From Invention to Innovation



U.S. Department of Energy
Inventions & Innovation Program

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Contents

Contents 2
Prologue 3
Acknowledgments 3

Part One: You, Your Technology, and The Innovation Process 4

The Innovation Process 4
Commercialization Strategies 6
Sources of Capital: Where the Money Comes From 12
Summary of Part 1 15

Part Two: Assessing Your Current Status: The First Step . . 16

Steps in Cadence: Prototype Development and the Engineering Process 16
Market Analysis: So It Works . . . Who'll Buy It? . . . 20
Business Development: The Strategy and Structure of the Innovation Process 22
Facing the Planning Task 23
Planning to License or Venture 26
Summary of Part 2 30

Conclusion 30

Appendix 1: Glossary of Commercialization Terms 31
Appendix 2: Bibliography of Useful References 37
Appendix 3: Legal Considerations 43
Appendix 4: Commercialization Planning 45
Appendix 5: Business Planning 47

Prologue

The Inventions and Innovation Program, formerly known as ERIP (Energy-Related Inventions Program), was established by the U.S. Congress in 1974. For many years it served as the only government program specifically offering assistance to independent inventors and very small businesses engaged in developing new energy-saving technologies.

I&I Program funding is based on a competitive proposal process. Requests for proposals are issued once each calendar year, usually in the spring. Proposals are selected for funding through a merit review process, judging all acceptable proposals against criteria published in the request. Moreover, the program's managers share important expectations with corporate finance committee members, informal or angel investors, and venture capitalists. The I&I Program exists to promote energy-related innovation that supports the Department of Energy's mission. In the I&I Program, that means support goes to technologies that are headed toward the market. The prospects for commercial success are an important ingredient in every decision to offer financial support through the program's grants.

This program remains clearly focused on energy generation and savings. It has refined that focus to target those industries representing major energy consumers in the United States. Streamlining the process of soliciting, evaluating, and funding projects means that inventors can receive funding for product development quickly and with a clear sense of what the funds are supporting.

For a full program description, the most recent solicitation announcement, program news, and helpful information, we refer readers to: http://www.oit.doe.gov/inventions

Acknowledgements

We want to acknowledge and thank a number individuals and organizations who have made it possible to revisit, revise, and update the material in this pamphlet. Above all, we thank the inventors, technologists, and entrepreneurs who have participated in the Inventions and Innovation Program as well as its predecessor, the Energy-Related Inventions Program, over the years. The content and any insights come from their open and honest discussion of their successes and failures in the innovation process. We hope their experience will continue to offer guidance to others with ideas for new technologies and ideas for products and services. We are certainly grateful for what we have learned from them.

The part Harold Livesay played in the original creation of the material in this document also deserves special recognition. His knowledge of business and business history as well as his wit and style put an unmistakable stamp on the work. His vision of what inventors, entrepreneurs, and owners of small businesses really need to know also goes a long way toward explaining why the Inventions and Innovation Program continues to receive requests for this pamphlet well over a decade after its first release. A great deal has changed in the past decade, but the basic views he held then (and continues to hold now) still ring true.

The personnel in the Inventions and Innovation Program deserve recognition and thanks, both for administering the financial support the U.S. Department of Energy provides for energy-related inventions and for the commitment to providing support that goes beyond the DOE grants. The information and encouragement this pamphlet intends to convey is just one example of the way the program mission seeks to disseminate information and support inventive activity. For more than 20 years this program has offered a range of services to talented inventors and entrepreneurs seeking to move technology and products from the world of ideas into market reality.

Revising and updating this material has brought both pleasure and a deep sense of responsibility. The pleasure has come in revisiting important topics. For any errors or omissions we accept responsibility. Finally, we thank you, the readers who continue to ask for such material, for your persistence in planning innovations. Your innovative efforts are what bring new products, processes, and services into the nation's market places.

David Lux and Marcia Rorke
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Part One

You, Your Technology, and The Innovation Process

If you have a technology or the idea for a product that you want to market profitably, you confront a long, vexing journey across tough terrain littered with the hulks of abandoned ideas, many of them good ideas. Some new products, however, do survive the trip. Dozens of them reach the market every year, sustaining the energy of the American economy and enriching their creators—at least sometimes. The purpose of this document is to increase the probability that your technology will make it and you will benefit.

The first step in making your idea one of the survivors is learning about the obstacles lying between you and the market. The second step is learning to plan a strategy that will see you safely through the barriers—in effect, learning to navigate. The final step requires actually making such a plan and executing it. We have designed this document to help you with the first two steps by showing that the major obstacles to commercialization fall into definable categories. By breaking these obstacles down into their components, and then translating them into sets of sequenced tasks, you can overcome them. Mastering this process will provide you with the foundation for step three: systematic, professional-caliber planning and execution.

To get an innovation into the market you must do more than just develop something that works. You must match technical development to an appropriately synchronized, increasingly sophisticated assessment of both your market and the channels through which your product may reach it. At the same time, you must evolve a business structure appropriate to more than just your stage of technical development. At the very least, your business structure must meet the needs for market research, the requirements for capital, and its obligations to government agencies (for example, paying taxes, meeting environmental regulations, keeping records to support patent claims). In addition, it must protect your (and other people's) investment in your technology.

This coordinated linkage of technical, market, and business development of a new technology comprises the "innovation process." Without comprehending that process you cannot plan effectively; unless you plan effectively you have little chance of seeing your idea commercialized. The innovation process necessitates planning for a variety of reasons, not the least of which is because without a persuasive plan you will not succeed in attracting the people and capital.

Getting your product to market will almost certainly require a formal business plan. Long before then you must begin planning, in writing, addressing your technical, marketing, and business strategies. The sooner you master this process the better. Moreover, a process of ongoing planning will help you organize your activities and accustom you to integrating technical, market, and business data. Unless you do these things, you will ultimately exhaust your resources without having shaped your technical insight into an attractive investment opportunity. Remember always that relying on sheer technical merit will surely lead to failure. On the other hand, while systematic planning based on the innovation process does not guarantee success, it vastly improves the odds. Systematic planning begins with learning about the process that confronts you.

The Innovation Process

The Innovation Process Table (next page) shows, in outline form, the relationship between technical, market, and business steps in the innovation process. It also lists some of the skills and people required as the process advances. This table, like all such linear, bi-dimensional representations of complex human processes, embodies some shortcomings, primarily in oversimplification (the actual process requires many more skills and people than could be shown here) and truncation. (The managerial stage, if represented in a scale proportionate to the two preceding stages would require a piece of paper 6 feet long.) The table, nevertheless, reflects the essential realities of commercialization of new products by independent or small business innovators. Above all, it accurately represents the relative relationships you should maintain between the columns as you proceed through the steps of technical development.

TABLE 1: THE INNOVATION PROCESS

Innovation Stage: Product Definition to Engineering Prototype

Technical Steps	Market Steps	Business Steps	Skills Required	People Involved
Product Definition	Preliminary Market Definition	Decide to Develop Define Intellectual Property Strategy	Intuition to Technical	Inventor
Working Model	Market Analysis Define: Buying Keys Three Points of Difference	Find Money File Patents Complete Commercialization Plan	Technical to Engineering	Inventor Local Technicians Friends as Investors
Engineering Prototype Test Refine	Identify Market Barriers	Find Even More Money Establish Intellectual Property: Patents/Trade Secrets Trademarks/Copyrights Decide to License or Venture Start Business/ License Plan	Engineering Legal Market Analysis Capital Acquisition	Inventor Engineer Patent Attorney More Investors Market Analysis Business Planner

Entrepreneurial Stage: Prototype to Production

Technical Steps	Market Steps	Business Steps	Skills Required	People Involved
Production Prototype Scale Up Test Refine Production Engineering Product Safety Engineering	Full Market Analysis and Plan Niches Barriers Pricing Competition Cost Data Distribution Method Alternative Applications Risk Analysis Sales Projections Hire/Train Sales Force Establish Warranties/Exchanges Arrange Customer Financing	Find Big Money Complete Business Plan Form Business Meet State and Federal Regulations Arrange Insurance Price Production Facility	Engineering Production Production Safety Entrepreneurial Financing Marketing Cost Analysis Legal Management	Inventor (?) Entrepreneur Investors Engineers Production Safety Attorneys Patent Corporate Accountants Consultants Marketing Business Management Financial Insurance Brokers Trade Union Officers
Limited Production Qualification Testing Running Changes	Contact Customers Commence Distribution Seek Product Endorsements Follow up Sales Advertise Publish in Technical Journals	Find Big, Big Money Start up Business Build Plant Buy Equipment Hire/Train Production Workers Arrange Product Service Purchasing Transportation Record Keeping	All of the Above **-PLUS-** Specialty Engineering Systems Engineering Sales Analysis Supervisory	All of the Above **-PLUS-** Foreman Labor Sales People Specialty Engineers Systems Engineers
Full Production Start up	All of the Above **-PLUS-** Expand Distribution Analyze Competitor Response	All of the Above **-PLUS-** Monitor Costs Finance Cash Flow Deficit Refine Production System	All of the Above **-PLUS-** Delegation Market Forecasting Strategic Planning Long-Term Financial Projections	All of the Above **-PLUS-** Expanding Management Sales Labor Force
Initial Growth	Increasingly Complex		Increasingly Complex	Venture Capitalist (?)

Managerial Stage: Production for Major Market Penetration

Technical Steps	Market Steps	Business Steps	Skills Required	People Involved
Product Improvement New Products Sustained Growth	Complexities Intensify		Complex Management	Entrepreneur (?) Fully Bureaucratized Management R&D Staff Venture Capitalist

Thus, for each step in the technical column, market and business steps run parallel. This arrangement embodies the hard reality that only the existence of a market justifies full technical development, and that effective market analysis and technical development absolutely require simultaneous attention to the creation of an appropriate business structure. Among these factors, you should keep in mind the primacy of the market, as well as the fact that as you seek support to continue technical development, you will increasingly have to define your market and back up that definition with evidence, not assertions.

While developing a new technology, however, most innovators tend to focus primarily on the invention itself: Does it work? Can it be made to work? If it works, does it do its task as well as or better than existing methods? In fact, the most crucial question that confronts any new technology is not "Will it work?" but: "Assuming it works as well as I think it will, will anybody buy it?" Unless the answer is that enough people will buy it at a price that will yield an adequate profit, it doesn't matter whether it works; it makes no sense to spend time and money on technical development. Many inventors ignore this most crucial of all questions. Or, starting from the self-evident truth that unless the thing works, no one will buy it, they reason their way to the comforting but spurious conclusion that if and when it works, everyone will want it.

Don't get caught up in this "better mousetrap" mythology. Take a trip to your neighborhood hardware store and ask for a better mousetrap. See what they show you, and ponder the lesson carefully. Of course, your technology will have to work in order to market it. Moreover, you may need persuasive, documented evidence assembled (expensively) by some independent, nationally recognized institution to persuade folks that it does work, but you will only reach that point if you get compelling, detailed answers to the ongoing question: "Who will buy it?"

No matter where you stand at this moment, from now on the question of how and to whom you will sell your technology should influence every decision you make, every step you take, whether you decide to license or venture. Eventually, the task of selling your technology will absorb more time, energy, and money than further perfecting it technically. People with whom you will have to interact in order to obtain the resources you will require will increasingly concern themselves with you, in addition to your invention. Your invention may provide proof of technical skills, but extensive support will additionally require demonstrated business skills from you, your associates, or your licensee.

Once you accept these linkages between the components of the innovation process, you will realize that you must broaden your scope beyond technical development into such things as commercialization strategies.

Commercialization Strategies

In order to reach the market, somebody has to produce your technology, and somebody has to sell it. In fact, as your invention moves toward the market, business skills become more important than technical skills. Your project will need increasing quantities of time from people who have these skills and, of course, it will consume more and more money. Because many innovations compete for these limited resources, however, you will need the kind of plans that impress them—the people who thoroughly understand the innovation process, or at least the business side of it. You will vastly improve your prospects of getting help from these folks by demonstrating your own comprehension of the process and your determination to commercialize your invention as soon as possible. You must write a plan that emphasizes overall business perspectives, not just technical elegance. For example, venture capitalists, the professionals who invest their own and other people's money, have a maxim that goes: "We'd far rather take a chance on a first-rate manager with a second-rate product than on a first-rate product in the hands of a second-rate manager." First-rate managers are, by definition, first-rate planners. As an innovator, you may lack experience, but you can start the learning process by planning for a clear and stable goal: reaching the market.

Basically, there are two ways to commercialize a technology: either you license someone else to produce and/or sell it, or you do the job yourself. Other options are variations of these two possibilities. Both of the principal commercialization strategies have implications you'll need to consider as you go along.

The Licensing Option

Licensing tempts many inventors because the amount of money, as well as the catalog of tasks, skills, and people required, may seem considerably less than in running your own business. That doesn't necessarily mean it's the right alternative for you. In the first place, you may not find a licensee, and you can bet none will find you. In the second place, even when it's possible, licensing has its pros and cons. Here are some considerations:

The Negative

- **You lose control of the technology.** Usually total control, for a long time, and often forever.
- **Your own involvement is reduced.** In most cases, you'll have no further direct involvement at all. You may stay around as a consultant to the licensee, but usually for a limited time only.
- **Finding the right licensee is tough.** The right one may make you rich. The wrong one may bury your technology, or butcher it. Even if you can eventually get it back, it may be too late.
- **Protecting your interests is crucial.** But it's also extremely difficult to do. Negotiating with licensees means playing with the big boys. They confront you with the immense staff resources of the corporation—lawyers, market analysts, production engineers---a tough team for you to take on by yourself. Licensing agreements, when properly done, result from tough negotiations between two parties. The other side has professionals to represent it, so you better have one of your own. If you're an amateur at the game—and you almost certainly are—you need the help of a professional with experience in such negotiations.

The Positive

- **Licensing multiplies the resources to develop your invention.** The licensee, if it's a dynamic firm—and you don't want to license any other kind—can immediately put whole teams of professionals to work developing, producing, and marketing the technology. Insurmountable financial mountains to you may be petty cash molehills to them.
- **They see things you don't.** Licensees often perceive uses, and therefore markets, for your inventions that you don't see. One licensee turned a salt-water taffy machine into a new and highly efficient concrete mixer. The more markets, the more potential income.
- **You may make some money and you may make it soon.** The licensee may pay you money up front, although probably not as much as you hope. In addition, they may agree to a minimum amount of royalties for some period.
- **Licensing frees you to do something else.** If what you want to do is retire, or go back to developing new products, then giving up control of the technology may serve your interests rather than defeat them.

If you have a technology with a demonstrably strong potential market, thriving businesses out there may want your invention. Some large corporations regularly acquire new products that way, but you should also keep in mind that smaller firms, though they may be less well known, offer possibilities as well. Many of them can't afford expensive research and development programs, but nonetheless need new products. Furthermore, smaller firms often operate much more dynamically than big ones, so don't write them off.

Before considering licensing, however, you should be able to answer yes to all these questions:

1. **Do you have a patent, copyright, or other legal protection?**

   If not, you won't get far, because no company will risk investing in an unprotected innovation. Why should they pay you for something you don't own?

2. **Do you have a working model, or better yet, an engineering prototype?**

   If not, you can't prove the thing will work with competitive efficiency (unless it's self-evident that it will, which doesn't happen often). If you haven't made it work, your licensee will have to, which will cost them money, which will weaken your bargaining position. Indeed, licensing may succeed or

fail on the basis of your technical development prior to licensing. Your licensee may have neither the skill nor the commitment that you bring to the task.

3. **Do you have credible data about the size of the market, including probable impact of selling price on quantity demanded?**

4. **Do you know what it will cost to produce at various levels of output?**

You may have thought licensing would enable you to avoid the last two of these questions. On the contrary, if you don't know the answers, then you don't know what your invention will be worth to your licensee; therefore, you don't know what payments you can reasonably demand. Your licensee will work up a version of all these figures. You may not be cheated, but these estimates of sales and profits are likely to be on the low end and costs on the high side.

In short, you not only have to demonstrate technical feasibility, you also have to demonstrate your understanding of production and marketing in a written plan. Planning will help you decide whether you want to venture or license in the first place, and then help you carry out that decision by supplying you with the data you need to raise money for your own business, or to persuade a prospective licensee to talk you out of it.

At the very least, if you decide to license your invention, you'll have to complete the steps on the Innovation Process Table through a "working model." Reaching the "engineering prototype" stage would greatly increase both your chances of finding a licensee and the amount of money you may convince the licensee to pay. By contrast, if you want to start your own business, or develop a product within a business you already operate, you'll have to do everything on the table through the "entrepreneurial stage."

Doing It Yourself: The Venturing Strategy

Starting your own business, or venturing as it's often called, will require more from you, but has its own advantages and disadvantages to consider:

The Disadvantages

- **It's risky.** Many new businesses fail. A new business built around a new product runs a double risk, especially because the list of reasons for new business failures reads like a catalog of many inventors' weaknesses. These include (among many, many others):
  - lack of management skills
  - overestimating the market
  - poor planning
  - inability to delegate responsibility
  - inadequate financing.
- **Resources remain limited.** You'll have whatever money you yourself can raise, and raising the kind of money required to set up mass production and marketing usually takes a professional. If you aren't one, you'll have to find one.
- **You'll be spread increasingly thin.** As the number of tasks and skills required multiplies—and it does, with a vengeance—you'll spend more and more time either doing them, or finding someone who can and will.
- **You probably won't make much money for quite a while.** Building a business gobbles cash, and a lot of it will continue to be yours. If you can find a company and finance it adequately, you may be able to pay yourself a salary, but it'll probably be modest—your backers will expect you to be frugal with their money.

The Advantages

- **Running a company can be exciting.** If you have the will and skill, you may enjoy it more than inventing. Some inventors are entrepreneurs by experience, and some by instinct. The inventor/entrepreneur can sometimes achieve powerful things, as Edwin Land at Polaroid and Bill Gates at Microsoft have shown. The combination, however, occurs rarely.
- **In the long run, you may make a lot more money**. If your invention turns out to be a big success, your rewards could vastly exceed the royalties you could expect from any licensing agreement.

- **Even if it's your company, you may not have to run it.** Building a successful business involves hiring all kinds of people, as the table shows. This could include a chief operating officer. There are plenty of examples of inventors who retained a large or controlling interest in their companies, but turned the management of it over to someone else.

Obviously, being in business for yourself can mean a lot of different things. You may decide you want a company that engages in the whole range of activities involved in designing, manufacturing, and selling your product. More likely, you will focus on some parts of the process while making arrangements with other firms to do the rest of it. After all, even General Motors buys a lot of its parts from independent suppliers and lets franchised dealers do the retailing.

As the sponsor of an invention, you may already be in business formally. Even if you think that you don't have a company in the legal sense, the day you commit yourself to making a financial success of your invention you embark on a business enterprise in the eyes of the Internal Revenue Service, however small and informal that enterprise may seem to you. Therefore, if you haven't yet thought of the time and money you've invested getting this far in terms of a business proposition, start now, whether you think your business will stay small or grow. If you haven't created a structure that provides you with limited liability (that is, a structure that legally insulates your personal assets against losses you may incur in your business), you should see a lawyer soon. Prospective investors will concern themselves with this issue, even if you haven't.

If you intend to develop your business around your technology, experience suggests that your company will have to grow, even if it's sometimes possible to get an invention into the marketplace without building a large company. If, for example, you've invented a specialized tool with a large profit per sale, you may be able to bootstrap your business by selling one, taking the proceeds and making two more, selling them and making four, and so on. Even in such rare cases, however, you will ultimately have to decide to stay small (running the risk that some larger firm, seeing your success, may invade the market with a competitive product) or to expand.

If you run a growing business you'll eventually need capital from outside sources, which means you'll need a formal business structure providing limited liability to investors—one in which tasks are subdivided functionally (manufacturing, marketing, and others) and assigned to professionals hired to carry them out. The two things intertwine, because no rational investor will put up the kind of money you'll need for a company of even modest size unless you have at least a plan for such a formal structure. Investors know, even if you won't admit it, that inventors generally prefer doing everything themselves; moreover, they know that building a successful enterprise absolutely requires genuine delegation of authority, something most inventors find extremely difficult to do. If you hope to grow a business, therefore, you must accept the ironic proposition that to keep overall control yourself, you'll have to delegate a lot of specific authority to other people.

Successful management of a business requires launching, mastering, and controlling a dynamic process, as well as dealing with continuous change caused by such things as the business's growth, new technology in the industry, revisions in tax laws, and behavior of competitors. A successful, growing, and dynamic business rests on a foundation of continuous planning, involving constant updating to reflect changing circumstances, goals, and organization. The plan will help keep you on track, and it's an invaluable tool with which to sell yourself and your business to prospective investors, customers, and suppliers, as well as to the people you want to recruit for your company. This last has crucial importance, because you can't grow much without first-class help, and people worth hiring want to know what they're getting into, especially in terms of future prospects.

Prerequisites Common to Licensing and Venturing

Despite the apparently great differences between licensing and venturing as commercialization strategies, they prove to have a lot in common, including certain prerequisites. Some things you simply have to do whether you hope to persuade someone else to buy the rights to produce and distribute your invention, or decide to do it yourself. Remember that either way somebody will have to spend money, a lot of money. Whatever you may have spent so far will shrink in comparison with

what's required henceforth. So whether you want to go on and market it yourself or convince someone else to buy the rights to do it, you have to put together a convincing package. This includes:

- **Proof that it works.** This means a working model, or better yet, an engineering prototype. There's no substitute for showing investors or would-be licensees something they can see, touch, and watch do its stuff. Without at least a working model, you haven't much chance of interesting people beyond family and friends who put their trust in you personally. Strangers (and friends who are experienced investors) demand:

- **A market analysis.** This means a serious breakdown of who the potential customers are, how many of them there are, how much they will pay, what the competition is, and how you will beat it. In addition, you need to know the channels through which products like yours reach the market.

  You should be able to show three significant points of difference between your product and the competition. If you can't, you've got a problem. You had better be sure your invention has no fatal flaws. For example, one inventor had a device that depended on a manufacturer converting an experimental glass product into a mass production item. When the manufacturer quit making the glass, he effectively killed the invention at the same time.

  Above all, you have to be able to show why people will buy your product, and show this through statements from prospective customers, backed up with believable figures in dollars and cents. The surest way to turn off any prospective investor who asks about the market is to say, "When they see it, they'll jump for it." It ain't necessarily so. Your market analysis determines whether it's worth going on with your invention, regardless of its technical elegance, and that analysis forms the basis for the next thing you need, which is:

- **A written plan.** What kind of plan you'll need depends on your commercialization strategy. If you want to license, your commercialization planning will generate the information you need. The outline in Appendix 4 will get you started with the writing.

  If you plan to venture, you will need a formal business plan (Appendix 5). This is a detailed analysis showing what you intend to do to develop, market, and sell your technology, how much all this will cost, and who will do the work required with all this information translated into a year-by-year, dollars and cents projection 5 years into the future. Investors (other than friends and family) will absolutely demand such a plan; prospective licensees may insist on one. And even if they don't, you should have one. Without it you have little ammunition with which to combat their campaign to beat down your price.

Other Factors in Choosing A Commercialization Strategy

In deciding to license or venture, you should accept that, either way, you will have to give up some measure of ownership and/or control. In a sense, therefore, you're not deciding whether to get out, but when, how completely, under what circumstances, and by what method. In other words, you're looking for an exit strategy at the same time you're looking for a commercialization strategy.

In addition, no matter which commercialization strategy you follow, you will increasingly have to involve yourself with people from the business world. These folks have different imperatives, different expectations, and speak a different language from yours. Many of them care nothing about technology except as a possible money spinner. Like it or not, you will increasingly need these people, so you have to learn to deal with them pretty much on their terms. They're not likely to translate their professional language for you. Understanding these realities of the business world is just one of the skills of the entrepreneur, a role you'll have to understand and that someone—you, a partner, a licensee—will have to play. Building a business absolutely requires the skills of the entrepreneur: the know-how to assemble all the components, make them function harmoniously, and sustain growth. If you yourself have run a business, you have a first-hand idea of what it takes. If you haven't, then you have a lot to learn. Whether you have the aptitude for it is something you have to ask yourself, and answer honestly.

If you decide that you aren't cut out to be an entrepreneur, or don't want to be one, that doesn't mean you can't create a business around your invention. It does mean you'll have to get an entrepreneur on your team, and soon. They don't come easy; you'll have to do sufficient spade work to turn up enough evidence to persuade one to cast his or her lot with you and your technology. And they don't come cheap; entrepreneurs want a piece of the action, probably a big piece, but may be worth it: Chester Carlson was an inventor who couldn't balance his checkbook, much less run a company, but an entrepreneur named Joe Wilson made him a multi-millionaire by building a company called Xerox.

Every library has do-it-yourself handbooks containing self-administered tests that will help you decide, but you can begin dealing with the question of whether you want to be an entrepreneur by looking at the Innovation Process Table and answering these questions:

1. Which four tasks do you do best?
2. Which four do you do worst, or think you would do worst?
3. Which four tasks do you enjoy most, or think you would enjoy most?
4. Which four do you enjoy least, or think you would enjoy least?

If at least half your answers to question 1 don't come from columns other than the technical column, or if more than half of your answers to question 2 do come from the business or market columns, you probably aren't much of an entrepreneur.

If at least half your answers to question 3 don't come from columns other than the technical column, or at least half the answers to question 4 do come from the business or market columns, then you probably don't want to be an entrepreneur. (Of course the reverse applies as well.)

These questions about what you do best and enjoy most aren't just a gimmick to help you decide if you're an entrepreneur, or whether you want to license your invention or run your own business. They also serve to introduce another dimension you should consider carefully in deciding how to commercialize your technology—the dimension of costs.

Think About Costs At All Costs

As you know, there are three kinds of costs: money, time, and personal. The three of them are intertwined, and to some extent interchangeable. If you think you can't afford to hire a model maker, for example, you may decide to save money by building it yourself at a cost of your time, which in turn often involves a personal cost to your health, your marriage, and so on—not to mention the fact that you may produce a poor model.

To measure these costs accurately in relationship to one another, you must understand and apply the principle of opportunity cost. In terms of money, it's the interest lost by putting money somewhere other than in the safest investment you can find, such as U.S. government securities. That's exactly what you've done when you've put your money into your invention. It's also what you'll be asking investors to do, and you can bet your last dime that professional investors never lose sight of opportunity costs. They'll demand a steep price for putting money into your high-risk venture.

Opportunity costs, however, also apply to time and personal costs. While you're doing one thing, you can't be doing something else, and if you spend a lot of time doing things you don't do well, you may be wasting something more precious than money. In the long run, money costs may be the least expensive of all because, if you run out of money, there's always bankruptcy. If you run out of time, there's only the grave. Financial bankruptcy is as American as apple pie, and plenty of people have survived it to go on to later success. Bankruptcy in time or spirit, on the other hand, is a disaster from which there often is no recovery.

All this argues for riding the expert express instead of the do-it-yourself local. The Innovation Process Table should convince you that eventually you'll have to get expert help. (If you have a patent attorney, in fact, you already have.) Look at the table and at your answers to the previous set of questions. Keeping in mind the interplay of the three kinds of costs, including the opportunity cost factor, ask yourself again: "What's the best way to commercialize my invention, and what help do I need first to get the show on the road?"

Many innovators will of course respond, "Whatever strategy I choose, whatever step I decide to take next, whatever role I see for myself, the help I need is money."

Sources of Capital: Where the Money Comes From

This subject—finding money to finance perfecting a product, producing it, and getting it into the market—concerns every inventor. Unhappily, as you will see, it turns out to support only a brief discussion here. No easy answers, sure-fire solutions, or readily accessible pools of funds exist.

Debt Capital (or going to the bank)

A prevailing axiom says banks won't finance inventors. Generally, that seems to be true, but startling exceptions to the rule do sometimes turn up. In addition, the late Al Shapero, a professor at Ohio State who did most of the empirical research in this area, found banks more willing to lend to new businesses than the conventional wisdom and literature would suggest. Shapero suggested some basic principles to keep in mind when trying to borrow from banks. First, don't take no for an answer, even within a specific bank. He found instances where loan officer B approved an application that loan officer A had tossed in the waste basket. Second, try more than one. If bank A says no, go to bank B, and so on until you run out of banks. They don't all have the same loan policies, especially for small business. In addition, you may find small banks more receptive than big ones. Business tends to gravitate to big banks; small ones often have to scramble for it.

New banks may prove more receptive than old ones. Four centuries ago, Machiavelli recommended to the ambitious that they attach themselves to rising newcomers who need followers, rather than hunt for a place near the established greats, who already have their retinue of retainers. It works in politics, and sometimes applies in banking as well.

Obviously you can't approach any banker armed only with a lot of fast talk about your invention's technical capacities. Even the most liberal banker has a business outlook, so you'll need to have a business-like proposition, which means once again you have to have your homework done and refrain from nonsensical statements on the order of, "When they see this, they'll have to buy it." They won't. On the other hand, if you do have a business proposition that the banker won't take a chance on, he or she may know somebody in the informal investment network to whom you can talk.

You also can use your own (and others') credit cards as a source of debt financing. On the upside with this option, you'll need neither plan nor permission (other than a healthy credit limit). On the downside, it's easy to exceed your limit quickly, things can get out of hand quickly, and this option can become very pricey. Think carefully.

Potential suppliers and customers stand to gain from your success. They probably won't throw any cash your way, but suppliers may extend credit, and prospective customers may give you advance orders.

Government Funding

The federal government has numerous sources of support for innovations (write your senators and congressional representative), and you should not neglect state and local governments as potential sources of assistance. Take a look at the Inventions and Innovation Program and the Small Business Innovation Research Program (SBIR) at the U.S. Department of Energy.

California, Connecticut, Massachusetts, Ohio, and other states have venture capital funds. So-called enterprise zones and incubators have appeared in many areas, and offer various kinds of assistance to business start-ups. Staffs in such organizations often have contacts with prospective investors.

Equity Capital

What we know about equity financing for innovation in the American economy suggests that understanding the funding process requires peeling back several layers—like peeling an onion. The visible outer layer consists of formal investment capital companies, including small business investment companies, the investment banking network, the stock market, and so forth. At the core of the onion sits the inventor supporting development out of the family income while contributing time, skill, and labor—building "sweat equity" in the technology. Between these two extremes, the makeup of the intervening layers remains somewhat unclear. As we describe it, bear in mind that exceptions

exist to every general statement, but that planning based on exceptions runs high risks.

The capital layers of the onion relate to the stages of development shown on the Innovation Process Table. As the inventor moves down the table, he or she moves from the core toward the outer skin of the onion, but only by taking steps in the marketing and business columns in parallel to the technical steps. As we've argued throughout, the farther you go, the more money you'll need; the more money you need, the more you'll have to present formal, systematic evidence, in the form of a plan, of your product's market potential.

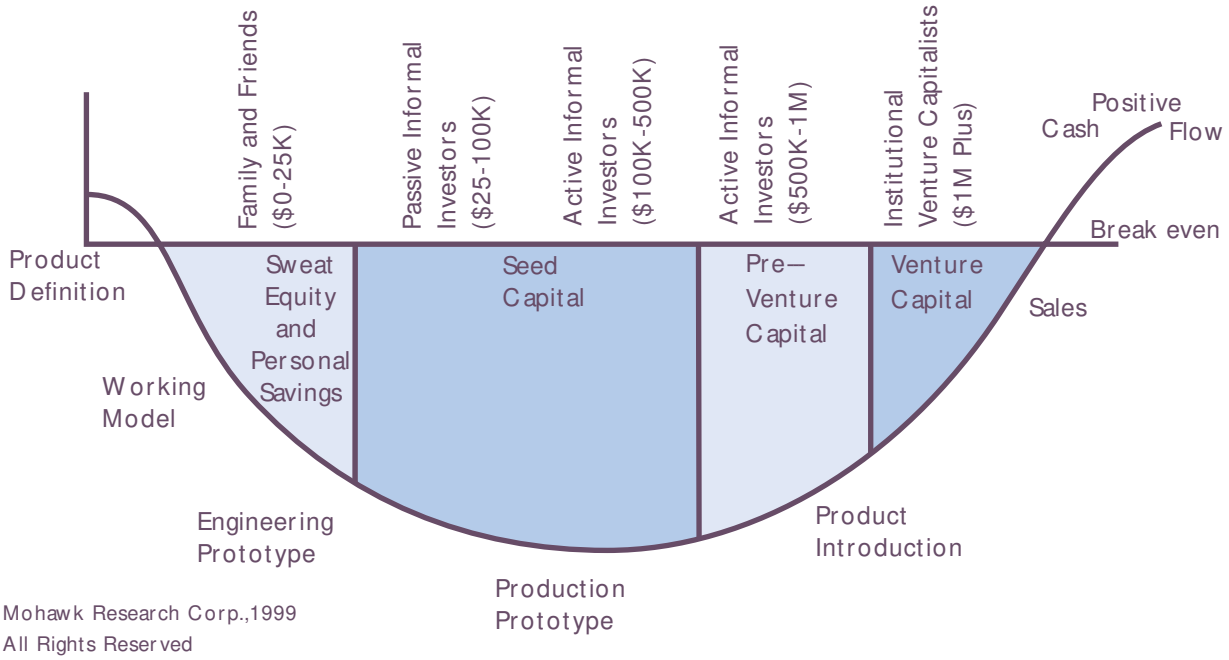
At the outset, we can dismiss the two extremes, the core and outer skin of the onion, and focus on the intervening layers. On the one extreme, no one has to tell inventors about sweat equity; on the other, no formal venture capital organization will invest in a project (with a few, rare exceptions) before the engineering or production prototype stages. If you are an inventor and are still reading this document, you probably haven't advanced that far.

As they move from product definition to concept development to working model, inventors have to find more and more money or its equivalents, such as credit, unpaid contributions of labor, and others. This in turn requires widening the circle of investors—in effect, moving outward from the core of the onion. Once the inventor has poured in everything he or she can (or will), relationships—relatives, friends, and personal acquaintances—usually provide the next source. Relatively unsophisticated as investors, these people want to help the inventor for personal reasons, because they have faith though they know little or nothing about the technology. Some may simply feel it's a good gamble to get in on the ground floor; nobody wants to miss out on the next Xerox.

In most cases, however, the inventor uses up all the funds he or she can get from these personal sources without having reached a stage of development that will attract professional investors. The invention then has entered the "Valley of Death," from which many never emerge. (See Figure 1: Valley of Death.)

Here, the search for money begins in earnest, as the inventor moves beyond an immediate circle of relatives, friends, and close acquaintances into the layer made up of strangers and people who are professional rather than personal associates (i.e., third party investors).

Figure 1: VALLEY OF DEATH



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These include:

- **Equity from employees—actual or potential.** If you have people working for you, they may contribute their time, and some of them may have some money they'll invest. If you can attract an entrepreneur into your organization, he may assume some of the financial burden, as Joe Wilson did for Chester Carlson in Xerox's early years.

- **Professionals for whom you're a client.** Patent attorneys, accountants, and business consultants, for example, sometimes find a project attractive enough to supply their services in return for a share of the business. In addition, many of them keep an eye out for promising investments, both for themselves and for friends who have money with which to speculate on early-stage technologies. If this happens, you may tap into:

- **The "old boy/old girl network" of wealthy individuals.** This includes not only the kinds of people mentioned above, but also doctors, dentists, lawyers, and retired business people. These kinds of people invest for a variety of reasons: to make money, obviously, but also for tax advantages, for fun and excitement, or to do something to bolster their community. They have several things in common: they tend to be aware of one another, often have had previous investments in common, and restrict their activities to local enterprises; therefore, they form local (or at most, regional) and highly personal networks.

  In addition, they may invest informally, but that doesn't mean they throw their money around casually. If you seek support from these people, they'll want to know a lot more about your experience, business abilities, and the market for your technology than your relatives and friends demanded. They'll succumb much less readily than your relatives did to wondrous tales of your invention's technical wizardry. In fact, a problem that congenitally plagues encounters between inventors and would-be investors, no matter what the stage of technical development, is the inventor's inveterate tendency to dwell *ad nauseam* on technical virtues while brushing aside business problems—when investors would prefer precisely the opposite emphasis. At whatever stage you have to seek these people out, you better have done your business and marketing homework, as well as your technical sums.

  If you have, and if you've reached the production prototype stage or farther, some other sources may open to you, including:

- **Institutional venture capital.** As you and your project move through the innovation process (Figure 1: Valley of Death), increasing amounts of capital are required. At the same time, investors become increasingly demanding. As we said before, as the stakes get higher, evidence, not assertions, becomes increasingly important. Investors who are responsible for "OPM" (other peoples money) want to know the market opportunity is going to be large enough to give them the returns that attract them to the investment business. There is no hard and fast way to know what an institutional venture capitalist will want in the way of a return, but it won't be modest. A standard, or baseline expectation, is found in the 10/5 rule that says you can expect a venture capitalist to want at least a 10 times return on investment within 5 years. (Yes, that is 10 x in 5 years.) Think for a moment about what that will mean. Suppose you want to give an investor 10% of your company in return for a $1million investment. Under the 10/5 rule, a venture capitalist will want to see persuasive evidence that you can create a $100 million company in 5 years. After all, in proposing a 10% share in exchange for $1 million in capital, that's what you've asked a venture capitalist to believe.

The 10/5 rule is just a rule of thumb, many venture capitalist groups want more—few are interested in less. Venture capitalist often use the term "hockey stick growth" to describe the kind of growth they will expect you to manage. If you think the "old boy/old girl network" expects a lot, wait until you meet these people. Think twice before you seek this kind of capital to support your project. You must do your homework expertly to get this money, and then you'll need to work tirelessly and relentlessly to manage the growth. Every step along the way is going to be based on formal planning. Talk to people who have done it, before you decide whether institutional venture capital is really for you.

If you decide it is, recognize the fact that getting it demands not only a great product, but also a thorough and disciplined planning process by a competent and reliable team.

Beyond The Valley of Death

If you put together a combination of resources permitting you to build an engineering or production prototype that works—and if you couple that to the appropriate components of a professional-class plan—then you and your product may emerge from the Valley of Death on the magic wings of a licensee's technical and financial resources, or the powerful thrust of professional investors' venture capital. All these things go hand-in-hand. If you have assembled proof of business and market viability as you approach the point of demonstrating technical viability, then you'll be nearing the market. You'll have in hand the foundation on which you (or someone else—a licensee maybe) can launch a competitive product or build a new enterprise. You'll surely have the arguments you need to persuade the most hard-headed backers that you have a commercial vehicle worth getting aboard.

For many inventors that happy day lies somewhere in the future, but you should start now developing credible answers to the non-technical questions you'll confront as you look for ever larger quantities of capital.

In summary, then, remember that informal investor networks operate on a local, personal basis. Look close to home. Remember that investors beyond the immediate circle of friends and family have a different outlook. You must be prepared to show them that you'll make money for them. The closer you get to institutional sources of capital, the more polished your business package must become.

The final, hard truth lies in the relationship between money and ownership—not the same thing as control. To get money, you'll probably have to give up some ownership. Just how much you'll have to trade for capital varies from case to case, but if you need a lot of money, you will have to surrender a considerable, quite possibly a majority, share of your interest. Some inventors find this the toughest decision of all. Some find they can't do it, prefer to stay small, and some die broke. Others bite the bullet, decide that 20% or 30% or 40% of something beats 100% of nothing and move on.

It's a highly personal decision. Some inventors have likened it to deciding whether to put a child up for adoption. No one can tell you what to do, only what options and consequences you may confront. Because it's a personal decision, you must weigh the personal factors. As you confront the choice of giving up one thing to get another, ask yourself: What kind of person are you now? What kind of person do you want to become as time goes by? What do you want your invention to do for you? If your invention succeeds, it will change your life beyond recognition. Make sure it changes in your way; that control you don't have to surrender to anybody.

Summary of Part 1

Thus far in this document we have:

- Provided a glimpse of the road ahead, the innovation process
- Summarized the basic characteristics of commercialization strategies, pointing out the looming necessity to choose the one best suited to you
- Sketched the basic contours of innovation financing.

Throughout, we have repeatedly emphasized the indispensable role that planning must play for a technology to succeed, regardless of its technical merit. For most inventors, much of the innovation process lies ahead. The immediate challenge is henceforth to advance systematically according to plan. We turn now to a discussion of ways to do just that.

Part 2: Assessing Your Current Status: The First Step

The innovation process, commercialization strategies, tough personal assessments and choices, funding, and the necessity for systematic planning—all this rigmarole may seem an impossibly formidable array. You can, however, master it step by step. You begin to deal with the manifold details of these specific requirements by making a general assessment of where you are, where you want to go, and how you hope to get there. To this end, the Innovation Process Table shows the steps through which a successful invention passes from first product definition to full market penetration. The process may vary slightly in specific cases, but most inventions, including blockbusters such as Xerox, Polaroid, Apple Computers, and Velcro, have trod this well-worn path. Unless you don't want to make more than pocket change, the odds are very high that you'll have to travel some distance down the table.

The technical development steps occupy only one column, and should occupy only a portion of your time. The tasks in the other columns have to be performed as well, not necessarily in exactly the parallel time frame the table suggests (such are the limitations of tables), but if you get far down one column while the others lag, you'll eventually bog down completely.

If you're like most inventors, you have advanced primarily down the left-hand column, while lagging in the others. If so, you must begin to think about the tasks you've neglected. By analyzing where you stand now, you will take a first step toward deciding on a plan to commercialize your invention. In addition, you can isolate the areas in which you most need help, which in turn will aid the process of preparing a plan to move forward toward the market.

To locate yourself, put the Innovation Process Table in front of you and:

1. Go down the technical, business, and market columns and draw a line through every task you've completed.

2. Go down the skills and people columns. If you have the skill yourself, or if you have made definite arrangements for the help of someone who has, draw a line through the item.

3. Look at the result. The pattern should give you a pretty good indication of how close you are to commercialization, bearing in mind that licensing will require completing all or most of the steps of the innovation stage, and producing it yourself will require everything in both the innovation and entrepreneurial stages. You should also be able to see the kind of help you will need to move on, and the kind of people you'll have to deal with along the way.

If you are like most inventors, your marked-up table will show that you've paid least attention to the market. You will need to consider in detail where you stand with respect to each of the three columns—technical, market, and business—on the left-hand side of the table. We will, therefore, begin with the technical column, the one with which most innovators feel most comfortable. We will then take up the others in turn, showing how you can assess your current status and initiate forward planning in the form of sequenced tasks directed at specific obstacles.

Steps in Cadence: Prototype Development and the Engineering Process

Organizing Your Thoughts

Before you make a substantial investment of time, money, or effort in technical development, you should have lucid, credible answers to the four basic questions below. If you decide to continue technical development, you must also concurrently address market and business development issues. Indeed, as we have said so often before, the intertwining of market, business, and technical development (shown on the Innovation Process Table) means that you must address all these questions continuously and repeatedly, while revising your plans according to any changes that emerge in the answers.

1. Is it new?
Your invention, that is, or does it already exist? Can you protect it? How do you find out?

2. What does it do?

In describing the possible applications of your technology, remember that two heads are better than one. You think you've invented the perfect product to do a certain job. Someone else may look at it and say: "What an ideal thing to do..." and suggest something that never occurred to you.

Does your idea fall in an area where you're not the expert? An honest answer to this question might just point out that you're not the one to invent it. If it's not within your field or your educational background, beware. You're starting out at a disadvantage. Most inventions, innovations, and new ideas emerge as an outgrowth of years and years of innovators' experience in the same field or discipline as the new product.

3. Who needs it?

Thousands of unneeded inventions are conceived, developed, perfected, and patented each year. These go nowhere, so be honest with yourself or get honest, unbiased, outside help in answering this question. Don't spend the money to patent your idea or to develop it further if no one needs it.

Taken together, your answers to questions 2 and 3 constitute a basic product definition.

4. Does it pencil?

You may have a business plan; you may have a patent or a license; you may believe you have the necessary financing; but, does your project really pencil? That is, can your product be made at a cost and sold at a price that will yield enough profit to make a viable business or new product line? If everything goes wrong, what's the down side? Have you checked your numbers with more than one source? An unbiased source?

Face this "Does it pencil?" question now. Prospective investors will want to see the answer and see the work that produced it.

If you don't know, or can't figure out whether your project pencils, stop where you are. Don't spend another dime on technical development until you do know.

If, on the other hand, you can demonstrate to yourself and to a neutral party that your invention has strong profit potential, then you can turn your attention to the technical development steps ahead of you.

From Concept to Production: The Steps

From a technical standpoint, there are five major steps for any product, process, or service to get to the marketplace:

1. Product definition
2. Working model/proof of concept
3. Engineering prototype
4. Production prototype
5. Qualified production item.

Bridging the gaps between these steps might be straightforward for a simple product such as the Hula Hoop, or it might be very complicated, cost millions (or even billions), and take years—witness space technology.

Whatever the complexity of your own technology, as you develop it you will probably build (or have built for you) most, if not all, of the model prototypes shown in Table 2.

TABLE 2: FAMILY OF SCALE MODELS/PROTOTYPES

Mockup	Working Model	Engineering Prototype	Production Prototype
Purpose			
Built to demonstrate relations of adjacent parts	Built to illustrate the concept functioning—especially the relative motions of any connected moving parts	Built to demonstrate important design parameters; used to test reliability, speed, accuracy, etc.	Built to illustrate performance requirements are met, production problems can be resolved, quality control can be achieved
Characteristics			
Built to scale; need not work	Not always to full scale; probably does not operate optimally	Usually hand built; often full scale; durable to withstand testing	Built as much like the mass produced item as possible, differing only in the volume level of production

If you have already built a model or prototype, the table will help you locate yourself on the technical development continuum. The column below each prototype specifies first the purpose for building that particular form, and second its general characteristics.

Let's define and discuss the technical development steps and models/prototypes that demonstrate the completion of those steps:

1. Product definition: Preliminary thoughts about the new product, process, or service—incorporating an understanding of user needs. A translation of your technical ideas for meeting user needs into a preliminary design; initial calculations and drawings that demonstrate theoretical validity of product definition.

You should obtain legal advice on how your technical ideas should be reduced to writing—possibly with dates and in a bound book, among other writing tips—with a view toward obtaining intellectual property protection. Also, find out how you should explain it to a disinterested party who can both understand and remember just what you've done.

At this stage spend lots of time and very little money. Be very critical of your own thoughts. Review the literature in depth. Don't let any assumption get by without challenge. Build your mockup and show it to friends, family, coworkers, colleagues, friendly professors. Answer all their questions. Pay particular attention to the devil's advocates. Why don't they like it? Why do they think it won't work? Remember, this analysis mostly costs you time, so use it—lots of it.

2. Working model/proof of concept: A reduction to practice, proof of concept. The working model is often less than full scale, inexpensively and crudely constructed, and need not function optimally. It is intended to test the most basic operating parameters and to aid in the design of an engineering prototype.

At this point you've got to quit making excuses and achieve real feasibility. Build this model yourself only if you have the ability and the manual dexterity to produce it to professional standards. Otherwise, have it done by a professional—pay to have it done right. Remember, this model has to work; it must prove the idea, the concept. If you really think you've done it right, and it still doesn't work, go back to step 1 and build another mockup. Don't go further until you have your proof-of-concept model.

3. Engineering prototype: An actual working version of a product, apparatus, or process used to gather data on operating performance and production requirements. Most often one-of-a-kind and commonly fitted with special instrumentation, this model is usually hand-made, but always of sufficient technical quality to determine whether a production prototype can (or should) be built.

The transition or scaling-up in sophistication from a working model to an engineering prototype follows logically in terms of technical development. And, as pointed out, you almost certainly will have to do this in order to "sell" your invention to investors or licensees. These people will want to see systematically derived and independently validated test results, not a lot of guess work. Taking this step usually requires not one, but a series of improved versions that culminate in the final engineering prototype.

At this point, the costs, time, and frustrations really mount. Your hand-made prototype will require parts that are:

- Expensive
- Hard to get
- Proprietary, or
- Unknown.

Worse yet, your first real prototypes probably won't work as well as your own original working model. So you will have to refine, redesign, rebuild, retest, and spend more money. Time becomes a nightmare, because time is money.

4. Production prototype: A full-scale, completely operational model designed to determine production and fabrication requirements for the production item. Also, the production prototype is used to generate the final pre-production performance data on

operation and durability. Usually hand built, the production prototype must conform as closely as possible to the design standards for the final full-production product or process.

Here you plunge into the real world of high-priced help, including (to name a few) CAD designers, tool and die makers, design engineers, expediters, facility planners, and, that most perverse of experts, the production engineer. You will need all these people and more to build a true production prototype. The items you built in steps 2 and 3 above just won't make it in the real marketplace because they will cost too much to make, not embody sufficient safety factors, and most serious of all, won't perform to specifications through a reasonable product life cycle. Lots of inventors have gone broke trying to prove otherwise. Your reputation will depend on efficient, durable, and safe products, fully production qualified. You can destroy that reputation by forcing an unready prototype prematurely into the market.

5. Qualified production item: A full-scale, fully operational model manufactured in an initial, limited production run under conditions as close as possible to final production. It is used to ensure that final production runs will produce a product meeting design standards. Product qualification prototypes are often subjected to independent third-party testing, especially if the product must meet industry or government regulatory standards.

Getting to this step means getting to the brink of market entry. The process of qualifying a product consumes staggering amounts of time and money, for you'll inevitably run into things that never occurred to you in the beginning or along the way—safety, legal, regulatory, liability, wear-and-tear, product infringement, break even cycle, and pollution problems to name a few. These qualification tests, however, put the finishing touches on the technical development process, which in one sense consists of constructing a series of prototypes for the purpose of conducting more sophisticated tests leading to better designs.

Testing Your Technology

Few inventors/innovators have ever seen a development test plan, much less written or executed one. Hiring an expert in this field as early as possible might, therefore, be a good investment. Testing must be properly planned, executed, and evaluated to provide the optimum return for its usually very substantial cost.

Your Technology and Its Market

Even if you haven't built a working model, we probably don't have to convince you that you should. An inventor's natural inclination to see his invention work usually provides sufficient motivation. Scaling up from working model to engineering prototype follows logically in terms of technical development; moreover, as we pointed out previously, you may have to do this in order to "sell" your invention or process to investors and licensees. To repeat, these people want to see systematically derived test results, not a lot of guesswork. The closer you are to production prototype, the more convincing you can be—if you have these test results.

None of this means that you should automatically go from concept to working model to engineering prototype. Whether you should depends not only on whether it's technically feasible, but equally (at least) on whether the potential market justifies the expense. In other words, you shouldn't go to the expense of continued technical development unless there's a market big enough to repay you, and to provide your backers with a decent return on their money. It doesn't make sense to build the thing just to see if it will work. If you persist in developing it without hard-nosed exploration of the market, you're not in business; you're supporting a hobby. If that's what you want to do, and you can afford it, that's all right. Just don't kid yourself; you certainly won't fool any of the business professionals with whom you'll have to deal more and more as you develop increasingly sophisticated versions of your technology. And deal with them you will, unless you have the skills of Leonardo DaVinci and the wealth of the Indies (in which case you probably wouldn't be reading this document in the first place). Moving toward production prototype requires a multitude of skills and a lot of money.

Part Two

The kinds of people who have the skills and money you need have one thing in common: they're not hobbyists. They're professionals who want evidence—not assertions (and you can make this a slogan; paint it on your workshop wall). Certainly they don't want assertions such as, "Everybody needs one," "When they see it work, they will buy it," and "If the stockholders found out they passed this up, there'd be new management tomorrow." These kinds of comments mark you as an amateur, and as one professional investor said, "We don't have time for amateur night." For these people, as for many others whose help you'll need, the hallmark of a professional is assiduous, unrelenting attention to the market, manifested in systematic market analysis.

The first step, then, in planning to take a product into the marketplace (commercialization) is to develop your product, checking frequently as the definition clarifies, to verify market requirements. Don't think that you or anyone else can dictate to the buyer. Market knowledge, advertising, salesmanship, reputation, quality—these things sell products. Not wishful thinking and dreams. Technology doesn't sell itself. You have to sell it and you have to prove it can be sold in order to justify further development. This will show you where you should stand in terms of market analysis relative to your current stage of technical development. If you've lagged behind, start catching up. Above all, if you haven't begun a systematic analysis of the market, start now.

Market Analysis: So It Works . . . Who'll Buy It?

We have argued that while any commercialization strategy requires a working prototype, a market justification should exist for every dollar spent developing one. We can't repeat too often the fact that just because something works doesn't mean enough people will buy it to support the expense of producing it. As you move through the stages of technical development, you will come under increasing pressure—from potential investors, licensees, and others—to demonstrate who your customers will be, what channels exist to distribute your product to them, what competition you will face, and how your product will compete successfully.

Market analysis, like the other tasks you have to perform, gets more complex the closer your technology gets to the market. Whether you decide to license or venture, a full-scale analysis forms a basic part of your appeal to prospective licensees or investors. Either way, an appropriate market analysis becomes an essential component of your commercialization plan. At every step of technical development, you should have appropriately detailed and documented responses to the questions incorporated into the commentary on the following pages. Ask yourself how prepared you are right now to supply the required information.

Market Identification

What specific customer needs does your product satisfy?

Who will buy your product? Can you list specifically the people or companies that you consider likely customers? Why will they buy?

What product characteristics encourage these customers to buy? Does your product have these characteristics?

Is the timing right? Do some events have to occur (or conditions exist) before people will buy your product? Is there any chance that the time for your product has come and gone (or is almost gone)? Or is now the time, and, if so, why?

Does a market exist right now for your innovation? If not, you had better have some compelling reason to think that one will emerge soon. If one does exist, you should be able to say something about it, and about the way your technology relates to it.

Market Size

Define the market for your product in detail; identify segments of that market and specify their size in terms of units that can be sold.

Although this information is difficult to obtain and it may seem like an excursion into fantasy land, this is the beginning point of an investor's or licensee's decision. After all, if you can speculate on the technical potential of your innovation, you can speculate on its market potential.

Your Customers

Who is the end user of the product?

The end user may not be your customer, but your product obviously will have to satisfy his or her needs. You will need to analyze in detail those characteristics of the end user that might affect his or her demand for your product. If your end user is a retail consumer, you confront different characteristics from those presented when the end user is a manufacturer.

Distribution

Knowing your market means knowing more than who the end users are. You have to know the existing channels of distribution that pass goods from producer to end user. In an economy as sophisticated as the one in the United States, complex distribution networks exist for almost every conceivable product. If such a channel doesn't exist, that constitutes a major barrier in its own right, and you'll need a strategy to overcome it. In fact, the structure of many major American industries resulted not so much from the needs of manufacturing, but rather from the fact that existing distribution channels couldn't be adapted to market a new product. Examples include the meat packing industry, farm machinery, automobiles, sewing machines, office equipment, and computer software and hardware.

Distribution networks suitable to your product probably exist already. This fact refines the question, "Who are your customers?" For example, if you have invented a carburetor that you hope to persuade automobile companies to put on new cars, and the driving public to install on cars they already own, you have identified two different end users, neither of them your customer. To find your customer, you'd have to locate the chain of distributors that supplies the new and replacement markets in carburetors, and focus your efforts there. Lots of inventors have wasted valuable time and money trying to sell the end user, who wasn't, in fact, the customer, or trying to sell to the customer without considering the end user's needs. In fact, your product must accommodate every link in the marketing chain.

You must therefore know the distribution channels through which your product moves from manufacturer to end user. This includes knowing each intermediate step and the kind of firm that performs it. For example, carburetors go direct from manufacturer (large corporation) to auto assembler (large corporation) on the one hand; on the other they also go from manufacturer to jobber (usually medium-sized corporation) to regional jobber (usually a family firm or partnership) to local distributor to parts department of new car dealer (may be a family firm, partnership, or owned outright by auto company), or to local parts store (franchised or otherwise). It makes a difference.

- Do you know the distribution chain for your product, complete with company names?
- Are your customers end users, or members of the distribution network?

Your Competition

To succeed in the marketplace you have to know your competition as well as your competitive advantages and disadvantages. You should be able to list your competitors in detail. If you think you have none, you'd better be prepared to prove it. Ask yourself how the customer solved his problems before your product came along. If, in fact, you confront no competition, you must consider the possibility that no competition may mean no market.

You should also be able to list the specific characteristics that differentiate your technology from products now in the market. And you should be able to describe the differentiation. If at any point in the development of your product you can't identify at least three points of difference, it may be time to quit. Moreover, your answers to these questions should enable you to explain why your potential customers will make two decisions: to quit buying from your competition and to buy from you.

As you develop your technology, you should continually integrate estimates of manufacturing costs (no matter how crude) and market potential (no matter how preliminary) into consideration of your commercialization strategy. As you advance toward a market-ready prototype, the multiplication of tasks and skills, the increasing number of people, and the swelling flow of information will press upon your capacity to manage your enterprise. You will need to adapt the structure of your firm to support your evolving technical development and commercialization strategy.

Part Two

Business Development: The Strategy and Structure of the Innovation Process

The Innovation Process Table implicitly embodies the progressive development of an appropriate business structure, just as the "Valley of Death" diagram embodies the development of innovation finance. Indeed, successfully negotiating the trail from concept to market requires an appropriate business structure, an axiom obvious in the skills and people columns of the Innovation Process Table, which shows that technical progress necessitates a team operation too complex to run like a corner grocery or a hair-bending establishment. Less obvious, perhaps—but equally certain—the process of acquiring sufficient capital for a development that forces innovators into a business format that both persuades investors that development will go forward successfully and provides them with legal safeguards such as limited liability.

If you do not have a functioning business already, you too will confront the necessity of:

- Building a business from scratch,
- Entering a partnership or alliance with an existing firm, or
- Finding a licensee.

Neither of the latter two strategies will, however, dispose of the problem entirely, for you will have to develop your technology (and therefore your business structure) sufficiently to make it an attractive acquisition for an existing firm. In fact, opting for any commercialization strategy has implicit structural consequences for your business, because the moment you decide to develop your technology for the purpose of profit, you have activated a business, whether you know it or not. (If you doubt this, try persuading the Internal Revenue Service to exempt you from those portions of the tax laws relating to business activity.) It, therefore, behooves any innovator to have at least a rudimentary familiarity with business structures and their relationship to the innovation process, including the search for capital.

A business grown from scratch usually passes through some or all of the following structural stages:

1. Sole proprietorship (the "default" condition)
2. Sole proprietorship with limited liability (a personal incorporation)
3. Partnership (the "double fault" condition)
4. Partnership with limited liability (a limited partnership)
5. Close corporation (stock not publicly traded)
6. Public corporation (stock publicly traded).

These stages result from the pursuit of strategies that achieve two general objectives en route to the final goal of successful, sustainable market penetration:

1. Creating a legal form appropriate to securing capital, building a management team, and producing a marketable product
2. Organizing the people and skills in a structure that optimizes the ratio between inputs and outputs.

The former, of course, involves the expanding corpus of legal documents (and, of course, lawyers' fees) required to:

- Secure limited liability for investors,
- Trade ownership shares for capital infusions and keyman services,
- Meet the array of local, state, and federal laws regarding the environment, safety, and employee benefits, among others,
- Secure liability insurance and, finally, if the big dream comes true,
- Take the company public.

The latter objective involves (among other things):

- Prioritizing the required skills,
- Obtaining those skills by appropriate, sequential hiring,
- Arraying people and tasks in a structure producing accountable results; that is, it both achieves the specified goals and objectives of the original plan and collects data to update and revise it,
- Revising the structure to accommodate the demands of success or to eliminate the causes of poor performance.

The results of this structural evolution will manifest themselves in the firm's organization charts, as skills are articulated in functionally specialized departments, arranged in a line and staff organization. This nomenclature may conjure images of Fortune 500 giants, but even the smallest business should function systematically in the present, guided by a plan anticipating structural change to support new strategies appropriate to revised goals and objectives. Without such planning, even the most promising technology has a high probability of joining the ranks of small business casualties.

No matter where you stand now, no matter how far your idea may be from the market, you cannot begin too soon considering both your choice of commercialization strategy and the structural foundation you will need to support it. Forget Emerson and that better mousetrap nonsense. Remember what Coolidge said, "The business of America is business," and plan accordingly. You should survey the list of firm structures and locate your own. Then peruse the other lists that follow, marking those goals and objectives appropriate to your current state of technical and market development. You should then be able to ask the questions: "Is the current structure of my firm appropriate; that is, will its structure support the strategy I'm following? And, how long will it remain adequate?"

To some extent you should be able to answer the question yourself. For example, if your organization chart looks something like either Figure 2 or Figure 3, your structure will not support a move to finance the development of a production prototype by selling stock to the general public. On the other hand, if you currently have a balsa wood mockup in your garage, you don't need to worry yet about creating a structure like that diagramed in Figure 4.

In general, however, only an attorney can provide expert advice on such subjects as tax implications of business structures, suitability of a given structure to provide various kinds of legal advantages, and the relationship of structure to various methods of raising capital. When you seek professional legal advice, you will find your lawyer absolutely adamant on the subject of planning, without which his/or her ability to counsel you (and your ability to remain in compliance with the law) will be strictly limited.

In this section, we have argued that you must select a commercialization strategy for your technology, and an appropriate, satisfying role for yourself on the trek to the market. We have repeatedly emphasized the need for you to engage, starting right away, in systematic analysis and planning that integrates the technical, market, and business dimensions of your project.

By now, you should have a fairly clear assessment of where you stand in the innovation process. You should also have a sense of the kind of information you'll need to engage in systematic planning. We will therefore turn now to the planning process itself.

Facing the Planning Task

We realize that few inventors have had the training or the opportunity to engage in planning and that many have little inclination to begin. Someday you may write (or sponsor the writing of) a complex, polished, professionally turned out, full-blown business plan, but that task lies in the future for most inventors. The trick is to begin commercialization planning now, and to realize that planning, like developing a technology, is an incremental, ongoing process—not the instantaneous creation of a finished product. Start crawling now in order to sprint later.

In fact, your plan should evolve in much the same way as your technology. At first simple and brief, then more detailed and complex as you refine your understanding of the marketplace and decide what role you yourself will take. Also, as circumstances force you to deal more frequently with strangers, rather than with family and friends, you will have to provide greater detail about complex issues. Despite its inevitably greater complexity, your plan must remain framed in plain, simple, declarative sentences that tell what you want to achieve, and how you plan to achieve it. Above all, your plan must always reflect you and your objectives.

Who Writes the Plan?

For the moment the answer must be, "You do." And, even if now or later someone else assumes responsibility for it, you must remain a major contributor, reviewer, and user of the plan. After all, it contains your goals and objectives. You will supervise its implementation. It deals with your technology. Who then is better qualified than you to do your plan, no matter what the level of your skills? Remember, after all, practice makes perfect. And when better to begin planning than now, no matter what the stage (even at the concept level) of your technologies development? If you do begin now, by making an assessment of your current technical, market, and business development (as discussed in previous pages), when the time comes for third parties (for example: investors, bankers, and prospective employees) to see it, you will be far ahead of the game.

Figure 2

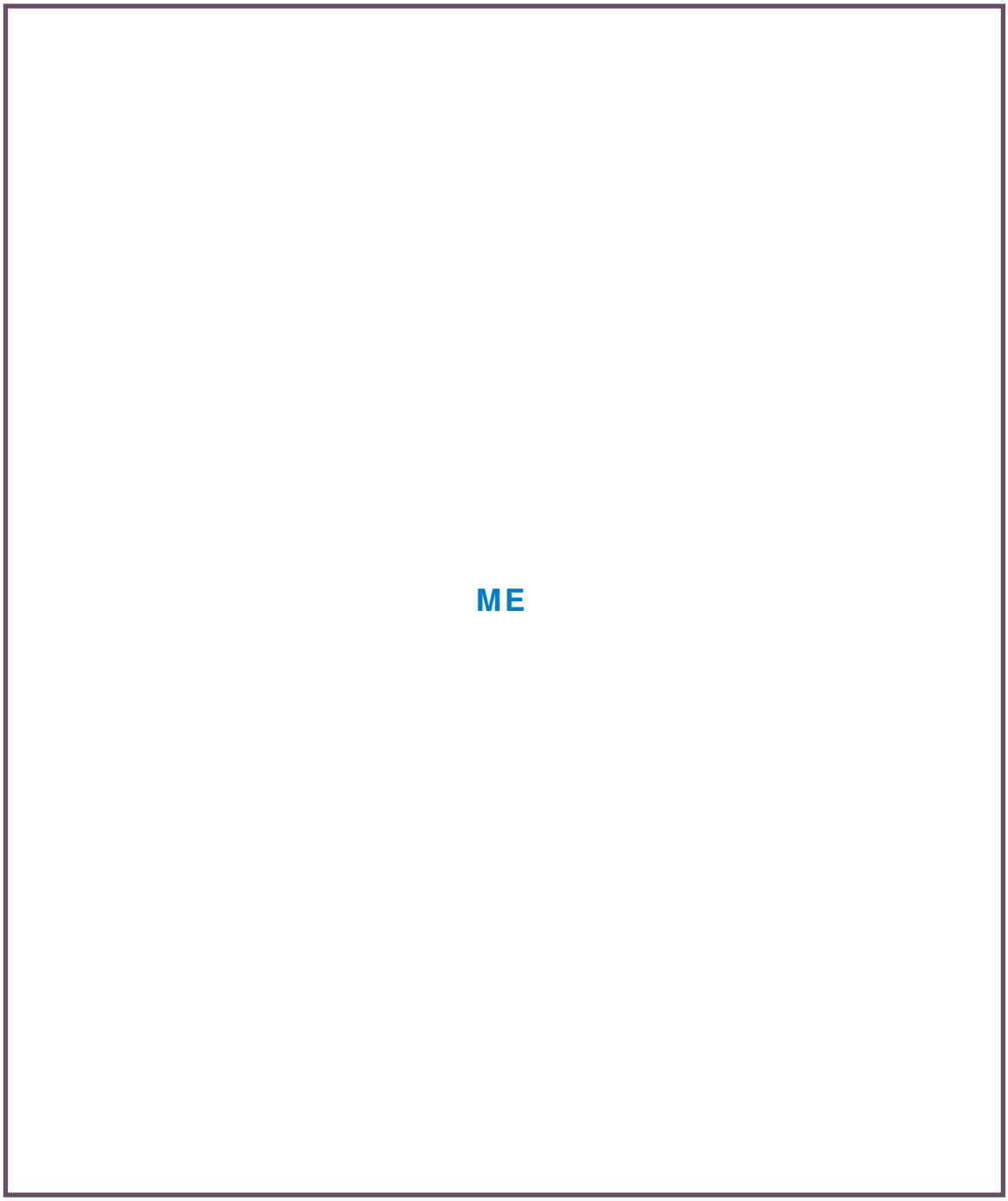


Figure 3

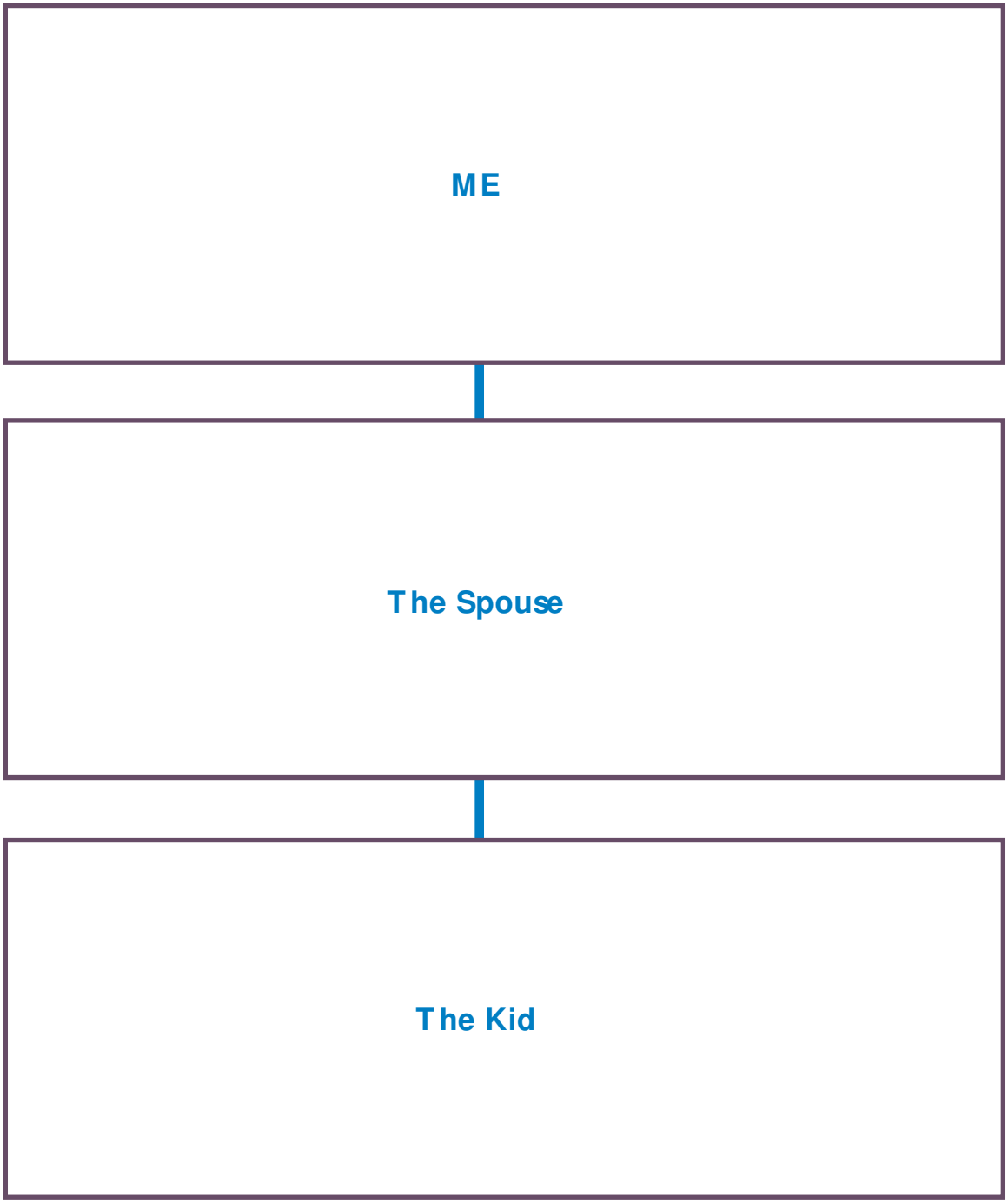
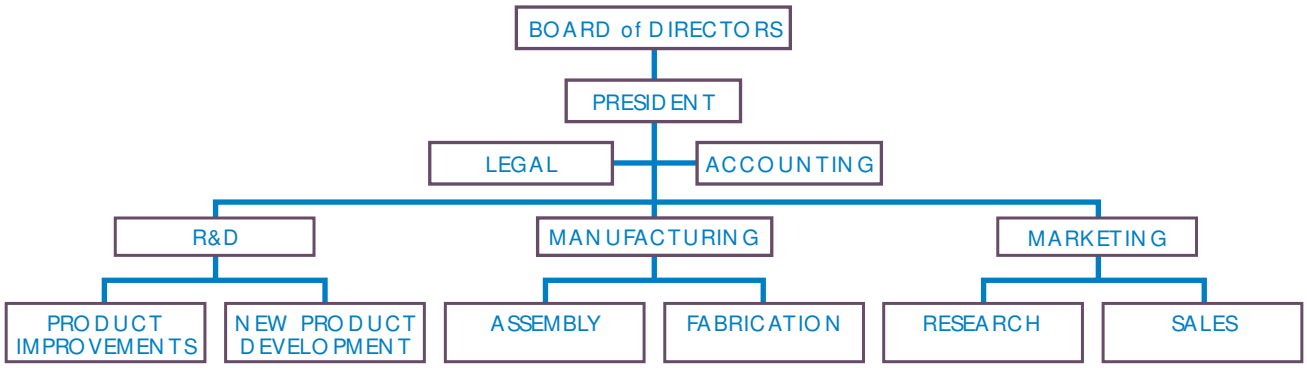


Figure 4



What Level of Complexity Is Required?

The kind of plan you produce and its level of complexity depend on several factors, including, but not limited to:

- Your stage of technical development
- The commercialization strategy you select
- The growth strategy you select (bootstrap, slow and steady, or high growth)
- The amount of capital you will need for development
- The sources of capital you will approach (family, informal investors, bankers, institutional equity investors).

Your plan may begin as a simple description of your project—not just the technology, the whole project—including information on management, commercialization strategy, resources required for development, and so forth. As you progress through the innovation process, however, you will become more knowledgeable about your market and your plan will change to reflect that increased knowledge. Later, when you have commercialized your invention, your old plans will seem to your business as snapshots seem to your childhood.

How to Get Started

Start by writing a goal in general terms, either long or short range. Then, factor the goal into specific tasks prerequisite to achieving the goal, and arrange these sequentially. These must be finite tasks with observable results; that is, you and others must be able to tell that you have finished them. More important, perhaps, you must be able to demonstrate to others—prospective investors, for example—that you know how to define objectives and achieve them. For instance, you might set yourself the goal of producing parts for your technology more efficiently. No one could fault this as a goal, but it contains no finite means of measuring its achievement unless broken out into tasks such as: "Using a competitive bidding process, find a machine shop subcontractor by July 1."

If you think out your goals and objectives carefully in terms of required resources, tasks, and measures of achievement, your plan will emerge clear and specific.

In the next few pages we consider the planning process, and the plan itself. This subject deserves your most concentrated attention and efforts, for the commercial future of your technology almost certainly depends upon it.

Planning to License or Venture

The Role of a Commercialization Plan

In the preceding pages we have dealt with such topics as:

- Choosing a commercialization strategy for your technology and a role for yourself

- Translating your commercialization and personal strategies into a coherent constructive commercialization plan
- Locating your technology's current status on the technical development process, market analysis, and business development continuums, and emphasizing the subordinate relationship of technical development expenditures to market potential
- Assessing your market and ways to reach it
- Detailing the licensing and venturing strategies, asserting the need to plan effectively in order to follow either successfully
- Raising money, and relating potential funding sources to various stages of development.

These topics coalesce in the writing of a commercialization plan, a document of potentially immense value. In this brief treatment we don't pretend to convey you from your current status in terms of information and planning (whatever that may be) to the point where you have in hand a polished commercialization plan, and even less a business plan in the formal sense. Indeed, we focus not so much on doing quickie plans as on persuading you of the need to plan systematically, and on showing you ways of planning to write formal plans.

Writing a commercialization plan means taking a major step. You should maximize its benefits. One way to achieve this profit maximization lies through hard work generating answers to questions like the ones we have raised. When you have answered them, you will have assembled the bulk of the materials required for an effective planning document. The more detailed and accurate your answers, the better off you will be. A commercialization plan must honestly work toward a comprehensive description of the technology and the methods to move it into the marketplace. Framed in positive language, it should discuss the project developers, market, marketing strategy, and financing. Remember that truth and evidence underpin a credible, useful plan.

You will derive multiple benefits from developing a plan:

- It will crystallize your ideas about how you want to commercialize your technology
- It lets you manage product development rather than letting the project manage you
- It will help you develop the information necessary to entice others to consider licensing your technology or investing in it
- It lets you explore options and alternatives
- It establishes an action plan to which you can—and should—refer continually
- It helps you establish goals and performance targets.

Writing a long-range, detailed plan not only generates the kind of material you need to make an effective presentation to prospective licensees or investors, but also shows you the resources your project will require. Your plan will help you decide what part you yourself will play in developing the project and in running the resulting enterprise—or in continuing product development with a licensee. Make no mistake about it, if you have a technology that works—one for which a large enough market exists to make it worth producing—you'll still need a plan in order to succeed. As a precursor to that step, and as a means of assembling data to make decisions about the further development of your technology, a commercialization plan makes a good start.

Developing or formulating a commercialization plan forces you to organize your thoughts, formalize your assumptions, begin translating these into projections (perhaps as far as 5 years ahead depending on the stage of development your technology has reached), and reduce everything to writing. Few people have much experience along these lines; most find it a challenge. On the other hand, practically everybody operates on the basis of informal planning. If you've ever sat down and figured out where to get the money to keep your invention going, how to allocate your time, or whom you might get to help you solve some technical problem, you've engaged in informal planning. What you must do is convert that informality to a systematic process encompassing all the steps necessary to move your technology into the marketplace. In fact, you began that thought process when you crossed out the various tasks, skills, and people on the Innovation Process Table.

Part Two

If you decide to venture your technology, you will eventually need a formal business plan, and you may need professional assistance putting one together. In fact, the business plan has emerged as a document with a widely recognized generic format; it can be written at several levels of complexity, as well as for various purposes and audiences. If you are considering venturing, you should familiarize yourself with the basics because even if someone else writes the actual plan, the principal burden of developing the necessary information falls on you. Creating a commercialization plan can give you a long head start. Keep that in mind as you consider the material that follows.

If you decide to partner or license, you still need to engage in a formal planning process. Indeed, your planning may need to become more detailed and precise, particularly if you plan to license. Those who venture maintain more control than you will if you license your technology. They can make corrections, or even play things by ear more readily than you can as a licensor. Licensing and partnering fix commitments, promises, and options in formal agreements. Don't let yourself get lulled into a false sense of security with such platitudes as: "They're big; they'll do it all." What happens if "they" don't see things your way? What if the management changes in the company that took a license for your product? When you enter into a partnering or licensing agreement, you are surrendering at least some measure of control. That surrender means you want the commitments made up front. The only way to know you are making the right commitments is to have a formal, written plan.

Inexperienced inventors hoping to license often dismiss the idea of formal planning for much beyond technical development. They often claim "I can't write the business plan for someone else." That's certainly true, but as we've maintained steadfastly, formal business planning isn't the only kind of planning required in the innovation process. Indeed, in the innovation process, formal business planning is not even appropriate until someone has generated detailed information on the technical, market, and organizational requirements for getting a product to market. Commercialization planning is just as critical in licensing as it is in venturing, perhaps more so, in many cases.

In licensing, a formal planning process is critical to establishing the value of the technology you plan to transfer. Without evidence in the form of a written plan, you weaken your negotiating position significantly. Of equal importance, perhaps, when you enter into a licensing agreement without a plan that clearly lays out the technical, market, and business development issues that need to be addressed as your technology moves toward the market, you lose the opportunity to shape its course on that path.

You can develop your commercialization plan at several levels: as a basic outline; as a simple, step-by-step guide through the earliest stages of developing your technology; as a reminder to collect information you will need during market analysis or other tasks; or as a way to articulate both long- and short-range goals. As time passes, your planning effort will generate the information you need to write a formal business or licensing plan (or both). Even in the early stages of the innovation process, however, the effort put into commercialization planning has value. Whether you intend to license or venture, you need this plan; only the specific content and level of detail differ. The eventual audiences for your plan and the information it creates include your development team, potential licensees, prospective investors, and anyone else from whom you would like assistance.

Components of a Basic Plan

To make a good first cut at commercialization planning, even when you haven't decided whether you want to venture, license, or partner, use a basic planning outline such as the one below. Any basic plan will contain the following components, and will prove an invaluable tool for making decisions about your commercialization strategy:

- Cover page
- Table of contents
- Executive summary
- Detailed discussions of
  - The project
  - The product
  - The market.

If you think you might want to start your own business, you will also need to include sections detailing the company, your marketing strategy, an operations plan, and a management plan. Each

major section of a plan should contain subsections, as illustrated in the discussion below:

The Project

Provide the reader with background information on your project as well as detailed information about the project team. This is not the place to tell your reader all about how you got the idea, or about the technical elegance of the invention, but rather to present:

- A succinct statement telling the reader what you want to do (i.e., license, venture, joint venture, sell) and the advantages of this commercialization strategy
- A description of your enterprise, its structure (e.g., sole proprietorship, corporation), what it does, and how it does it
- A description of your project team, including evidence of your technical and management qualifications to complete the project while providing similar information about your associates now in business, as well as information about the officers of your company
- A description of your other professional commitments—what they are and how they will affect your plan.

In effect, this section lets people know about the business opportunity you're creating, your commitment to the project, and your capability to move forward.

The Product

Here you tell the reader about your invention in technical language, remembering that non-technical people—potential investors and prospective licensees—will also need to understand your plan. Reduce your description to the simplest terms that will convey a full understanding of the technology, including:

- What it is
- What it does
- What potential applications it has
- What tasks remain to make it market ready.

The Market

You need to demonstrate the size and nature of your market to convince the reader your project is a good bet. Be realistic. Also, emphasize how the performance features you spelled out in the description of the product match the user needs you can demonstrate in your market information. This is how you document the validity and business potential of your product definition. Interested investors and prospective licensees will check your assertions using their own staff of paid experts. Furthermore, if you plan to license, this estimate will become your negotiating tool. If you haven't done a thorough job, or if you don't believe the numbers, you may lose your shirt. Finally, if you aren't sure which strategy you should select, completing this work may tell you.

Venture Planning

If you want to produce and/or sell your invention yourself, you must have a business plan (unless you plan to operate indefinitely at "mom and pop" size). An effective, polished commercialization plan can serve as a strong foundation; however, a business plan demands a significant step upward in sophistication of information and presentation. Thus, if you intend to venture your invention, you will probably have to add some sections to your commercialization plan, and you will probably want to have a professional review and polish it. The additional sections may include:

- Marketing strategy
- Operations plan
- Management plan
- Financial information and risk analysis.

Management Functions in New Venture

The management section of any planning document deserves special attention. If you decide to license, it may not matter, but only if the project is simple and requires absolutely no contribution from you after you sign the deal. If you go into business or look for outside capital to support product development headed toward licensing, management may well make or break you in the minds of prospective investors. If your vision of a licensing deal includes your continued involvement through contributions of know-how or follow-on technical support, potential licensees will also take a keen interest in your management and your team. If you refer to the Innovation Process Table, you will see that as you pass from the innovation to the entrepreneurial stage, moving from working model toward production prototype, the variety of tasks and skills required multiplies significantly. This should help convince you of the necessity of building a team, delegating responsibilities, and moving toward a structure of systematic management.

Management remains the most important factor in the success of a new business and effective partnering. As we have said before, it is axiomatic in the new venture field that a second-rate product with a first-rate management team has significant advantage over a first-rate product in the hands of second-rate management. Obviously, the greatest advantage of all goes to a first-rate management team commercializing a first-rate technology.

The most important thing an innovator/entrepreneur can do is distinguish those tasks he or she can perform well from those that should be delegated. The next most important things involve determining what additional management is needed and then recruiting that management.

In addition to elaborating on the plans you have with respect to management, you may need to provide more detailed discussions of your technology, including confidential information. You may also want to include articles published about your technology, as well as testimonials from satisfied customers, or from prospective users. Such information should go into appendices. A completed plan—either commercialization or business—may run 20 to 40 pages.

With a plan, you may control the innovation process.

Without a plan, the process will surely control you.

Summary of Part 2

Planning requires an on-going process of information collection that supports a coordinated, systematic approach to technical development, market assessment, and marketing strategy, as well as the assembly of an appropriate business structure. The innovation process not only provides a template for planning in these areas, it also facilitates the first planning step: deciding exactly where you stand now.

Conclusion

If this document has convinced you that planning takes a lot of work and that you should begin now, we have succeeded in our purpose. But the work will pay off, if you do it well. Many's the inventor who moaned and groaned through systematic commercialization planning and lived to describe it as the best thing that he or she had ever done.

Appendix 1: Glossary of Commercialization Terms

This glossary contains terms often used in discussing commercialization strategies and the innovation process. This glossary, however, does not include many of the standard accounting, business, and legal terms you will need to know in order to plan an individual commercialization strategy. You can find such standard terms in textbooks or in specialized dictionaries at most public libraries.

Terms

art technology: An art technology is one whose invention (or use) follows from know-how, craft skill, or experience, rather than from formal scientific and engineering knowledge.

Inventions based on art technology occur in virtually all fields. In many applications, such inventions are readily accepted. When they occur in industries based on formal scientific and engineering principles, however, art technologies can face formidable market barriers. Roentgen's X-ray photography, which preceded scientific knowledge of radiation, was an art technology that led to new scientific knowledge. In the computer industry, by way of contrast, the tantalizing possibilities inherent in art technology, in the form of new software or modifications to existing software packages, has created a market for art technology that often results in the fragmentation of supposedly standardized technology into locally distinct uses largely dependent on know-how.

best available technology: In some highly regulated industries (such as hazardous waste disposal) government regulations mandate purchasing equipment or processes under a best-available technology standard. Thus, if testing can establish that quality, a technology has a clear-cut marketing strategy. When the technology fails to prove itself "best," however, or when testing criteria work against innovation, best-available technology regulations erect virtually insurmountable market barriers.

Common mythology also ascribes variants of best-available technology standards to other, non-regulated industries: "When they see it, they'll have to buy it," says the inventor. In fact, counting on best-available technology standards seldom, if ever, constitutes a viable marketing strategy outside those few closely regulated industries. Even there, marketing strategies relying on best-available technology standards are likely to become time consuming, frustrating, and very risky. (See 20/30 rule; market barrier.)

boilerplate: Those standard, legal sounding paragraphs appearing in all contracts, such as licensing agreements, and in most venture capital and investment documents.

bootstrapping: (See financing.)

business plan: A standard business document, the business plan (typically 25-35 pages long) is a written statement intended to crystallize business objectives, inform readers about the business, and provide a guidebook for managing the company. Often used as a prospectus when seeking financing, the standard business plan will contain a brief executive summary, a history and description of the business, and sections detailing the company's market analysis, marketing strategy, financial projections, organization, and capitalization. A typical business plan may also contain appendices detailing such things as patents, financial projections, explanations of special problems or capabilities, and resumes for the company's key personnel.

capital: The total money and property a business owns or has at its disposal. It is important to recognize how the various specific types and sources of capital typically correlate with the technical, marketing, and business development steps in the commercialization process for small businesses:

sweat equity—The unpaid effort and labor the owner of an intellectual property brings to the commercialization process. Actually a form of capital, sweat equity (along with personal and family savings) will usually suffice to move from concept to working model and to make the first serious passes at market analysis and business planning. In some cases, sweat equity and personal savings will take a technical development program through the engineering prototype.

Appendix One

seed capital—Early-stage, limited capital (typically in the $25,000 to $100,000 range for the very earliest stages, $100,000 to $500,000 later). Usually raised locally through networks of friends and informal investors, seed capital will probably bring a technical development program to production prototyping while market analysis and business planning become formalized.

pre-venture capital—Typically in the $500,000 to $1 million range, pre-venture capital often brings more active involvement from investors. This is the capital that commonly produces product qualification models, limited production, and the first introduction of the product or process into the market. Market strategy and business planning must be set, even if they still require fine tuning.

venture capital—Formal (or institutional) venture capital is almost always the last form of equity capital to appear in the commercialization process (other than an SEC regulated stock offering). Usually $1million and up, venture capital is most often available to businesses that already have achieved market penetration and are headed toward the break even point. Formal venture capitalists are only interested in businesses that have potential for rapid growth. Anyone seeking venture capital must recognize the implications of the 10/5 rule (as a basic standard, formal venture capitalists expect start-ups to produce a 10 times return on investment in 5 years). Full production capability, a real market and defined marketing strategy, and a working business structure—these are the things that attract venture capital.

captive inventor: Inventorship and ownership of an invention are separate issues. Ownership, which by definition involves property, can become a contractual matter. A captive inventor is one who works under an arrangement that assigns ownership to someone else (usually a situation specified among the terms of employment). Determining ownership of an invention can become a complex legal matter, and some states have enacted laws governing the circumstances under which ownership of an invention is assigned to an employer, rather than to the employee-inventor.

cash flow: One of the most important financial measures for any business. Cash flow is the difference between the amount of money coming in during a given time and the amount going out over the same time (usually the short term—calculated in months, or even in weeks or days). When the money coming in is greater, there is positive cash flow. When expenses exceed income, a business has a negative cash flow.

The importance of a positive cash flow is seen in the plight of any small company with few cash reserves, a large backlog of new orders and a negative cash flow. At best, such a business will need substantial new credit or loans to meet short-term expenses; at worst, negative cash flow will spell disaster for an otherwise healthy firm.

commercialization plan: The basic planning document for moving technology into and through the commercial innovation process. The commercialization planning process is one that defines applications' possibilities for inventions and new technologies. The purpose is to explore options, define the resources needed, and produce the information necessary to establish commercialization options. The outcome is in sorting and prioritizing options in application-specific deployment planning. Such planning yields the product definition needed to begin effective new product development. An effective commercialization plan contains the information needed to select venturing or licensing strategies, and usually provides the basis for effective business planning.

cross-licensing: In many industries—such as automobiles, petroleum, equipment manufacturing, and communications—individual companies commonly exchange technology through cross licensing agreements. Under such agreements, firms typically grant royalty-free licenses to other participants, in exchange for reciprocal rights to their competitors' technologies. (See licensing; royalty-free license.)

due diligence: A legal term, due diligence refers to the formal investigative procedures a business must undergo when entering into certain regulated financial arrangements, such as making a public stock offering.

Appendix One

More generally, inventors and small businessmen might be well advised to pursue their own due diligence investigations when negotiating with investors or prospective licensees.

end user: The actual user of a technological product or those products derived from technological processes.

The significance of this term appears when the end user is distinguished from the customer. Frequently the customer (the person who actually buys) and the end user are different individuals, as is almost always the case with industrial tools, supplies, or products, and always the case with sales to an OEM (original equipment manufacturer). The customer and the end user do not always share the same incentives to buy a new technology, and the difference in their willingness to employ innovations often forms a critical market barrier. Distinguishing the end user from the customer can be the most crucial step in developing an effective marketing strategy.

engineering prototype: See prototype.

entrepreneur: A person who undertakes to start and operate a business, usually assuming the greater part of the financial risks involved—and consequently reaping a large part of any rewards earned. In the commercialization of new technologies, the entrepreneur is frequently someone other than the inventor.

equity: Normally describes the total value of the preferred and common stock of a business. The term equity is also used frequently in describing the percentage of ownership a person or group holds in a business.

exclusive license: See license.

exit: The sale of equity (ownership) in a business.

exit strategy: The plan or method those holding shares of ownership intend to use when liquidating equity.

financing: A general term used to describe the ways to acquire capital necessary for establishing, operating, or expanding a business. While financing strategies vary considerably in complexity, those most small businesses can use for sustainable commercialization fall into just three types:

bootstrapping—Self-generated financing from current income (requires a reliable positive cash flow).

debt financing—Borrowed money.

equity financing—Sale of a share in ownership to acquire capital.

intellectual property: A general term describing the legally protected ownership of copyrights, inventions, know-how, logos, patents, service marks, trademarks, trade names, or trade secrets.

invasionary technology: A technology or technological process whose commercialization requires competing directly with other technologies already dominating that particular market.

license: An agreement under which the owner of an intellectual property allows someone else to make, use, or sell things protected by ownership. With an exclusive license, the licensee gains sole right to employ the intellectual property governed by the license, although such a license may carry limitations on territory, field of use, product, or time. Under a limited or nonexclusive license, the person granting the license is free to grant other similar licenses on the same intellectual property. (Also see cross-licensing; royalty-free license.)

licensee: The person or company gaining rights to an intellectual property under a licensing agreement.

licensing: The general term describing the legal process in which a license is granted on an intellectual property. One of the two basic commercialization strategies available to individual inventors. (Also see venturing; cross-licensing.)

licensor: The person who grants use of an intellectual property under a licensing agreement.

limited license: See license.

linchpin technology: A technology for which commercialization increases the market potential

for other supporting or ancillary technologies. In some cases, commercialization of a linchpin technology will actually call for the invention of new technologies, just as inventing the light bulb called for new electrical generating, transmission, and distribution technologies. In other cases, the linchpin technology will reorder or revitalize existing technology, as the automobile did to the petroleum refining industry.

Generally, linchpin inventions face formidable market barriers.

market barrier: Those obstacles other than the needs for technical development, market analysis, and business planning that must be overcome in commercializing a technology.

Indeed, the normal commercialization activities (technical development, market analysis, and business planning) will expose market barriers. These can be things such as: extraordinary capital costs, user acceptance problems, the need to establish extensive advertising, sales, distribution, user education, or maintenance capabilities, the NIH syndrome, linchpinning, or an inability to meet the 20/30 rule. Obviously, no list of market barriers can be exhaustive, but all such barriers must be identified and addressed before sustainable commercialization is really possible.

market channels: The step-by-step paths along which technologies move from producer to the end user. Writing these out (or diagramming them) is one of the basic first steps in market analysis.

marketing: Those activities involved in analyzing the sales potential of a product or process, as well as those activities involved in customer service, advertising, distribution, and selling. In the commercialization process, marketing actually breaks down into three vital parts:

> **market research and planning**—Analysis and evaluation of the market, which includes such tasks as identifying market barriers, channels of distribution, market size, and who will buy. Market research should begin at the concept development stage, and play a continuing role in technical development as well as in developing market strategy and business organization.
>
> **market management**—Advertising, promotion, and customer service. These critical service functions play a central role in sustaining the commercialization process.
>
> **sales and distribution**—Management of the channels of distribution and sales force. By definition, sales and distribution are the obvious goals of any commercialization effort. Less obviously, perhaps, these activities can also furnish important information tion leading to product improvements, the development of new applications, or even to new technologies.

model: See prototype.

negative cash flow: See cash flow.

NIH: Initials standing for "Not Invented Here," a phrase used to describe industry reluctance to adopt innovations originating outside that industry's normal R&D channels. The NIH syndrome can form a crucial market barrier, especially in some of the older, more established technology-based industries such as automobiles, steel, oil, metallurgy, and transportation.

OEM: Initials standing for "Original Equipment Manufacturer." Such firms typically purchase various parts, supplies, or even sub-assemblies from other manufacturers. (See end user.)

paid-up license: See royalty-free license; license.

positive cash flow: See cash flow.

product: In the language of the innovation process, a product is what goes to market. In fact, "products," in this sense, can be services or processes just as easily as things.

product definition: The first step in setting the planning and resource requirements for moving an invention into the commercial innovation process. The product definition brings together knowledge of user needs (market information) with understanding of technical capabilities. The product definition establishes the specific features or functions that need to be developed, enhanced, or emphasized both in creating the product and in designing a marketing plan.

APPENDIX ONE

production prototype: See prototype.

product qualification model: See prototype.

prototype: A prototype can be a mockup, model, or actual working version of a technological device or process. Prototypes are used to generate information that will help design or perfect the final production process.

working model—A reduction to practice, proof of concept. The working model is often less than full scale, inexpensively and crudely constructed, and need not function optimally. Intended to test the most basic operating parameters and to aid in the design of an engineering prototype.

engineering prototype—An actual working version of a product, apparatus, or process used to gather data on operation, performance, and production requirements. Most often one-of-a-kind and commonly fitted with special instrumentation, this model is usually handmade, but always of sufficient technical quality to determine whether a production prototype can (or should) be built.

production prototype—A full-scale, completely operational model designed to determine production and fabrication requirements for the production item. Also used to generate the final pre-production performance data on operation and durability. Usually hand built, the production prototype must conform as closely as possible to the design standards for the final full-production product or process.

product qualification model—A full-scale, fully operational model manufactured in an initial, limited production run under conditions as close as possible to final production. Used to ensure final production runs will produce a product meeting design standards. Product qualification prototypes are often subjected to independent third-party testing, especially if the product must meet industry or government regulatory standards.

Together, the sequential development of these various prototypes and models forms the core of a complete technical development program, one that will lead to a viable production item or process.

royalty-free license: A license requiring no further royalty payments. Also called a paid-up license. At times, such licenses are granted with an up-front, one-time cash payment. Other times they are granted without any financial consideration involved; this is particularly the case under cross-licensing agreements and with government use of inventions developed under public funding.

seed capital: See capital.

sweat equity: See capital.

technology: Commonly thought of simply as mechanical or science-based ways of doing work, this word actually warrants careful attention. Technology comes in all varieties, and on all scales, from the smallest consumer item to vast industrial complexes. For the sake of clarity, it is worthwhile to point out that all technologies, large or small, will fall into one of four categories:

know-how—Knowledge or experience allowing effective and economical use of technological products, processes, or tools. Often mistakenly considered intangible, or even of negligible commercial value, know-how actually constitutes one of the most marketable intellectual properties inventors can bring to the commercialization process in some industries, electronics for example. Know-how often furnishes the only basis for commercialization, whether through venturing or licensing.

process—A way of doing things, making things, or controlling a manufacturing activity.

product—An actual thing to be manufactured, used, or consumed.

tools—Those things needed to make products or implement a process. (Something will be a tool to end users, even while those who manufacture and sell it consider it a product.)

All four of these technological entities can be protected as intellectual property and any of the four can become the object of commercialization. Indeed, with some inventions commercialization may be possible through more than one of these four technology categories. In that case, deciding whether to commercialize the invention as product, process, tool, or know-how constitutes a crucial first step toward the market. When commercialization requires developing an invention through more than one of these forms, the invention is probably a linchpin technology.

10/5 rule: A rule of thumb that says formal venture capitalists want start-ups to produce a 10 times return on investment within 5 years. (Also see venture capital under the glossary listing for capital.)

20/30 rule: A very general rule of thumb for assessing market potential with an invasionary technology. Variously stated by different people, the 20/30 rule really just says that to succeed in the market a new technology must do its job 20% better and 30% cheaper (or *vice versa*) than existing technology. (Also see best available technology.)

venture capital: See capital.

venturing: A general term to describe a commercialization strategy based on creating a new business. Sometimes the meaning of venturing is expanded to describe a commercialization involving significant expansion of an existing small business. One of the two basic commercialization strategies available to individual inventors. (See entrepreneur; also see licensing.)

working model: See prototype.

Appendix 2: Bibliography of Useful References

An enormous body of information is available to anyone interested in the topics covered in this pamphlet. Any experienced researcher will tell you, however, that a few good starting points serve far better than enormous lists. You can find plenty of material on the Internet or in libraries. You certainly won't need to go far to find material and advice, and, in fact, you may find your biggest problem is trying to sort through the piles of references and search engine 'hits' you'll generate in an unorganized search. You may quickly find you need the help of an information specialist just to separate the wheat from the chaff. With the Internet, you also need to watch for outright scams, amateurs offering poorly conceived opinions, and quick-buck artists who want to charge you for information compiled from readily available public sources.

More than ever before, the first stop in your search for information should probably be at a local library. The information age is transforming these venerable institutions, and the reference librarians often have access to databases, search engines, and resources that can turn a frustrating do-it-yourself effort into a few minutes at the terminals. Libraries not only stock books, journals, and government publications, but most now do online searches and have the capability to download and print full text material. Such service—even at a small public library—can save a lot of legwork. Best of all, libraries are increasingly paying the fees required to get access to the most sophisticated information and resources, which they in turn provide to you at little or no cost.

The more pressing your need for information, the more likely you'll want to talk with an experienced reference specialist, particularly if you can get to a university that has an engineering college or a business school. (Don't be put off if you're not a student or faculty member. As a taxpayer, you have the right to use the libraries at most public universities, and at a lot of private ones as well.) Don't be shy. Remember, librarians need to justify their technology, too. Asking them to do a search spreads costs across one more use. Usually, they are only too glad to help.

The following pages list some useful sources, organized by major topics discussed in this pamphlet.

Technology Commercialization, Studies of General Interest, and Useful Business History

Gordon Baty. *Entrepreneurship for the Nineties.* 1990. An update of a classic from the 1980s. Anecdotal, and still good.

Alfred D. Chandler, Jr. *The Visible Hand.* 1977. Most consider Chandler the 20th century's foremost scholar on the growth of American business. Chandler sees the process as primarily driven by technology, some of it contributed by individual inventors. Anyone seriously interested in technology and the development of modern corporations will find this an important source.

Robert G. Cooper. *Winning at New Products: Accelerating the Process from Idea to Launch.* (2nd Ed.) 1993. Conceived as a "how-to" for large and medium-sized companies, Cooper's work nevertheless makes valuable reading. The stage-gate model is for managers who deal with multiple new product efforts, but the principle of parallel progress in technical, marketing, and business tasks is clearly evident and applies to the independent inventor or small business just as readily as to the big companies.

Peter Drucker. *Innovation and Entrepreneurship: Practice and Principles.* 1993. Not the usual definition of entrepreneurship, but an excellent book. The first edition was published in 1985. Topical and timely, it has aged extraordinarily well and still deserves attention.

Harold C. Livesay. *American Made: Men Who Shaped the American Economy.* 1979. Says a great deal about technological innovation and the commercialization process in American history. Telling its story through the biographies of nine businessmen and inventors from Eli Whitney to Edwin Land, this book remains a basic source for anyone interested in new product development and commercialization.

Thomas P. Hughes. *American Genesis: A Century of Invention and Technological Enthusiasm, 1870-1970.* 1989. A history that celebrates the likes of Edison, Bell, and the Wrights. Hughes offers many insights into the process of invention and the paths to commercial success.

Appendix Two

Donald A. Norman. *The Design of Everyday Things. 1990.* Norman is a psychologist who writes about our frustrations with technologies that we have trouble operating effectively (e.g., the VCR programming functions). His focus on frustrating designs offers a powerful statement on what makes for good design. He also gives a good deal of attention to what makes for good design in the things we use every day. Anyone interested in new product development can learn something important.

Henry Petroski. *Invention by Design: How Engines Get from Thought to Things.* 1996. Case studies in invention. Petroski details the product development process and explains the importance of engineering design that satisfies market needs.

Self-Help Just for Independent Inventors

There are many self-help books for inventors and small business owners who have new product ideas. Almost all claim to offer one-stop shopping. In fact, most have a very clear bias toward either venturing or licensing and present the innovation process from a definite point of view. You'll want to look at several in the library before you buy one. Which ones you choose may well depend on whether you are looking to develop a product or service, a consumer item or an industrial process, a one-of-a-kind or a mass production item. As always, look for the right kind of help.

Don Debelak. *Bringing Your Product to Market.* 1997. A publication from the book series published by *Entrepreneur Magazine*. Debelak offers check lists, "how-to" advice, and resource information. Particularly good for the emphasis on issues such as prototyping and the importance of market knowledge.

Howard Bronson, Peter Lange, and Peter Langram. *Great Idea! Now What?* (Small Business Sourcebooks) 1995. Intended for independent inventors. Strong on evaluating your new product idea, but carries through the process to the "how-to" for starting a small business.

Richard C. Levy. *The Inventor's Desktop Companion: The Guide to Successfully Marketing and Protecting Your Ideas.* 1995. (Rev. Ed.) Levy is a successful toy inventor who gives no-nonsense advice on how it's done. A big book, the emphasis is on licensing in the fast-moving world of consumer products.

Thomas E. Mosley. *Marketing Your Invention.* (2nd Ed.) 1997. Mosley brings his experience as an invention evaluator for public sector inventor assistance programs to bear. This work is strong on taking a hard look at evaluating your project. Includes many useful tips and is particularly strong in identifying problems, including the dangers of inventor scams. This is another of the offerings from Upstart Publishing, which specializes in publishing self-help books for inventors and small businesses.

Harvey Reese. *How to License Your Million Dollar Idea: Everything You Need to Know to Make Money.* 1993. As the title suggests, this book carries a heavy emphasis on licensing and intellectual property. It can help you decide whether an early-stage idea is worth pursuing.

Helpful Information of All Kinds

Even for those who have not taken the plunge into Internet use, the Web is the best place to get contact information such as names, addresses, and telephone numbers of the specific person with whom you might want to talk. If you're not connected to the Internet, a trip to your local library to get help searching, or even to learn how to do all those mouse clicks yourself, will probably save time and effort if you're trying to get information that is up-to-date and accurate. Many agencies, such as the Patent and Trademark Office, maintain online phone books and mailing addresses that allow you to pinpoint contacts. The Government Printing Office supports an online bookstore.

The best place to start is with the Inventions and Innovation Program in the Office of Industrial Technology at the U.S. Department of Energy. This program is sponsoring publication of this pamphlet, and while the Inventions and Innovation mission specifically targets energy-related inventions, the information you'll find in their *news* and *related links* sections can serve you well no matter what kind of product or service you're seeking to develop. The Inventions and Innovation Program maintains the site specifically to provide program information, news, and announcements of interest to inventors and small businesses. Just remember, as with any publicly available information source, you'll need to qualify the leads and check for yourself that the listed products and services can really meet your needs.

Appendix Two

You'll find the OIT sponsored Inventions and Innovation Program site at:

http://www.oit.doe.gov/inventions

Another very useful place to look for information specifically aimed at small businesses is the Small Business Administration. You'll find its Web-based information center at:

http://www.sba.gov

On its Web site, the SBA provides specific contact information for its many local offices (you can also use the phonebook) and resources, information on financing, starting a business, training opportunities, government contracting opportunities for small businesses, access to SCORE consulting, and many other useful things.

One particularly useful area on the SBA Web site is at the page for the Small Business Development Centers.

http://www.sba.gov/sbdc

You find listings for local offices (addresses and phones) as well as a set of links to online resources, tutorials, worksheets, and tips.

A third publicly available service that can save real time and money is provided by the online capabilities list of the U.S. Government Printing Office. You can find the latest information, and these folks even maintain their own online bookstore. You'll find them at:

http://www.gpo.gov

If you want the latest information from the Patent and Trademark Office, it maintains an extensive site that includes a database that enables online patent searches. You can also download patent application materials. We always advise riding the expert express when it comes to patents, but as with the other sites listed in this section, you'll find an ocean of useful information. For example, you'll find patent statistics, links to patent offices in other countries around the world, and the PTO customer service telephone number (1-800-PTO-9199). It also publishes news, announcements of public interest, a complete telephone directory, and address listings for the PTO.

The site is located at:

http://www.uspto.gov

Market Analysis

Perhaps the most important thing to understand when looking for information on marketing is that this is definitely not a one-stop subject. You'll find information and sources break down into works on strategy, market analysis, advertising, sales, and market management.

The first thing you need to know is where to start. If you want to go with your product idea through the complete innovation process, you'll eventually need to get a working familiarity with all the areas of marketing. For most inventors and small businesses, however, the most pressing need is to understand what's actually happening out there in the marketplace: Who's buying what? How much do they pay? And why?

The need to answer these kinds of questions means the most logical place to start is with market analysis. This is when you get the information you need to know to produce a useful product definition. The product definition will help you figure out strategies, who the competitors really are, and just how much you really need to know about channels of distribution, pricing, sales, advertising, and market management. You probably need to know more than you think, even if you plan to license. Indeed, market analysis is the key to valuing technology and very often provides the best information when you begin looking for licensees.

To get started, try these:

William A. Cohen. *The Marketing Plan.* 1997. A basic "how-to" with a workbook format containing forms you fill in. If you don't have answers, you need more information. Cohen's forms are intended to lead you to the basis for a formal marketing plan. Although it has been around for a while, this author's *Developing a Winning Marketing Plan* (1987) also warrants looking at, particularly for the sample marketing plans it offers.

John V. Ganly. *Data Sources for Business and Market Analysis.* (4th Ed.) 1994. If you need to know how to find an overview of market trends, market size, or any other first cut at statistical information, this is worth a try. Ganly takes a global perspective and provides listings for sources of market information in as many areas and industries as possible.

Appendix Two

Malcolm H. B. McDonald and Warren Keegan. *Marketing Plans That Work: Targeting Growth and Profitability.* 1997. If you really want to understand marketing and its importance, this work makes an excellent starting point. Somewhat formal in their definitions and analysis, the authors nevertheless succeed in explaining why you need to think about things like segmentation or positioning. Excellent both in the overview and explanation of marketing principles.

Geoffrey A. Moore. *Inside the Tornado: Marketing Strategies from Silicon Valley's Cutting Edge.* 1995. An updated offering from the author of *Crossing the Chasm*, a marketing classic from the early 1990s. Moore concentrates on the high tech companies of Silicon Valley, but his insights into market efforts for product launches with new technology carry a much broader message. Many marketing texts assume well established markets and an existing company. They really aim primarily at improving marketing efforts. For inventors and technologists seeking to introduce genuinely new products in emerging markets, Moore's works are well worthwhile.

Sarah White. *Complete Idiot's Guide to Marketing Basics.* 1999. Don't let the title put you off, White really has provided a general overview to marketing basics, including the all-important topic of market analysis. Not entirely focused on new product development, but the very general quality of the coverage for all the topics in marketing is this book's greatest strength.

When you're ready for a more formal approach to marketing, try:

Philip Kotler. *Marketing Management: Analysis, Planning, and Control.* (9th Ed.) 1996. When you've covered this, you've gotten it all. You might also want to look at the *Principles of Marketing*, which Kotler co-authored with Gary Armstrong (8th Ed., 1998). These are standard textbooks in business schools.

Patents, Licensing, and Other Intellectual Properties

Unfortunately, in most intellectual property matters, the costs and the decisions have to be faced up front, but you can be forced to live with the consequences for a very long time. This is why so many people give the following advice: "The best help you can get is the cheapest no matter what it costs!" Trying to write your own patents (it can be done) or negotiate your own license can easily become a recipe for disaster. You need to be involved in intellectual property decisions, but if your ideas really have merit and value, you're going to need professional help sooner or later. This is an area where "sooner" is definitely better than "later".

How much you're really going to have to spend creating and protecting intellectual property will probably depend on just how valuable your ideas really are. Getting a grip on the real value of your ideas is the first step in choosing an intellectual property strategy: patenting, licensing, trademark protection, and successive steps. To get started, you're going to need to know something about the different types of intellectual property and how they work. Don't overlook the fact that they most often work together, and you might well need to consider creating multiple forms of intellectual property. Trade secrets and know-how, for example, often enhance the value of patents in a licensing negotiation. You need to speak the language, not as an expert, but at least well enough to talk with the experts so that you can find the kind of help you really want and need.

Start with the basics. You can get a wealth of information from government publications. To get started with the most recent pamphlets, news, and guides, try the Web site maintained by the Patent and Trademark Office. If you need help or a connection, your local librarian can help you find information on their site:

http://www.uspto.gov

This is an area where the Inventions and Innovation program at the Office of Industrial Technologies can also provide you with up-to-date leads:

http://www.oit.doe.gov/inventions/links.shtml

There is also a useful online resource covering intellectual property basics provided by the Franklin Pierce Law Center at this address:

http://www.fplc.edu/tfield/ipbasics.htm

The Cornell Law School offers a similar site (also searchable) at:

http://www.law.cornell.edu

Appendix Two

The Patent and Trademark Office publishes basic (and readable) pamphlets and guides that are available through the U.S. Government Printing Office. These are updated frequently, and some titles you might want to look for are:

- *Basic Facts about Patents*
- *Basic Facts about Trademarks*
- *General Information Concerning Patents.*

These are pamphlets you're likely to find in your local library, but you'll want to check the GPO indexes to make sure that your library is maintaining the most recent and up-to-date versions in its pamphlet files. Using library resources, make sure to check that anything you get on patents has been published since 1995 (the last major update in the law).

Other organizations also publish useful guides that make good starting points. The American Bar Association Section of Patent, Trademark, and Copyright Law puts out an informational booklet that many law firms pass out to clients and prospective clients.

What is a Patent?

If you can't find one at a local law firm or in the library, try contacting the your local chapter of the American Bar Association. If all else fails, you can search for publications on the ABA Web site:

http://www.abanet.org

To go directly to the search engine for their publications, use this address:

http://www.abanet.org/abapubs

The Licensing Executives Society (U.S.A. and Canada) also has a number of publications that may prove worthwhile. One of the most important is a Consultants and Brokers List, which is updated every two years. The Web site is at:

http://www.usa-canada.les.org

You can also contact them by writing or calling:
Licensing Executives Society
(U.S.A. and Canada), Inc.
1800 Diagonal Road, Suite 280
Alexandria, VA 22314 2840
Tel: (703) 836 3106
Fax: (703) 836 3107

The Licensing Executive Society has also joined forces with the Inventions and Innovation Program in the DOE Office of Industrial Technology to produce a useful pamphlet called *Making the Licensing Decision* (1998). Copies are available from either the Licensing Executives Society or the Inventions and Innovation Program.

Finally, while it's not easy to find a great deal of material that treats the lighter side of intellectual property, you might want to look for this title while you're at the library:

Marjorie Stiling. *Famous Brand Names, Emblems and Trademarks.* London, 1980. Why not have some fun while you're in the library? Find out how England's Bass Brewery managed to get trademark registrations 1, 2, and 3. Or, find out how the words "play well" produced the LEGO trademark.

Business Planning

A lot of material is available, much of which says pretty much the same thing. Among the many business planning guides currently available, these offer something worthwhile:

David H. Bangs, Jr. *The Business Planning Guide: Creating a Plan for Success in Your Own Business.* (8th Ed.) 1998. Forbes lists this guide among its favorites. As the number of editions suggests, it's been around for a while. Still, this new edition is up-to-date and even contains material on how to use the Internet for business planning.

Joseph R. Mancuso. *How to Write a Winning Business Plan.* 1992. This is a revised edition of a classic. Also look for other titles by the same author. Maybe an overly slick text, but this work has an excellent appendix, which includes sample business plans and a source directory.

Linda Pinson and Jerry Jnnett. *Anatomy of a Business Plan: A Step By Step Guide to Starting Smart, Building the Business and Securing Your Company's Future* (3rd Ed.) 1996. A widely recognized guide for writing your own business plan from Upstart Publishing, among the most widely recognized sources for small business guides and self-help manuals. If you ask for recommended sources on business planning at your state's Small Business Development Center, this work will almost certainly appear on the list they give you.

Appendix Two

Eric S. Siegel, Brian R. Ford, Jay M. Bornstein, and G. Young Ernst. *The Ernst & Young Business Plan Guide.* 1993. Another useful guide that has been updated periodically. The authors stress the need to read business plans with the investor's eye (rather than the entrepreneur's).

If you want a readily accessible online kit (including a tutorial), the SBA offers one on its SBDC pages:

http://www.sba.gov/starting/indexbusplans.html

Financing Innovations

Entrepreneurship gets a lot of attention these days. If you make a trip to your local library or bookstore, you'll find rows of titles. Searching the Web will produce thousands of hits. As always, a few good starting points prove far more useful than trying to wade through piles of material.

For online access, once again the best starting place is with the Small Business Administration Web site:

http://www.sba.gov

The SBA will lead you to many resources and opportunities such as the Ace-Net, an online Angel Capital Electronic Network the University of New Hampshire maintains for the SBA located at:

https://ace-net.sr.unh.edu

(That extra "s" in the Ace-Net URL is supposed to be there. When you see an address with the https, it means you're going to a secure server. You'll need a net browser that can handle security encryption. They are readily available.)

There is a fee to post an Ace-Net listing, and it's not for everyone. Still, if you want an Angel Capitalist to find you, the SBA is providing an important service. Be sure to take the time to read and understand the SBA and SEC information pages before you decide this is for you.

There are also some classics and some basic works you might want to look for in your local library or bookstore:

Entrepreneur Magazine Guide to Raising Money. 1997. Published by *Entrepreneur Magazine*, this guide provides a useful and comprehensive overview of pros and cons to financing strategies, as well as ways to find capital.

Daniel R. Garner, Robert R. Owen, and Robert P. Conway. *The Ernst & Young Guide to Financing for Growth.* 1994. Useful not only as a guide to financing strategies as presented by Ernst & Young's Entrepreneurial Services group, this guide also explains the tax implications and SEC reporting requirements for equity financing. Includes a section on state and federal financing programs.

David J. Gladstone, *Venture Capital Handbook.* (2nd Ed.) 1988. Still going strong, this venerable classic surveys the whole problem of raising venture capital. Tells you how to find formal venture capitalists and some hard truths about what you'll find. Read them and weep—and learn. It emphasizes the importance of the business proposal, with a lot of "how-to" material.

Seth Godin. *The Bootstrapper's Bible : How to Start and Build a Business With a Great Idea and (Almost) No Money.* 1998. Bootstrapping gets little enough attention from financing professionals. Godin is an experienced entrepreneur who has participated in the creation of several successful ventures. *The Bootstrapper's Bible* uses his own experience with a 1986 start-up as the basis for his suggestions, but also offers insights drawn from the likes of Starbucks, Bose Corporation, and Dell Computer.

Kate Lister, Tom Harnish, Catherine E. Lister, and Thomas D. Harnish. *Directory of Venture Capital.* 1996. Highly recommended as a guide for determining whether your business is likely to attract investors. Contains names and addresses of over 600 active venture capitalists (as of 1996). The publisher, John Wiley and Sons, also advertises a companion computer disk that contains a directory of active venture capitalists.

Stanley E. Pratt (Ed). *Pratt's Guide to Venture Capital Sources* (23rd Ed.) 1999. Pratt's guide, regularly updated, is a standard. It's expensive. Look for it in a library that has a strong business reference section.

Appendix 3: Legal Considerations

Ignorance Excuses Nobody

More than many other societies, Americans rely on the law to order their affairs and settle their disputes. (Illinois alone has more lawyers than all of Japan.) The law intertwines business just as it does all dimensions of American life.

Inventors, like other businessmen, should keep abreast of the legal implications of their activities, and make decisions based on that information where appropriate. Keeping straight with the law while using it to your advantage can be an expensive, time-consuming nuisance. Failing to do so can lead to ruinous, career-wrecking disaster. As Ambrose Bierce said, "A lawsuit is a machine that you go into as a pig and come out as a sausage."

Brief List of Potential Problems

Only a lawyer can give you legal advice. We list below some areas where you may need it:

Patents, copyrights, trademarks, trade secrets: Protecting your interest is vital. Few laymen know how to do it.

Liability: If you've got a workshop, someone may impale his hand on a scratch awl; if you have a factory, one of your employees may get hurt; some delivery man may fall off your loading dock. If you've got a product that injures somebody, you may be liable for faulty design, manufacture, or both.

Business structure: Should you incorporate? If so, in what form? Where? Maybe a limited partnership would better serve your interests.

Do you want to sell stock in your company? Meet the folks from the Securities and Exchange Commission (among others).

Rules and regulations: Federal, state, local; safety and health, environmental—the list goes on and on. Do you have a list? Are you in compliance? Do you have all the licenses you need?

Labor: You can't just hire anybody you please, pay them whatever they'll take, and work them any hours to which they'll agree. Someday some union official may show up to tell you he plans to organize your employees. Then what?

Taxes: A big one. You're subject to property taxes, local, state, and federal income taxes (corporate and personal), excise taxes, and an assortment of license fees when, where, and if they apply. You may also have to collect and hand over state and local sales taxes.

If you hire people, you may have to withhold and account for Social Security and income taxes for your employees. Then there's workmen's compensation.

On the other hand, you may be able legally to avoid or reduce some of these obligations if you know how. Hiring certain types of workers can reduce your taxes, as can buying certain kinds of equipment.

Tax laws also have a dynamic effect on investors. A change in the rules governing capital gains or other tax shelters might bring investors to your door. On the other hand, the wrong changes might make them vanish overnight. You need to know not only what the rules are now, but also some sense of changes in the offing.

Finally, a common way of financing early-stage enterprises is to pay key employees with founders' stock. Do this the right way and your success might make them rich; do it wrong and they may wind up with a tax bill that will eat them alive.

Licensing: See the "Licensing" section.

Advertising: You can't claim just anything about your product; somebody may ask you to prove it.

Is That All?

No, as a matter of fact, the list above doesn't begin to cover every legal contingency you may encounter. As you can see, "free enterprise" doesn't mean the liberty to do whatever you like. Freedom is liberty constrained by law, and you, like everybody else, has to live within the applicable constraints.

Appendix Three

If you decide to get a lawyer, choose carefully. You want someone experienced in the kind of work you need. Ask around, get referrals, then interview your choice by asking him or her the questions to which you need answers. If you don't like what you hear, get a second opinion. Watch out for the fine print. Make them tell you what it means. They can translate that gobbledygook into English, and will if you push hard enough.

The chances are that you have already consulted an attorney, if only with respect to patents. If not, you'll probably find one a necessary member of your professional team. Choose well and he or she will prove one of your most beneficial assets.

Appendix 4: Commercialization Planning

Commercialization planning gives you a way to evaluate commercial potential for new technologies and new product ideas. Formal planning organizes the technical, market, and organizational information needed to evaluate and develop your idea's commercial potential. Writing the plan as a formal document will help your organize your thinking. A formal plan also gives you a document you can use to attract new interest in your project.

The first step in commercialization planning involves getting organized: drafting a statement of purpose (executive summary), assessing work to date (project summary), and taking stock of available resources (internal factors). These basics allow you to test your product ideas and very often lead to entirely new ideas for products and services based on your ideas. Getting these basics right also helps define the new resources and partnerships you'll need to exploit your ideas (external factors).

Your last step in the planning process is to sort and prioritize potential applications into a workable plan for each product idea (deployment planning). Deployment planning creates the product definitions you need to really enter the commercial innovation process. This last step in commercialization planning can often lead directly into formal business planning.

Using a commercialization plan outline brings together information and points up gaps in resources. In early stages of planning, all of the information called for in this outline may not be available.

Commercialization Plan Outline

Executive Summary

An executive summary needs to be very short (under two pages). At the same time, you must also give a very broad overview of key technology, market, and organizational issues you want to address. Give emphasis to your projects needs as well as its strengths. Write about the project strengths first, however. The project's strengths actually provide the basis for understanding your needs.

Whatever specific format you use to write the executive summary, give ready answers to four questions:

- How will you develop your technology and products, transfer or license them, and ensure commercial success?
- Why should potential partners take an interest in the commercial potential of your projects technology or products?
- What is your project's timetable?
- Why are you and your organization involved?

Project Summary

Make the case for commercialization from your point of view. What has your team done so far? Where does this project stand with regard to your resources and objectives? Why is the project focused in this particular R&D area? What are your best possible exit points?

Internal Factors and Applications Analysis

Organizational goals, objectives, and mission usually determine whether you should try to develop a new product in-house, seek a license, or look for some other form of partnership. Most technologies and product ideas are robust enough to offer multiple application possibilities. The best commercialization strategy very often depends on the application you choose rather than the technology itself.

If your project depends on a parent organization (a company, a joint venture, or a research laboratory), consider your project from the broader organizational perspectives of goals, mission, and objectives. Show how your project and plan align with your parent organization's mission. What commitments and resources do you already have, and what will you need from the parent organization?

Whether a one-person start-up, a family business, or a corporation, you need to take the time to consider your organization's internal factors in light of several potential applications. This planning step addresses the decisions on venturing, licensing, and partnerships.

External Factors

This planning step deals with resources and partnership issues. It has two major purposes: first, to define and sort potential applications; second, to identify appropriate partners for each potential application.

Appendix Four

Technology Application Deployment Plans

As the final step in commercialization planning, you need product specific plans for technical development and marketing. The sorting process in the previous section gives you the number and order of product-specific plans you need.

Here's a simple outline you can use:

A. Project overview (i.e., summary of product uses, market potential, business potential, and competitive advantage)

B. Market analysis

C. Product definition (i.e., user requirements matrix)

D. Partner assessment (if appropriate)

E. Intellectual property

F. Commercial deployment analysis

G. Deployment risk analysis

H. Immediate next steps

Appendix 5: Business Planning

It's not practical to begin real business planning until you've made a number of assumptions and decisions. You've got to try out your ideas and know where you want to go—that's the task of commercialization planning. Only when you've decided what kind of business you want to have can you start to plug your planning information into a business plan outline. The best business plans are working documents; they lay out descriptions of planning assumptions, goals and objectives, and resources. With those in place, running the numbers becomes a significant activity, one that can tell you whether you're being realistic. Remember the first rule of planning: "garbage in; garbage out."

There are many business planning guides available in libraries, bookstores, online, and on disk. You'll find some recommendations in the bibliography. We don't recommend spending a great deal of money on any business planning activity (whether for guides or consultants) until you've gotten a basic idea of what the generic format looks like. When you're ready, local Small Business Development Centers (look in the state listings of your phone book) will provide a limited number of hours of free consulting help, as will the local SCORE chapter. These organizations also frequently sponsor workshops and seminars on business planning.

The first task, however, is to get familiar with the basic outline for a business plan. Here's a generic format:

Business Plan Outline

Cover Sheet

Don't overlook this critical page. The cover should include the most critical contact information: the name of the business, address, phone numbers, principals, date of plan. It's okay to include a very brief (one or two sentence) synopsis on the company purpose, or any other appropriate information about your company and plan.

Executive Summary

This should be short—one page is best, certainly not more than two pages. Still, the executive summary needs to give a genuine overview and tell the reader what to expect in the remainder of the plan. Emphasize your strengths, certainly. But also don't shy away from a capsuled statement of needs, obstacles, and issues you plan to address. Things you really must include are statements on the major business purposes, a description of products or services, a statement of marketing objectives, and some indication of what a reader can expect when he or she turns to the financials section. Try to be up front and direct about whatever ugly problems you face and how you will resolve them. In business planning, you probably will need to wait until you've got the major sections blocked out before you write the executive summary.

Table of Contents

The table of contents—it should be one page—is an essential part of a good business plan. It should be specific enough to let readers get to the sections they want to find very quickly. Include subheadings as far down as you can without causing the table of contents to go beyond that single page. Experienced readers of business plans almost never read from start to finish. Some turn immediately to the financials, others to the section on the management team or the marketing strategy. Most will give up if they can't find exactly what they want. Put some thought into the table of contents.

History

Yes, the history of the business (or project) is a critical element in business plans. You'll need to tailor this section to your needs as either a start-up venture or an existing business. If your history is brief, this section should explain how your venture came to exist, its organization to date, and the backgrounds of the founders. If yours is an existing company, you should explain the major highlights of your history, keeping it brief and adding detail through appendices as needed.

For many readers, your credibility emerges from your accomplishments. This is especially true if you plan to use your plan to raise capital. People want to know about you and the background of your business. Experience counts.

Definition of the Business

Describes exactly which needs your business meets or plans to meet. Whose needs are these? How will your business meet those needs? The questions to answer in this section are really very simple. This is a place where getting opinions from friends and trusted advisors can really help you shape your plan.

Appendix Five

Definition of the Market

Describe the size and location of your market, your projected market share, and how you plan to get this share. You'll also need to describe the customers you plan to target, giving a detailed profile. This is also where you describe your competition. Be honest, just because they are your competitors doesn't mean it's impossible for them to do anything right. How do you plan to meet and beat the competition? How are you getting to the market? Finally, if advertising and promotion are in any way important to your commercialization efforts, briefly describe what you're planning to do. The people who read your business plan are going to look carefully at your marketing strategy and planning.

Description of the Products or Services

You can choose to put this section before or after your marketing section. Which you choose will depend on your project. Here you need to lay out your product definition (or definitions). What product or service will you sell? Where are you in the R&D cycle? What have you done to establish fabrication or assembly capabilities? Do you have any intellectual property protection in place? Planning any? In addition to describing your product or service, you need to address these kinds of questions here. Technical information, however, belongs in appendices—not here.

Management Structure

For many who read business plans, this is the first (and most critical) section they look for in your table of contents. People to whom you show a business plan are going to want to know who is in charge, how things get done, and how you plan to grow. Who are your key personnel? Is there evidence that there is really an effective team in place?

If you're already in business, you need to outline key background information on the company principals, the organizational structure, staffing, employee policies, and the reporting structure. Again, details (organization charts, employee policies, and similar documents) should go into appendices. If you don't have any of these basic things, you're not exempt from work here. People who read your plan are going to want to know how you're going to put these things together. Getting a product through the innovation process is a team effort. Describe your team, how it works, and how you're going to build for the future.

Objectives and Goals

Here is where you lay out what you really want to do in this business. Are you planning to bootstrap? If you are, writing this section may be most important for yourself—to give yourself the opportunity for formalized brainstorming. If you plan rapid growth, equity financing (or taking on significant debt), or even an eventual licensing deal, what you put into this statement presents your business opportunity to those you want to impress.

The amount of detail will vary according to your plan and your strategy. Remember, this is where you need to strike that critical balance between brevity and thoroughness. Make sure your trusted friends and advisors read over your drafts before you put yourself on the line. You want to get this right, and you'll probably need help. Don't forget to cover (besides your business objectives) the time frame you expect to fit, your specific targets, and key short-range objectives. Finally, be sure to explain why your strategy and tactics are the best for your company.

Financial Data

Those business plan readers who don't go first to the management section will usually make their first stop here. In a sense, this is the climax to the business plan. The other sections have provided the rationale and the raw data you need to run the numbers. How do you plan to fund operations over the near term? You'll need to forecast balance sheets, cash flow analysis, statements of earnings, forecasted statements of changes in financial position, and cost-volume-profit analysis. For almost every small business, the most important forecast is the company's projected break even point. Experienced investors and analysts will look at this section with particular care. Provide as much detail and documentation as possible. Disclose the accounting policies and the major assumptions made in your plan.

You need to start plugging numbers into the *pro forma* spreadsheets for the financials as soon as they become available. While we always recommend taking the first cut at planning on your own, this section is an area where you're most likely to find the need for help sooner rather than later. Once you're ready, a professional accountant can be worth his or her weight in gold when it comes to laying out the financials in a clear, consistent, and professional manner. Get the information together and, if you need

help, you can try the local SBDC or SCORE chapter. They'll tell you when you need to start looking for higher priced, more specialized help in compiling your financials.

Appendices

You can include any appendices and specific supporting information that you feel your plan requires. Few people will look at these, however, until you've gotten their interest in the major sections of the plan. Keep the main part of the plan as clean and uncluttered as possible. When in doubt, attach useful information here. Thick business plans for small businesses strike many as pretentious or obviously flawed, but that's the only real watchout item here.

As with the whole plan, a real key to usefulness is likely to appear in the way you organize things. Put things in the right place (which probably means following the order of the outline above), and mark them clearly so you and your readers can find them quickly. Provide brief explanations to describe what things are and how a reader might use them. Once you've gotten past the hurdle of getting someone interested in the plan, this is where they'll go to study the details. Take care with the organization and presentation. It would be a shame to lose someone's hard won interest because of sloppy material poorly organized in the appendices.

Notes

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