewed as recyclers and simply part of the chain of converting iron ore to steel. It makes sense for the integrated mills to convert iron ore directly into the high volume, high value, sheet steel where the greatest profit margins are available. The entry of the minimill can be viewed as a stimulant, helping to improve the overall efficiency of the industry.

Even if it could be assumed that, instead of starting with scrap steel as the primary input material, the minimills used the same type of raw materials as the large integrated steel mills, there is no need to assume that integrated steel producers would face ruin. If the smaller minimill steel-making technologies are indeed superior, the larger producers can introduce them directly, by acquiring existing minimill operators or by creating spin-offs focused on the minimill technologies. This would be market driven. The development of the minimill technology was itself market-driven, with a compelling competitive advantage for more enterprising companies like Nucor - using raw materials in much smaller scale, highly efficient operations.

Other reasons for the minimills having taken market share from the traditional integrated mills have nothing to do with technological advantages. For example, the integrated mills had substantial pension and retirement obligations referred to as “legacy costs” for many thousands of retired workers whereas the newly-created minimills had none. Nucor also has no unions and its workers are paid largely on the basis of performance. This was and remains a highly motivated and productive workforce. There was also far less capital required to open a minimill than to open or refurbish an integrated mill. These differences greatly reinforced the technological advantages.

In the last 10 years, both integrated and minimill producers have grown substantially. U.S. Steel more than doubled its revenue to about $15 billion while substantially downsizing. Nucor more than tripled its revenue to the same approximately $15 billion, without having the heavy baggage of old plants and a huge bloated and cumbersome organization. Many of the old line integrated operations have been shut down, largely because of the minimills. Their fate was probably destined for larger scale demise, however, because without the benefit of the minimills, the United States steel industry would have likely been collectively knocked out of the global steel market. So in an ironic but positive twist of fate, instead of having foreign companies taking over the business, the surviving integrated steel mills became stronger and more competitive. Plus Nucor and other minimill operators have grown into world class competitors themselves. European and Asian steel conglomerates, including Japanese giant Mitsui & Co. with its various affiliated steelmaking companies, have been buying up global market share but have not taken over U.S. Steel or Nucor which remain as strong American players in the global steel market.

The leaders of the surviving integrated mills did an excellent job in addressing the problems within the industry as the minimill technologies were coming along. They used an inventoritis-free approach in understanding their markets properly while developing and executing a sound marketing strategy, focusing on producing high volumes of high quality sheet steel directly from raw materials in efficient, integrated operations. They did not fall into the technology game and start trying to integrate minimill technology into their already overly-complicated operations. Instead, they let the minimill operators take over the complicated range of products at the lower end of the market while shutting down their antiquated plants and getting rid of a huge part of the bloated infrastructure and organization. Had they not done so, there is a good chance they would have been knocked out of the global steel industry as production from lower cost countries ramped up.

The next example will illustrate a simple case where an existing corporate player was able to avoid market share loss by cleanly blocking a potentially disruptive innovator entering valuable markets it wanted to keep to itself. It differs from the steelmaking example in which the incumbent players let the new players come along and continually undercut the bottom end of the market.

How did General Electric Handle the Threat of the Patented Hybrid Railway Locomotive?

The diesel-electric freight locomotive manufacturing industry in North America has a very small number of players with only two dominating the market since the 1970s. General Electric (GE) owned the market with a 60% share in 2005. Prior to 1983, General Motors' Electro-Motive Division (EMD) had a 60% share. The market shares have slowly and steadily reversed for these two players.

This locomotive manufacturing business is roughly split into three product categories: yard switcher locomotives in the 1,000 to 2,000 horsepower range, road switchers in the 2,000 to 3,000 horsepower range and road or line-haul locomotives above 3,000 horsepower. A diesel-electric locomotive is basically an electrical power plant on steel wheels. A diesel engine powers a DC generator or an AC alternator that in turn generates electricity which is fed to big electric motors called 'traction motors' that turn each axle. They come with either AC (alternating current) or DC (direct current) traction motors and there are advantages to each, with each type being used in roughly equivalent numbers. Each railroad has its own preferences.

For locomotive manufacturers, the most profitable units sold are the ones in the high horsepower range selling for somewhere in the range of $1.3 to $2.2 million each, depending on the horsepower, whether AC or DC traction and various other considerations. Higher horsepower leads to higher prices and the AC traction models are more expensive than DC models. There are not many models to choose from and there are good profits to be made in selling parts and maintenance service packages to the host railroads. The yard switcher locomotives, used to move railcars around the yards, are considered to be at the low end of the market.

For yard switching needs, railways often keep fixing tired old locomotives and putting them into yard service where they can last as long as half a century. It costs hundreds of thousands rather than millions of dollars for the yard locomotives and they don't cost nearly as much to maintain since they don't work as hard as the road locomotives. These yard engines tend to be fuel hogs and produce a lot of pollution. Every time someone starts moving them, there is a big puff of smoke as the engine ramps up its power to move from one part of the yard to another or to pull or shove a cut of cars along one of the yard tracks. Since they only move 10 to 20% of the time, they spend the rest of the time idling, burning at least a barrel of diesel fuel per day simply idling between tasks.

A small upstart company from Canada called Railpower Technologies started producing a line of patented hybrid yard switching locomotives in 2001. These 2,000 horsepower hybrid locomotives each have, instead of a big 2,000 horsepower engine, a small diesel engine of about 500 horsepower running at constant speed and high efficiencies whose job it is to charge a large bank of batteries that provide the additional horsepower when needed. Instead of throttling a big 2,000 horsepower engine up and down for each movement while idling the engine most of the time (burning fuel in a big engine while not doing any work), the hybrids work by drawing down the batteries when they need the most power. The smaller diesel engines in the hybrids start up and shut down automatically depending on battery levels and power needs. The net result is that they burn about one-third less fuel and produce about 90% less smoke.

But hybrid locomotives are expensive, at about a million dollars each. Another drawback of the hybrids is that they rely on batteries, an unpredictable and under-developed technology area.

If hybrid locomotives were less expensive, they could have been categorized as a market-based disruptive technology coming in at a low price point. The fuel cost saving with the hybrid does much to make it more competitive but doesn't quite make it work economically. Further higher fuel prices can change that. What does make a significant difference is government intervention through ever tightening environmental regulations on air pollution. A technology can be disruptive for non-economic reasons so those relevant factors need to be taken into consideration. In any event, a market has developed for these hybrid yard locomotives and there are hundreds now being produced although many are being recalled due to problems with the battery technology

In 2006, Railpower president and CEO Jose Mathieu, like the minimill operators from the previous example, confirmed his view that the better market opportunities were up-market, with higher horsepower locomotives. Beginning with the base developed in the yard switchers, Railpower has produced innovative designs for road switchers and began manufacturing them. But this is as far as things have progressed and Railpower has a very big challenge in taking additional market share. Unlike the minimill case where the integrated producers let the minimills encroach on their markets, while themselves focusing on the upper end, higher profit portion of the market, GE has built a fireline that Railpower will have a very difficult time crossing.

In early 2005, shortly after Railpower started gaining market acceptance of the hybrid yard locomotive, GE announced a hybrid road switcher locomotive. GE has not built any yet but has let the industry and media know all about it. From the GE press announcement currently posted on the corporate website:[14]

> The future of rail is just around the bend.
>
> GE engineers are designing a hybrid diesel-electric locomotive that will capture the energy dissipated during braking and store it in a series of sophisticated batteries. That stored energy can be used by the crew on demand - reducing fuel consumption by as much as 15 percent and emissions by as much as 50 percent compared to most of the freight locomotives in use today. In addition to environmental advantages, a hybrid will operate more efficiently in higher altitudes and up steep inclines.
>
> GE engineers are developing a hybrid locomotive with the goal of creating the cleanest, most fuel-efficient high-horsepower diesel locomotive ever built.

While issuing a pre-emptive marketing announcement (note this Edison marketing technique) GE was investing heavily into the development of suitable batteries for use in high-horsepower hybrid locomotives. And as Railpower essentially just treads water in the hybrid market, moving up from the current low horsepower units and focusing its R&D on high-horsepower units, GE continues advancing the core enabling technology in a rational way. By the time the market has ripened in line with GE's forward-thinking strategies and the technical feasibilities have been established, (assuming hybrid road locomotives can be proven to be practical,) GE will be ready - and far before Railpower.

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14. General Electric Company (2005). Hybrid locomotive: The future of rail is just around the bend (file eco-050503). Retrieved April 30, 2007 from GEC corporate web site: http://tinyurl.com/2b3blu

In addition to GE having firmly placed a strategic product offering at the place in the market where it is not willing to let a competitor go unchallenged, GE has been able to capitalize on its huge size, both the size of the parent company and of its installed base of locomotive fleets. It can also effect price changes strategically to make it very difficult for competitors to gain a foothold in its key markets. As a result, General Motors left the locomotive business in 2005, having sold its EMD subsidiary to a leveraged buyout group.

GE has done an outstanding job in earning its current firm position in the market over the past 25 years, knocking General Motors out of the business completely. GE's recent profits from the locomotive business are excellent and there seems to have been no problem establishing strategic firelines to prevent new competitors like Railpower from taking market share GE isn't willing to concede.

An example involving popular consumer products would be the new digital camera technology that exposed traditional players in the photography field to big challenges. This example will illustrate that even extreme potentially disruptive technologies can be managed to advantage. This shows that industrial and consumer products companies share many similarities in the ways they can manage innovation and technological change.

How did Kodak Handle the Big Switch to Digital Photography?

Kodak (Eastman Kodak Co.) is a Fortune 500 company that was recently faced with a disruptive technology, the digital camera. George Eastman founded the company in 1880 and Kodak started becoming a household name when he introduced the user-friendly Brownie camera in 1900, soon followed by a home movie camera, projector and film. Photographic film and paper is where the company has been making most of its money ever since. The company developed its film business completely in-house and has dominated the film market for a century. Film, photographic papers and photo-processing chemicals became such a common item that Kodak became one of the largest companies in the world. At its peak in 1988, the company had almost 150,000 employees worldwide.

The first filmless electronic camera was invented and patented by Texas Instruments in 1972. Mass marketing the product was a big technical challenge with a difficult road ahead especially when trying to get to the point where digital cameras would produce high quality images. The threat was that people would be taking pictures without using film and without necessarily needing to print them out on photographic papers. One can hardly imagine a better example of a potentially disruptive technology because a whole new business model would be needed for Kodak if this digital technology was going to develop.

Digital camera technology did continue to develop and in the year 2000 sales of digital cameras matched and began to surpass sales of film cameras. There were US$1.9 billion in digital cameras representing 6.7 million units sold in North America that year, about 10% more in dollar sales than for film cameras. In 2006, there were about 30 million digital camera sold in the US market and sales appear to have peaked. A further potential disruption is that wireless telephones are now being equipped with built-in digital cameras, with many already thus equipped and the prediction being that about 70% of them will be by 2009.

So what happened to Kodak? Although the company went through a severe transition that is ongoing, it still occupies a high position on the 2006 Fortune 500 list as #155 with 2005 sales of US$14.3 billion, a 5.6% increase from the previous year, albeit with a net loss of $1.4 billion. Net losses in 2006 were narrowed by $750 million to $600 million. There were 51,100 employees in 2005, a drastic reduction of about 2/3 of the total number from the 1988 peak of almost 150,000 employees, with further reductions expected.

The transition is not yet complete and success is not assured, but Kodak remains a global player operating with a radically changed business model. It now operates in the high technology market while still supplying its traditional products where there are suitable markets for them.

Kodak is taking some serious hits but remains alive as it adapts to radically-changing market conditions. It has not become a casualty of technological change, nor does it need to become one, so long as it continually adapts to changing conditions. The following paragraphs provide details of the transition which is a substantial work in progress.

Kodak chose to embrace digital camera technology. There was a series of focused technical R&D innovations aligned with the upcoming market needs. During the 1970s and earlier, when digital camera technology was in the formative stages, Kodak was involved. Kodak invented various sensors to convert light to digital images and was developing this technology through the 1980s.

It was the Kodak scientists who developed the world's first sensors that were in the megapixel category - the threshold above which image quality became useable for still photography. Their first successful sensor was able to record 1.3 million pixels and digitally produce a reasonable quality 5x7 inch photograph. Kodak released the first professional "DCS" digital camera system using a Nikon F-3 camera equipped with Kodak's 1.3 megapixel sensor. This expensive product was released in 1991 and targeted at journalists, realtors, insurance adjusters and others who were willing to pay a premium price for being able to capture quality images in the field for quick delivery and use elsewhere.

Like Thomas Edison, the Kodak company obtained over 1,000 patents as part of an effective marketing strategy. However, Kodak's patents were all in the digital photography field, as part of a defensive fireline.

For 2006, Kodak owned 16% of the United States digital camera market, increased from less than 15% market share in 2002. This was done against formidable competitors, including Japanese consumer electronics giants Sony (17%) and Canon (20%). Konica Minolta was knocked out completely and Panasonic, Nikon, Hewlett-Packard, Olympus and Fujifilm remain as smaller players. New competitors in 2006 include Samsung and Matsushita. For comparison, Sony had 24% of the market in 2002, reduced to around 17% currently.

Kodak created and aggressively promoted some great innovations through the 1990s to introduce the public to the idea of digital photography. Microsoft, IBM, Hewlett-Packard and FedEx Kinko's joined in with Kodak on various co-marketing campaigns. Photo discs, image editing workstations, photo kiosks, internet image exchange networks and special color printers are among the product offerings.

Kodak developed more customer contact points through digital kiosks, marketing specialized computer peripherals through various outlets, while making deals with wireless telephone multinationals. To get into the market for wireless telephones with built in cameras, Kodak established internet-based image swapping centers. In 2006, the company entered into a ten year global licensing and marketing arrangement with Motorola to codevelop camera-equipped wireless phones with Kodak sensors. These sensors will allow people to use the phones with Kodak kiosks and other services.

Kodak also expanded its traditional business into developing markets such as China, India, Eastern Europe and South America. Inexpensive disposable film cameras became another product offering.

Acquisitions were part of the strategy. One of Kodak's noteable acquisitions was the billion dollar acquisition in January 2005 of Creo Inc., a publicly-traded Canadian company specializing in supplying prepress printing and workflow technology and systems used by commercial printers worldwide. This was to round out Kodak's move into a solid position in graphics communications, part of its digitally-oriented growth strategy.

Creo had a poorly-performing stock. It also had the reputation of being a big R&D spender at over 13% of revenue in 2004 relative to its competitors. There was a failed shareholders' revolt leading to the acquisition. The dissenters argued that Creo was a poorly-performing company largely due to bloated cost structures and excessive R&D spending. In 2006, the R&D activity at this new division of Kodak was still a contentious issue. Kodak is still in the process of integrating the acquisition and it will be interesting to see how this develops and what strategies are applied to improve performance. There are likely good opportunities to improve this acquisition which may turn out to have been an excellent bargain for Kodak.

The way that Kodak addressed the potentially-destructive digital camera technology was a complex combination that included exiting some market areas, embracing digital camera and related digital technologies, acquiring companies in related fields and putting in firelines to protect certain market segments. The R&D people as well as the others involved did an impressive job in executing initiatives responsive to the radically-changing market.

Kodak is surviving the disruptive fire that is quickly turning its traditional photographic film and papers business to ashes. However, many challenges remain and if the company does not keep moving forward the way it has been, it might end up getting cut into pieces by inside or outside operators, or get absorbed by a large competitor such as Hewlett Packard.

George Eastman's 19th century company has become an inspirational example of what is possible in the face of extraordinary circumstances. It has certainly been a difficult time for a great many of the employees and families impacted by the recent and continuing massive reductions in the number of jobs. However, it is also important that the company is still around for those who still have their jobs and for the new employment opportunities created in the change process. Change is certainly not always easy, Kodak's transition is by no means complete, and there are many things that can go wrong. But Kodak has made it this far and has again earned its respected place in history. The company went through difficult times yet did not fall from industry leadership.

Inventoritis-free Marketing Strategy Must Lead R&D Initiatives

Most company managers and owners have problems dealing with innovation, an area most companies find to be quite challenging. Some companies handle potentially-disruptive marketplace and technological changes just fine while others get destroyed in the face of them.

If we look upstream for the root causes of this incongruity, it becomes readily apparent that inventoritis has much to do with it. Henry Ford's earlier description of an inventor as one who “frequently wastes his time and his money trying to extend his invention to uses for which it is not at all suitable” (followed by his assertion that “Edison has never done this”) can be extended to include the institutional inventor and supporting organization. The responsibility for products, especially new ones, is often left to the technical people in the R&D centers who are somewhat isolated and not tied into the marketing strategy center. One can hardly blame them because, in many cases, there is no center for marketing strategy. This kind of confusion and poor leadership in the innovation process can easily lead to serious problems.

Without clear leadership and direction from the market strategy center, the R&D people waste time and money developing or extending products and technologies to irrelevant ends. They might also be engaged in research projects that are not aligned to relevant markets or corporate best interests. There is little value in funding R&D to support technologies that become little more than solutions looking for a problem that might not exist, simply because the proponents think the problem exists. It is an easy matter for a company to waste tremendous resources speculating on technologies and products, believing or hoping they are tomorrow's winners. People and companies often fall in love with their products while the market really doesn't care. As a result, most new product launches fail.

If there is a central, solid, market strategy, it seems the bridge to the R&D center is often missing or in the wrong place. There needs to be a good bridge so that disruptive technologies can be quickly recognized and successful strategic shifts made before it becomes too late. Not many managers currently recognize and properly assess potentially disruptive technologies. Fewer successfully make the strategic changes to prevent disruptions to their business. Technologies do not become disruptive if they are properly addressed and managed in a timely manner. A well-managed potentially-disruptive technology could become a normal sustaining technology. Without a good bridge, the R&D resources and capabilities are much less likely to be properly channeled or directed towards managing technological change opportunities. The General Electric Locomotive and Kodak examples demonstrate that good management can anticipate and take advantage of radical technological changes.

Companies should rationally apply R&D spending to where it has a positive impact on performance, in areas that lead to improvement of gross margins. This was confirmed in the 2005 Booz Allen Hamilton study of the global top 1,000 R&D spenders. Sustaining technologies tend to fall into this category. Converting potentially disruptive technologies into sustaining technologies will lead to more predictable results from R&D spending.

In cases where there is a good match between a new offering and the market, a positive financial experience is a normal result. This seems quite obvious, yet it does not occur often enough. Among the top 1,000 R&D spenders, the Booz Allen Hamilton study found no correlation between R&D spending and performance except in the area of gross profit margin improvements. But those results were lost when considering overall measures of performance including sales growth, operating profit and shareholder return. A higher percentage of the new product launches need to succeed for the R&D costs to correlate to overall performance improvements.

The solution is simple enough. Arbitrarily dumping more money into R&D won't solve the problem. Companies should not approach new products and technologies speculatively. They need highly skilled and market-savvy people to consider new ventures with great clarity from the market perspective. They must avoid any temptation to pursue technologies or prepare product offerings that they do not know will be filling an actual or properly anticipated need. Those needs are not always obvious and the challenge is to develop ways to correctly determine them. This is difficult and requires tremendous skill.

The process of continually dumping large amounts of money into speculative R&D activity hasn't worked - especially when no credible marketing research efforts have been conducted. Neither has evaluating the various clever and interesting things that come from the labs while systematically and often arbitrarily deciding which ones to keep supporting, kill, shelve or start. The Booz Allen Hamilton study results confirm these true statements. Therefore it does not seem reasonable for R&D activity to be led by any decision-maker who is not within the core market strategy area. Nor should anyone leading the R&D activity have any type of inventoritis.

Some companies have been doing just fine in managing potentially disruptive technologies so long as they did not have serious unmanaged inventoritis issues. Managers do not need to blame innovation failures on externalities like “disruptive technologies.” They can look inwardly because, in fact, inventoritis is disruptive.