NEW BUSINESS CREATION: INTERNAL VENTURES OR SPINOFFS?

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ABSTRACT

This study was prompted by our curiosity about several interesting trends in the U.S. high technology industry – mainly the incredible boom of startups and the increasing use of the spinoff mechanism by many large corporations.

Our objective was to learn more about the different methods for new business or product development. When technology innovation occurs in an established company and the firm is faced with a new business development opportunity, five outcomes are likely: 1) the company develops the technology within its existing business and organization; 2) the company spins-off the project into a separate business unit; 3) the company sells or licenses the technology to another firm; 4) the entrepreneur leaves the company to start his or her own business; or 5) nothing happens and the innovation is never developed.

This paper attempts to outline the factors that lead to successful innovation, as well as the obstacles. It also explores three difficult questions facing a firm when presented with a new business or product development opportunity: 1) Is the project worth doing? 2) If the project is worth doing, should the firm develop it themselves? 3) If the firm decides to develop it themselves, should the firm develop it internally or pursue a spinoff strategy?

Based on interviews with managers of innovative companies and extensive research, we provide a framework to help managers better decide the best course of action for a new business or product development opportunity. The goal is to encourage managers to systematically evaluate all of the relevant factors surrounding a new business development opportunity. The framework provides a recommended approach for new business development – either internal venture or spinoff – based on our assessment of the factors contributing to the likelihood of success or failure.

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Table of Contents

LIST OF TABLES

LIST OF FIGURES

1.0 Introduction

Organizations need to recognize opportunities for new ideas and determine the best means to transform them into growing businesses.

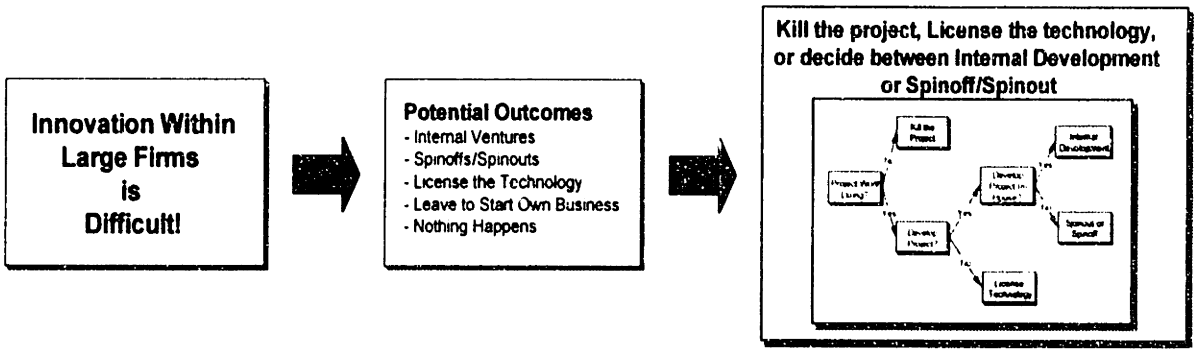
Much has been written on corporate entrepreneurship and managing corporate innovation, including Steven Brandt's "Entrepreneuring in Established Companies", Rosebeth Moss Kanter's "Supporting Innovation and Venture Development in Established Companies", Robert Burgelman's "Designs for Corporate Entrepreneurship" and Peter Drucker's Innovation and Entrepreneurship, to name a few. A number of theoretical models also exist to help promote innovation within a company including Burgelman's "Process Model for Internal Corporate Venturing in the Diversified Major Firm".

This paper does not attempt to develop better tools for promoting internal innovation – it attempts to explore the different alternatives for the development and implementation of technology innovation. When technology innovation occurs in an established company and the firm is faced with a new business or product development opportunity, five outcomes are likely: 1) the company develops the technology within its existing business and organization; 2) the company spins-off the project into a separate business unit; 3) the company sells or licenses the technology to another firm; 4) the entrepreneur leaves the company to start his or her own business, or; 5) nothing happens and the innovation is never developed.

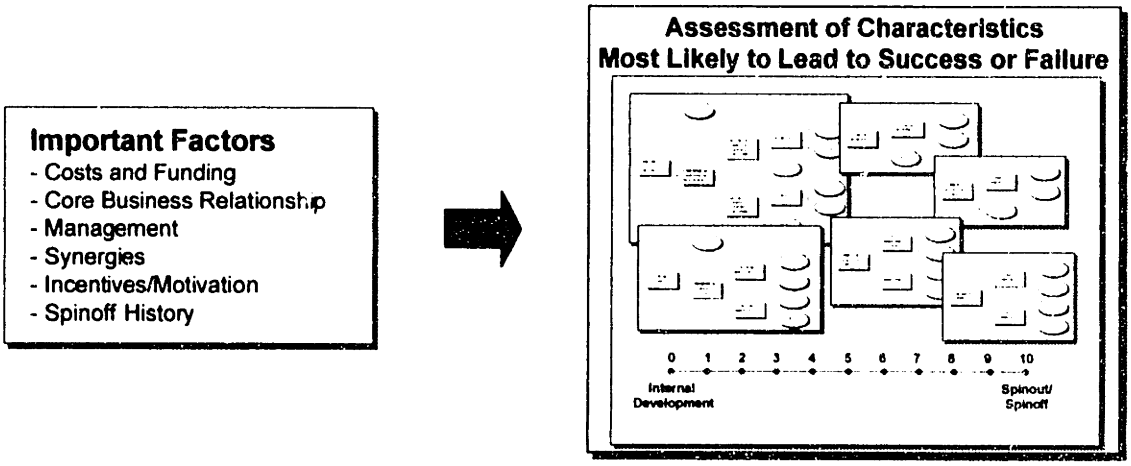
Why are certain companies successful in recognizing talented entrepreneurs, encouraging entrepreneurial innovation and retaining entrepreneurs within the company? What factors contribute to their success? Why do companies spin-off separate business units and what are the benefits? Beyond the much studied traits typical in entrepreneurs, why have people left established companies to start their own businesses? Could management have provided incentives that would have changed their minds?

1.1 Thesis Overview

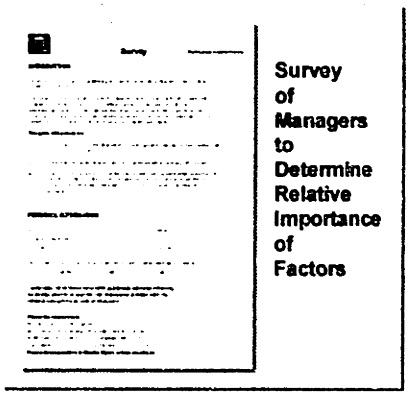
First we discuss the challenges of innovation within large firms and the likely actions taken with regard to new business or product development opportunities. Then we explore three questions facing the firm and the relevant factors associated with answering the questions: 1) Is the project worth doing? 2) If the project is worth doing, should the firm develop the project itself, or license the technology? 3) If the firm decides it should develop it, should the firm develop it internally or spin it off?

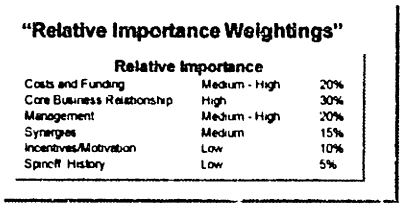


After identifying the important factors to be evaluated, we attempt to correlate the characteristics that lead to success or failure in internal developments and spinouts. Using decision flow diagrams, we allocate "values" based on an assessment of the project characteristics in each area.

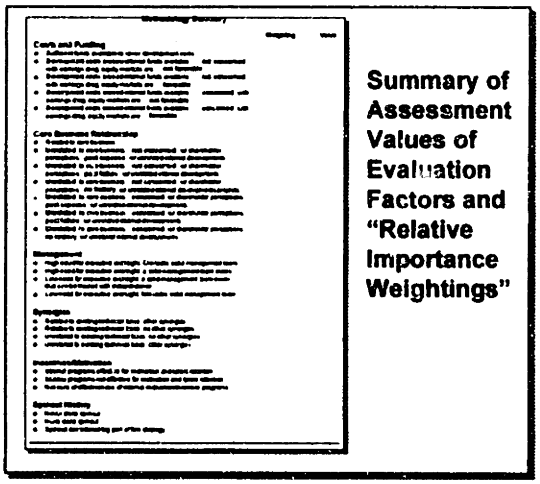


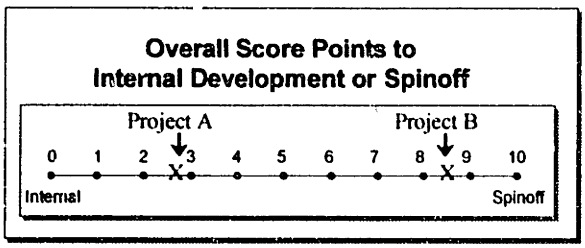
We surveyed a number of managers of innovative companies who have experience in deciding the fate of new business proposals, in order to determine the relative importance of the factors.





Finally, taking into consideration the "value" for each factor (determined by an assessment of the project's characteristics) and the relative importance of each set of factors (as determined by the surveys), we can calculate an overall score for the project.





Section 2.0 – New Business or Product Creation describes the challenges of innovation and the likely actions large firms take to develop new businesses or products. It discusses the obstacles of internal development and the successes and failures of companies attempting to foster innovation within the organization. It describes the differences between spinoffs and spinouts and their value to overcoming internal development obstacles. It also discusses technology licensing, the circumstances surrounding employees leaving the firm to start their own company and examples when nothing happens; that is, the new product is never developed.

Section 3.0 – Decision Framework explores three difficult questions facing a firm when presented with a new business or product development opportunity: 1) Is the project worth doing? 2) If the project is worth doing, should the firm develop the project itself? 3) If the firm decides it should develop the project itself, should the firm develop it internally or pursue a spinout or spinoff strategy? Section 3.0 also discusses the relevant factors associated with a new business or product development opportunity in order to develop an understanding of their effect on a decision.

Section 4.0 – Survey Results presents the results of surveys and interviews of a number of managers of innovative companies who have previous experience in deciding the fate of new business proposals. The purpose was to solicit their views of the important factors to be considered in determining the proper disposition of a proposal.

Section 5.0 – Framework. Based on interviews with managers of innovative companies and extensive research, Section 5.0 provides a framework to help managers decide the best course of action for a new business or product development opportunity – primarily to help them towards a better understanding of the factors that lead to success and failure. The framework assumes a decision has been made to "go ahead" with a new business or product development opportunity and addresses the question: "Should the firm develop it internally or spin it out?"

Section 6.0 – Case Studies attempts to validate the framework based on two case studies: Thermo Electron and Science Applications International Corp., SAIC. It discusses the strategies employed by these two firms and applies scenarios of actual new business development efforts to the framework to determine if the strategies employed would have been recommended based on our assessment factors and values.

Our intent is to highlight a complex set of characteristics that lead to success or failure in a firm's ability to innovate – bring new ideas to market – and synthesize these characteristics into a framework that encourages managers to evaluate the important factors influencing the likelihood of success in determining the most effective development method. It is our hope that the findings and conclusions discussed in this paper begin to seem rather simplistic to the reader, signifying some success in simplifying an elaborate set of new business or product development opportunity characteristics.

When considering all of the relevant factors that should be evaluated in deciding whether or not to develop a new project internally, we postulate that over 8,000 (2^{13}) nodes or decision points are required to satisfactorily determine the most effective development method. Through decision tree analysis, with groupings of factors weighted per their relative importance, we hope to provide a more manageable and understandable framework to help indicate the best course of implementation when presented with new business or product development opportunities.

2.0 New Business or Product Creation

One of the key differences between established and young companies is their ability to respond to technological change. There is little doubt that during the past decade the pace of technological change has accelerated significantly in most technology oriented industries. The findings presented in this section suggest the continued growth in technology will further perpetuate the trend towards the establishment of smaller, innovative companies.

2.1 Innovation

Long-term improvements in economic performance demand that firms develop an adaptive culture in which innovation features prominently. In order to nurture an innovative and flexible workforce that facilitates product and process changes, an environment must be created which eliminates cautious and protective attitudes and encourages risk-taking. The harnessing of the creativity of the workforce in order to promote innovation is a problem for most companies. We know that innovation is good, but how is it achieved? What systems and work environment need to be in place to encourage innovation? How do we change the culture of an organization to make innovation a central part of it?[1]

The new product innovation process consists of a complex set of activities aimed at creating and exploiting a new technology, process, or product. Innovation has been referred to as any "high risk idea that is new to the sponsoring organization, and which the organization believes has high profit potential or other favorable commercial impacts for them".[2] Innovation has been described a number of different ways:

- The amplification of organizational chaos (Ikujiro Nonaka)
- Creative destruction (Joseph Schumpeter)
- Innovation = invention + application (Kuczmarksi)
- The adoption of an idea or behavior that is new to the organization adopting it (Zaltman, Duncan and Holbeck)

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[1] Smith, Malcolm, "The Development of an Innovation Culture", *Management Accounting-London*, February 1998
[2] Souder, W.E., Managing New Product Innovations, 1987

Innovation is sometimes misunderstood as simply a process, which inevitably flows out of invention.[3] The fact is that innovation is a very complex process, which requires special attention in designing it for a particular organization. Innovation's desired impact is to face the increasing competitive markets and to give business returns to the innovator. Unless attention is given to the process, the company's overall likelihood of successfully competing and gaining the greatest returns is greatly diminished.

Young, entrepreneurial companies have been very active and successful in capitalizing on sudden shifts in technology. The computer industry is a good and well-known example. The early 1980s were the age of the mainframe. It was widely used, but only by organizations with significant financial resources. Within a decade, at least two technological waves upset the status quo. First was the entry of the minicomputer, offered by companies like DEC. Then came the workstation (Sun, Hewlett Packard, Apollo, etc.), that subsequently paved the way for powerful personal computers made by Compaq, Dell, Gateway, IBM, and Apple. The same story can be told for other industries, such as software and computer networking. Dominant companies such as Cisco, Bay Networks, Microsoft, Oracle, and Lotus were entrepreneurial startups that rode to prominence by capitalizing on their ability to respond to technological change.

Technological innovation in small companies is likely to be sustained because startups continue to attract top talent from established companies. AT&T lost its president and CEO designate Alex Mandl to Associated Communications, a privately held wireless communications startup. Another top AT&T executive, Jim Barksdale, left to run Netscape. Companies such as Intel, Nynex, Sun, and Merck have faced similar losses of top tier talent. The trend of top executives departing large firms for startups is fueled in large part by the significant money to be made in the initial public offering boom of the early 1990s. Corporate venturing – either internal or through spinouts or spinoffs, is the large company's response to this trend.

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[3] Port, O., "Back to Basics", *Business Week Innovation*, Summer 1989

Five actions are likely to occur when companies are faced with a proposal for a new business or product development opportunity: 1) develop in-house (internal venturing), 2) spinoff or spinout, 3) sell or license the technology to another firm, 4) the employee leaves to start his or her own company, or 5) nothing happens and the innovation is never developed.

2.2 Internal Venturing

Experts recognize the increasingly important role of entrepreneurs in corporate growth and the expansion of business opportunities. The current trend is towards creating a competitive advantage through entrepreneurship. Commonly used descriptors are:

- Internal venturing – when organizations encourage employees to take risks in pursing their ideas and innovations.
- Corporate entrepreneurship – the process by which firms notice opportunities and act to create value through new hierarchies or ventures.[4]
- Intrapreneurship – the method of obtaining flexibility among managers by identifying people likely to set up their own business, then enabling them to act as entrepreneurs within the company.

Many companies have established "new venture" groups within the firm to promote business innovation. Among the documented companies known to have started new venture divisions during the 1960s, 1970s, and 1980s are:[5]

Table 2-1: New venture organizations

1965 - 1970	Dow, Boeing, Monsanto, Raytheon, Ralston-Purina, Ferro, General Mills, St. Regis Paper, Boise-Cascade, GTE Sylvania, American Standard, H.J. Heinz, Scott Paper, Standard Oil, Owens-Illinois, W.R. Grace, M&T Chemicals, Union Carbide, Celanese, GE, and Exxon
1971 - 1976	Motorola, Rexnord, Teflex, Lockheed Aircraft, Dravo, and Corning
1977 - 1982	Xerox, Merck, Acme-Cleveland, IBM, Air Products & Chemicals, Allied Chemical, Gould, Clorox, Gillette, General Foods, Levi Strauss, Uniroyal, and Du Pont
1983 - 1988	Signode, Martin Marietta, Kodak, Colgate-Palmolive, Westinghouse, Tektronix, and Measurex

[4] Jones, Gareth R. and Butler, John E., "Managing Internal Corporate Entrepreneurship", *Southern Management Association, Journal of Management*, December 1992

[5] Gee, Robert E., "Finding and Commercializing New Businesses", *Research-Technology Management*, January-February 1994

The key to creating an entrepreneurial environment is to develop and articulate a specific strategy for encouraging innovative activity. In order to create an entrepreneurial environment, traditions need to be set aside in favor of new processes and procedures. Are resources available to try new ideas? Will management allow experimentation with new products? Does the organization encourage risk taking and tolerate mistakes? Are the employees focused on new ideas? Is it easy to form autonomous project teams within the organizational structure? Is there a top management vision related to innovation? Do the current system, structures, and practices present insurmountable roadblocks to the flexibility and fast action needed for innovation?

As we will discuss later, there are a number of obstacles to overcome. When entrepreneurs become managers, their risk profile is changed and bureaucratization tends to occur. As firms become large, coordination problems exist between entrepreneurs and managers due to increased management responsibilities and the lack of visibility of entrepreneurial performance.

Procter & Gamble

Procter & Gamble has a history of new product introduction – from fluoride toothpaste to disposable diapers. In 1993, P&G undertook a number of steps to revitalize innovation, with the biggest being the establishment of a Corporate New Ventures group to promote entrepreneurship throughout the company.[6] P&G took a hard look at its entire portfolio of projects under consideration and in development and concluded that a number of good ideas were not being explored due to the structural limitations of the company. They saw the need to develop ideas that did not fit neatly into the sector categories of business, ideas that combined sector technologies, and ideas that the sectors could not work on due to resource limitations. They also saw the need to catalog past and present new product introduction successes and failures in order to gain a better understanding of pre-market predictors of

[6] Whitney, Dean and Amabile, Teresa, "Corporate New Ventures at Procter & Gamble", *Harvard Business School Case 9-897-088*, June 1997

product success. "The key to innovation is not so much picking the winners as in weeding out the dogs." P&G developed a systematic process for evaluating new ideas based on:

- Is there a basic market need?
- Is the technology to deliver the product achievable?
- Will it be profitable?

Bell Atlantic

Bell Atlantic launched an intrapreneurship program, which gave employees a $1,000 per project expense account and five hours per week of company time to work new business opportunities. They also offered intensive four day training sessions and rewards of up to $1,000 regardless of success or failure. If a project was later accepted for commercialization, they offered the creator the option of investing ten percent of their salary into the project in return for five percent of the profits.[7]

Many technical breakthroughs are more attributed to the perseverance of the individual rather than effective implementation by the organization. When his bosses at 3M told intrapreneur Phil Palmquist to stop working on reflective coatings because that wasn't his job, he continued four nights a week from 7:00 to 11:00 P.M. Soon he had a product 100 times brighter than white paint. Among other things, it now lights up roadway signs at night when your headlights shine on them. In a more extreme case, George Swenson, another 3M intrapreneur, was fired when he wouldn't stop working on a new roofing material. He continued working on the project despite the fact that he was no longer employed. Once he had it working, the company relented and rehired him.[8]

Texas Instruments Inc. studied 50 of its new product introductions and determined that every failed product, without exception, lacked a zealous volunteer champion – an intrapreneur. The common denominator of all intrapreneurs is a personal drive to implement their visions

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[7] Pryor, Austin K. and Shays, E. Michael, "Growing the Business with Intrapreneurs", *University of Western Ontario (Canada) Business Quarterly*, March 22, 1993

[8] Pinchot III, Gifford, Intrapreneuring: Why You Don't Have to Leave the Corporation to Become an Entrepreneur, New York: Harper & Row, 1985

of a product, which enables them to overcome the existing organizational barriers.[9] There are numerous cases of individuals who have played a hands-on role in driving innovations and businesses against significant obstacles:[10]

Table 2-2: Innovations and Intrapreneurs

Innovation	Intrapreneur
IBM's personal computer	P.D. Estridge
Apple's computer graphics tablet and plotter	Brian Ehlers
AT&T's Ferreed switch, System 75 and Horizon PBX	Alec Feiner
Du Pont's Riston printed circuit materials	A.B. Cohen
Texas Instrument's Speak-n-Spell	Gene Franz, Paul Breedlove
3M's Post-it Note Pads	Art Fry
Xerox's 2600 copier	John Webb
Intel's bubble memory business	Stuart Sando, Dick Clover

2.3 Spinouts and Spinoffs

In a sense a spinout or spinoff is the large firms' answer to the wave of startups because it can provide the motivation, incentives, and development flexibility not easily achieved in a large organization. Spinoffs exist in two basic varieties that share a common element: they involve the separation of one of a company's business lines into a new entity. There is a subtle difference between a "spinout" and a "spinoff". In a spinout, the parent firm retains a majority of the equity in the new company and offers new stock to the public; in a spinoff, the parent usually distributes stock in the new company to the existing parent firm shareholders.[11] Since one purpose of this paper is to study the barriers to innovation and not to compare the positives and negatives of spinouts and spinoffs, we use the two terms interchangeably, but basically mean the separation of the firm's new business into a separate entity.

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[9] Pinchot III, Gifford, "Introducing the 'Intrapreneur' ", *IEEE Spectrum*, April 1985
[10] Pinchott III, April 1985
[11] Wilke, John R., "Innovative Ways: Thermo Electron 'Spins Out' Units in Unusual Strategy for Creating Products," *Wall Street Journal*, August 5, 1993

- Spinoff – Traditionally, spinoffs are considered a form of a tax-free, pro-rated stock dividend.[12] The term spinoff is used to describe the separation of a business unit of a company into a new subsidiary and the subsequent pro-rated distribution of its shares to the shareholders of the parent corporation. In the case where the spinoff conforms to the applicable tax code, it is taxable neither by the parent company nor by its shareholders, since there is no real change in ownership and no capital gains realized at the time of the transaction. Shareholders are taxed at the time when they sell the securities of a subsidiary.

- Spinouts (or carve-outs) – Spinouts also result in the separation of a company's business into a new corporate entity. Contrary to spinoffs, however, the new entity's shares are not distributed to the existing shareholders of the parent, but are held by the company. A minority holding of the new company is commonly offered to the public through an IPO.

A spinout enables a subsidiary to draw on the wisdom, experience, and practical assistance of the parent firm. It also offers a degree of independence that appears to foster innovation and growth. Each spun-out subsidiary has its own board, operating CEO, and financial statements, while the parent provides strategic direction and central resources. As in any other corporate structure, the parent can provide executive management skills, industry and government relationships, employee plans, and perform time-consuming administrative functions, freeing the subsidiary's CEO to concentrate on products and markets.

Usually spinoffs occur when the parent concludes that letting go of an under-performing unit can free up the unit's hidden value and/or managerial talent, enabling its performance to improve over time. An effective spinoff also allows the parent company to focus more closely on its primary mission without management being spread too thin.[13]

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[12] Glassman, David M., "Spin-Offs and Spin-Outs: Using 'Securitization' to Beat the Bureaucracy", *Journal of Applied Corporate Finance*, Fall 1988, Volume 1

[13] Stovall, Robert H., "The Spin-off Doctors: Trend Toward Spinning Off Companies' Business Units", *Sales & Marketing Management*, March 1997

Spinoffs also provide incentives and motivation not easily achieved within the organizational structure of a large firm. When Tenneco Inc. spun out a division, Tenneco's information systems executive Dave Goselin saw his dream become reality when he was named president of TennEcon Services.[14] Gosselin is now motivated by the responsibility of running his own $25 million company.

While companies have always spun off new firms, the number of companies executing the spinoff strategy has been increasing. 41 spinoffs were completed in 1996, with a total value of $94 billion, up from 1995 when some 33 spinoffs with a value of $51 billion were completed.[15] This may be attributable to a growing awareness on the part of the parent company that new products that don't fit into their strategic plans sometimes can best be developed and marketed by an independent firm, which may be the best way to make money. Also, corporations that are downsizing find it easier to justify an equity position in a spinoff. "As an internal unit, you're graded on the amount you can save," says Gosselin of TennEcon. "If you're independent, you're judged on the service you provide."

2.3.1 Examples

There are numerous examples of companies completing spinoffs – ITT (with ITT Industries and ITT Hartford), General Motors (with EDS), Sprint (with 360 Communications), 3M (with Imation), etc. Xerox Technology Ventures (XTV), a subsidiary of Xerox Corp., was founded in 1988, when Xerox found itself in the midst of difficult negotiations with several of its managers and employees interested in spinning off a company to commercialize software technology invented at Xerox. Many large companies are increasingly facing similar issues of their employees wanting to build their own companies. There are several reasons for such a move. Some employees may perceive the atmosphere in large companies to be too bureaucratic. Others may find that the projects and technologies they are working on do not fit well with the strategic direction of the company. The recent waves of corporate restructuring and downsizing have also contributed to this trend due to the elimination of many highly promising projects. Lastly, many engineers and managers have seen their

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[14] Gupta, Udayan, "Intrapreneurs: From The Inside Out", *Information Week*, August 7, 1995
[15] According to J.P. Morgan & Co.

colleagues achieve unparalleled financial and professional success by setting up their own companies and taking them public.

Xerox and other companies have developed corporate venture capital programs to profit from the inevitable and increasingly frequent departures of such employees. XTV is allocated $30 million to invest in technologies invented at Xerox, that were not of direct strategic interest to the company. XTV's venture managers look for promising but non-strategic Xerox technologies and employees that have interest in commercializing such a technology. If a business plan appears very promising, Xerox's lawyers create a new spinoff company, independent of Xerox. XTV funds this company through an injection of equity financing. XTV's managers add value to this new company by giving it access to resources such as technology, office space, purchasing, etc. Ultimately, the new company and its employees can sever all links to Xerox. It can go public, get acquired, get further financing from other sources, or remain independent. At this stage, XTV partners cash out their investment. The key aspect of the investment is that it is made with the sole purpose of obtaining a high financial return.[16]

The Lucent Technologies' spinout from AT&T was an "instant success".[17] The spinout of Lucent involved an initial public offering of a portion of the new company's stock, and a tax-free distribution of the remaining shares to existing AT&T shareholders. The spinout approach has also been widely employed in Japan, where Hitachi has 13 spinouts, and Matsushita has seven.[18]

Even a company noted for its corporate entrepreneurship is executing the spinout strategy. In 1996, Imation Corporation – a maker of digital data storage products, color proofing tools and X-ray imager's – was spun off from 3M. Imation currently has $2.25 billion in sales, sizable markets in 60 countries, and 11,000 employees. Heavy investments in research and

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[16] Hunt, Brian and Lerner, Josh; "Xerox Technology Ventures", *Harvard Business School Case N9-295-127*, March 1995
[17] Siwolop, Sana, "Investing It; Quiet Spinoffs Talk the Loudest in Returns", *The New York Times*, February 23, 1997
[18] Bruckner Coles, Carol, "A Spinoff Strategy to Ignite Growth", *The New York Times*, May 3, 1992

development and significant price cutting in certain markets lowered the unit's net income from $75 million in 1993 to $4.4 million in 1995, not including the additional $80 million restructuring charge allocated to the Imation unit by 3M. The move should be good for both 3M and Imation since the Imation unit constituted a drag on 3M's earnings and the unit no longer has to bear company-wide charges such as the $80 million restructuring charge.[19]

2.3.2 Spinoff/Spinout Performance

One 1996 study of U.S. companies that utilize spinouts in which the parent retained at least 50 percent of the subsidiary shares and had annual revenues of at least $200 million revealed that over a three-year period, they averaged compound annual returns of 20.3 percent – 9.6 percent better than the Russell 2000 Index. Those companies that spun out multiple subsidiaries fared even better. Three years after the spinout, their subsidiaries showed annual returns of 36.8 percent. The parent companies themselves experienced average annual shareholder returns of 31.1 percent.[20]

The results suggest that spinouts are an effective way for companies to exploit growth opportunities and increase shareholder value. Safeguard Scientifics, for instance, has spawned six new companies since 1985, with revenues growing from $66 million to $1.9 billion in 1996. Another study examined the characteristics of firms involved in spinoffs and tested whether the spinoffs induce changes in investment incentives and economic performance. One conclusion from the study was that spinoffs generate significant improvements in the cash flow margin as a percentage of revenues for the parent firms.[21]

One study reported that if one were to buy stock in every spinoff since 1990 and held it for three years, one would have returned an annualized 31.8 percent, 18 points better than the

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[19] Oslund, John J., "3M Co. Spinoff is Given Name Imation Corp.", *Star Tribune (Minneapolis, MN)*, April 17, 1996

[20] Anslinger, Patricia; Carey, Dennis; Fink, Kristin and Gagnon, Chris; "Spinouts: A New Spin on the Corporate Structure", *McKinsey Quarterly*, 1997

[21] Johnson, Shane A; Klein, Daniel P. and Thibodeaux, Verne L, "The Effects of Spin-offs on Corporate Investment Performance", *Journal of Financial Research*, Summer 1996

S&P 500.[22] Another study reports that spinoffs are outperforming the market by an average of 20 percent in the first 18 months of independent operations.[23]

However, the performance of spinoffs seems to be a controversial subject. One unpublished study looked at 167 spinoffs completed between 1985 and 1995 and concluded that spinoffs beat the market only because of a few spectacular performances. The majority of both parents and spinoffs did no better than the overall stock market.[24] Another study looked at 61 spinoffs between 1992 and 1997 (in which both parent and spinoff had a market capitalization of at least $100 million) and compared the combined stock performance of parent and spinoff with the S&P 500. Only 40 percent outperformed the market; 60 percent underperformed.[25] Another study of 162 spinoffs from 1965 to 1990, concluded that even though the shares of parent companies had risen 67 percent three years after the spinoff and the spinoffs themselves rose 76 percent, since both the parents and subsidiaries are much more likely takeover targets, much of the stock price gains are attributed to increased market activity surrounding a potential takeover.[26]

2.3.3 Why do spinouts promote growth?

The changed relationship between the parent company and the business unit has a number of positive effects, relating to corporate governance, motivation, talent retention, risk-reward benefits, and funding.

Corporate governance. In contrast to business units, who are 100 percent owned by the parent company and thus subject to countless reviews, meetings, and reports, spinouts are under the direct scrutiny of investors and analysts who constantly measure them against other companies. Corporate centers are in effect forced to limit their interactions with the subsidiary to ways that add value.

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[22] Study conducted by Steven Bregman, senior analyst of the Spinoff Report

[23] Study conducted by J.P. Morgan & Co., reported in Carey, Dennis C., Elson, Charles M., and Saul, Ralph S., "When A Spinoff Is On The Board's Agenda", *Directors & Boards*, January 1997

[24] Study conducted by Karen Wruck, an associate professor at Harvard Business School, and Eric Wruck, a consultant at Wellesley, MA-based Econalytics, reported in Hayes, John R., "Pepsi's Panacea", *Forbes*, October 20, 1997

[25] Study conducted by Forbes Magazine

[26] Study conducted by Professors J. Randall Woolridge and James A. Miles of Penn State University and Patrick Cusatis of Lehman Brothers

Motivation. In spinouts, corporate boards can use the market to align pay closely to performance, awarding managers stock in their own spinouts rather than cash bonuses and/or parent company stock. Victor Poirier, CEO of Thermo Cardiosystems (a Thermo Electron spinout) pointed out: "What you do is represented in the stock price." Sarnoff Corp. is another company whose overall strategy is based on the founding of new companies to bring its technologies to the marketplace. To reward its employees, Sarnoff allows its employees "to share 25 percent of royalties and 25 percent of equity position of a new company" spun out of Sarnoff based on internally developed technologies, said one of its vice presidents.[27] Sarnoff has spun out eleven companies to date.

Talent retention. Companies sometimes lose their most talented people because they cannot offer them enough independence. Spinouts feed the desire of executives to be autonomous. Business unit presidents can be CEOs of their own companies, rather than small parts of a large firm.

Funding. The stock market's close scrutiny of a company's performance often inhibits the funding of new projects that might drain the company's earnings. In addition, spinouts often attract new investors if the new project is not directly related to the company's core business. Because spinouts enable investors to buy shares in distinct businesses, they can attract a new set of shareholders. For example, in the case of the R.J. Reynolds spinout of Nabisco, investors can own shares in the food company without owning shares in the parent tobacco company. In addition, it can be argued that the market will value a new project being spun out more favorably than if undertaken within the parent company because the parent company's performance tends to overshadow the performance of the smaller unit.

After DuPont sold off its medical products business, it became apparent that a promising technology using DNA-based diagnostics to detect bacterial contamination no longer fit the company's strategic plans. DuPont's answer was to spinout the business, retaining a

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[27] Yoshida, Junko, "Opportunities Heat Up On Both Coasts -- Digital Video Creates Jobs At Startup, Sarnoff", *Electronic Engineering Times*, April 20, 1998

majority stake but selling a minority position to raise cash. The result was that the new business introduced four new products, including a screen for E. coli in foods, the parent divested unrelated product developments, and together they generated the necessary development funding and provided entrepreneurial incentives to the developers.[28]

One drawback of spinouts is the duplication of administrative costs related to managing the legal, regulatory, financial reporting and human resources aspects. In addition, the cost of a spinout's debt is likely to rise once its assets and liabilities are separated from the more secure parent.

There are many motivations for a spinoff that go beyond the scope of this paper: eliminating conflicts between the businesses of the parent and its subsidiary; divesting a business which the market currently favors or disfavors; separating a regulated business from an unregulated business; or allowing the parent or subsidiary to compete more effectively because of legal or regulatory changes. Although we state earlier that we use the two terms, spinout, and spinoff interchangeably, the evidence suggests we're primarily referring to spinouts. This is based on the premise if the new business has too much "upside potential", a spinout is the more desirable avenue because the parent retains more than 50 percent of the equity and therefore participates in the future profitability of the subsidiary.

2.4 License the Technology

Technology licensing is the transfer of technology for a fee from one firm to another. Technology licensing has been rising at average annual rates of over 18 percent internationally and over 10 percent in the U.S.[29] Licensing a technology to an outside firm affords the creator the benefits of tapping the revenue stream of a product without suffering any of the risk consequences. The creator of the technology is removed from funding the enterprise and still may see some financial upside. This method of technology development

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[28] Unknown, "What To Do With Noncore Technologies", *Chemical Week*, May 29, 1996

[29] Kotabe, Masaaki, Sahay, Arvind, and Aulakh, Preet S., "Emerging Role of Technology Licensing in the Development of Global Product Strategy", *Journal Of Marketing*, Winter 1996

or business creation is best used when the company has neither the time nor the financial resources to pursue a project. This is a widely used technique in the Biotech-Pharmaceutical industry where drug development is extraordinarily risky and time and capital intensive. A business model paradigm has developed within the Biotech-Pharmaceutical industry whereby a large pharmaceutical company makes an investment into highly speculative research being done by a Biotech company (often a startup). This is something of a "pre-arranged" reverse license. In return for this investment, the Biotech firms agree to license any subsequent technologies resulting from the research while the pharmaceutical companies diversify the risk of investing on such internal research.

Further investigation into technology licensing reveals an additional drawback beyond limiting the financial upside potential of the technology – access to technologies that are created from the original license. For example, suppose Company A grants a license to Company B to create a specialized computer chip, but during development of the chip, Company B discovers that by using the technology provided by Company A they can build a faster chip by engineering around Company A's technology. What has Company A gained? They have licensed away the incubation technology but are left with no royalties from the new chip. While this discussion is hypothetical and one hopes that legal remedies exist to discourage this type of situation, it highlights the potential downside risk to licensing as well as the need to constantly monitor technology rights after it has been licensed.

Some divisions of Lockheed-Martin Corp. are utilizing a combination of the spinout and technology licensing strategy. Under the Entrepreneurial Leave of Absence Program, employees desiring to start businesses can use up to two years of unpaid leave to do so.[30] The company typically invests up to $250,000 in return for 10 percent equity. The startup pays a patent-licensing fee ranging from $5,000 to $20,000, depending on the product's likely market, and royalties – one to five percent of gross revenues – for the life of the patent. The company provides incubator space, management advice, and introductions to potential

[30] Hise, Phaedra, "New Recruitment Strategy: Ask Your Best Employees to Leave", *Inc.*, July 1997

investors. So far, employees on leave have launched four companies: Genase, Electroless Plating Recycling Systems, Optical Biopsy, and Fast Technology.

This methodology of business creation or technology development is best associated with high risk, costly developments where the licensor is clearly willing to forego control of future products or is comfortable with limiting the financial upside of such an investment.

2.5 Employee Departures

One effect of a firm's failure to promote creativity and reward entrepreneurial behavior is the departure of an employee to found his or her own firm. Thus, an inverse relationship between internal corporate and outside entrepreneurship seems to occur. If internal corporate entrepreneurship fails in the original firm, more outside entrepreneurship occurs. In high technology industries, entrepreneurs cite frustration as one of the main reasons they leave to start their own firm. Edson DeCastro could not get Kenneth Olsen, chairman of the Digital Equipment Corp. to back his idea for a new computer, so he left to form Data General Corp. Steven Wozniak could not convince the Hewlett-Packard Co. to build small computers, so he formed Apple Computer Co.[31]

Employee entrepreneurs often see better profitability potential and financial rewards outside of the firm because of the difficulty that large companies have in aligning rewards with internal corporate entrepreneurship. Although the original firm has incurred all of the sunk costs associated with originating the new idea, it may gain none of the benefits if the entrepreneur leaves to start its own company.[32] The failure to adequately pay for entrepreneurial performance is a primary reason for people leaving the company to start their own business. "Perceptions of long-term equity may be particularly important in the case of those intrapreneurs who are evaluating the gains from leaving the firm to start their own hierarchies against the gains from staying with the organization."[33]

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[31] Pinchot, 1985

[32] Cooper, A.C., "The Role of Incubator Organizations in the Founding of Growth-Oriented Firms", *Journal of Business Venturing*, 1985

[33] Jones and Butler, 1992

An innovative company should be able to take advantage of the opportunity when an employee proposes a new idea. "If these intrapreneurs do not get support and encouragement, they become a frustrated and nagging negative force in the company. Alternatively, they will take their ideas or skills elsewhere, either to set up their own businesses or develop their intrapreneurial skills in competitor companies that have a more favorable environment."[34]

> Some years ago, a university student checked up on former employees of a Fortune 100 technology-based company who had left to start new ventures. The company regretted the loss of these very bright employees and had consoled itself that at least they had not gone over to the competition. The company was consoled; that is, until the student informed them that after ten years the combined sales of these new entrepreneurs exceeded those of their corporate alma mater. They had not gone to the competition; together they had become the competition. What if that energy could have been harnessed within their old company?[35]

2.6 The Innovation is Never Developed

There are many instances where companies fail to act upon an opportunity that later prove to be successful. One of the most well known examples comes from Xerox's Palo Alto Research Center (PARC), where the company was able to develop a technology, but unable to convert it into market success.[36] In the 1970s, PARC designed and built a personal computer that incorporated a list of "firsts" – the first graphics-oriented monitor, the first "mouse", the first word processing program for non-expert users, the first local area communications network, the first object-oriented programming language, and the first laser printer. However, Xerox's Dallas-based Office Systems Division (OSD) was focused on getting a "minimum capability" word processing product out within 12 months, which was based on proven non-programmable electromechanical technology. PARC antagonized OSD by vigorously criticizing any product that was not software oriented. The end result was that PARC's technology languished and Wang Labs and Apple Computer launched the personal computer revolution. By the time PARC found a sponsor within Xerox for their computer system, it was too late. IBM had moved in, established a technology standard, and begun to

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[34] Cooper, 1985
[35] Pryor and Shays, 1993
[36] Howard, William G. and Guile, Bruce R., Profiting from Innovation, New York: The Free Press, 1992

dominate the hardware side of the industry. A number of factors contributed to Xerox's failure in the personal computer market.

- PARC did not make the effort to build coalitions with other parts of the organization.
- PARC's managers and their management style and philosophy differed dramatically from the rest of Xerox and therefore they never really "fit in" with Xerox's upper management.
- PARC failed to consider business issues such as feasibility, price, cost, competitive positions, and customer acceptance.
- Xerox as a company was intolerant of risk – a perspective fundamentally opposed to innovation.

2.6.1 Innovation Incentives

A study of typical employees revealed the following factors (and the percentage of people responding to them) as leading to improved performance:[37]

- Job enables them to develop abilities 61%
- Pay tied to performance 59%
- Recognition for good work 58%
- Job requires creativity 55%
- Job allows them to think for themselves 54%
- Interesting work 54%
- Challenging job 53%
- A great deal of responsibility 50%

These factors reinforce the belief that employees are willing to work on new projects and challenging teams if the rewards are apparent. Some managers believe that allowing the innovator to be in charge of the new venture is the best reward. Others say that allowing the corporate entrepreneur more discretionary time to work on future projects should be the reward. Others insist that special capital should be set aside for the corporate entrepreneur to use whenever investment money is needed for further research ideas.

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[37] Goddard, Robert W., "How to Reward the 80s Employee", *Personnel Management*, April 1989

3.0 Decision Framework

We have learned through extensive research of existing literature that there are different ways to successfully manage the development of a new project. We have observed that some companies innovate well within a firm's existing organizational structure and others do not. Section 2.0 discusses common traits that exist in successful innovation efforts, as well as the obstacles or characteristics that work against an organization. It details successful spinout stories and the factors inherent to their success. There are also situations in which a company may elect to license a technology rather than develop it internally or spin it off.

This section explores three difficult questions facing a firm when presented with a new business or product development opportunity: 1) Is the project worth doing? 2) If the project is worth doing, should the firm develop the project itself? 3) If the firm decides it should develop the project itself, should the firm develop it internally or pursue a spinout or spinoff strategy? The primary objective of this section is to provide a basis for understanding the characteristics associated with a new business or product development opportunity and the key evaluation factors in determining the project's fate. A good understanding of these factors will help make sense of the survey results (Section 4.0) and the decision framework methodology (Section 5.0).

3.1 Decision Framework Objective

Our objective is to provide a framework based on these observations to help managers decide the best course of action for a new business or product development opportunity – to help guide them towards a better understanding of the factors that lead to success and failure and the "right" decision. The goal is to develop a framework – a flow diagram or decision tree to enable top management to assess new ideas and determine the best alternatives for implementing them. We hope to encourage managers to systematically look at the relevant factors surrounding a new business or product development opportunity and provide a tool to help them determine the best course of action. A number of factors contribute to a decision of what to do with a new business idea. Does it relate to the core business? Does it provide a competitive advantage? Are there synergies? What are the opportunities for knowledge

transfer? What is the potential upside in terms of profitability? Does it fit well within the existing organizational structure? Are the necessary financial resources available? What are the key factors that influence management's decision to move forward with a new business or project? What factors are most important in deciding whether to develop a new business or project internally, spinout or spinoff a new business unit, license the technology, or decide to pass up the opportunity?

3.2 Survey

We surveyed a number of managers of innovative companies who have previous experience in deciding the fate of new business proposals. The survey is contained in Appendix I and the findings are presented in Section 4.0. The purpose was to solicit their views of the important factors to be considered in determining the proper disposition of a project proposal. Imagine a gathering of many "innovation experts" in one room – people with experience in evaluating new project ideas and deciding their fate – and challenging them with the task of identifying and prioritizing the factors important in deciding: Project "go" or "no go"? License the technology? Develop it internally? Spinout or Spinoff?

3.3 Relevant Factors

There are three difficult questions that must be answered: 1) Is the project worth doing? 2) If the project is worth doing, should the firm develop the project itself or should it license the technology? 3) If the firm decides it should develop the project itself, should the firm develop it internally or pursue a spinout strategy?

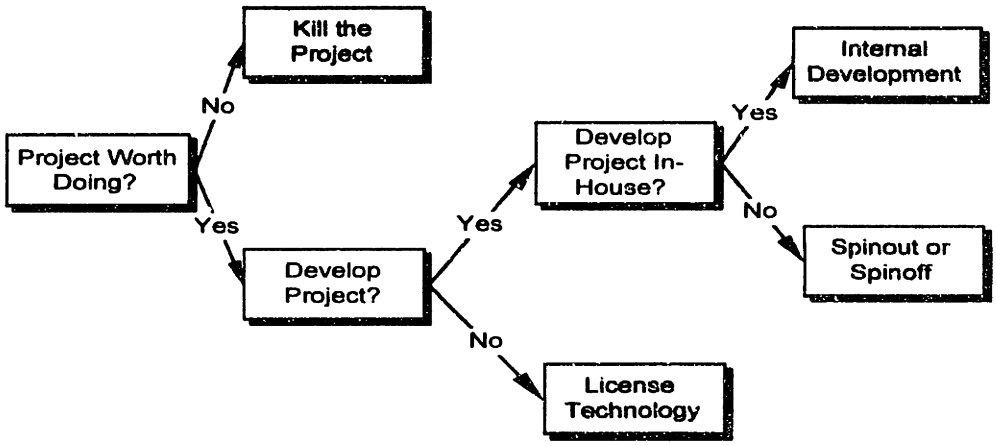

Figure 3-1: Flow diagram for new business decisions

It is helpful to discuss the relevant factors associated with a new business or product development opportunity in order to develop an understanding of their effect on a decision. An attractive new product concept must adequately address a number of tough questions, including how the product will perform and provide value to the customer, how the product will be manufactured, how the product will successfully compete with present and potential alternative products, what the financial benefits to the company might be and how the product and target markets will mesh with the company's competencies and values.[38] Based on our research findings, there are a number of factors that must be evaluated in considering the disposition of a new business or product development opportunity.

Table 3-1: Evaluation factors

Firm strategy	Technology and other synergies
Firm development portfolio	Organizational culture
Technical feasibility	Financial resources
Business opportunity	Need for incentives/motivation
Competitive advantage	Need for executive oversight
Risk / probability of success	Attractiveness of capital markets
Costs and funding	Quality management team
Relationship to core business	Spinout administrative support

3.4 Is the Project Worth Doing?

There are many factors that must be assessed before it makes any sense to discuss the best course of action for a new business or product development opportunity. The merits of the new business or product development opportunity must be evaluated to determine whether the potential benefits of the project outweigh the negatives. If the project is not worth doing in the first place, there is no sense deciding whether it should be licensed, spun out, or internally developed. Market-based evidence suggests that as many as 40 percent of new products launched fail in the marketplace, and that 46 percent of the industry resources devoted to new products are spent on failed or cancelled projects.[39] Management needs to be

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[38] Goldhar, J.D. and Bragaw, L.K., "Information Flows, Management Styles and Technological Innovation", *IEEE Transactions on Engineering Management*, 23:51-62

[39] Smith, 1998

able to identify probable new product winners early, and to allocate development resources to these projects. This makes the 'screening' stage of the innovation process vitally important.

Many leading firms have developed a systematic process for moving a new product project through the various steps from idea to launch. There a number of factors that many managers and firms identify as the key to determining whether or not a project is worth doing.

- Firm's Strategy – Does it fit with the firm strategy? Does the firm view itself as an innovative company? For example, does the firm view itself as a technology leader, follower, low cost producer, seeker of market niches, etc.? Is it looking for new projects with potentially high payoffs? Does it have opportunities to develop new ideas? Is the firm currently achieving its objectives for growth? Are there certain markets the firm is trying to gain entry?
- Business Opportunity – Is there a current market for the product? Is it large, medium, or small? Is the revenue potential high? Will it provide the firm with a competitive advantage? Profitability? Return on investment?
- Technology – Is it technically feasible? Is the maturity of the proposed technology development considered embryonic, evolving, or mature? Is there overall technology strength in terms of breadth, patentability, and competitiveness? Is there a reasonable probability of success? Does the payoff justify the risk? Is there a satisfactory balance of low, medium, and high-risk programs?
- Development Portfolio Program Balance – Is the current mixture of R&D programs satisfactory? Is there a satisfactory mixture between improving existing products and work on new products? For example, does the firm currently have enough short term (less than two years), medium term (two to five years), and long term (greater than five years) programs in its portfolio?
- Cost – Are the required funds available?

3.4.1 Firm Strategy

Does the firm view itself as a technology leader versus a technology follower, lowest cost producer, etc.? Is there a top management vision related to innovation (new products, market niches)? A growth company will be more receptive to new ideas and be more interested in the question of the best means to develop the product for market introduction. For example, Intel's entire growth strategy is related to technological innovation and staying ahead of its competitors through rapid and continuous product introduction. It views itself as a technology leader and is obviously more receptive to new ideas than a company satisfied with its position and strategic direction. A company with stagnant or declining growth may need to explore new markets or market niches and is willing to gamble on new projects.

One key factor to assess in identifying successful future products is the project fit within the company in terms of market research, managerial skills, sales and distribution, advertising and promotion, technology, research and development, and manufacturing. Another key to successful new product introduction is the alignment of strategy and new business development resource allocation. The mission, vision, and strategy of a business are made operational through the decisions that the firm makes on where to spend money. For example, if a firm's strategic mission is to grow through leading-edge product development, its strategy should be reflected in the number of new projects being funded – innovative projects that will lead to growth. Similarly, if the strategy is to focus on certain markets, products or technology types, then the majority of R&D spending should be focused on such markets, products or technologies.[40]

- Is the project consistent with the firm's strategy? For example, if the firm has defined certain technologies or markets as key areas to focus on, does the project fit into this area?
- What percent (or how many dollars) should be spent on defending the existing business base, extending the existing business base, and on diversification?
- What percent of resources should go to new product developments? To maintenance projects? To process improvements? To fundamental research?

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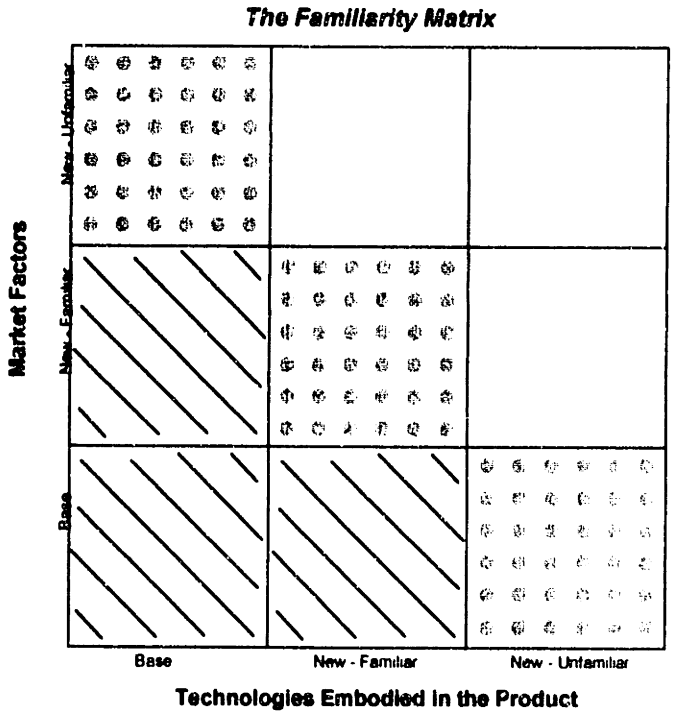
[40] Cooper, Robert G., Edgett, Scott J., and Kleinschmidt, Elko J.; "Portfolio Management in New Product Development: Lessons from the Leaders – II", *Research-Technology Management*, Nov – Dec 1997

- What should be the split of resources to different types of markets and to different technology types in terms of their familiarity to the business? The inset "Familiarity Matrix" helps with the tradeoff between "which markets to enter" and "which products to pursue" and helps answer the question "How to best enter these product-markets to avoid failure and maximize gain?" A high level of corporate involvement (internal developments, acquisition) is recommended for projects in the "slashed" areas, a moderate level of corporate involvement (licensing, internal ventures, joint ventures) is recommended for projects in the "dotted" areas, and a low level of involvement (venture capital, educational acquisitions) is recommended for projects in the "blank" areas.[41]



Ideally, a firm's business strategy includes a new product strategy, which specifies new product goals (e.g., percentage of sales to be derived from new products), areas of focus (e.g., those markets, technologies and product areas where new products will be developed), and plans and priorities (e.g., the desired breakdown of spending across markets, technologies, product categories, and project types). The size and complexity of the project must be also be evaluated. In addition, a firm's readiness to innovate needs to be taken into consideration with respect to possible disadvantages associated with diversification in terms of moving to a new product class with new types of users and new competitors, new processes and new technology.

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[41] Roberts, E. and Berry, C., "Entering New Businesses: Selecting Strategies for Success" *Sloan Management Review*, Spring 1983

3.4.2 Business Opportunity

Is there a market for the product? Will it be profitable? What is the return on investment? Does it provide a competitive advantage? The first step is to determine the project's marketplace merits in terms of market size, the market potential, the level of competition, and the potential level of market acceptance. The next step is to determine the customer needs and the level of customer acceptance. In order to represent realistic viewpoints, the firm should use an unbiased party to perform the analysis. The evaluation is critical to both growth and profit projections. What is the competitive situation in terms of barriers to entry, rivalry, buyer/supplier power, and potential substitutes? Will the new product provide a competitive advantage? What is the profit potential? A detailed financial analysis is required, with present value forecasts of the investment and sensitivity analyses evaluating potential risks and "what if" situations. Characteristics conducive to success include a large, high-growth market, high end-user need, low competition intensity with few competitors, few new products, and little or no price competition.

3.4.3 Technology

Is it technically feasible? Is the technology mature? What is the level of technology strength in terms of breadth, patentability, and competitiveness?

Embryonic – The maturity of the technology should be subject to some evaluation at this phase, but should be allowed some further development prior to a final evaluation of future potential. Many technologies fail to perform as advertised at this stage. If a definitive decision is made to not develop a technology past this stage, then consideration should be given to selling off or licensing the technology.

Evolving – This is perhaps the most important stage in which to make a definitive decision with respect to the technology. It is generally at this point that an informed and credible decision about how to move forward with a technology is possible.

Mature – At this point in the development, a more informed decision is possible. The technology is fully developed and has likely been in the market for a certain period of time.

Hopefully, the time in the market has provided data to allow a reasonable evaluation of the potential future benefits of the technology. Ironically however, this is also the stage where a product has created a life of its own and will have many biases within the company. Once a proper evaluation of the maturity of the technology has been made, the next step is to determine the technology merits related to project success.

Risk – What is the probability of success and does the payoff justify the technical, cost, and schedule risk? In evaluating project risk, it should be considered the highest order of all the evaluation criteria, for it is project risk that must be overcome in order to reap the rewards of a new product introduction. A thorough technical appraisal must be done, which focuses on the economic and technological feasibility. The firm must also consider the legal, patent, and regulatory ramifications.

Technology Strength – What are the strengths and weaknesses of the technology? How does the technology differentiate the product and provide sustainable competitive advantages? In a study of 1,000 new product launches in hundreds of firms, it was determined that the number one success factor is a unique, superior product – a differentiated product that delivers unique benefits and superior value to the customer.[42] The strengths and weaknesses can be divided into several categories to assess the breadth of the technology or product, the protectability of the technology, and the competitiveness of the product.

Breadth – What is the overall marketability of the technology? Does the technology appeal to wide market or does it target a niche market?

Protection – Can the technology or product be protected with patents or trademarks? If it is a service business, can it be realistically protected through branding or trademarks? In some cases, the best protection for a technology is to keep it "company confidential". If a product or technology can be reverse-engineered or modified to circumvent a patent or trademark, not

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[42] Cooper, Robert T. and Kleinschmitdt, Elko J., "Stage Gate Systems for New Product Success", *Marketing Management*, Fall 1992

filing for legal protection avoids exposing the product in the public domain. This provides an inherent "first mover advantage".

Competitiveness – Is the product unique? Is it superior in terms of quality and performance? Is it highly innovative? First to market?

3.4.4 Development Portfolio Program Balance

Is there a satisfactory mixture between improving existing products and work on new products? Is the current mixture of development programs satisfactory (i.e. short, medium, and long term)? Effective portfolio management has three main goals:[43]

- Maximize the value of the portfolio against an objective, such as profitability.
- Achieve the right balance and mix of projects in terms of risk versus reward, ease versus attractiveness and across various markets, technologies, product categories, and project types (e.g., new products, improvements, cost reductions, maintenance and fixes, and fundamental research).
- Provide a link to the business strategy. Portfolios should align with the firm's strategy in terms of strategic fit and resource allocation.

There is often a conflict between return on investment, strategy, and balance. For example, the project that yields the greatest net present value or internal rate of return may not help balance the portfolio. Similarly, a project aligned with business strategy may sacrifice other goals (such as short-term profitability). When evaluating a new business or product development opportunity, a firm tends to focus on factors such as cost, risk, and time, which leads many firms to pick the "low hanging fruit" – projects that could be done quickly, easily and cheaply. Often these projects are trivial ones – modifications, extensions and updates – while the significant products, the ones needed to develop real competitive advantage and major breakthroughs, are often placed on the back burner. The result is a portfolio of short-term projects, with longer-term, innovative projects missing.

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[43] Cooper, et al, 1997

The intended market should not be considered as highly as one might think. Often, when new products are developed, the market initially intended is not the market it ends up benefiting the most. Therefore, a portfolio of projects should maintain a good balance between efforts focused on core businesses and efforts not.

3.4.5 Costs and Funding

Are the financial resources available? How scarce is internal funding for new business or product development opportunities? Is the firm concerned with development costs eroding the firm's earnings? Is there a need or desire to raise equity capital through the public markets?

Obviously, if a company does not have access to the necessary funds to develop a new project, an internal venture is not possible. The spinout mechanism whereby the firm creates a subsidiary and offers equity to the public is an option (assuming the market conditions or the public's perception of the new business's potential are favorable for raising capital). These two factors are key determinants in whether or not a firm decides to initiate a new business or product development opportunity.

3.5 Should the firm sell or license the technology?

There are many motives for licensing a technology: to pursue a global marketing strategy, to accelerate the pace of market penetration, a means of establishing standards, and a method of funding or amortizing R&D costs.

Are there potential network externalities for the technology (i.e., the increase in utility for a user due to the increase in the number of other people using that product or other goods in conjunction with that product)? In many cases, the relative attractiveness of a technology is influenced by their sales history; a given product is more attractive the larger the base of its in-place users. These effects imply that the greater the network externality, the higher will be the incentive for the firm to license a technology – to disperse the technology to the producers of associated products.

Are complementary products required (i.e., the combination of goods that must be present and working together for the consumer to derive utility from the consumption of the good – other technologies, associated production facilities, organizational knowledge, distribution and sales, etc.)? As firms strive to focus on their core competencies, technology licensing is a good way to avoid the development of the necessary complementary products. A firm should avoid trying to do everything, especially things it cannot do well, and find other firms that possess the competencies it needs.[44] For example, Sun Microsystems licensed its microprocessor designs to Philips because it had a greater capacity to integrate the chip into an end product and make and sell the end product in large numbers.[45] The decision by Sun to license its reduced-instruction set computing technology enabled Sun to avoid investing in complementary assets for manufacturing.

Strength of technology? Because many patents and processes can be invented around at modest costs, competitors can quickly gain access to new technologies. If other firms can easily gain access to a new technology, it makes sense for the firm to recover some of its investment through royalties and licensing fees before losing market share and competitive advantage.

Does the firm have the necessary development funds available? High-technology products require significant capital investment. Technology licensing is especially applicable to small, innovative firms that are more likely to lack at least some of the required technological assets than to larger, more technologically well-rounded firms.[46]

Does the firm need help in generating consumer acceptance of its technology? A firm seeking to gain rapid access to a new market may choose to license its technology. Due to shortened technology life cycles, establishing new markets one after another is not attractive because an idea revealed in one market can be copied by other firms and appear in other

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[44] Levy, Michael, John Webster, and Roger A. Kerin, "Formulating Push Marketing Strategies: A Method and Application," *Journal of Marketing*, Winter 1983

[45] Khazam, Jonathan and David Mowery, "The Commercialization of RISC: Strategies for Creation of Dominant Designs," *Research Policy*, January 1994

[46] Barney, Jay, "Strategic Factor Markets: Expectations, Luck and Business Strategy," *Management Science*, October 1986

markets. Technology licensing is a means to enlist the support of multiple firms to simultaneously introduce technologies in many markets.

3.6 Should the Firm Develop Internally or Spinoff the Business?

Based on our research, we identify the following factors as critical to the success or failure in developing a new business or product development opportunity, depending on whether it is developed internally or through a spinout.

- Relationship to Core Business – How closely does the project relate to the firm's core business? To what degree is the intended market related to the firm's existing business base? Is there a need to separate an unrelated business to maintain the firm's identity?
- Synergies – To what degree does the technology relate to the firm's existing technical base? Are there opportunities for knowledge transfer? Are there technology synergies? Are there other synergies?
- Organization and Incentives/Motivation – Are there organizational structure and culture impediments? How important is the need to incentivize employees? For example, is employee turnover a problem? Are people leaving to start their own companies? Does the firm have difficulty attracting and retaining top quality talent? Has the firm successfully developed new products unrelated to the existing business base in the past?
- Costs and Funding – Are the necessary funds available? Is there a need to turn to the equity markets to generate capital? Is the firm concerned with shareholder perception due to earnings drag?
- Management – How much need or desire is there for executive oversight? Does a quality management team exist that can be trusted with independence? Is the necessary legal, administrative, finance support available to support spinout?

3.6.1 Relationship to Core Business

While managers think they control the flow of resources in their firms, it is really customers and investors who dictate how money will be spent. Since companies that don't satisfy their customers do not survive, companies often find it difficult to invest adequate resources in new business or product development opportunities because of misalignment with its core

business and customers. When faced with a new business or product development opportunity, the people and processes in the firm do not allocate freely the critical financial and human resources needed to succeed.

Some important questions to ask are: Is the new business or product development opportunity closely tied to the core business? Is the intended market related to the existing business base? Do business synergies exist? If not, is the firm unconcerned with shareholder perception or maintaining the firm's identity? If the answers to these questions are yes, there appears to be a compelling argument towards developing the new project within the organization. However, in cases where the new project has a different intended market or is unrelated to the existing business base, the spinout mechanism may be a better alternative.

3.6.2 Synergies – Technology and Other

To what degree does the technology of the new business or product development opportunity relate to the existing technical base or core competencies? Is there opportunities for knowledge transfer? Are there other synergies to be realized from developing the new project in-house, such as relationship to existing marketing efforts, manufacturing capabilities, or distribution channels?

The core competencies may or may not have any direct relevance to the selection of a technology, particularly if it is a potential growth business. The decision to retain a technology is greatly supported by the existence of synergies with the current business. If the new technology can help the firm gain market position through current distribution channels, marketing resources or manufacturing operations, separating the technology from core business through a spinoff may not be in the best interests of the firm as a whole.

3.6.3 Organization

Does the culture, size, and flexibility of the firm's organization support internal development? Most large companies have developed an organizational structure designed to

operate to protect the established business, ensure control, and thus minimize risk.[47] This creates barriers to innovation because it conditions people to believe that stability and control are the most important attributes of good management. As discussed earlier, many successful innovations are a result of individual obsession, accidental discoveries, and people finding new uses for products intended for different markets. After 25 years of studying IBM, General Electric, Polaroid and Xerox, one researcher found that not one single major product had come from the formal planning process.[48] Management often applies logical hindsight when evaluating new business or product development opportunities. In his book, Serious Creativity, Edward De Bono states: "If every valuable creative idea is logical in hindsight, then it is only natural to suppose, and to claim, that such ideas could have been reached by logic in the first place, and that creativity is unnecessary. That is the main reason why, culturally, we have never paid serious attention to creativity."[49]

The various forces of a centralized organization exert powerful pressure in the same basic direction: towards the management of risk rather than the taking of risk, towards top-down rather than bottom-up decision making, and often towards shorter-term financial gains. The combination of detailed planning, elaborate checks and balances, decision-making through consensus, and careful top-down review often creates an environment that discourages risk-taking, inhibits experimentation, and limits the autonomy of members of an organization.

Centralized organizations also often result in resources being spread too thinly, efforts being duplicated, expertise and costs not being shared across businesses, and resources not concentrated in ways that build sustainable competitive advantage.

As managers rise through the corporate ranks they build a set of individual tools and tendencies that allows them to function successfully in their individual roles.[50] However, these tools limit their ability to assess the viability of a new concept. Managers use these

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[47] Pryor and Shays, 1993
[48] Quinn, James Brian, "Managing Innovation: Controlled Chaos" *Harvard Business Review*, May-June 1985
[49] Clemmer, Jim, "Strategic Planning Smothers Innovation", *CMA Magazine*, November 1996
[50] Burgelman, Robert A. and Sayles, Leonard R., Inside Corporate Innovation, Free Press, 1986

tools to restrict their thinking when evaluating new business or product development opportunities. Examples of this "risk averse" thinking includes:

- How does this initiative maintain our capacity to move into an area where major current or potential competitors might move?
- How does this help us find out where not to go?
- How does this help us create new and defensible niches?
- How does this help us mobilize the organization?
- To what extent could it put the firm at risk?
- When should we get out of it if it does not seem to be working?
- What is missing from our analysis?

There are three distinct organizational factors – organizational size, age, and complexity – that create obstacles to internal innovation.[51]

Organizational size: The separation between entrepreneurship and management increases as the firm grows, causing an increase in risk aversion, increased rigidity, and bureaucracy. Increased size also provides less opportunity to demonstrate discrete performance contributions, which reduces motivation.

Organizational age: Older firms tend to be less innovative, less flexible, less likely to anticipate the need for productive change.

Organizational complexity: An increase in the number of management levels reduces the autonomy and authority given to internal corporate entrepreneurs.

3.6.3.1 Strategies for Achieving Successful Internal Development

Quinn noticed that the following characteristics are present in large firms that are successful innovators. First, innovative companies have a clear-cut vision and the support necessary to sustain it. Second, innovative companies tie their visions to the realities of the marketplace. And third, most innovative companies keep the organizational structure flat and the project teams small.

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[51] Jones and Butler, 1992

With few exceptions, the only instances in which firms successfully develop new products or businesses is when the firms' set up an autonomous organization. Such organizations, free of the power of the customers of the core business, are able to focus on a different set of customers. In other words, companies can succeed in developing new business when their managers align their organizations with the forces of resource dependence, rather than ignoring or fighting them.[52]

In looking at the computer industry again, IBM dominated the mainframe market but missed by years the emergence of minicomputers. Companies such as Digital Equipment Corporation, Data General, Prime, Wang, Hewlett-Packard, and Nixdorf took advantage of the minicomputer market. But each of these companies missed the desktop personal computer market. It was left to Apple Computer, together with Commodore, Tandy, and IBM's stand-alone PC division, to create the personal-computing market. Similarly, the firms that built the engineering workstation market – Apollo, Sun, and Silicon Graphics – were all newcomers to the industry.

DEC's failure in the personal computer market was not due to a lack of trying. Four times between 1983 and 1995 it began work on personal computers targeted at consumers, but four times it failed to generate support within the company. DEC failed because it launched all four efforts from within the organization. Even though there was top-level support for moving into the PC business, those who made the day-to-day resource allocation decisions in the company never saw the sense in investing the necessary money, time, and energy in low-margin products that their customers didn't want. Higher-performance initiatives that promised upscale margins, such as DEC's super-fast Alpha microprocessor and its adventure into mainframe computers, captured the resources instead. In the 1990s, DEC finally set up a separate PC division, but it was not totally autonomous from DEC's mainstream business because it was still held to corporate standards for gross margins and revenue growth.[53]

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[52] Christensen, Clayton M., The Innovator's Dilemma – When New Technologies Cause Great Firms to Fail, Harvard Business School Press, 1997

[53] Ibid.

Why was IBM successful in the personal computing industry when many other leading mainframe and minicomputers makers failed? It created an autonomous organization in Florida, separate from its New York headquarters, that was free to procure components from any source, to sell through its own channels, and to develop a cost structure appropriate to the technological and competitive requirements of the personal computing market. The organization was free to succeed along metrics of success that was relevant to the personal computing market. In fact, some have argued that IBM's subsequent decision to link its PC division much more closely to its mainstream organization was an important factor in IBM's later difficulties in maintaining its profitability and market share in the PC industry.[54]

If the organizational structure and processes are to support an internal development, the culture of the organization must support and reward innovative behavior. The organization must believe that senior management will support innovative thinking and grant the time required for successful results. Venture teams – teams charged with developing new products – are effective when they are allowed to operate as though they are in business for themselves. A venture team can offer favorable ownership and entrepreneurial characteristics, speed, better decisions, agility, and adaptability. The organization should be focused on adding value to the efforts of the venture team by helping, supporting, and guiding, but should avoid doing the venture team's job. However, unless the venture team is composed of individuals with a proven track record of developing new product lines for the corporation, it will need help.[55]

In cases where the new business or product development is different from the firm's core business and if it is unlikely the firm can successfully separate the effort from the mainstream organization, then the spinout or spinoff method is highly recommended.

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[54] Christensen, 1997

[55] Lester, Don H., "Critical Success Factors for New Product Development", *Research-Technology Management*, January/February 1998

3.6.4 Incentives/Motivation

Is there a need to incentivize employees? Is employee turnover a problem? Does the firm have difficulty attracting and retaining top talent? If the answers to these questions are yes, the firm should take a hard look at the spinout or spinoff strategy for the reasons discussed in Section 2.3.3.

3.6.5 Costs and Funding

As a firm grows large and becomes successful, it faces increased pressure to generate new revenue each year to maintain its desired growth rate. The primary reason is that growth rates have a strong effect on share prices. Because a company's stock price represents the discounted present value of its forecasted future earnings or its projected earnings growth rate, new projects that reduce a firm's short-term earnings will likely cause the firm's market value to fall. Therefore, a key question to be addressed is whether there are sufficient funds available to cover the development costs. If yes, is the firm concerned the project will adversely affect shareholder perception due to the impact on earnings? If the firm does not have sufficient funds available to cover the development costs, or it does but is concerned with eroding its earnings base, a spinout strategy may be the best alternative.

A number of factors determine the viability of this option: Are the market conditions favorable to spinning off the business? Will an initial public offering for the new business or product development opportunity generate greater financial support if separated from firm? What is the public's perception of the new business's potential benefits? Traditional financial theory states the market should value the new business the same, regardless of whether the parent or the subsidiary is raising funds. However, evidence suggests spinning out a business can attract new capital.[56]

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[56] Anslinger, et al. 1997

3.6.6 Management

Is there a need or desire for top-level management oversight or control? Or, does a quality management team exist that can be trusted with independence? This is a crucial point in deciding if a firm should develop a new project in-house or whether it has the opportunity to spinout a new division. Without a capable management team, the latter alternative is not very attractive.

A study of 40 new product development efforts in 15 large, mature organizations to determine if large organizations developed an ability to sustain innovation over a long period of time revealed the number one obstacle to innovation is an organization's senior management.[57] Senior managers' attention is often focused toward large-scale strategic activities, which absorb the organization and leave little available for internal innovation. This often creates intense workload pressure and different objectives regarding strategic direction and the desire to satisfy those objectives. Will project managers and superiors have clear, shared agreement on the goals and the strategy of the effort? This is essential for an internally managed project to be successful. In the case where there is disagreement between top management and the idea "champion", the most likely result is the departure of the employee to start his or her own business. However, the spinout strategy is often a suitable compromise because it provides autonomy to the employee and assuming top management has confidence in the employee's capabilities, provides the company the opportunity to reap some of the benefits of a successful development.

3.6.7 Spinout History

Has the firm ever executed the spinout strategy in the past? Is the necessary legal, administrative, management, and financial expertise available to execute spinout? If not, is the firm willing to make the investment to develop the necessary expertise?

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[57] Dougherty and Hardy, "Sustained Product Innovation in Large, Mature Organizations: Overcoming Innovation-to-Organization Problems"

4.0 Survey and Interview Results

We surveyed and interviewed a number of managers of innovative companies who have previous experience in deciding the fate of new business proposals. The purpose was to identify factors that managers consider important in determining the proper disposition of a business or technology. The surveys were designed to solicit information to input into the development of the decision framework described in Section 5.0. It is important to note that these surveys were not conducted in a quantity or format sufficient to gain statistical significance but rather to solicit specific insights into new business development. As can be seen from the survey (see Appendix I), the questions were tailored specifically to gain insight into the internal decision making process that takes place within the closed ranks of a company's leadership. The intent of Parts One and Two of the survey was to verify that we had selected "innovative" companies; companies with a array of options available to them, both organizationally and financially. In this section we attempt to decipher the responses and highlight significant. We then used this information to develop the weightings assigned to the various factors of the Section 5.0 framework. The companies surveyed and interviewed include:

Figure 4-1: Companies responding to survey

Network Solutions - a SAIC spinoff	Xerox
Tellium - a BellCore spinoff	Thermo Electron
Qualcomm	Analog Devices
Siemens-Nixdorf	Weyerhaeuser
Kodak	

The respondents to our questions included managers who have been intimately involved in the "business disposition" process and participate in their firm's decision making process. Approximately half of the surveys were conducted through interviews. Respondents to the survey were at the Vice President level or higher. In some cases, interviews were conducted with members of the Board of Directors. While board members may not typically be involved in such decisions, we believe the sources to be credible based on the fact that the particular companies being surveyed were small, suggesting that the board still retains

substantial control over the company's day-to-day decisions. The following describes our interpretation of the information we obtained through this process.

Part One –Tell Us about Your Firm

Key findings:

- All of the respondents considered their firm to be a leader in technology and innovation.
- Survey responses varied in relation to the background and position of the respondent.

All of the firms responding to our requests for information were large established firms with a history for implementing innovative business models. There were two exceptions, Tellium and Network Solutions, recent spinouts of BellCore and SAIC respectively, who are both smaller firms. All but two of the firms are publicly traded. The privately held companies were SAIC and Tellium. SAIC is employee-owned and SAIC (minority) and private equity investors jointly own Tellium. The firms ranged in size from less than 1,000 employees to more than 50,000. Most of the firms have annual revenues in excess of $1 billion. All of the respondents indicated their firms were innovative and were considered technology leaders in their industries. All of the firms create new technologies internally and possess the financial resources to formulate businesses around these technologies.

The large firms were organized with many separate divisions. However we made no attempt to correlate the business or technical inter-relationships of the divisions. Most of the respondents considered the divisions to be autonomous in their decisions to go forward with new businesses, but most required board or CEO level approval prior to spinning out or licensing a technology.

The respondents' positions, backgrounds, and viewpoints varied widely, which presented some interesting differences between the responses to the questions and the educational or professional backgrounds of the respondents. The importance of some of the factors varied depending on whether the respondent held a technical or financial position in the company. For example, one respondent holding a senior financial position was asked his view on a

spinning out a business and how he would rate the motivation to spinout a new business based on the relationship to the firms' core business or organizational culture. The same question was posed to a senior technical person in the same company. The financial manger ranked both as having weak influence, while the technical manager ranked both as strong or very strong. Although difficult to quantify, this correlation appeared to be prevalent throughout the responses and was even more pronounced in the interviews.

Part Two – Your Firm's Business Creation History

Key findings:

- All of the firms have had opportunities where all of the surrounding factors pointed to spinning out businesses, but chose not to.
- Most companies have seen little success in licensing internally developed technologies to other firms.
- One firm's philosophy is "if the market will buy it, we will sell it".

This portion of the survey was designed to solicit responses pertaining to a company's business creation history and to determine a company's propensity to spinout, license, or develop technologies and businesses internally.

Spinouts

When questioned about the firms' history with spinouts, the majority of the firms had spun-out technologies into separate business units. Some businesses were spun-out in equity carve-outs, while others had been re-created as separate, but financially dependent units. The majority of the firms had done multiple spinouts.

Most of the firms surveyed believe that the management of a spinout company should come from the parent firm. An associated finding was that if the management team did come from the parent, the team was most likely involved in the original creation of the business. This finding correlates with responses to the Part Four questions related to the fact that spinouts can be a useful motivation or retention incentive technique. This is discussed in more detail in the Part Four evaluation.

An interesting finding was that most firms had previous opportunities to spinout businesses and had chosen not to. Two companies responded that they would decide to keep a new business within the parent if they were based on technologies that may be useful to the companies' competition. They believed that if these businesses were separated from the parent the technology could be more easily obtained by their competitors. Another reason given for not spinning out a new business is that it could impact the parent firm's use of the technology in the future. This relates to two of the factors described in Section 3.0: technology synergies and relationship to core business. It is also interesting to note that the firm with the greatest propensity to spinout businesses (Thermo) stated that it does so for primarily one reason only – to take advantage of the business opportunity.

Licensing

All but one of the companies had licensed technologies to outside firms. The firms that had licensed technologies reported limited success and one company did not license any of their technologies because it believed there was little to gain in doing so. In fact, they believed that if the market was be willing to pay for such a technology, then they should sell the technology (in the form of a new business) on their own.

Part Three – Development within the Existing Organization

Key findings:

- Respondents indicated a strong desire to keep the technology or business internal if it was related to the firm's core business.
- One computer chip manufacturer believes that retaining a technology or potential new business within the existing organization helps deny the technology or market to the competition.

This section of the survey was designed to solicit responses that would identify factors important to formulating a decision to keep a business or product within the company as opposed to a spinout or licensing of the technology to another firm. As may be apparent, all of the companies indicated a propensity to develop business and technologies internally if the

technology was related to the core business. Historically, most of the responding firms kept new businesses within the parent. Even Thermo Electron keeps technologies related to its core business within its parent organization.

Another reason for keeping development internally was to deny both the underlying technology as well as the business opportunities to the competition. As a reasonable assumption, some companies believe that limiting the exposure of a technology limits the competition's access to that technology. The implication is that if it is important to your ongoing business, keep it within the parent organization.

Finally, one firm identified that the returns of the business was of particular importance in deciding to keep the development internal to the company. For instance the interviewee suggested that the short term versus long term returns of the projects played a significant role in making a development decision. If the rewards tended to be beneficial in the short term, and in his mind less risky, then the company should keep the technology within the firm. Consequently, if the investment was deemed to be longer term and, correspondingly the returns farther out, the firm would look towards outside financing sources (i.e, spinout or equity carve-out). One fact that must be mentioned is that all the firms surveyed indicated that the financial resources necessary to develop new technologies was not a limiting factor.

Part Four – Spinout

Key findings:

- Firms with a broad, diverse business base viewed the relationship to the core business as a non-essential element.
- If the market valued the potential spinout highly, one firm believed they should sell it.
- Firms with more previous spinout experience had a greater propensity to spinout new businesses.
- One firm mentioned the motivation to divest of a technology or business if the risk of financial "downside" or market volatility was high

In this section we asked the respondents to identify the factors they deemed important when making the decision to spinout a business. They were requested to identify factors that were specifically related to spinouts as opposed to internal development or licensing. We found that the companies with the most diverse and unrelated businesses tended to rate the relationship to the core business as low.

The companies with the greatest propensity to spinout business tended to spin the business out if the opportunity presented itself and if the market was willing to invest in the business. An anecdotal instance of this was noted in an interview with Gary Weinstein, CEO of ThermoTrex Corp., a spinout of Thermo Electron. Mr. Weinstein noted that in the early days of Thermo Electron much attention was given to the internal operating patterns of a new business prior to spinning it out to the public (i.e., management, a positive financial track record, etc.). But as the "Thermo" name and market presence became widely known, the up-front thought and planning expended prior to spinning out a business was focused on the public's desire to invest in the new business. Thermo now believes, in Weinstein's view, that if the market is willing to invest in a new business, that it is better for the investors and Thermo Electron to let the market be involved from the beginning. When questioned, most of the firms believed that external market conditions figured heavily in making the determination of the dispensation of a business.

SAIC tends view spinouts as way to limit the financial "downside" risk. This is true even in the case of a technology that is closely related to the firm's core business. The respondents believed that the company had a duty to the employee shareholders to maintain a conservative approach on "riskier" new technologies and business. The company believes that by retaining a significant share of the spinout, they can share in the "upside" while maintaining a diverse ownership position in riskier and/or more market volatile businesses. In general, risk was identified by the respondents as a major factor in determining whether or not to spinout a new business.

The responses validated our assumption that the companies with the greatest propensity to spinout businesses valued the need to provide incentives and motivation to its employees. As

discussed in Section 2.3.3, at least two factors help motivate employees in a spinout: 1) autonomy for the management team and 2) the liberal use of vesting stock and options as an incentive. .

The availability of logistic support in the spinout area was found to be of little consequence to the respondents, since all of those interviewed believed that the necessary support was easily obtained or developed. Our initial hypothesis was that the company must have some internal expertise in this area and someone to "champion" the spinout strategy. However, while the respondents placed little relevance in the lack of a "champion", the companies with more experience in spinning out businesses clearly demonstrated that the company as a whole became the champion and provided the spinout support.

Part Five – License a Technology

Key findings:

- Most firms are reluctant to license technologies or have not done so.
- The few instances of technology licensing occurred when the companies felt the technology would become a dominant design.
- Cross licensing can play an important role in competition.

In this section of the survey we asked the respondents to provide their views on the important factors in deciding to license a technology to an outside firm as opposed to developing it internally or forming a separate business unit. As with the other questions in the survey, we again asked the respondents to evaluate the factors in terms of their relative importance.

The majority of the respondents thought that the relationship to the company's core business was a relatively strong influence on making this decision, with the exception of one of the respondents, who had a purely financial background. However, a specific point of note is that while companies responded that they have licensed technologies, they stated that they are reluctant to do so. While we have no quantitative data to show otherwise, we concluded during the interviews that most of the respondents believe there was little to gain and much to lose in licensing. The notable exception to this opinion is when the technology can become a

standard or dominant design and the greatest share of revenues is reaped from the peripheral business and not the technology itself. This helps establish a larger market share of product technology without direct competition.

An R&D manager of a very large consumer products company stated that a major benefit of licensing is not from the royalty stream of a technology but from the cross licensing of a complementary technology from the licensee.

We also found that most respondents placed smaller significance on the maturity, or development stage of the project or the cost to develop the technology. The cost appeared to have much less impact on the decision, provided that the risk was not significant. In other words, the money can be found provided the risks are commensurate with the investment rewards. Our conclusion is that most companies avoid licensing technologies when possible.

Part Six – Is the project worth doing?

In this section of the survey we asked the respondents to rank, in terms of importance, the factors that were most important when making the decision to move forward with a project or to forgo the project altogether. The factors included: the relationship to the firm's strategy, the business opportunity, the financial returns, the marketability of the technology, the risk associated with developing the technology, the "fit"of the project into the company's current portfolio of development projects, and the finally the cost of developing the technology.

The managers view the business opportunity as the most important and the program balance (the mixture between developing new businesses and improving existing businesses) as the least important. However, the consensus begins to fall apart after that. We then begin to see a ranking that closely follows the personal background of the respondents.

For instance, the respondent or interviewee with the strongest technical background ranked project risk as the most significant factor in making the decision to move forward with a new business. This is in contrast to those respondents with financial backgrounds, who ranked risk and cost as the least important factors.

A surprising finding throughout the investigative process was that the majority of managers did not place more emphasis on designating a "champion" for the business or project. This fact seemed to become less important as the companies' propensity to spinout businesses increased. Only one company identified this as the most important factor. However, one respondent identifies the motivational effects the spinout would have on its employees as key determining factor.

It was clear throughout the interviews that the majority of managers with the broadest business experience believed that the opportunity and the "fit" of that opportunity within the firm's overall strategy held the most weight in the decision making process.

4.1 Conclusions of Survey

The information obtained from the surveys and interviews was used to develop the decision framework described in Section 5.0. As we integrated this information into the framework, we found the need to re-contact some of the respondents to request further information or clarification. While the readers of this document will not necessarily agree with the definitions and categories used in the framework, we believe that they best represent the information obtained through our literature research and the surveys and interviews.

5.0 Framework

The objective of this section is to develop a methodology to help companies decide what to do with technology development proposals – focusing on the tradeoff between internal development and spinoff/spinout. If we assume a decision has been made to "go ahead" with the development and "licensing the technology" is not being considered, the main question becomes: "Do we develop it internally or spin it out"?

The goal is to develop a scoring methodology to consider management's assessment of all of the relevant factors to help with a recommendation? For example, suppose a project has a positive net present value, but internal funds are scarce and there's a lack of market appreciation for the investment, neither an internal venture nor a spinout appears to be an attractive solution. When an obvious solution is not available, managers must make difficult choices. Our intent is to provide a framework to help managers assess all of the relevant factors and recommend a course of action based on these assessments and the consensus priorities determined in our research and surveys.

5.1 Methodology

The main objective is to encourage managers to systematically look at all of the relevant factors surrounding a new business or product development opportunity and provide a tool to help indicate the best course of action. We propose the use of a simplistic decision model to indicate whether an assessment of all the relevant factors points towards a spinout or internal venture.

There is no statistical basis for this framework. It is only an attempt to synthesize into a simple and logical decision matrix – based on our understanding and the inputs from some managers – the relevant factors that merit consideration in deciding whether or not it makes more sense to do a project in-house or spin it out.

The framework is composed of five steps:

Step one:

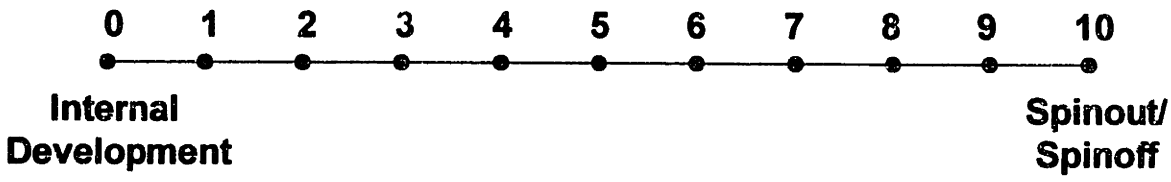
Logically arrange the relevant evaluation factors in related groups or "factor groups". For example, the following questions are all related to "Core Business". Is the project related to the core business? Is the firm concerned shareholders may perceive project as having minimum value or detrimental effects to the firm as a whole? Has the firm demonstrated past success in executing unrelated internal ventures?

Step two:

For each of the "factor groups", identify the characteristics of a project which most likely will lead to success or failure for each method (internal development or spinout/spinoff). For example, an unrelated new business opportunity, with concerns of shareholders negatively valuing the investment and the firm has no previous history of successfully executing unrelated internal ventures, will most likely lead to failure if attempted internally.

Step three:

Assess the "factor groups". Use flow diagrams to assess each "factor group". Assign a value for each factor on a scale from 0.0 to 10.0 based on the likely outcome. In other words, rate each potential outcome, with 0.0 representing a strong tendency towards more success developing the project internally. For example, the situation described in Step two above would yield a value of 10.0 since it is a prime candidate for a spinout.



Step four:

Determine the relative importance of each "factor group". Based on the survey results, weight each "factor group" as a percentage to reflect its overall relative importance. For example, the relationship to core business for a new business or product development

opportunity is a more important consideration in determining the project's execution than the need to incentivize employees. Therefore, it should be weighted more heavily.

Step five:

Determine the overall score. Synthesize the results based on: 1) the assessment of each "factor group" and 2) each "factor group's" relative importance. Multiply the "factor group" value by the "relative importance weighting" and sum for all the factors to determine an overall score. A score of 0.0 is a perfect candidate for internal development and likewise, a score of 10.0 is a perfect spinout candidate.

5.1.1 Step one – Evaluation Factors

The following is a summary of the factors described in Section 3.0 related to the internal venture versus spinout tradeoff:

Costs and Funding

- Sufficient funds available to cover development costs
- Concerned with earnings drag
- Attractiveness of equity markets

Core Business Relationship

- Relationship to core business
- Concerned with shareholder perceptions for unrelated business
- Past success or failure with internal developments of unrelated projects

Management

- Level of need for executive oversight
- Existence of a solid management team

Synergies

- Relationship to existing technical base
- Other synergies

Incentives/Motivation

- Effectiveness of internal programs for performance motivation and talent retention

Spinoff History

5.1.2 Step two – Characteristics of Success or Failure

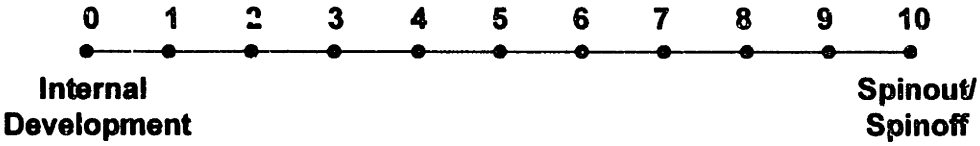
Based on our research and observations, we can assess the likelihood of success or failure of internal ventures versus spinouts based on an assessment of each of the factors.

Table 5-1: Characteristics of internal venture or spinout

Costs and Funding	
Sufficient funds available to cover development costs	Internal venture
Concerned with earnings drag	Spinout
Attractiveness equity market	Spinout possible
Core Business Relationship	
Related to core business	Internal venture
Concerned with shareholder perceptions for unrelated business	Spinout
Past success with internal developments of unrelated projects	Internal venture
Management	
Level of need for executive oversight	Internal venture
Existence of a solid management team	Spinout possible
Synergies	
Relationship to existing technical base	Internal venture
Other synergies, such as marketing or manufacturing	Internal venture
Incentives/Motivation	
Effective internal performance motivation programs	Internal venture
Spinoff History	
No past spinouts	Internal venture

5.1.3 Step three – Assessment of "factor groups"

Each potential outcome is assessed on a scale from 0.0 to 10.0, with 0.0 representing a strong tendency towards more success developing the project internally and 10.0 representing a



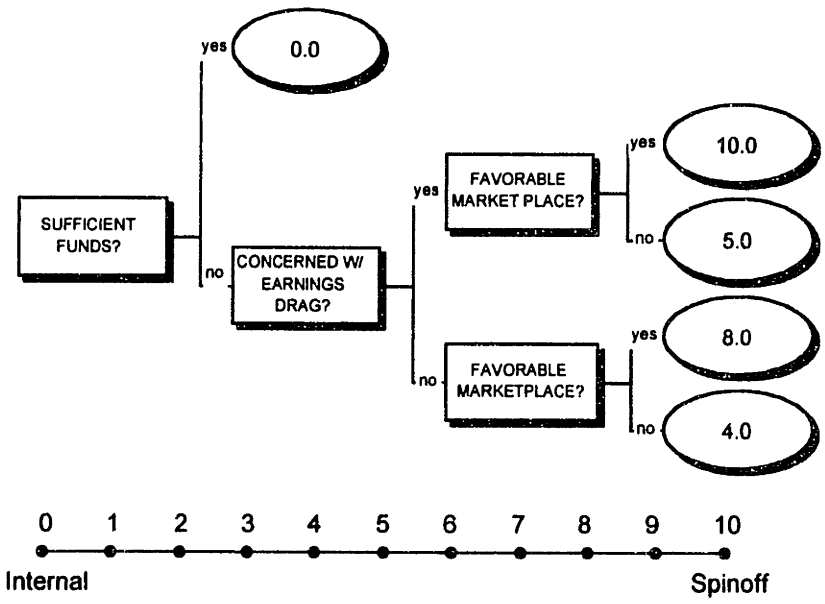
strong tendency towards more success spinning out a project. These assessed values are based on our conclusions derived from our research on the characteristics leading to successful or failed projects.

Flow diagrams can be used to clearly depict the tradeoffs that must be made for each area and the assigned values of the different outcomes.

5.1.3.1 Costs and Funding

Are there sufficient funds available to cover the development costs? If the answer is yes, an internal venture is possible and therefore rates a 0.0 value. If the cost of development exceeds the internal funds available, at least two other factors need to be assessed: concerns

Figure 5-1: Flow Diagram for Cost and Funding



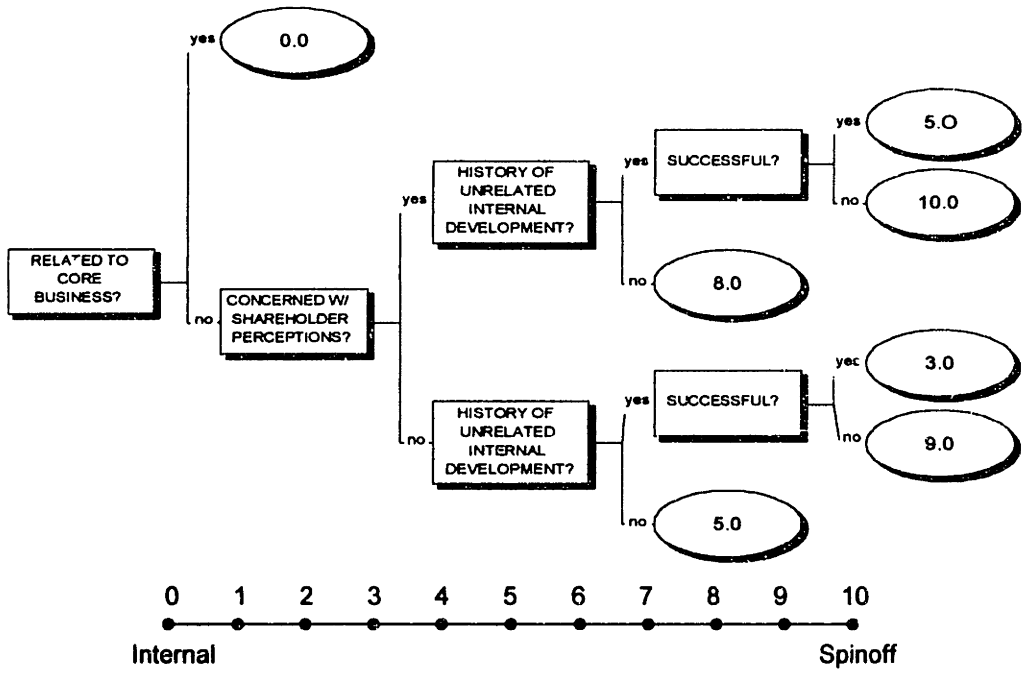
with negative impacts on the firm's earnings and the attractiveness of the equity markets to raise additional funding. A favorable marketplace valuation of the investment is the biggest driver in this case. An unfavorable marketplace yields values in the middle of the scale (5.0 and 4.0), since the lack of internal funds available and the inability to generate public funds representative of the investment's value doesn't point to either an internal venture or a

spinout. The combination of a concern for the firm's earnings and a favorable marketplace yields a value of 10.0, meaning a strong tendency towards a spinout for success.

5.1.3.2 Core Business Relationship

Is the new business or product development opportunity related to the firm's existing core business base? If the answer is yes, an internal venture is the most likely avenue for success and therefore rates a 0.0 value. If the new project is unrelated to the firm's core business, at

Figure 5-2: Flow Diagram to Assess Relationship to Core Business

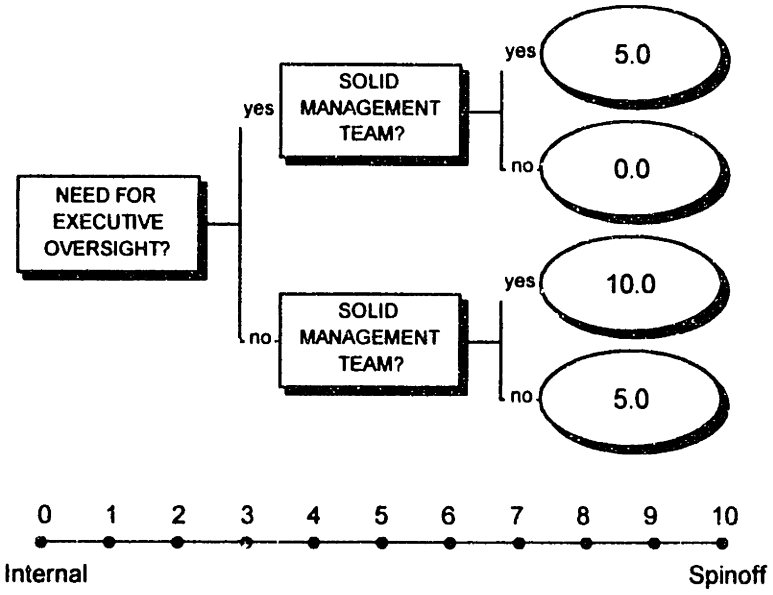


least two other factors need to be assessed: the concern that the shareholders' view of the investment will negatively impact the firm's market value and the firm's past history of unrelated internal developments. Obviously, if the firm is concerned about the shareholders' perception of the new project, a spinout is preferred (10.0). However, the more important consideration is the likelihood of success in developing an unrelated business internally. If the firm has demonstrated success with unrelated business ventures in the past, a value towards internal development is assigned.

5.1.3.3 Management

Two factors are extremely important for this area: Is there a high need for executive oversight and does the firm have a solid management team that can be trusted with independence? If there is a high need for executive oversight for whatever reason and the firm lacks a solid management team that can be trusted with independence, the assessment is obvious – the likelihood of success with a spinout is very low so the assessed value is 0.0. On the other hand, if there is not much need for oversight and the firm has a management team it can trust with independence, the assessed value is 10.0. Other combinations of these two factors present difficult tradeoffs and thus yields values in the middle of the scale (5.0).

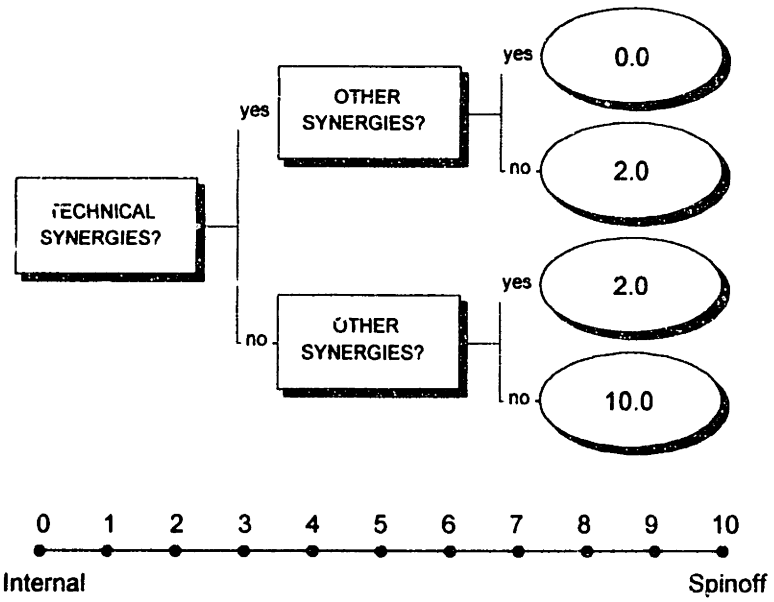
Figure 5-3: Flow Diagram to Assess the Management Team



5.1.3.4 Synergies

Does the new business or product development opportunity relate to the firm's existing technical base? Are there other synergies such as marketing, manufacturing, or distribution channels that may be realized with an internal development? A yes answer to both of these questions definitively points to an internal development (0.0), a yes answer to one of the questions also points towards an internal development (2.0), and a no answer to both points to a spinout (10.0).

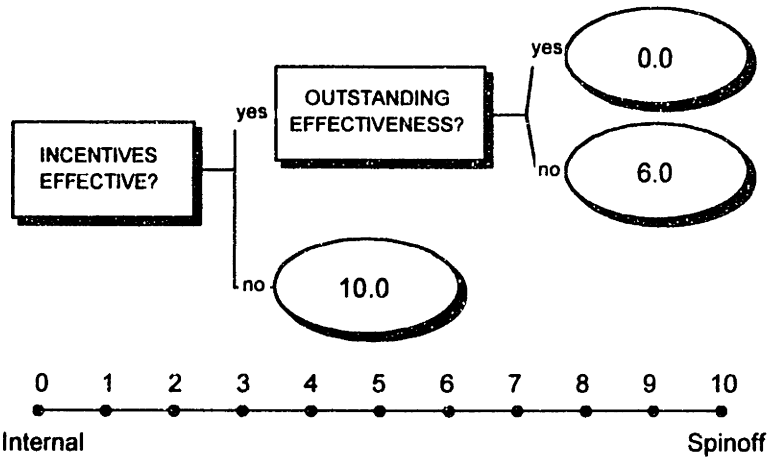
Figure 5-4: Flow Diagram to assess the Synergies of the Opportunity



5.1.3.5 Incentives/Motivation

Are the firm's internal programs effective for motivating and retaining top talent? A definitive yes signifies that the need to spin out a project to provide employee incentives is not necessary (0.0). However, the lack of effective motivation and talent retention programs points towards a spinout (10.0), for the reasons discussed in Section 2.3.3.

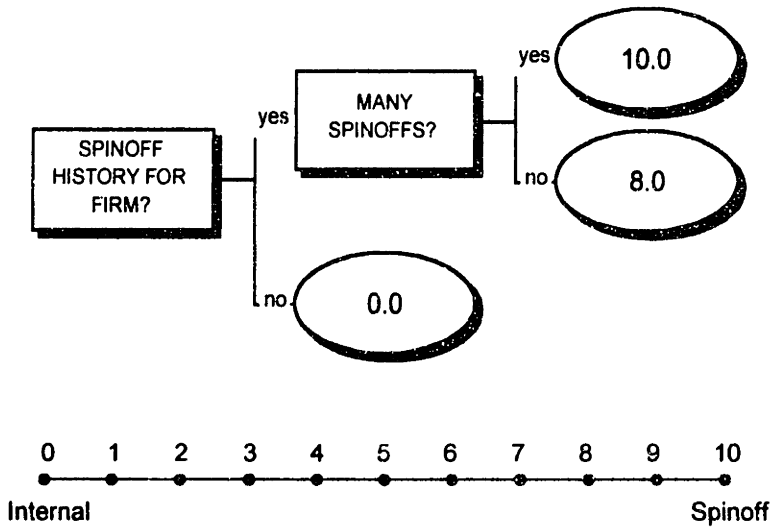
Figure 5-5: Flow Diagram to Assess Firm's Incentive Program



5.1.3.6 Spinout History

Has the firm ever engaged in a spinout in the past? If the firm has never done a spinout, the effort involved establishing the proper support mechanisms in terms of financial, legal and administrative support points towards an internal venture as the least painful road to take.

Figure 5-6: Flow Diagram to Assess Firm's Spinout History



5.1.4 Step four – Determination of Relative Importance

What factors are most critical to the senior management of a firm when evaluating a new business or product development opportunity? The difficulty is in prioritizing the importance of each factor. Certainly, some of the factors are more important than others in determining the disposition of a new business. For example, if development of unrelated businesses within existing organizational cultures has not been successful in the past for a particular firm, it is obviously recommended that a new project with similar characteristics not be undertaken within the existing organizational structure. Or, if the firm is confident that a particular investment will generate satisfactory returns but internal financial resources are not available, the firm must explore other alternatives for raising capital, such as a spinout. Or, if the firm determines that it cannot trust a management team with independence, the project must be developed internally.

For the reasons discussed in Sections 2.0 and 3.0 and based on the results of the surveys, we weighted the relative importance of each grouping of factors in the table below. The lack of a relationship to the firm's core business is the most important reason a firm should spinoff a business unit (assessed as High). Following in importance are management and funding (assessed as Medium to High). Technical and other synergies are assessed as Medium and incentives/motivation and spinoff history is assessed as low, in terms of relative importance. Based on these assessments, we assign appropriate "weighting factors" to each, ensuring the total equals 100 percent.

Table 5-2: Weighting of Factors

Costs and Funding	Medium - High	25%
Core Business Relationship	High	30%
Management	Low - Medium	10%
Synergies	Medium	20%
Incentives/Motivation	Low - Medium	10%
Spinoff History	Low	5%

5.1.5 Step five – Determine overall score

The final step is to multiply the "factor group's" values by the "relative importance weighting" and sum the results to determine an overall score. The closer the score to 0.0 indicates the assessment of all the relevant factor points towards an internal venture. Likewise, the closer the score to 10.0 points towards a spinout.

Example – Let's look at two hypothetical projects with the following characteristics:

	Project A	**Project B**
Costs and Funding	Sufficient funds available to cover development costs	Insufficient internal funds, concerned w/ shareholder perception, and favorable market conditions
Core Business	Unrelated to core business, not concerned w/ shareholder perceptions, past success w/ unrelated internal developments	Unrelated to core business, concerned w/ shareholder perceptions, past failure w/ unrelated internal developments
Management	High need for executive oversight; a solid management team exists	Low need for executive oversight; a solid management team exists
Synergies	Related to existing technical base, no other synergies	Unrelated to existing technical base, no other synergies
Incentives/ Motivation	Not sure of effectiveness of internal motivation/incentive programs	Not sure of effectiveness of internal motivation/incentive programs
Spinout History	Never done spinout	Never done spinout

Using the flow diagrams for each "factor group", we can determine a value for each of the grouped evaluation factors and determine an overall score by multiplying its "relative importance weighting" and summing the results.

	Project A					**Project B**				
	Weight		Value		Score	Weight		Value		Score
Costs and Funding	25%	X	0.0	=	0.0	25%	X	10.0	=	2.5
Core Business	30%	X	3.0	=	0.9	30%	X	8.0	=	2.4
Management	10%	X	5.0	=	0.5	10%	X	10.0	=	1.0
Synergies	20%	X	2.0	=	0.4	20%	X	10.0	=	2.0
Incentives/Motivation	10%	X	6.0	=	0.6	10%	X	6.0	=	0.6
Spinout History	5%	X	0.0	=	0.0	5%	X	0.0	=	0.0
Total					**2.4**					**8.5**

The total score points to a recommended approach. In this case, Project A is more likely to be successful with an internal development and a spinout is recommended for Project B.

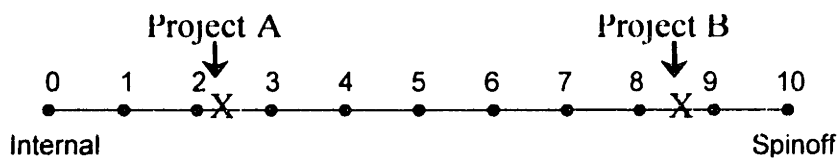


Table 5-3: Methodology Summary

	Weight	Value
Costs and Funding	20%	
Sufficient funds available to cover development costs		0.0
Development costs exceed internal funds available, **not concerned** with earnings drag, equity markets are **not favorable**		4.0
Development costs exceed internal funds available, **not concerned** with earnings drag, equity markets are **favorable**		8.0
Development costs exceed internal funds available, **concerned** with earnings drag, equity markets are **not favorable**		5.0
Development costs exceed internal funds available, **concerned** with earnings drag, equity markets are **favorable**		10.0
Core Business Relationship	30%	
Related to core business		0.0
Unrelated to core business, **not concerned** w/ shareholder perceptions, **past success** w/ unrelated internal developments		3.0
Unrelated to core business, **not concerned** w/ shareholder perceptions, **past failure** w/ unrelated internal developments		9.0
Unrelated to core business, **not concerned** w/ shareholder perceptions, **no history** w/ unrelated internal developments projects		5.0
Unrelated to core business, **concerned** w/ shareholder perceptions, **past success** w/ unrelated internal developments		5.0
Unrelated to core business, **concerned** w/ shareholder perceptions, **past failure** w/ unrelated internal developments		10.0
Unrelated to core business, **concerned** w/ shareholder perceptions, **no history** w/ unrelated internal developments		8.0
Management	20%	
High need for executive oversight; firm lacks solid management team		0.0
High need for executive oversight; a solid management team exists		5.0
Low need for executive oversight; a solid management team exists		10.0
Low need for executive oversight; firm lacks solid management team		5.0
Synergies	15%	
Related to existing technical base, other synergies		0.0
Related to existing technical base, no other synergies		2.0
Unrelated to existing technical base, no other synergies		10.0
Unrelated to existing technical base, other synergies		2.0
Incentives/Motivation	10%	
Internal programs effective for motivation and talent retention		0.0
Internal programs not effective for motivation and talent retention		10.0
Not sure of effectiveness of internal motivation/incentive programs		6.0
Spinout History	5%	
Never done spinout		0.0
Have done spinout		8.0
Spinout considered big part of firm strategy		10.0

5.2 Framework Constraints

- *Simplistic framework.* As discussed in Section 3.0, there are *many* factors a firm must consider in determining the proper disposition of a new business or product development opportunity. This attempts to simplify a complex problem; it does not attempt to account for all aspects of the problem. The goal is to simply encourage managers to systematically look at all of the relevant factors surrounding a new business or product development opportunity and provide a tool to help indicate whether an assessment of all the relevant factors points towards a spinout or internal venture.
- *Not statistically significant.* There is no statistical basis whatsoever for this framework. As stated earlier, it is based on inputs from selected managers and our understanding of the relevant factors that merit consideration in deciding whether or not it makes more sense to do a project in-house or spin it out.
- *Assumes a viable project.* The framework focuses on the tradeoff between internal development and spinoff/spinout. This assumes a decision has been made to "go ahead" with the development.
- *Quality inputs.* The output is only as good as the input. Since the framework relies heavily on managers' assessments of the relevant factors, poor judgement or inherent biases will obviously skew the results.
- *Author's judgement.* The assessment values correlating to the "factor groups" are based on our conclusions derived from our research on the characteristics leading to success or failure in projects. The values are obviously subject to debate or adjustment.
- *Not firm specific.* The "relative importance weightings" will vary from firm to firm, according to the firm's strategy, its current focus, its culture, and its management style. We determined the importance weightings based on our research and surveys. These should be tailored to the individual firm. For example, some firms are more concerned with reducing technical risk or liabilities; others (like Thermo Electron) rely heavily on spinouts to incentivize employees.

6.0 Case Studies

This section provides a more in-depth look at two companies who utilize the spinout mechanism: Thermo Electron and Science Applications International Corp., SAIC. These in-depth studies are included to highlight the thought process that went into developing the framework. We chose two companies that are considered innovative and have success both with internal business creation as well as spinoffs. It is our hope that these case studies give the reader more insight into why companies choose to spinoff or spinout new businesses. First, we provide some background on the two companies and explain their motivations. Then we apply the framework to the particular situations with these two companies in an attempt to test the framework's effectiveness. In the case of Thermo Electron, we give a description of the company and its history and highlight a specific spinoff example, Thermedics. We then apply the Thermedics case to our decision framework in an attempt to better understand Thermo Electron's motivations.

We then discuss SAIC and its recent disposition of its Network Solutions Inc., NSI, subsidiary. This case is described because it provides an example of a spinoff that was done explicitly for the purpose of taking advantage of a high valuation in the public market. This case also served to help eliminate certain factors from the framework methodology.

Finally, we apply the framework to another spinoff of SAIC; Tellium Corp. Tellium is a start-up striving to be a leading supplier of optical networking solutions for the telecommunications industry. Tellium provides a strong benchmark for the framework because it was an internally developed technology (developed within BellCore, a SAIC subsidiary), that could have moved forward within the parent or as aspinoff.

6.1 Thermo Electron

6.1.1 Introduction

Thermo Electron's strategy is identifying new markets and spinning out new projects in an agile startup environment. Thermo Electron is a leading manufacturer of environmental-monitoring and analysis instruments, paper recycling equipment, implantable heart pumps, mammography systems, alternative energy systems, and many other products aimed at

improving environmental quality, health, and safety. Thermo Electron is a $3.6 billion company whose main business is to generate new businesses – it is the parent of 22 publicly traded subsidiaries.

6.1.2 History

George Hatsopoulos – an MIT Ph.D. graduate, founded Thermo Electron in 1956. For the first ten years, the company performed contract research and development for the federal government and major power-generating utilities, growing to $2.9 million in revenue by 1966. At that time, the company began to set up business units to develop commercial products based on the firm's research in well-defined industrial market niches. Thermo Electron grew steadily through the 1970s, reaching revenues of over $230 million by 1981. In the early 1980s, the combination of the U.S. recession and the collapse of oil prices caused a sharp decline in Thermo Electron's revenues and profits. Hatsopoulos restructured the company, closed a number of plants, exited a number of markets, and redirected its strategy away from capital goods into higher growth technology-oriented environmental, biomedical and energy industries.[58]

By the early 1980s, the company's sales had grown to $200 million, the business had diversified greatly, and Thermo Electron was no longer a small company in which managers' performance was closely linked to the company's stock activity. Thermo Electron needed the ability to respond quickly to new opportunities, but the company faced a few obstacles:

- Motivating managers to take appropriate risks, since the size and diversity of the company had negative effects on its entrepreneurial edge.
- Raising capital to fund new ventures.
- Stopping new technology R&D outlays from negatively impacting the company's earnings.

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[58] Baldwin, Carliss Y.; Forsyth, Joetta; "Thermo Electron Corporation", Harvard Business School Case 9-292-104, June 1992

Hatsopoulos wanted his company to last "almost forever" – continually renewing itself by spinning off new businesses from a robust set of core technologies. As he explained:

> The probability of success of a new venture may be small, but the reward can be big. We want to go after big rewards. By having a diversity of businesses we can go after these rewards without betting the company. This way we average out the gambles – diversity is a central part of the company strategy. To do this successfully, we need to give very big incentives to the people who come up with new ideas while maintaining the environment and reward structure of a small company.[59]

6.2 Thermedics – Thermo Electron's First Spinout

In the early 1980s, Thermo had the chance to develop a revolutionary heart-assistance device, but at a substantial investment in development and commercialization cost over as long as ten years. Thermo Electron had limited funds available and was concerned about the artificial heart's impact on Thermo Electron's earnings. "To maintain our relationship with stockholders, we have to show a progression of profit, and thus we need to support earnings".

The solution: sell stock in a newly created subsidiary, Thermedics Inc. In 1983, Thermo Electron sold 16 percent of Thermedics. The public offering gave Thermedics managers three percent of the shares and turned them into entrepreneurs. The offering also raised over $5 million. Since then, the company has spun out divisions at the rate of about one a year. Following Thermedics in 1983 were the spinouts of Thermo Process Systems and Thermo Instruments in 1986, followed by Thermo Power in 1987, Thermo Cardiosystems in 1989, Thermo Voltek in 1990, and ThermoTrex a year later. Thermo spun out paper recycling equipment maker Thermo Fibertek in 1992, Thermo Remediation in 1993, and ThermoLase in 1994. In 1996, the company spun out Thermo Optek (optical instruments), Thermo Sentron (precision weighing and inspection equipment), ThermoQuest (mass spectrometers), and Thermo Bioanalysis (biochemistry and information management systems) subsidiaries. See Appendix II for a summary of all of Thermo Electron's subsidiaries.

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[59] Janower, Andrew S. and Sahlman, William A.; "ThermoLase", Harvard Business School Case 9-897-092, August 1996

Thermo Electron gives managers ownership in the spinout through options. If the spinout does well, the managers do very well themselves. They also have a lot more visibility for their work, and they have a following with investment analysts. By having to deal with outside investors, they gain a sense of being independent, which provides additional motivation.

Given Thermo Electron's success, why haven't other firms adopted the spinout philosophy? IBM has attempted to implement this structure to some degree, but it set up semi-autonomous divisions while still maintaining control. Hatsopoulos: "You cannot do it artificially. In other words, you cannot make those groups independent without a real mechanism because they know that you can give them some independence and then take it away. Therefore they really don't feel independent."[60]

6.2.1 Rationale

Thermo Electron spins off a business unit into an autonomous corporation when the unit has demonstrated the capacity to generate revenues, raise equity and debt, and function independently under its own management team. In an interview with Thermo Electron's treasurer, Mr. Theo Melas-Kyriazi, he stated the primary reasons for Thermo's spinout strategy is for the:[61]

- Development of incentives – the success of a new line of business is correlated to its employees' participation in the benefits of its success.
- Promotion of managerial accountability and depth – since the shares of the subsidiary are traded in the open market and thus, are under the continuous scrutiny of the public
- Cash generation – spinoffs provide the opportunity for the subsidiaries to raise their own capital in the equity market. Furthermore, they provide the opportunity to raise additional funds by means of convertible debt, at considerably reduced price compared to straight debt raised by the parent.

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[60] Kahalas, Harvey and Suchon, Kathleen; "Managing a perpetual idea machine: Inside the creator's mind", Academy of Management Executive, May 1995

[61] Yeroulanos, Pavlos, "Effects of a Spin-Off Strategy on Shareholders' Wealth: The Case of Thermo Electron Corporation", MIT Sloan Thesis, May 1994

Thermo Electron does not base their decisions to spinout a unit on any hard and fast quantitative rules. Hatsopoulos explains, "The bottom line, considering everything, is: what are the chances for a venture to succeed? We expect 70 percent of them to succeed. As it happens, more like 85 percent succeed. We are careful, because if we have too many failures, the whole strategy goes out the window."[62]

In order for a line of business to be deemed appropriate to function in autonomy, it must satisfy a certain set of criteria:[63]

- Opportunities for aggressive growth in a large potential market segment
- Strategic plan demonstrating growth and a need for financial support
- A product with the capacity to raise funds from various financial markets
- A solid management team which has demonstrated its capacity to function independently from the management of the parent company
- A future earnings stream whose potential is substantial enough to attract investors
- Receptive to the public in order to command an attractive offer price (depending on cycles in market conditions and market perception of value)

6.2.2 Results

In the late 1980s, a Wall Street analyst dubbed Thermo "A Perpetual Idea Machine". The company's spinout strategy has allowed it to successfully nurture a unique, entrepreneurial climate that allows employees to pursue their own ideas – and develop new businesses – while also creating long-term value for the company's shareholders. Hatsopoulos explains: "I do not believe that you can create new businesses and attract entrepreneurial teams that are motivated enough to make these new businesses succeed without giving them a sense of independence. His brother John, the company's president, adds, "We found that the only way we could sustain the process of creating new businesses was to be able to maintain the benefits of a small company while preserving the advantages of a big company."[64]

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[62] Baldwin, 1992
[63] Reese, Jennifer, "Thermo Electron: How To Grow Big By Staying Small", Fortune Magazine, December 28, 1992
[64] Baldwin, 1992

6.3 Thermedics Application to the Framework

In an attempt to better understand Thermo Electron's motivations, we evaluate each of the factors identified in Section 5.0. We reduced the information compiled through literature research, interviews, and surveys, into useable inputs and applied them to the framework.

6.3.1 Costs and Funding

Were there sufficient funds available to cover development costs? No.
Were there concerns about the negative impacts on the Thermo's earnings? Yes.
Were the equity markets attractive in order to raise additional funding? Yes.

Assessed Value = 10.0

6.3.2 Core Business Relationship

Was the new business related to Thermo's existing core business base? No.
Was there a concern that the shareholders would view the investment negatively? Yes.
Did Thermo have a history of internal developments of unrelated business? Yes.
Were they successful? Yes.

Assessed Value = 5.0

6.3.3 Management

Was there a high need for executive oversight? No.
Did a solid management team exist that could be trusted with independence? Yes

Assessed Value = 10.0

6.3.4 Synergies

Did the new business relate to Thermo's existing technical base? No
Were there other synergies, such as marketing, manufacturing, or distribution channels that could have been realized with an internal development? No.

Assessed Value = 10.0

6.3.5 Incentives

Were Thermo's internal programs effective for motivating and retaining top talent? No.

Assessed Value = 10.0

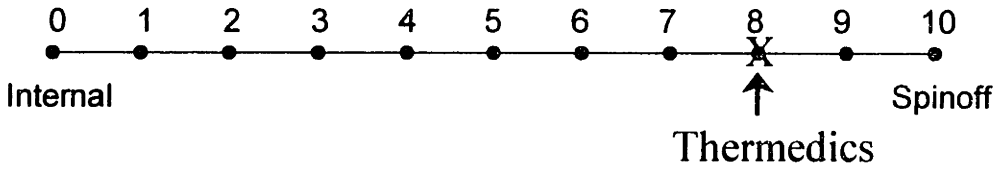
6.3.6 Spinout History

Had Thermo spun out businesses in the past? No.

Assessed Value = 0.0

Table 6-1: Thermo Electron –Thermedics Business Creation Value

	Weight		Value		Score
Costs and Funding	25%	X	10.0	=	2.5
Core Business	30%	X	5.0	=	1.5
Management	10%	X	10.0	=	1.0
Synergies	20%	X	10.0	=	2.0
Incentives/Motivation	10%	X	10.0	=	1.0
Spinout History	5%	X	0.0	=	0.0
Total					**8.0**



6.4 SAIC

6.4.1 Introduction

SAIC is a San Diego, California-based company with fiscal year 1998 revenues of $4.3 billion and approximately 35,000 employees. SAIC is an employee-owned, diversified professional technical services company. Since its inception in 1970 the company has grown dramatically and has always promoted an entrepreneurial spirit within its work force. The company is the largest employee-owned company in the United States whose shares are directly held by the employees, as opposed to being held in a retirement vehicle such as an Employee Stock Ownership Plan, or ESOP. While the company has grown dramatically over the last 28 years, its earnings are generated primarily through lower margin consulting and system integration contracts. The company now sees its ability to analyze and develop technologies as an entrée into increasing shareholder value. Because the company's structure is conservative due primarily to the employee ownership structure, the company maintains its conservative "full control of the business" approach by spinning off the riskier businesses. The company has recently spun off two businesses. The first is Network Solutions Inc.,

Network Solutions was spun off for a variety of reasons, but none stronger than to tap the frenzy of public capital being placed into Internet-related companies. The other influencing factor was a corollary to the first. SAIC employee shareholders were pressuring the SAIC Board of Directors to adjust the SAIC stock price to reflect the potential public market value of Network Solutions. The company eventually spun out 20 percent of Network Solutions to the public and increased the SAIC stock valuation by $300 million.

The second spinoff is Tellium Corp., a technology company that was born from the seeds of Bell Research Corporation, BellCore. A majority of Tellium (70 percent) was spun out to outside private equity and management to minimize both the technical and financial exposure to SAIC. The spinout of Tellium involved more analysis that of NSI, simply because it was relevant to SAIC's core integration and consulting business. Part of the spinout analysis involved changing the course of Tellium to become an equipment manufacturer and supplier.

6.5 Network Solutions, Inc. – a Spinout of SAIC

In the first quarter of 1995 SAIC acquired Network Solutions, the worldwide leader in Internet domain name registration services. The company currently acts as the exclusive registrar for second level domain names within the *.com*, *.org*, *.net*, *.edu,* and *.gov* top-level domains (TLDs). By registering Internet domain names, the company enables businesses, organizations and individuals to establish a unique Internet presence from which to communicate and conduct commerce.

Internet registrations within the TLDs maintained by the company increased by 6 percent from approximately 340,000 domain names registered at June 30, 1996 to approximately 908,000 at June 30, 1997, representing 87 percent of the companies total net registrations. Net revenue from Internet domain name registrations subscriptions accounted for 81 percent of the company's net revenue for the sixth months ending June 30, 1997.

The company also provides an Intranet consulting, network design and implementation service to large companies that desire to establish or enhance their Internet presence, or re-engineer their legacy network infrastructures. According to Zona Research, Inc. the market

for Internet services in the year 1999 will exceed $14 billion, up from $3 billion in 1996.

The company acts as the registrar for second level domain names within the .com, .net, .edu, and .gov TLDs pursuant to a cooperative agreement with the National Science Foundation. Prior to September 14, 1995 the agreement was a cost reimbursable, fixed-fee contract, under which the company was paid directly by the National Science Foundation for providing registration services. The National Science Foundation and the company amended the cooperative agreement to allow the company to charge customers a subscription fee of $50 per year. The Cooperative Agreement by its terms expires in March 1998, although the National Science Foundation may, at its option, expand the cooperative agreement through September 1998.

6.5.1 Why Network Solutions Was Spun Off

The company was acquired for the purpose of providing Internet integration services. The original intention of the acquisition by SAIC was to grow the company internally. SAIC purchased Network Solutions to complement its core competencies. Nobody in SAIC perceived that the Internet would take off like it has, from a commercial perspective. As the Internet explosion occurred in the 1990s, the company was presented with the dilemma of whether to invest more heavily in Network Solutions as a core business or attempt to attract outside capital. The company soon realized that keeping up with the Internet explosion would be too big of a drain on the use of its internal capital. Therefore, the company saw opportunities for generating capital from external sources. Originally the company sought investment from venture capital firms and other potential partners. Potential suitors consistently wanted control of the company; something that SAIC was not willing to give up. Therefore, in 1997 SAIC decided to tap the public markets.

SAIC retained 80 percent of th› ›mpany and spun out 20 percent to the public market. The transaction raised approximately $59 million, with SAIC receiving $10 million in dividend pay out and the remainder of the raised capital going directly to Network Solutions. The question we are addressing in this thesis is should the company develop the technology internally, should it spin out the technology, license it, or kill it. Clearly killing the

technology in this case is not a good option because of the demonstrated profitability. Developing the technology internally was not an option if Network Solutions was going to keep up with the Internet market. Licensing the technology was not in option because simply, there was no technology to license; this was, for all practical purposes, a customer service and integration business. Therefore, the only viable option in this case was to spin out the business.

Several factors came into play in executing the spinout. First, the company was looking for a CEO that was more experienced in public companies than in startup companies. This type of person was not going to be found within SAIC management. During the executive search for this individual, SAIC was suffering from the over-inflated market value for executive compensation in Internet-related companies. SAIC viewed this person as just another division manager and did not understand why the CEO should not be satisfied with a salary of $200,000 per year. Therefore, it was important that the incoming CEO is compensated heavily with stock options tied to the company's performance rather than with salary and bonus. Secondly, SAIC was carrying approximately $12 million in goodwill on its books from the acquisition of Network Solutions, which it wished to clear. And finally, SAIC perceived the Internet commercialization as a highly risky business, and wished to put it at an "arms length" fr AIC.[65]

6.6 SAIC – Tellium

Tellium was created from a spinoff of BellCore, the research laboratories of the Regional Bell Operating Companies, RBOC's that was created with the breakup of AT&T. SAIC acquired BellCore from the RBOC consortium in 1997. Tellium (not named at the time) was born from innovations created within BellCore. Tellium develops networking products for optical networks. These products were created from innovations that were developed within BellCore, but due to "non-compete" clauses with its previous owners (the RBOC's), BellCore had been forbidden from manufacturing any products. Tellium was founded in May 1997 with a portfolio of 52 patents and 13 employees from the Optical Networking

[65] This information was obtained from the Network Solutions offering prospectus as well as with interviews with the CEO and CFO of SAIC, and the current chairman of Network Solutions

team that had been associated with Optical Networking Technology Committee and the Multiwavelength Optical Networking Consortium projects at BellCore.[66] Tellium departed BellCore with the key developers (employees) of this technology.

6.6.1 SAIC – Tellium Application to the Framework

Like in the case with Thermo Electron, in an attempt to better understand SAIC's motivations we evaluate each of the factors identified in Section 5.0 for the Tellium spinout. The primary source of this information was direct discussion with SAIC's representative to the Board of Directors of Tellium.

6.6.1.1 Costs and Funding

Were there sufficient funds available to cover development costs? No.
Were there concerns about the negative impacts on the SAIC's earnings? Yes.
Were the equity markets attractive in order to rise additional funding? Yes.

Assessed Value = 10.0

6.6.1.2 Core Business Relationship

Was the new business related to SAIC's existing business base? No.
Was there a concern that the shareholders would view the investment negatively? Yes.
Does SAIC have a history of internal developments of unrelated business? No.

Assessed Value = 8.0

6.6.1.3 Management

Was there a high need for executive oversight? No.
Did a solid management team exist that could be trusted with independence? Yes

Assessed Value = 10.0

6.6.1.4 Synergies

Did the new business relate to SAIC's existing technical base? Yes
Were there other synergies, such as marketing, manufacturing, or distribution channels that could have been realized with an internal development? No.

Assessed Value = 2.0

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[66] From Tellium briefing and interview with member of Board of Directors

6.6.1.5 Incentives

Are SAIC's internal programs effective for motivating and retaining top talent? Yes.
Are SAIC's incentive programs considered outstanding? No.

Assessed Value = 6.0

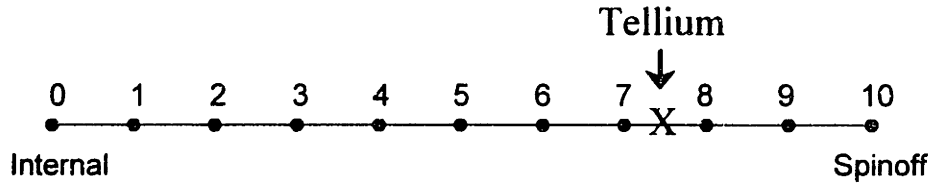
6.6.1.6 Spinout History

Has SAIC spun out businesses in the past? Yes.
Many times? No.

Assessed Value = 8.0

Table 6-2: SAIC – Tellium Business Creation Value

	Weight		Value		Score
Costs and Funding	25%	X	10.0	=	2.5
Core Business	30%	X	8.0	=	2.4
Management	10%	X	10.0	=	1.0
Synergies	20%	X	2.0	=	0.4
Incentives/Motivation	10%	X	6.0	=	0.6
Spinout History	5%	X	8.0	=	0.4
Total					7.3



7.0 Summary

This thesis was prompted by our curiosity of several trends in the U.S. high technology industry – mainly the incredible boom of startups in key high technology sectors and the increasing use of the spinoff mechanism by many large corporations.

Our objective was to learn more about the different methods for creating new businesses from internal technological developments. We discovered, when technology innovation occurs in an established company and the firm is faced with a new business or product development opportunity, five outcomes are likely: 1) the company develops the technology within its existing business and organization; 2) the company spins-off the project into a separate business unit; 3) the company sells or licenses the technology to another firm; 4) the entrepreneur leaves the company to start his or her own business, or; 5) nothing happens and the innovation is never developed.

We observed factors that exist in successful innovation efforts, as well as the obstacles or characteristics that work against an organization. We explored three difficult questions facing a firm when presented with a new business or product development opportunity: 1) Is the project worth doing? 2) If the project is worth doing, should the firm develop it themselves? 3) If the firm decides to develop it themselves, should the firm develop it internally or pursue a spinout or spinoff strategy

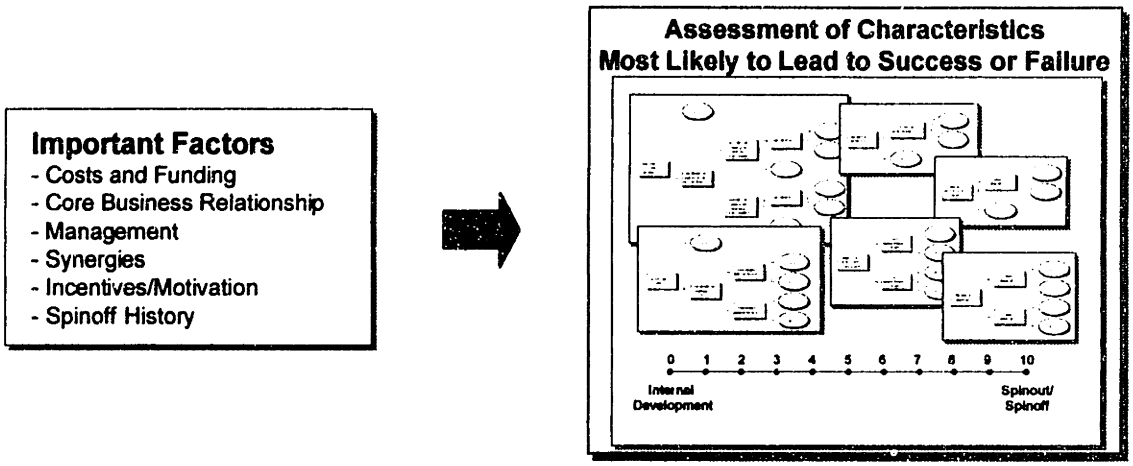
7.1 Why we developed a framework

We created a framework to help managers decide the best course of action for a new business or product development opportunity – to help them towards a better understanding of the factors that lead to success and failure. What we found in our research was that a significant amount of work had been done in why incentive plans worked, and why spinoffs were or were not successful. What we did not find was a model that would allow a manger to make an informed decision on what to do when faced with the dilemma of creating a new business. Therefore, we attempt here to create a basic model that can be followed by a manager when

faced with that decision. This model was developed from the insight gained from our research, interviews, and surveys.

7.2 How we developed the framework

We created the framework by performing an in-depth analysis of the research that had been done on spinoffs and incentives to promote business creation. We then applied our findings to develop questions that we posed to managers involved in these decisions within companies that had seen both success and failure in attempting to create new businesses. After



identifying the important factors to be evaluated, we attempted to correlate the characteristics that lead to success or failure in internal developments and spinouts. We then created a survey to prompt discussions with managers involved in the business creation process. The surveys were used to solicit viewpoints on the information that we believed to be relevant to the validation of our decision framework. The purpose was to identify the important factors considered in determining the proper disposition of a business creation proposal. It is important to note that these surveys were not conducted in a quantity or format to gain statistical significance but rather to solicit specific responses. As can be seen from the survey (see Appendix I), the questions were tailored specifically to the internal decision making process that takes place within the closed ranks of a company's leadership. Using decision flow diagrams, we allocate "values" based on an assessment of the project characteristics in each area. This was an iterative process that was limited by the low number of surveys and time constraints; additional iterations could further refine the framework to a more useable state. Finally, taking into consideration the "value" for each factor (determined by an assessment of the project's characteristics on a scale of 0.0 to 10.0) and the relative

importance of each set of factors (as determined by the surveys and interviews), we can calculate an overall score for the project. The final score is reflective of the likely outcome of success of failure of the project and determination to keep the creation of the business internal to the parent organization or spin it out.

7.3 Our Conclusions

We have developed a framework that we believe is useable by managers to asses the disposition of a project. We have based the framework on past research, surveys and interviews, as well as our own perceptions and experience. The table below summarizes the relative importance of the relevant factors. From this information and through application of the framework defined in Section 5.0, management can make an educated assumption about the disposition of a project.

Table 7-1: Weighting and Value

Costs and Funding	Medium - High	25%
Core Business Relationship	High	30%
Management	Low - Medium	10%
Synergies	Medium	20%
Incentives/Motivation	Low - Medium	10%
Spinoff History	Low	5%

There are many factors a firm must consider in determining the proper disposition of a new business or product development opportunity. This thesis attempts to simplify a complex problem; it does not attempt to account for all aspects of the problem. The goal is to encourage managers to systematically look at all of the relevant factors surrounding a new business or product development opportunity and provide a tool to help indicate whether an assessment of all the relevant factors points towards a spinout or internal venture.

There is no statistical basis for this framework. As stated earlier, it is based on inputs from selected managers and our understanding of the relevant factors that merit consideration in deciding whether or not it makes more sense to do a project internally or spin it out. It

assumes that a project is viable and the decision has been made to move forward with the project. The framework focuses on the tradeoff between internal development and spinoff/spinout.

In addition, the output is only as good as the input. Since the framework relies heavily on managers' assessments of the relevant factors, poor judgement or inherent biases will obviously skew the results. The assessment values correlating to the "factor groups" are based on the author's conclusions and judgement derived from our research on the characteristics leading to success or failure in projects. The values are obviously subject to debate or adjustment. Another limitation is that the framework is not firm specific. The "relative importance weightings" should vary from firm to firm, according to the firm's strategy, its current focus, its culture, or its management style. We determined the importance weightings based on our research and surveys. These should be tailored to the individual firm. Some firms are more concerned with reducing technical risk or liabilities; others (like Thermo Electron) rely heavily on spinouts to incentivize employees.

8.0 Potential Future Work

8.1 Further validation / refinement of the framework

Increase the sample size to improve the inputs into the framework. A large number of surveys could provide relative importance weightings with statistical significance. In addition, more applications of the framework to actual internal developments and spinouts will go a long way towards refining the "factor values". The framework can also be expanded to consider the pros and cons with licensing technologies and to address the spinoff versus spinout tradeoff.

8.2 Valuation of company IPOs to determine value of "lost" projects

A detailed analysis of startup firms may also be useful. Can we make a compelling argument to large firms' top management by gathering data on the financial performance of startups? Although we're not certain of the probability of success, the idea is to 1) compile a list of initial public offerings over the last 15 years for technology sectors; 2) research the biographies of the founders; 3) attempt to correlate startups with "parent" firms to see if any trends emerge (are there a significant number startups attributable to one "parent" firm?); and 4) assess the aggregate value of the startups in comparison to the "parent" firm. One magazine reported there is over 200 startups in Washington State run by former Microsoft employees. Imagine the headline: *Startups Founded by Former Employees of Make Believe Corp. Valued at $300 million – 30 percent of Make Believe Company's Net Worth.* Hopefully, the result could be used to help top executives recognize the need to develop an effective means for addressing and implementing divergent business ideas.

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Appendix I - Survey

INTRODUCTION

THIS SURVEY IS DESIGNED FOR MANAGERS PARTICIPATING IN DECISIONS TO INVEST IN NEW BUSINESSES OR PRODUCTS.

This survey is being conducted as part of a student research project at the Massachusetts Institute of Technology's Sloan School of Management. The purpose of the study is to determine what factors are most critical to the senior management. More specifically, what factors are most important in deciding whether to develop a new business internally, spinout or spinoff a business unit, license the technology or forgo the opportunity?

The goals of this study are:

(i) To determine the key factors that influence management's decision to move forward with a new business or project

(ii) To determine the factors that play the most significant role in "spinning off" a business.

(iii) To develop a framework based on this data to help management better understand the factors that contribute to the success or failure of a business and to decide the best course of action when presented with a new business or product development opportunity.

PERSONAL INFORMATION

Name:_____ Telephone:_____

Company/Organization:_____ FAX:_____

Your Title:_____ Email:_____

Please rate your firm's propensity to create new business, either internally or externally:

❑ High ❑ Low ❑ Never

Confidentiality: *Information provided on this questionnaire will remain confidential and data will be presented in aggregate only. Individual questionnaires will not be released to any party for any purpose whatsoever.*

Please fax responses to:

MIT Sloan School of Management
Management of Technology Office, Attn: Greg MacDonald
50 Memorial Drive, Suite E52-101, Cambridge, MA 02143
Voice Number: 617-253-3733, Fax Number: 617-253-3154

Please direct questions to Charles Myers or Ken Jacobson.

PART 1 – Please tell us about your firm

How many employees are in the firm?	❑ fewer than 1000 ❑ 1000 to 4999	❑ 5000 to 9999 ❑ 10,000 or more
What were the last reported annual revenues?	❑ less than $250M ❑ $1B to $5B	❑ $250M to $999M ❑ greater than $5B
What was the firm's average growth rate in revenues over the past five years?	❑ less than 10% ❑ greater than 15%	❑ 10% - 15%
How is the firm owned?	❑ Public	❑ Private
Does the firm view itself as an innovative organization?	❑ yes	❑ no
Does the firm view itself as a technology leader or follower?	❑ leader	❑ follower
Does the firm create new technologies internally?	❑ yes	❑ no
How many divisions or single business units does the company have?	❑ less than 5 ❑ 10 or more	❑ 5 to 9
On a scale of 1-5 (5 being autonomous), how much autonomy do divisions have with respect to decision making?	1 2 3 4 5	
Do the divisions require approval before spinning-off or selling a technology or innovation from:	❑ Sr. V.P ❑ Board of Directors	❑ CEO
Does the firm have an excess or shortage of internal funds available to support new internal business/project development?	❑ excess	❑ shortage

PART 2 – Your Firm's Business Creation History

Has the firm ever spun-off a business or a technology into a separate company? If yes, how many times?____	❑ yes	❑ no
Has the firm ever licensed an internally developed technology to an outside firm? If yes, how many times?____	❑ yes	❑ no
If the company has spun-off businesses, did the new management come from within the parent firm?	❑ yes	❑ no
If management came from within the firm, were they initially involved in the development of the technology?	❑ yes	❑ no
If the firm has created a new business from internal innovations, were the innovations related to the firm's core business?	❑ yes	❑ no
Has the firm had opportunities to spin out new technologies and chosen not to?	❑ yes	❑ no

If so, what were the main reasons for not choosing to spin out?

_____

PART 3 – Development within the existing organization:

Please provide your views on the important factors in deciding to develop a new business or product **within the existing organization** (as opposed to spinning-off the business or licensing the technology). Evaluate the following factors and rate them in terms of relative importance:

	Weak/Low					*Strong/High*
Relationship to Core Business – Closely tied to core business? Potential market related to existing business base?	1	2	3	4	5	6
Technology Synergies – Degree to which technology relates to the parent firms' existing technical base?	1	2	3	4	5	6
Other Synergies – Marketing, manufacturing, distribution channels?	1	2	3	4	5	6
Firm Strategy – Traditional project development method?	1	2	3	4	5	6
Organization – Culture, size, flexibility supports internal development? Sufficient personnel resources available (numbers, skills, a quality management team)?	1	2	3	4	5	6
Financial Resources – Internal funding available to support development costs?	1	2	3	4	5	6
Incentives/Motivation – Need for added employee incentives?	1	2	3	4	5	6
Management – Desire for top-level management oversight or control?	1	2	3	4	5	6
Other:_____	1	2	3	4	5	6
Other:_____	1	2	3	4	5	6

PART 4 – Spinout or Spinoff:

Please provide your views on the important factors in deciding to **spinout** a new business or product from the existing organization (as opposed to developing it within the existing organization or licensing the technology). Evaluate the following factors and rate them in terms of relative importance:

	Weak/Low					*Strong/High*
Relationship to Core Business – Lack of business synergies? Unrelated to existing technical base?	1	2	3	4	5	6
Firm Strategy	1	2	3	4	5	6
Organization – Organizational culture, size, flexibility does not support internal development?	1	2	3	4	5	6
Financial Resources – Need or desire to raise equity capital through public? Concerned with development costs eroding the firm's earnings?	1	2	3	4	5	6
Incentives/Motivation – Need to incentivize employees? Employee turnover a problem? Difficulty attracting and retaining the best talent?	1	2	3	4	5	6
Market Conditions – Favorable market conditions for IPO? Ability to generate greater financial support if separated from firm?	1	2	3	4	5	6
Management – Existence of a quality management team that can be trusted with independence?	1	2	3	4	5	6
Spinout Support – Legal, administrative, management, and finance expertise available to execute spinout?	1	2	3	4	5	6
Other:_____	1	2	3	4	5	6
Other:_____	1	2	3	4	5	6

PART 5 – License a technology:

Please provide your views on the important factors in deciding to **license a technology** to another firm (as opposed to developing it within the existing organization or spinning it out). Evaluate the following factors and rate them in terms of relative importance:

	Weak/Low					*Strong/High*
Relationship to Core Business – Lack of business synergies? Unrelated to existing technical base?	1	2	3	4	5	6
Firm Strategy	1	2	3	4	5	6
Organization – Organizational culture, size, flexibility does not support internal development?	1	2	3	4	5	6
Financial Resources – Internal funding insufficient to support development costs?	1	2	3	4	5	6
Technology Maturity – Benefits do not outweigh the project risk?	1	2	3	4	5	6
Development Portfolio – Sufficient mixture of short, medium, and long term projects?	1	2	3	4	5	6
Other:_____	1	2	3	4	5	6
Other:_____	1	2	3	4	5	6

PART 6 – Is the Project Worth Doing?

Please provide your views on the important factors in making a decision to move forward with, or forego a new business or product development opportunity. Rank the following factors in terms of relative importance (with 1 being the most important):

Firm Strategy – Does it fit with firm strategy (e.g. technology leader, seeking new markets)? Growth objectives? _____

Business Opportunity: Is there a market for the product? Return on investment? Competitive advantage? Profitability? _____

Technology: Technically feasible? Technology strength in terms of breadth, patentability, and competitiveness? Is the technology considered embryonic, evolving, and mature? _____

Risk: Probability of success? Payoff justifies risk? Cost? Schedule? _____

Program Balance: Satisfactory mixture between improving existing products and work on new products? Current mixture of development programs satisfactory (i.e. short, medium, and long term)? _____

Cost _____

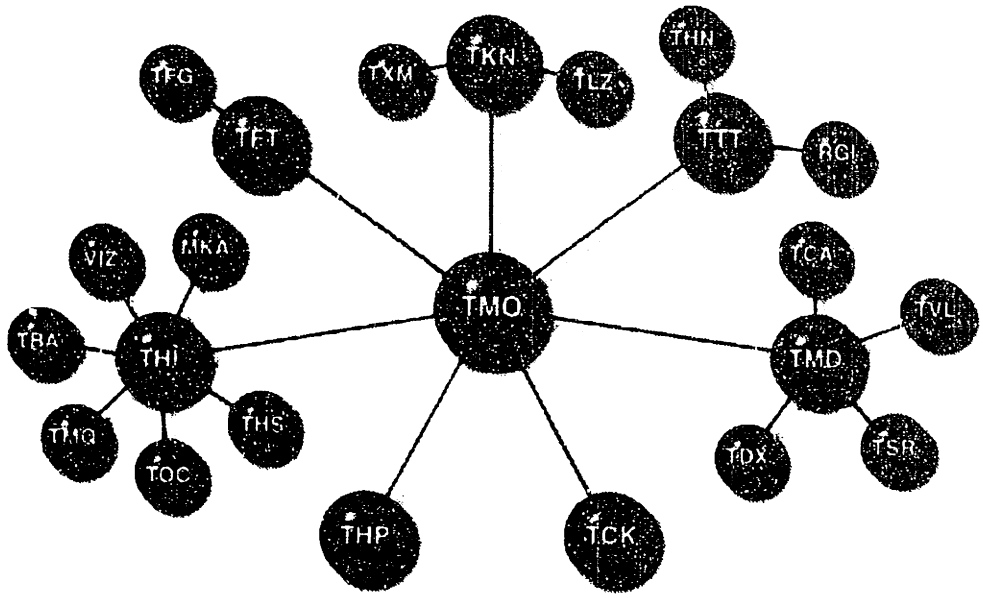
Other:_____ _____

Other:_____ _____

Other:_____ _____

Appendix II – Thermo Electron Companies

THERMO ELECTRON COMPANIES



Thermo Electron Corporation (TMO) - Instrumentation, biomedical products, alternative-energy systems, paper-recycling equipment, and other products and services related to health, safety, environmental quality, and personal care

Thermedics Inc. (TMD) - High-speed detection systems for product quality assurance, weighing and inspection equipment, electronic test instruments, explosives detectors, polymers, and biomedical products

Thermo Instrument Systems Inc. (THI) - Analytical, environmental-monitoring, and process control instrumentation

Thermo TerraTech Inc. (TTT) - Specialized industrial services, including environmental-liability management, infrastructure engineering, laboratory testing, and metallurgical heat-treating

Thermo Power Corporation (THP) - Intelligent traffic-control systems, industrial refrigeration systems, gasoline and natural-gas engines, natural-gas cooling and cogeneration units, and propane-powered lights

Thermo Cardiosystems Inc. (TCA) - Heart-assist devices, blood-testing equipment, and related disposables

Thermo Voltek Corporation (TVL) - Electromagnetic compatibility testing instruments, power-conversion systems, and power amplifiers

ThermoTrex Corporation (TKN) - Advanced-technology R&D, general-purpose and specialized X-ray systems, and laser-based hair removal

ThermoLase Corporation (TLZ) - Laser-based hair removal and personal-care products

Thermo Fibertek Inc. (TFT) - Paper recycling and paper making equipment, water-management systems, and accessories

Thermo Remediation Inc. (THN) - Environmental-liability management and compliance services, including fluids and soil recycling, nuclear remediation, and data-management systems

Thermo Ecotek Corporation (TCK) - Environmentally sound power plants and fuels, and naturally-derived crop-protection products

ThermoSpectra Corporation (THS) - Imaging, inspection, measurement, and temperature-control instrumentation

ThermoQuest Corporation (TMQ) - Advanced analytical instruments, laboratory equipment, and consumables for pharmaceutical development, biomedical research, environmental analysis, and forensic investigation

Thermo Sentron Corporation (TSR) - High-speed, precision-weighing and inspection equipment

Thermo Optek Corporation (TOC) - Optical spectroscopy and surface-science instrumentation

Trex Medical Corporation (TXM) - Mammography equipment and other specialized and general-purpose X-ray systems

Thermo Fibergen Inc. (TFG) - Systems to recover materials from papermaking sludge and to convert them into value-added commercial products

Thermo BioAnalysis (TBA) - Instruments and laboratory information management systems for biopharmaceutical research and clinical diagnostics

Thermedics Detection (TDX) - High-speed analytical systems for consumer product quality assurance and explosives detection

Metrika Systems (MKA) - On-line industrial process optimization systems

Randers Group (RGI) - Engineering consulting and outsourcing including water and wastewater treatment, transportation projects, process engineering, construction management, and operational services

Thermo Vision Corporation (VIZ) - Light-based technologies for scientific and industrial operations