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STRATEGIC ISSUES FOR COMPUTER SOFTWARE  
DEVELOPMENT IN MONTANA

By

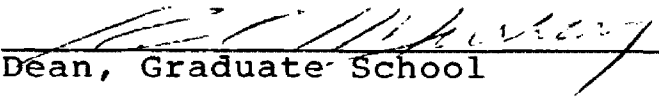
Edward R. Hanna

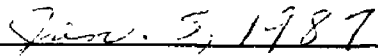
B.F.A., University of Montana, 1980

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for the degree of  
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1987

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## Chapter 1

### EXECUTIVE SUMMARY

The most recent U.S. Department of Commerce data shows the computer software industry in Montana, including development, sales, and services, to be comprised of 17 companies, with a total of 49 employees, and total revenues in 1982 of \$1,942,000.<sup>1</sup> This paper addresses the strategic issues that are of importance for small companies working in the computer software sector of the industry that would choose to locate in Montana. The dearth of models for such companies to follow suggests that there may be competitive restraints inherent to the location.

Turning to an analysis of the software industry, it is apparent that small independent suppliers of software are succeeding in the marketplace and are well positioned to take advantage of the continued growth of the software market in all product sectors.

Since much of this growth will be driven by technologies still in the research phase, the importance of an innovative approach to product definition and development should not be overlooked. Research, however, places a financial burden on the other business functions of the company, along with increasing its degree of risk. The small company must

carefully allocate its resources, and yet not cripple its creativity and technical integrity.

Many high technology companies have been entering joint ventures in order to share the burden of research, and gain more marketing clout. A real possibility exists that these ventures might actually reduce the small company's competitive position, particularly in industrial markets, and damage its credibility.

Federal government procurements are also a huge high technology market, especially regarding the computer industry. The small software company may have the opportunity to obtain government contracts for research that would substantially reduce its risk and financial burdens, and thus put the company in a better position to bring products to the marketplace. Government research contracting is not without its obstacles, and yet these are probably not insurmountable.

Montana's remote location burdens most products exported to the rest of the nation with high per-unit transportation costs. Its derivative industries are to a large degree dependent on the fortunes of its relatively few basic industries. A computer software company could sidestep these problems by being a basic industry itself, and incurring only low transportation costs on very lightweight, high-priced products. The company would still be vulnerable to other problems of state businesses, for instance, the difficulty of

capital acquisition and the very geographical remoteness from the centers of computer industry activity.

## Chapter 2

### THE COMPANY

The company being proposed in this paper is in the computer software business. It is either a start-up or an established company moving to the state; the paper aims to assess the obstacles and opportunities for software engineering in Montana and weigh the promise of both of these stages in company development.

The personal objectives of the founders of the company and their objectives for the venture should govern the structure of the organization. Since the nature of the software market demands constant innovation and product improvement, incorporating leading-edge technology, it is likely that the founders will fall into a class of entrepreneur that Rich and Gumpert call the Inventor-Researcher Entrepreneur.<sup>1</sup> This sort of company founder views the company as essentially a laboratory for developing new products, processes, or services. Perhaps another category, the Starting Pitcher, might also apply. This person is primarily interested in the process of creating a company and a product and getting it up and running.

The impetus to live and work in the state suggests a commitment to the rewards usually referred to as Montana's

quality of life. One would have to assume this to be a motive for the company's founders, since the computer industry is little developed within the state. Nor is there the critical mass of high technology firms, specifically computer industry companies, that is typical of northern California, the Boston area, or eastern-most Virginia. Other factors that seem to be primary in the choice of location for software companies, the presence of an acclaimed academic or government research institute, or major customers, are absent. Choosing Montana as a location implies an attempt to circumvent some of these location factors for the sake of the quality of life or other personal reasons.

The restraints that this places on the company narrows the venture's objectives. The most amenable goal for this company is what Rich and Gumpert call "be a niche company."<sup>2</sup> By targeting a narrow segment of a market, companies with this goal may grow to as much as \$5,000,000 to \$20,000,000 in annual sales, but not typically beyond that. This goal seems especially suited to the restraints that the remote location and founders' objectives place on this software company. Joint ventures and licensing are also possibilities, but high growth as a founding objective argues against this choice of location.

Growing fast and large in the computer software industry, now much more difficult as the industry matures, requires personnel and financial resources that this location impedes

rather than helps to provide. With the restraints of resources and other missing location factors, and the probable objectives of the founders, a portrait of a small software development company with a research orientation comes into focus.

The founders should decide the company's mission in terms of the performance expectations it promises to meet. In the strategic planning process, goals for sales growth, market share, net income, cash flow, and return on investment should be established. With a handle on these feasible goals, the company's mission should be weighed against the opportunity cost of the undertaking. It is probably best to answer during the planning stage whether this company will deliver personal and monetary rewards at least equivalent to those to be had in any other endeavor.

## Chapter 3

### THE SOFTWARE INDUSTRY

An overview of the U.S. software industry, revealing the industry structure, its market segments, and the projections for growth, allows the company to assess the quality of its strategic options. This overall environment determines in what ways the company must adapt its structure and activities to take advantage of the opportunities that exist. Of course, the promise that each of these strategies holds is qualified by the areas of expertise the founders bring to the company. When taken together, the handful of best opportunities should be apparent. In other words, the company must be market-driven as opposed to product-driven, and it is with this in mind that a discussion of the software industry follows.<sup>1</sup>

The software industry is relatively concentrated, though there are an increasing number of small independent companies. Large manufacturers of hardware are also suppliers of software and services, but a substantial portion of this market is held by smaller software suppliers and systems integrators. Participating to a lesser extent are telecommunications firms, semi-conductor manufacturers, publishing houses, and foreign suppliers. According to the most recent statistics available

from the U.S. Department of Commerce, compiled in 1982, there were 4,340 companies comprising the U.S. software industry.

The structure of the industry can be approached by grouping the suppliers along three different modes of product delivery. These are professional services (including contract programming, systems management and design, computer-related consulting, education, and training), software products (on magnetic disks or tape), and integrated systems (hardware combined with the supplier's software and sold as a system).

Figure 1 shows the approximate share of the market, in each of these areas, held by companies of various size. While large suppliers make up a small number of the total companies in each sector, they gather large percentages of the total revenues. Small companies are well represented in each area, however, as a group they divide a larger share of the total revenues in the integrated systems and software products sectors.

Software itself is usually segmented by type: systems and applications. Systems software automatically controls or manages the resources of the computer system. For instance, an operating system manages the performance of data processing tasks; a data base management system controls the use of files in a data base; a telecommunications monitor allows several terminals to communicate with each other and the operating system.



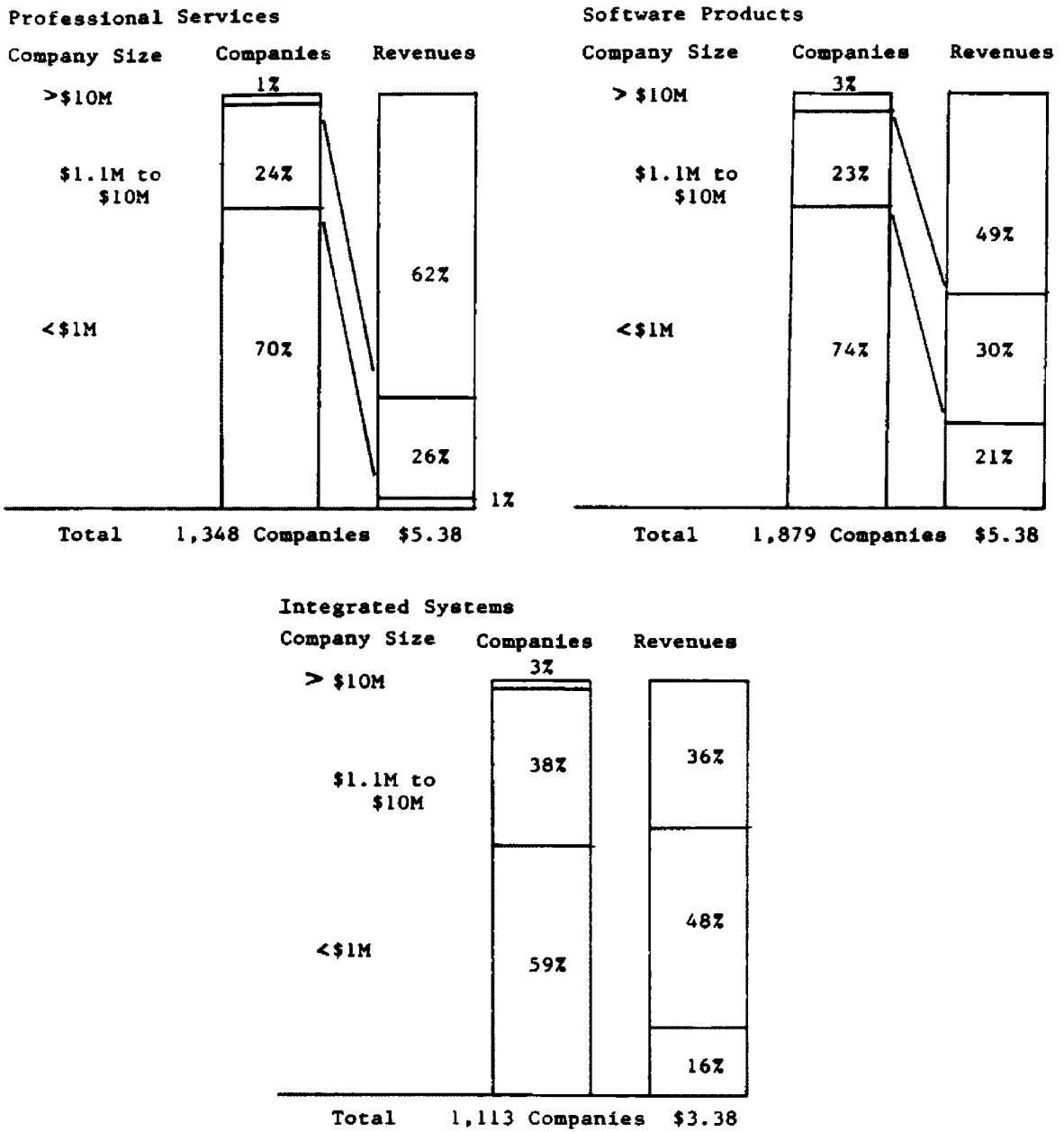


Figure 1. The Structure of the U.S. Software Industry by Mode of Delivery

Source: Office of Computers and Business Equipment, A Competitive Assessment of the United States Software Industry, p. 6

Applications software assists the user by performing specific tasks or instructions. It also is divided into two types. Cross-industry programs are those that have general applications in different situations, while industry-specific programs are created for a unique application within an industry.

Companies in each of the three industry sectors, professional services, software products, and systems integrators must define their market along three characteristics. First, whether they will develop systems or applications software. Within this area there is a division between applications that are industry specific and those identified as cross industry. The third characteristic is the size of the computer system that the software is designed for: microcomputer, minicomputer, mainframe, or super computer.

The product must be targeted so that the expected revenues will cover the high development costs of an innovative design. To help ensure this outcome, software products are typically designed for equipment with large installed bases such as Digital Equipment Corporation and International Business Machines products. Though the market is not usually segmented along hardware brands, the market share held by equipment manufacturers in each machine size category can affect the market size and potential life cycle of software products.

The multitude of suppliers, software products, and markets make the economics of the industry very complex, however, there seems to be a move toward packaged software and away from custom software and integrated systems. There are at least two factors contributing to this trend. One is the worldwide shortage of programmers coupled with a relatively low growth rate of programming productivity and growing user demand. Software applications for super computers and mainframes can typically be backlogged three to four years, and one way that this backlog is being overcome is through the use of packaged programs.

The second factor leading to the predominance of packaged software is the effort to lower the risks and costs associated with the unpredictability of software development. Typical is the Japanese emphasis on the development of software tools; their goal being the fast and inexpensive production of high quality commercial software. This can be seen as part of a worldwide move toward the standardization of the software development process.

### **Development Costs**

Development costs for packaged software programs designed for super computers and mainframes are much higher than those for personal computers. These costs are associated with the scale, up to and exceeding a million lines of code, and the years involved in the process. The result is a

very high cost per unit spread over the low number of sales to be had within the limited mainframe and super computer market. These programs tend to have long life cycles and high maintenance costs. Often the software is leased on a monthly or yearly basis with contracts let for the maintenance service. No doubt this accounts for the observation that software companies serving this market spend far more on research and development than on marketing. They also earn more from maintenance services than is the case with companies designing software for smaller machines. At the opposite end of the equipment spectrum, companies experience relatively lower development costs, spend a greater proportion of their revenue on marketing costs, and tend to have a higher volume of unit sales with shorter product life cycle.

The software packages designed for microcomputers are smaller, relatively less complex, and normally require less than one year in the development process. As opposed to the small installed base of super computers and mainframes, the microcomputer base numbers in the millions. A contrast also exists in the short product life cycle of microcomputer software which sometimes can be measured in months. The smaller size and lower level of complexity in this type of software allows the forces of fast-changing technology, planned obsolescence, and product differentiation to dramatically shorten the life cycle. For this reason, microcomputer software maintenance is much less of a factor both in terms of product

competitiveness and as a source of supplier revenues through service contracts. At the large systems end of the software market, maintenance costs run to 60 to 75 percent of the total life cycle costs that must be borne by the customer, and as much as half of the activities of the data processing staff may be spent on maintenance.<sup>2</sup>

### **Software Industry Growth**

While the software industry as a whole has been expanding at a rapid pace, different product segments have been experiencing different rates of expansion. Some segments in fact have been losing shares of the total software revenues, and though these changes have not reshuffled the relative importance of the segments, the declines are projected to continue.

Figure 2 shows the patterns of growth in the three sectors over the early part of this decade with projections for 1986 and 1987. The growing importance of packaged software within the total software market revenues is evident. Much of the growth in revenues has been produced in this sector and that pattern is expected to continue.

Growth and share of the total software industry revenues can also be examined from the perspective of type of supplier, type of equipment, and type of software (systems or applications). Figures 3, 4, and 5 show a trend of expansion in the market occurring by way of independent suppliers creating

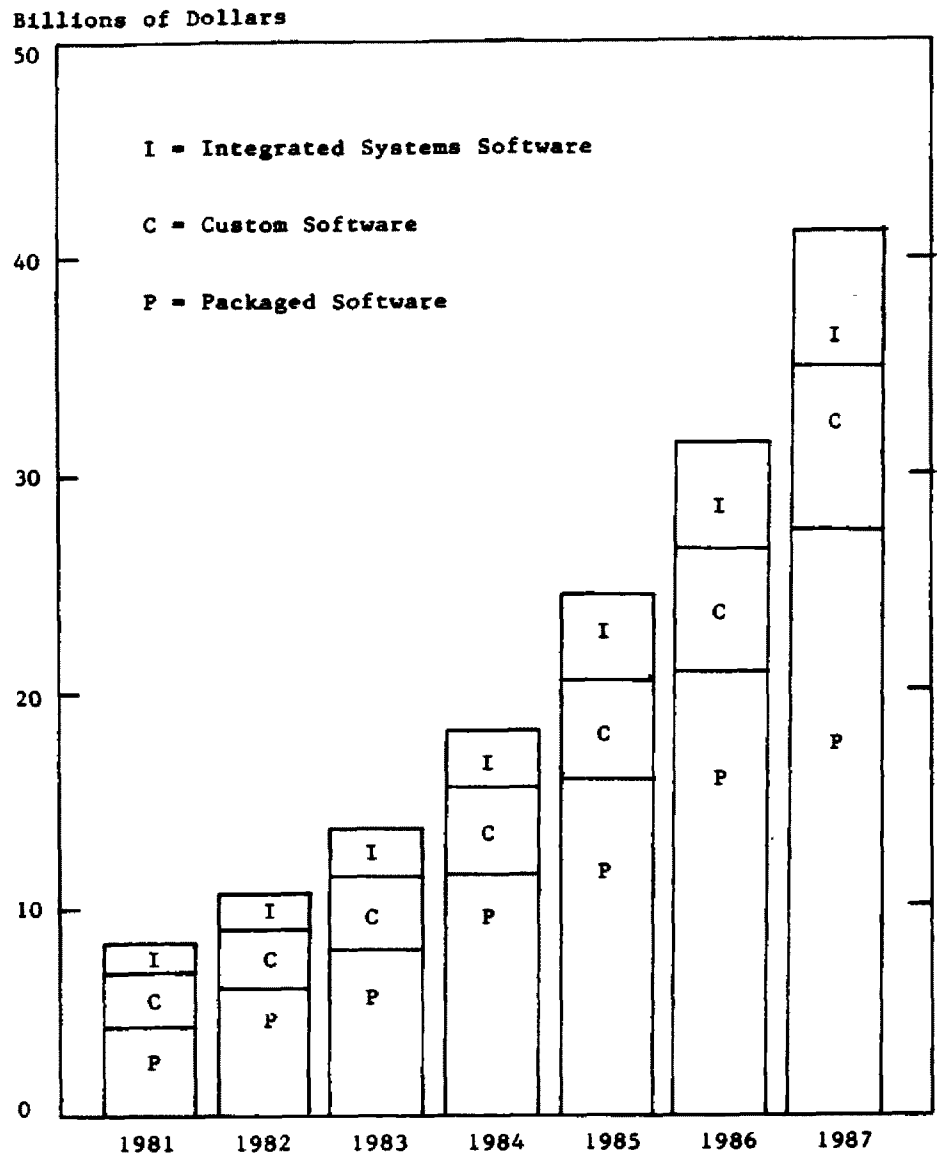


Figure 2. Total Software Revenues by Mode of Delivery

Source: Office of Computers and Business Equipment, A Competitive Assessment of the United States Software Industry, p. 20

Billions of Dollars

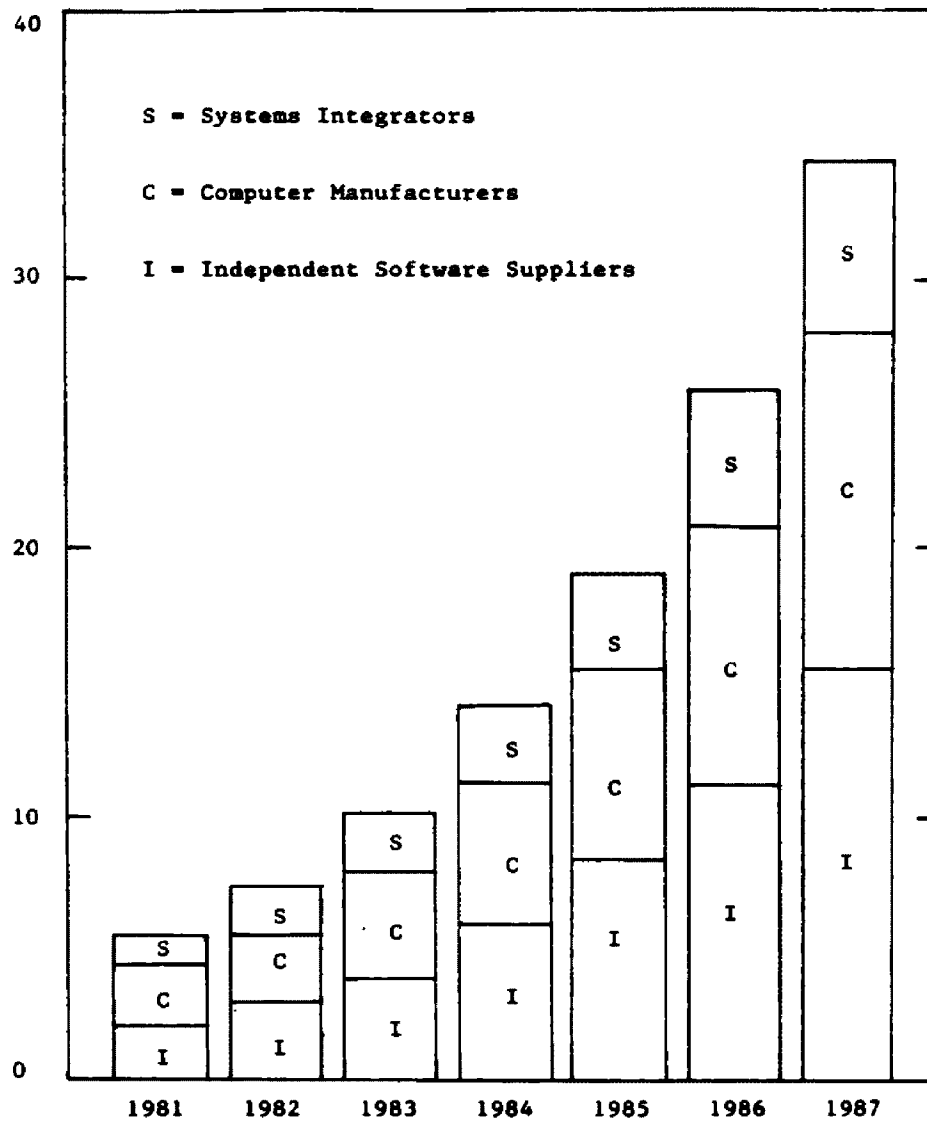


Figure 3. Software Revenues by Type of Supplier

Source: Office of Computers and Business Equipment, A Competitive Assessment of the United States Software Industry, p. 23

Billions of Dollars

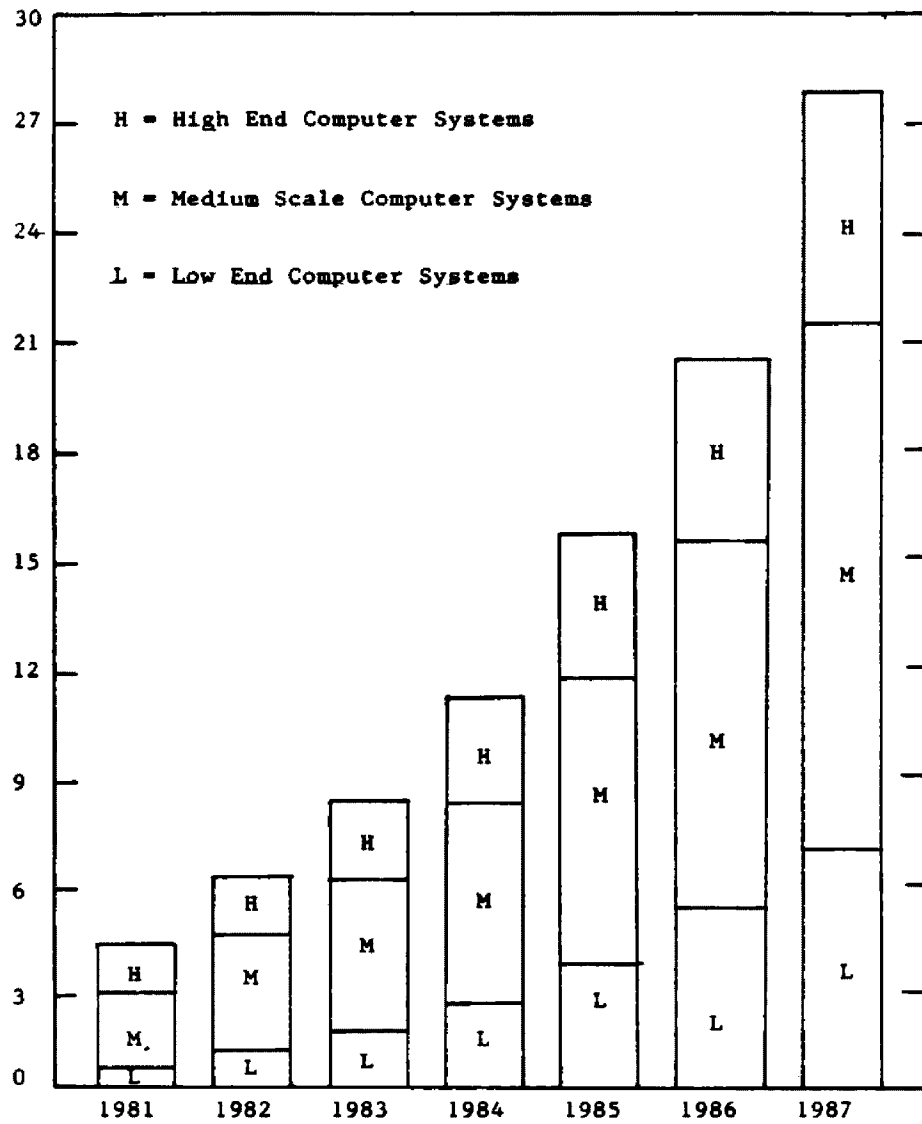


Figure 4. Software Revenues by Equipment Type

Source: Office of Computers and Business Equipment, A Competitive Assessment of the United States Software Industry, p. 24



Billions of Dollars

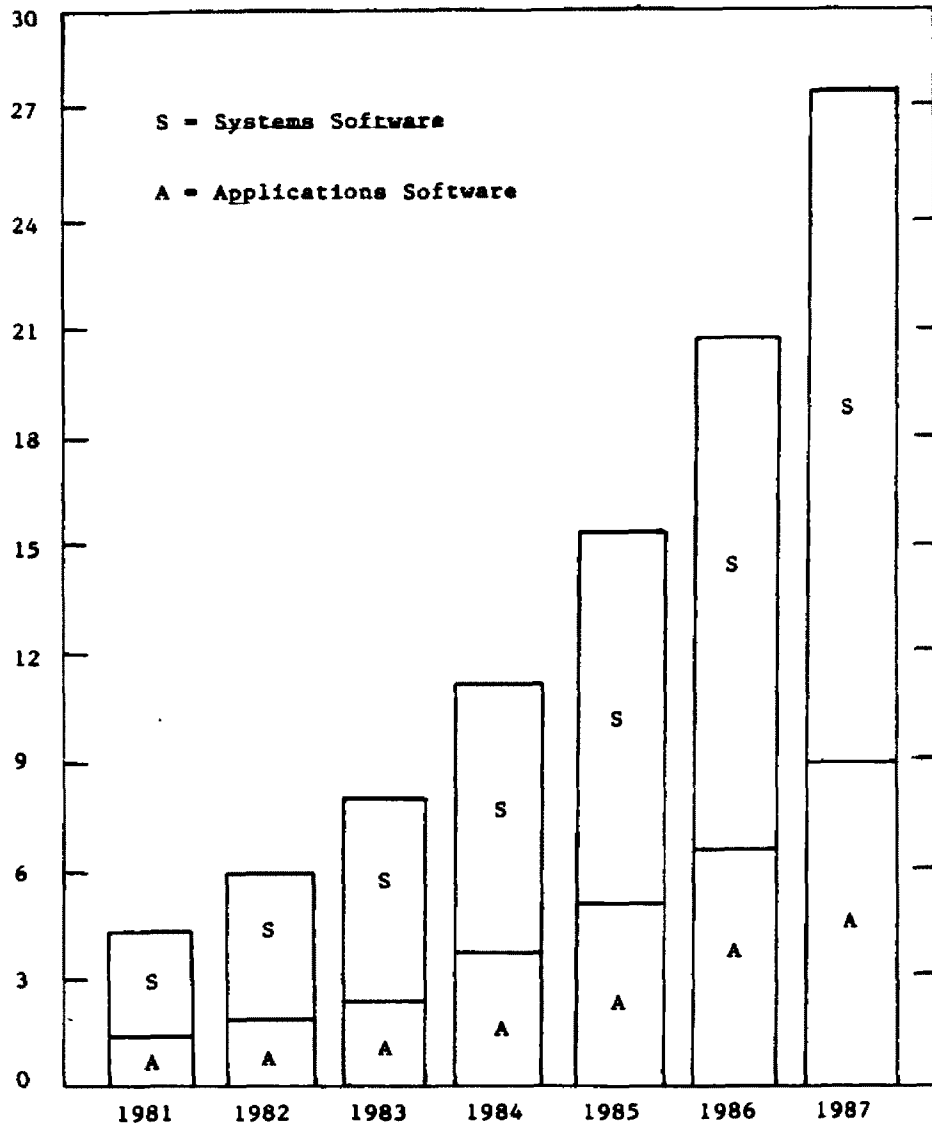


Figure 5. Software Revenues by Software Type .

Source: Office of Computers and Business Equipment, A Competitive Assessment of the United States Software Industry, p. 25

packaged systems software for minicomputers and super minicomputers.

Through the early 1980s the increase in the number of companies entering the software industry averaged about 20 percent yearly growth in the software products sector and about 18 percent growth in the professional services sector. Together these two sectors accounted for 77 percent of the total number of companies in the industry. This growth in the industry has been occurring despite a high number of exits through bankruptcy and failure and a general trend toward concentration through acquisitions and mergers.

Industry growth has been mirrored in the tremendous expansion in the number of products being brought to market. As an example, in the area of packaged software designed for the personal computer, Softsel, a market research firm, estimates that 200 of these products are introduced monthly.<sup>3</sup>

The growth in the number of products and the number of companies creating them has affected software prices. There is a general trend downward in price, while the performance, power, and complexity of the programs has increased. A wide variation in price for somewhat similar products, with frequent price reductions, characterizes the market, which may indicate a lack of surety as to the role of price in the marketing of innovative products.

For both technician and nontechnician users, software price ranks fairly low among the criteria for selection of a

product. A 1984 Software News survey shows that documentation, ease of use, features, and performance reliability are all ranked as more important than program price and vendor reputation among users in the research, education, government, and financial organizations surveyed.<sup>4</sup> Certainly price is becoming more of a competitive factor in some sectors of both the hardware and software markets, particularly in the area of personal computers where imported low-priced clones of the IBM PC are driving prices down, and in the proliferation of spread sheet program competitors for Lotus and Ashton-Tate.

The sophistication of the user has provided the demand pull stimulus to the fast growth of the software industry. The applications for both software and hardware are often in hand well before the product, in many cases, is fueling the research and development efforts of producers.

**Levels of research expenditures.** Expenditures on research and development as a percent of total revenue are much higher in the computer industry than an all-industry average. The five-year compound growth rate for research and development expenditures by computer manufacturers through the mid-1980s was 18 percent.<sup>5</sup> Some portion of these monies went to software development, since computer manufacturers are among the major software suppliers. The most recent U.S. Department of Commerce figure for research and

development expenditures among software products and services companies puts the 1984 spending level at \$262,000,000.<sup>6</sup> This represents a 48 percent jump over the previous year's level.

Spending on research and development in the public sector was quite similar. The federal government, primarily through the Defense Advanced Research Projects Agency spent \$249,000,000 in 1984 for basic and applied research.<sup>7</sup> Much of this was in the area of artificial intelligence, primarily a software issue. These high research and development expenditures, endemic to the computer industry, have led the federal government to relax antitrust laws on cooperative research in order to spread the costs. This has allowed the formation of companies such as Microelectronics Computer Technology Corporation, which coordinates the efforts of as many as 300 researchers from 20 companies. This action by the U.S. Government is at least in part a response to similar actions by governments in Europe and Japan to foster research in hardware and software.

The role of capital is particularly important in the software industry where new product opportunities often come only as the result of costly fundamental research. In the pursuit of innovation there is often no guarantee of a return on investments in research and development, and when a product is brought to market, sales can be slow, requiring financial support. Even though the potential for high

returns is there, high capital costs can preclude many research efforts. The availability of venture capital has provided the financial assistance at the initial growth phase for many innovative software companies. Their success has stirred the infusion of more venture capital into the industry, which has contributed to the high growth rate of the software industry in the United States. The availability of venture capital has historically varied to quite a degree. In place of this, there has been a rapid pace of acquisitions and mergers as established companies seek to buy technology and new product areas, often acquiring small companies lacking the financial and marketing resources to continue.<sup>8</sup>

**Projections.** Since the fortunes of the software industry, primarily the packaged software sector, are tied to the installed base of machines, software companies must be cognizant of trends in research and development, user applications, and sales within the hardware area. During the mid-1980s a slowdown, or slump, in the growth of industry revenues occurred and is expected to continue or improve only slowly through the end of the decade. The dynamics of this slowdown and the sectors of the market projected to be strong during the recovery and into the 1990s have implications for the direction of software company efforts.

There are at least three factors accounting for the slowdown in revenue growth.<sup>9</sup> The first, the rapid pace of product obsolescence, has resulted in an increased willingness among buyers to put off purchases in anticipation of new product introductions. The second factor is seen as both a decrease in the rate of spending on capital equipment and a related decrease in the portion of capital equipment spending accounted for by purchases of computers. The third factor is the increasing importance of equipment connectivity for buyers in the management information systems and computer integrated manufacturing markets. Without a set of industrywide hardware and software standards on which to base this connectivity, sales growth has slowed.

Buyer hesitancy is in part the result of the development of a longer purchase planning cycle, particularly in the information systems area, as companies spend more time studying their information network requirements. In the computer integrated manufacturing area the lack of connectivity must also be a factor in information systems purchasing.

Revenue growth is continuing in the minicomputer equipment segment as it decreases in the mainframe segment. Minicomputers are playing more of a role in the scientific and engineering community and appear to be favored in the developing information systems area. These smaller systems, particularly super minicomputers, match high performance with lower cost, giving more power for the dollar than main-

frame.<sup>10</sup> The continued success of Digital Equipment Corporation, despite the industry sales slump, is evidence of the importance of minicomputers and ease of equipment linkage in the current market. Business Week projects a strong upward trend in super minicomputer sales resulting in shipments of about 15,000 units in 1990, more than five times the number of mainframes expected to be shipped.<sup>11</sup> These growth rates will have an impact on the installed base of equipment which will create new opportunities for software products and services.

Super computer sales are expected to fall off as buyers anticipate new, much faster machines based on gallium arsenide chips and liquid-immersion coolant technologies to be introduced perhaps early in the next decade. Meanwhile, U.S. super computer manufacturers have begun to focus on software to maintain their competitive edge and to develop a broader range of customers. Most of this effort has been directed toward the area of operating systems, though new emphasis has been placed on expanding the base of applications software by marketing packages developed in universities and government research facilities, and by contracting with independent software companies.<sup>12</sup>

Through 1990, shipments of personal computers to the domestic market are expected to increase at an annual rate of 15 percent.<sup>13</sup> Increasing foreign competition in the form of so-called clones of Internatinal Business Machines' personal

computer, along with the slowdown in sales to the home market, has resulted in lower profits and the exit of many marginal suppliers from the personal computer sector. Sales were primarily of stand-alone packages in 1984, such as word processing, spread sheet, graphics, and data base programs.<sup>14</sup> Competition increased in the applications sector, both in cross-industry and industry-specific programs, as the use of market segmentation by user type led suppliers to these more narrow markets.

Software is expected to be the driving force behind total computer industry shipments through the decade, particularly in the business and industrial markets, as it increases the ease of use and versatility of computer systems.<sup>15</sup> There seems to be a shift away from very broad product positions to those keyed to narrow market segments.<sup>16</sup> Industry growth through the end of the decade seems as though it will be supported by continued demand in the scientific and engineering community for computer-automated design and engineering, related artificial intelligence work, and the huge potential demand for information networks in the business sector. Efforts have been increasing to solve the connectivity problem through the creation and adoption of hardware and software standards. These are typified by the creation of the Corporation for Open Systems, a consortium of two dozen computer industry competitors, including IBM, AT&T, DEC, and other notables, which is attempting to create and



promote a set of software standards.<sup>17</sup> Adoption of these standards would allow different brands of computers to communicate, thereby making the establishment of networks easier. With this accomplished, new products would be able to meet the demand for connectivity in the management information systems and computer integrated manufacturing markets.

Within the software market, the field of artificial intelligence is projected to outstrip the growth rate of the rest of the software products through 1990. There is some mention that artificial intelligence will open up new markets and lead the way out of the industry slump.<sup>18</sup> Computer-World puts the artificial intelligence market's rate of growth in revenues for the period ending in 1990 at 42 percent.<sup>19</sup> This compares favorably with the general software market's rate of 20 percent through the same period. The data are separated into segments of the artificial intelligence market which puts the expected revenues in 1990 of the expert systems tools segment at \$500,000,000, the market for artificial intelligence languages at \$350,000,000, and the natural language processing segment at \$200,000,000.

Opportunities in the marketplace must be matched with those characteristics which are permanent features of the company's capabilities and limitations. That is, the company should pursue those opportunities reasonably within its grasp in the short term. It must have come to a reasoned assessment of its strengths and weaknesses. The matter of market

selection and the product opportunities available in that market must be matched to the company's strengths. At least the attempt to meet the market needs must not be compromised by the company's weaknesses. What then, are the opportunities evident in this market analysis for the small software engineering company working out of Montana?

The proportion of small companies participating in each of the three sectors, professional services, software products, and integrated systems, is very promising. It indicates that there are no significant barriers to entry for companies with annual revenues under \$1,000,000. In the most important sector, packaged software, small companies gather 21 percent of the revenues suggesting that small vendor success is not inhibited by the lack of large-scale production and marketing capabilities. As the software market has grown over this decade, independent suppliers have grown both in number and in their portion of the total revenue faster than the other types of suppliers. As a form of organization, the independent supplier is becoming more common and no less profitable as the industry continues to mature.

### **Market Segmentation**

With the increased emphasis on industry-specific applications programs and packaged software for narrow market segments, competition from larger companies may increase in

territory formerly left to small companies, but the lack of competitive advantage in economies of scale in these markets may preserve the small supplier. Intensive market segmentation can work to the small company's advantage since it requires a lower commitment of resources, particularly to marketing. The tailoring of the product to the unique needs of specific user segments can give the small company the opportunity to achieve greater penetration in these areas of the market and gather a market share which will give it an advantage should price competition develop as the market matures.

Since the growth in sales in these segments will ideally be in the early stages, market share will be less expensive to achieve. Later, as these segments mature, increasing sales will become more expensive since it may require selling to competitors' customers. Early market share will also be important to the small company as incremental sales of the product to users in a mature market will accrue to the company from within its share.

The drawback to intensive segmentation is that the dependence on just a few segments makes the company more vulnerable to shifts in customer preference, and, as mentioned before, the entry of new competitors into these areas. The recent movement of IBM into the microcomputer to mainframe linkage area is an example. Due to the large installed base of IBM machines and its sheer financial and marketing

power, the small vendors who had proven the viability of this market are being squeezed out as the IBM product becomes the standard.<sup>20</sup>

The small company may have little alternative but to establish a rapid pace of innovation and product improvement based upon a market scanning activity that moves the company toward new segments and applications. As segments become more developed they become potentially more profitable to large competitors. The small company would do well to have moved the majority of its business on to new areas by then, particularly if equipment standards might favor large manufacturers. This means that the company must assume the risks and costs of research and development, and the instability of sales and overall performance that come with innovation and the potential for disruption in narrowly defined target segments.

## Chapter 4

### RESEARCH AND DEVELOPMENT

The two large user segments expected to drive the software market in the coming years, the scientific and technical area and the business sector, are projecting demand for software products that are based on technologies still in the research and development stage. These are artificial intelligence and operating systems based on software standards. Since the primary equipment this software is to be designed for is smaller than a mainframe, the scale of the software endeavor is well within reach of a small company's staff in terms of development time and the engineering complexity. The early stage of development provides the opportunity for the small company to gain a competitive advantage through the development of proprietary information and to introduce products in an as yet relatively uncluttered market.

The innovative nature of the software market allows creativity and technical integrity to play important roles in product development. The supply of these factors is not as dependent upon the size of the organization as are many competitive factors in other industries. There is, however, no doubt that there are some scale economies to be had in research and development. The major drawback for the small

company is obtaining adequate financing to make use of these factors, not just once but as an ongoing effort to undertake research in order to keep pace with technological change.

As John Hoskins puts it in "Designing a Technical Company," the company's primary asset and its central concern must be the effective use of its creative manpower.<sup>1</sup> The company is in an industry where its current product exists in a continuing series of new product ideas and innovations. Therefore, if its creative output is high, small inefficiencies won't shackle its growth, but when creativity is low even the highly efficient firm can be slowed to a halt.

### **Risk**

The company must also minimize the risk that this expenditure on research will be fruitless. There are four types of new product risk that the company must weigh against the degree of potential that might be inherent in any particular avenue of research.<sup>2</sup> These are decision process lead time, length of the forecasting time period, payback lead time, and the high cost of failure. The length of time between the decision to pursue a product idea and its actual introduction to the marketplace introduces risk, since volatile markets like software can change rapidly. Factors such as new competitors, their innovations, and changing economic conditions can alter the competitive environment, or render the new product obsolete.

Since the length of time that an opportunity lasts in a market is critical, the company needs to undertake long-range forecasting in order to become aware of a developing opportunity sufficiently in advance to ready a product. Ideally, the opening up of an opportunity and the introduction of the new product should coincide as nearly as possible. Interest in the marketplace for the technology and the product's user benefits should assist the company in gaining a good share of the market as opposed to introducing a product that is ahead of its time and, therefore, difficult to sell. Forecasting usually involves risk, especially when attempting to forecast the likely route of technological change and the demand for products that result in the process of this change.

The company should develop a product that has a competitive payback period for the user. Usually this is about a two-year period, but the closer to a one-year period the better.<sup>3</sup> At the same time, the company must consider its own payback period on the investment in the product. The high expenditures on research and development over the initial phase of product design, coupled with the possibility that early sales may be slow, lengthens the payback period and, thus, increases the company's level of risk. During this period, cash flow problems may occur as many months of negative cash flow can put a strain on the company's finances before incoming sales revenues turn it around.

The fourth type of risk inherent to developing a new product is the risk of failure. Failure implies a high cost in the waste of resources devoted to the product and in the damage that may be done to the company's reputation and morale. To reduce risk of this sort, and the other types mentioned above, there is a strong argument for companies to concentrate on improving an existing product. In established markets it is far easier to gather market data, make sales forecasts, demonstrate user benefits, and gain product acceptance.<sup>4</sup> This advice, when taken by a small high technology company, should not lead to a timidity that would make the company and its products more vulnerable to quick obsolescence, powerful competition from large competitors in more mature markets, or the lower profit margins and sales that result from pursuing products already late in their life cycle.

Perhaps the small company should not think so much of improving an existing product but consider innovation as a process of adapting existing methods or technologies to new markets. This cuts the risks in the idea of new inventions and steers a path along the edge of incremental technological change. A direction like this would probably be more scientifically satisfying, and that may be among the missions of this company as far as the founders are concerned. A direction like this also guards against producing products that are difficult to differentiate from the many others that seem



to crowd the packaged software market at the rate of 200 per month.

Can an aggressive research and development program be reconciled with relatively low risks? Donald Schon, in the "Fear of Innovation," states that uncertainty is a situation that requires action but defies analysis of risks. He goes on to say that the really innovative work of a company consists in converting uncertainty to mere risk.<sup>5</sup> The novelty of the technology behind a product and the unknowns in the market are always going to preserve uncertainties. That should not preempt participation in this sort of market, particularly when the opportunities play to the company's assessment of its own strengths. Schon suggests that "by selecting only these projects whose benefits justify their anticipated costs, by playing risks off against one another--in short, by a process of justification, decision, and optimization--we can (it is assumed) keep the risk of innovation within bounds."<sup>6</sup> After putting together an analysis of the product alternatives, their investment requirements, markets and technical feasibility, an investment decision must be made. It may be somewhat a matter of faith due to unresolvable uncertainty, but this is not atypical or restricted to high technology and a research orientation.

With a commitment to a thorough analysis of risks, feasible products can be defined that give direction to research and development efforts. This commitment should

begin with a market analysis that takes proposed products and examines each in terms of price (calculated on the basis of the return on investment to the user), market size and segmentation, and the vulnerability of the market competition. Included in the consideration must be an assessment of the user's business and the risk of disruption of the production process and variation in product quality that might result should the buyer install the innovative product. The buyer must be able to fully utilize the product without making costly adjustments to his operations.

Information from the market analysis in combination with the currently available technology serves to define feasible products and guides the planning of research and development. Once the process of development has begun, the market originally targeted may undergo change, or the product may prove to be beyond the technical bounds prescribed in the market plan, but the project may continue if the development process at that point suggests another product opportunity. Therefore, the research should not be carried out without attention to the possibility that new product options may occur as the development process unfolds. Continued market analysis likewise can define new opportunities that make use of the research to date. The research and development process has not necessarily failed if and when the original product proves unfeasible. The investment decision between competing potential product development projects should take

into account the ultimate salvage value of the research undertaken.

### **Technological Change**

The forecasting of technological change can give the company an idea of which product-related research may prove most valuable insofar as placing the company in a position to pursue product opportunities that appear as offshoots of the primary research. This forecasting places the company in a competitive position abreast of recent technological change at the end of the original development process. Since the long-term goal of the company is to keep pace with these changes, a requirement of the software industry, some research alternatives will fit within the probable long-range path of technological development better than other choices.

There are several techniques for performing technological forecasting that are becoming widely used in the technological planning process.<sup>7</sup> While quantitative techniques have been used to predict the short-term changes in the technological attributes of products, a strong degree of the judgmental underlies most technological forecasting methods.

One of two main branches of this sort of forecasting is known as exploratory forecasting, since it is based on an extrapolation of historical and current developments in technology. It relies on the forecaster's intuitive sense of the direction of change. Among the methods of regulating this

intuitive process to arrive at "most reliable" judgment are the well-known Delphi method and a type of trend analysis. Trend analysis entails building a linear regression model developed from a judgment of leading and lagging indicators of technological change in order to make projections of the likely path of development.

The second branch of technological forecasting, known as normative forecasting, attempts to outline the direction of technology based on judgments of the future needs of society and the possible near-term developments meant to fill them. There are three techniques that fall under the normative heading.

The first, morphological analysis, produces a matrix of all conceivable technological solutions to a given problem or societal need. From this matrix the forecaster determines the most promising approaches and the probable direction of change with regard to the original need.

Another technique is the relevance tree. This method establishes a hierarchy of probable paths to the solution of a given problem. The process of technological development gets broken down into segments under this plan and the forecaster is able to assess the sufficiency of knowledge at each level in order for the process of technological development to build to the solution of the problem. This can generate a sense of the product opportunities lying along the way to the

solution, and point out which branches in the tree may be developmental dead ends.

The final morphological method is known as a mission flow diagram. The forecaster attempts to identify the contingencies and alternative policies that may come into play as the attempt to satisfy that original need gets underway. The method is used to identify potential investments in technology that will be developed in tandem with that intended to fill the societal need.

Technological forecasting methods might predict the trends or evolution of technology, but the breakthroughs are another matter. They are best used to keep the company's research market oriented, and in this they are vulnerable to the quality of input. Not only technical information is needed but also data from market analysis efforts and general information about larger societal trends outside the company's main focus.

## Chapter 5

### JOINT VENTURES AND GOVERNMENT PROCUREMENT

Although a substantial part of the software market is made up of the home-use sector where the demand is for packaged programs for personal computers, a much larger portion requires software for nonconsumer, industrial uses. In its highest growth sectors, the software market is an industrial market where software, packaged, custom, or as part of an integrated system, is sold to users who incorporate it in the operation of their businesses, and to original equipment manufacturers who incorporate it as part of their end product.

The fact that the small software supplier may be participating in an industrial market adds the issue of technical credibility to the problems of research and development risks and financing. These are the major hurdles facing this company. Technical credibility in an industrial market must be established differently than in a consumer market. Where the burden falls to advertising and the effective use of mass distribution channels for software in the consumer market, credibility in an industrial market is more likely to be nurtured by service and customer relations.<sup>1</sup>

For a small supplier selling to the customer's technical people, personal contacts will be a far more effective

means of establishing credibility than advertising. At the root of the issue, the sales will no doubt be handled in-house under these circumstances, and so the contacts will be there to be cultivated. While these contacts serve a promotional function, a technical service function, and as a source of market information, credibility cannot be created out of air. It will depend on the reputation of the company's staff and on the quality of the product.

To ensure that quality, the strain that research and development place on a small company's finances in technical fields can readily compromise the other business operations. With a great emphasis on innovation in industries like computer software and the difficulty in controlling the research process, companies can be led to shortchange other functional areas, believing that research produces more competitive advantage per dollar. Perspicacious companies, allocating resources during the planning phase, may sense that with constraints on debt and equity, outside help in sharing research and development or marketing expenses might be the way to go.

### **Joint Ventures**

This is certainly the thinking behind the proliferation of joint venture projects in the high technology industries. Its viability as an alternative for the small company will have to be assessed in terms of the effect such a joint venture agreement has on the company's credibility, contact with

users, proprietary information, and other competitive factors in an industrial market.

A small software engineering company located in Montana would probably be interested in a joint venture with another company of equal size, if not more probably with one much larger. While the larger company would likely be seeking relatively cheap, fast access to technology, the Montana company would no doubt be in search of cash to support an already strained position in either marketing or research. An association with a large company might also lend the smaller company marketing clout and credibility as far as product delivery and technical support are concerned.

A study cited by Business Week, however, found that seven of ten joint ventures fail and are disbanded.<sup>2</sup> Among the reasons given for this high rate are changes in technology, markets, and partner objectives in midproject, or the difficulty in meshing management styles or undertaking cooperative research, or simply a lack of real commitment on at least one party's part.

In high technology joint ventures, suspicion of the other company's product or research capabilities and methods seems to play a large role in short-circuiting the trust and cooperation needed to market a joint product. Due to the competitive emphasis on proprietary information and self-reliance in research-oriented industries, the organizational cultures of both companies are more inclined to repel rather



than mix. This is particularly true when the joint agreement requires giving up absolute control over the critical functions of the business, and compromising to some extent the long-term strategy of the original company.

The number of unknowns that are implicit in industries driven by innovative technology add to the instability of joint venture agreements, which can end with the acquisition of the small company. Rather than gaining credibility, the company's reputation can be severely damaged when the venture fails to produce products, or is disbanded for other reasons.

When a successful joint venture is forged, the small company might gain a needed cash injection or assistance to complete a costly research project or the marketing support needed to get the product to a market that the small company did not have the resources or contacts to pursue. If the small company shares the marketing, perhaps making joint sales calls as part of the agreement, it gains the opportunity to build a reputation with those customers.

Despite the benefits to a small company of a successful joint venture, there can still be a downside. With technologically innovative products, a company's proprietary information may be crucial to maintaining a competitive edge, gaining market share early, and establishing a reputation as a leader in the introduction of new technology. In a joint venture, particularly one involving the sharing of methods and joint research, a company trades away the advantages that

it has been building up to this point. Though it may gain insight into its partner's fruitful research, and thereby benefit, when the venture is over, the similarities which the companies have taken on at the research level increase the competitiveness between them.

During the venture the small company probably has committed its research resources to the project at hand, to the detriment of research aimed toward the post-venture period. This can leave the company stalled when the joint venture ends. To attempt to continue with research and development as pursued within the venture, or with the aim to improve and offer new versions of the venture product, the company will have to dramatically increase its own level of financing in order to continue work on the previous scale.

A joint venture can also have negative implications for the small company's industrial marketing effort. Should the company have participated in joint marketing, preferably joint sales calls, it will have established contacts with the technical people among its customers' staffs and had the opportunity to build a reputation, albeit a joint reputation. After the venture has ended, these contacts will not be of much value if the company cannot develop a new product to sell to these customers. There is some likelihood that the company will have to find new markets after the venture has accomplished its objectives, perhaps because of saturation

in that market or the need for new technologies that cannot be developed and marketed on that scale.

If the small company on its own can maintain the same customers contacted through the venture, the company may find that these buyers are as equally committed to the small company's former partner. With a similar technological starting point after the venture, the former partner might be a tough new competitor. During joint sales calls, the small company may have been able to promote itself but perhaps not really distinguish itself and its unique capabilities from its partner's. The small company is probably not worse off than before it had made these contacts through the venture, but it must still cultivate the strong multidimensional relationship with these customers that could be the key to effective industrial marketing.<sup>3</sup> The small company may also have not yet had the opportunity to demonstrate its ability to provide technical support and problem solving for these customers. Technical service is one of the most important parts of the whole package that the company is selling through its product to the industrial user. To the extent that a joint venture is not conducive to demonstrating these qualities, the small company has probably not gained as much credibility as it had originally sought through a joint venture.

These are some of the motives that might lead a small company to seek a joint venture: an outside source of

increased funding for research and development, an ability to increase research and development spending due to a relief from marketing costs or more effective marketing. The marketing clout gained through a larger partner's sales force and distributors, in terms of scale and experience, lowers the selling costs per unit. Some aspect of each of these motives can be accomplished perhaps more satisfactorily, with more manageable risks, through government contracting.

### **Government Contracting**

Certainly such contracting is not without its pitfalls, potentially damaging ones for a small company. The federal government is such a large player in the overall software market in all three segments, professional services, software products, and integrated systems, that the public sector cannot be overlooked in this industry. Besides accounting for a huge market in itself, government contracting could be of strategic value to a small software development company. The company must, however, consider the high cost of developing a procurement proposal and the uncertainty of winning that contract award. Also it must assess the opportunities for commercialization of its research at the completion of the contract.

The basic rules guiding the procurement process are given in the Federal Acquisition Regulation document, and additional rules unique to Department of Defense (DOD)

contracting are laid out in the DOD FAR Supplement.<sup>4</sup> Since the DOD undertakes much of the computer industry contracting, the DOD FAR Supplement is the more important document for this company. At about 1,100 pages, the supplement contains the procurement policies and detailed procedural and administrative requirements that apply to procurements.

The federal government's basic contracting principles stipulate a full and open competition using the sealed bid method, though there are noncompetitive opportunities by way of unsolicited proposals. The paperwork burden increases with government work; the DOD requires the contractor to maintain records of the contract performance and to submit these on demand, for audit under the work surveillance rights held by the DOD. Another difference between private and public contracting is the requirement, made by the government, that the contractor submit within the contract cost proposal, a plan of audited direct and indirect costs.<sup>5</sup>

Public announcements of pending procurements are made primarily through the Commerce Department's daily newspaper, the Commerce Business Daily. It contains every proposed procurement over \$10,000, and the announcement appears 15 days before solicitations for property and services bids and 30 days before solicitations for research and development contract bids. The solicitation period allows 30 days for contractors to respond. Announcements are also made of solicitations of large contracts through prime contractors,

including a synopsis of these contracts. This is a notice of potential subcontracting opportunities.

Besides the Commerce Business Daily, small companies can learn of procurement opportunities through the Solicitation Mailing List. By applying for representation on this list under each contracting outlet where the company hopes to do business, the company is notified of subcontracting opportunities in prime contractor procurements. The small company must submit a bid on each notification, or a request to be maintained on the list.

Information concerning other subcontracting opportunities is published annually in the DOD's Small Business Subcontracting Directory. This document contains a state-by-state list of prime contractors with established plans for subcontracting with small businesses, and the nature of the product or service. Any contract that results is between the private businesses.

The Small Business Innovative Research program is a federal government effort from which companies can learn of the needs of various agencies for high technology research in the coming year. Contract awards are made on a competitive basis. Initially projects get Phase I development awards of up to \$50,000 to evaluate the technical merits of an idea. Further awards of up to \$500,000 over the subsequent one to two years are granted in order to develop the project. After that, private investment is expected to bring any commercial

applications to market, or government production contracts may result.

If not through the Commerce Business Daily or these other sources, the small company can learn of government agency research needs through contacts with agency technical personnel. Unsolicited proposals based on these unannounced needs can result in contracts to carry out the research.

According to Philip H. Francis, the government doesn't usually solicit proposals for contract research and development but, rather, reviews the incoming unsolicited proposals with regard to their fit with the agency's overall mission requirements and budget restrictions.<sup>6</sup> This is probably the best opportunity for the small company attempting to undertake innovative research and development that might eventually have commercial application but that in the short term will not pay for itself in the private sector. The procurement methods that require formal advertising are not likely to involve truly innovative research and development. These procurements must have specifications that are clear and precise enough to allow the bids to be evaluated on a common basis. In order to submit detailed proposals, the bidders must have the technical details of the project clearly defined, which is not likely to be the case in research and development procurements.<sup>7</sup>

The unsolicited proposal is the better avenue to innovative research contracts. Of course, this requires the

careful coordination of company objectives, forecasts of technological development, and a market analysis that includes government needs and commercial requirements. Research contracted by the government is not without the risks that exist with research in the commercial sector; will it bear fruitful products? It does relieve the financial strain in the sense that the research portion of product development has a shorter payback period with public contracting than is true in the private sector where the company must await sales.

**Promotional contacts.** A foundation must be laid before government research contracting becomes a sensible strategy. Promotional activities previous to the decision to seek a government research contract must have established the technical credibility of the company's staff, and cultivated contacts with the government's technical people. Often in small research-oriented companies, the responsibility for promotion of the company's areas of expertise lies with the staff specialist in that area of technology. The assumption is that the only person who can successfully carry out this portion of the marketing effort is the person who has actually developed the company's expertise in a given area, since it is likely that this is the only person who understands it in enough depth to communicate technical detail to sophisticated customers.<sup>8</sup> This promotional activity mainly involves



attending professional society conferences, writing and delivering technical papers, and participating in various planning and coordinating panels.

The importance of having reached the technical people within the government through these promotional activities is evidenced in a study undertaken by Edward B. Roberts.<sup>9</sup> In the 40 percent of all research and development contracts not made on a sole-source basis, that is, in those with formal competition, about 68 percent of the awards were made to companies that had been recommended by the technical initiator of the project, even though in many cases as many as 40 companies had been solicited.

Roberts believes that with research and development contracts of less than \$100,000 it is likely that even more pre-selection occurs. This is the situation because few formal reviews are required of these projects, and the actual award decision is made at a lower level of government. Since the research initiator is usually a technical person, and always a member of the evaluation team, this individual can easily exercise personal predispositions. Research and development proposals by nature require a subjective evaluation based on experience, judgment, technical prejudice, and previous encounters with potential bidders.

Roberts states that "the real award process is one involving long-term, person-to-person contacts between technical people in government and industry."<sup>10</sup> The ideas that

are generated in these interchanges are likely to later become government-sponsored research projects. When the technical initiator is the most informed as to the merits of the research on the evaluation team, and is confident in the capabilities of the company to carry through this research, that person is likely to guide the proposal of personal first choice through the evaluation process.

The regulations regarding negotiated procurements stipulate that the contractor be chosen to the best advantage of the government. The factors other than the lowest bid which influence the award process must be defensible, since the regulations require that the government justify the choice of a contractor other than the lowest bidder. J. R. Fox feels that this gives the lowest bidder an advantage.<sup>11</sup> Roberts counters this argument by maintaining that the contracting officer is not likely to return an award recommendation to the technical evaluation committee so long as budgeted funds cover this bidder's proposal.<sup>12</sup>

**The bid proposal.** The development of a bid proposal requires a great commitment of resources and indirectly increases the risk position of the company by precluding the company's ability to evaluate and respond quickly to the appearance of a new opportunity. Therefore, the importance of an early promotional foundation should not be overlooked.

The research and development proposal itself is also a promotional document.<sup>13</sup> It usually contains six sections: proposal summary, statement of problem, technical proposal, management plan, facilities and related experience, and cost proposal. The proposal summary may well be the only section of the document that will be read by those with the ultimate authority to decide its fate. Therefore, it must summarize the proposal and its merits persuasively, and support the proposal's technical superiority. The overall theme of the whole proposal should be introduced in this section, that is, technical mastery and honesty.<sup>14</sup>

The statement of the problem must communicate a thorough understanding of the need for the procurement, any ancillary problems or exceptions to the problem as stated. It should set the stage for the technical proposal and direct attention to the importance of the proposal's strengths.

In the technical proposal section of the overall proposal, the objective must be to sell the project by stressing its special advantages and pertinence to the customer's overall needs. Attention should also be given to the proposal's ability to minimize the customer's risks through careful planning and through his ultimate control over the execution of the project.

The remaining sections of the proposal document relate to the company's management of the project. They must outline the functional units of the company and the specific

project management team and describe the scheduling and responsibility for the project tasks within the organization. The objective is to show that the project fits naturally into the company's business activities, backed up by the inclusion of previous relevant project or contract details. The cost proposal section must, for federal procurements, contain a detailed financial proposal by task with audited direct and indirect costs. This aspect of the proposal must be signed by an authorized company officer and is legally binding.

Among the four types of fixed price contracts and the four types of cost reimbursement contracts that are typically used by the federal government, fixed price incentive and cost reimbursement contracts are normally used for negotiated research and development procurements.<sup>15</sup>

A cost reimbursement contract will reimburse the vendor for all allowable and allocatable costs to the contract. There is a cost limitation ceiling, and because the government bears the larger financial risk under these contracts, the U.S. Congress has established profit or fee limits of no more than 15 percent of estimated costs in experimental or research and development contracts.

Under cost reimbursement contracts, the company can invoice every two weeks for allowable costs. Unless the contract specifies otherwise, the payment period is 30 days.<sup>16</sup> Once the company has received 85 percent of the allowable

cost reimbursement, the contract administration officer can protect the government's position by holding the remainder in reserve. Under fixed price contracts, the company may invoice as costs are incurred with the payment period negotiable, which must not be less than 5 days and may not exceed 30.

Research and development contracting through the federal government presents a number of obstacles, from the regulatory maze, volumes of paperwork, and the possibility of slow payments, to the difficulty in communicating the company's capabilities. The size of the government's high technology market and its potential strategic importance, however, suggest that the small company evaluate its ability to conduct business in the public sector.

## Chapter 6

### MONTANA AS A LOCATION

The very small size of the computer industry in Montana immediately suggests a review of the negative factors affecting business development in the state. The company must assess which, if any, of these promise undue hardship for the practice of software development, or at least reasonably argue against the location of such a business in this state.

The Joint Subcommittee on Business, established by the Montana Legislature in 1982, outlined several issues that seem to bear on the state's economic development.<sup>1</sup> Among these issues are some that have a specific implication for small high technology companies: capital availability and labor pool skills.

The Joint Subcommittee cited a 1980 study by Western Analysis Inc. that showed that Montana banks had a higher security-to-assets ratio and lower loan-to-assets ratios, commercial loans-to-assets ratios, and loans-to-deposits ratios, compared to all U.S. banks.<sup>2</sup> The Joint Subcommittee concluded that this finding supported the view that financial institutions in Montana have a conservative lending posture. A survey of businesses included in the study indicated that 91 percent felt that a major constraint on

business expansion was the shortage of equity capital. Testimony before the Joint Subcommittee during 1982, regarding the Western Analysis report and other issues such as high interest rates, venture, and lending capital, showed that small business entrepreneurs felt that interest rates, the length of the loan term, and, generally, capital availability were stifling factors. Western Analysis concurred that the length of the loan term was often a problem.<sup>3</sup>

The Joint Subcommittee also sought to address the training of a skilled labor pool, and the enrichment of the university system research environment, intending to help create the conditions which seem to govern the location of high technology companies in California and the northeast.

Financing will probably be a major concern to the software development company. That the loan conservatism of Montana banks might make them even less likely to accept the riskiness of a high technology endeavor should not be the final roadblock to undertaking this venture. It is typical of high technology companies, particularly start-ups, to seek capital from sources other than banks. Banks can be among the most difficult of commercial sources from which small companies, particularly new or young ones, might seek capital.<sup>4</sup>

The lack of potential high growth that would interest venture capital, a 35- to 60-percent rate compounded annually, and the likelihood that this company would stay private due

to slow growth and riskiness, makes it unlikely that capital can be obtained through venture capital investment.<sup>5</sup> Solid conditions after the start-up period, with a promising product, could interest venture capitalists in second-round financing. This company is more likely to depend on owners' equity, state venture investment programs, and business activities such as custom software contracting to generate funds.

Richard Barrett, in his article "Montana's Economic Growth Theories," reports that there is little systematic evidence showing that Montana's regulations and taxes have a clear effect on the business climate.<sup>6</sup> He further states that national private market conditions rather than public policy are the predominant influence on local business conditions.

According to Barrett, the business climate and the degree of economic development in Montana are related more clearly to the transportation costs carried by Montana's export products and the national market conditions affecting basic industries. Montana's distance from the markets for its export goods and the fact that these goods tend to have a low value per unit of weight makes transportation costs a significant proportion of the delivered price of these products. This higher cost reduces the producers' competitiveness, limiting their ability to generate cash for expansion. The declining number of shippers and rising freight rates are contributing to this problem.<sup>7</sup>



In order to avoid this drawback, a software development company should export its product, distributed either on magnetic disks or tape which, rather than having a low value per unit of weight, have a very high value. Transportation costs would therefore represent a very small portion of the final delivered price of the product.

Montana's basic industries are principally a handful of natural resource companies.<sup>8</sup> These companies export products and, thus, expand and retract in response to national and international market conditions. Montana's derivative industries produce goods demanded by state income earners. The health of the derivative industries relies on the influx of cash by way of the basic sector.

Should the software company target Montana's derivative industries it would make itself vulnerable to the fluctuations in the basic industries' fortunes; of late these have not been bright. Besides that, it is doubtful that much of the growth in the software industry, expected to derive from scientific and technical applications and information networks, will occur through demand by the state's derivative industries.

Montana's basic industries might account for some of this demand, but they are likely to prove too narrow a market to sustain an innovative software development company. In the long run the company will no doubt be an exporter.

The remote location of Montana, while not a factor in transportation costs for software, does bear on the company's ability to participate in the meetings of professional societies and conferences, the ability to cultivate and maintain customer relations and technical services, and the ability to stay in close contact with federal government technical personnel. Clearly the company will incur costs above those it would incur in other locations. Some members of the company's technical staff will have to make a greater commitment in travel time to sales and promotional activities. Therefore, the size of the company's staff, job responsibilities, and job scheduling will have to reflect this greater investment in travel.

#### **The "Build Montana" Program**

The state has attempted to lessen the degree of the problem of capital acquisition through the creation of a set of loan programs and a high technology venture investment program. Under the auspices of the "Build Montana" program, the Montana Economic Development Board administers several business assistance offerings. To a software company seeking capital, the five loan programs under the Coal Tax Loan Program are probably of most interest. Each of these loans features a differing degree of state guarantee of bank and Small Business Administration (SBA) loans. The state guarantee ranges from simply backing the SBA guarantee, to

purchasing 80 percent of the loan from commercial lenders, to placing long-term deposits for the loan amount with commercial lenders.<sup>9</sup>

### **The Montana Science and Technology Alliance**

To help to circumvent the conservative lending policy of state banks and the "Build Montana" oversight committee, and to foster high technology development in Montana, the Montana Science and Technology Alliance was formed. With its stated goal being to make the basic industries more competitive, the program seeks to provide seed capital and technical assistance to fledgling companies and to those relocating to the state.<sup>10</sup> Eligibility is not restricted in any way that would affect this software company.

Alliance financial assistance has a dollar-for-dollar minimum matching requirement and additional restrictions including timely commercialization, the location of production facilities within the state, and a required attempt by the company to increase employment within the state.

The proposal to be submitted to the Alliance is much the same as a business plan and the review process similar to that undertaken by venture capitalists. The Alliance utilizes six reviewers, three of whom are suggested by the company, the other three chosen from the members of Montanans on a New Trac for Science. One or more members of a

Financial Advisory Panel established by the Alliance will also review the proposal.

With the matching requirement restraint, the state venture investment differs from the procedures of private venture capitalists. It is clearly an attempt to reduce the state's risk position since the Alliance must answer to the legislature for its actions. This stipulation effectively eliminates from state assistance all those projects which, despite promising rates of return, cannot be funded halfway by the company. It favors, instead, those projects which can be funded halfway but which may have lower rates of return on investment. The Alliance's risk aversion, to some extent, drives the product planning of those entrepreneurs who would seek assistance there.

Product planning and sales forecasts provide the data for the proforma income statements, balance sheets, and cash flow statements that a venture constructs in order to determine its funding needs.<sup>11</sup> Once the company has determined its greatest cash shortfall, as far as five years out, it has a fair enough handle on its basic cash needs, plus a contingency amount.<sup>12</sup>

To take advantage of Alliance assistance, the company must be able to raise at least half of this amount. Certainly the other option, scaling back the project or changing the product, can lead the company into poor decisions, regardless of the Alliance funding. If the company has faith

in its market analysis and technical foresight, its original product definition should be pursued until it proves unfeasible.

The Alliance's stipulation within the evaluation criteria, that the funded project shall realize significant tax revenues and jobs creation for the state, seems to tempt exaggerated estimates of growth and staffing needs among applicants. A review of the job creation estimates of funded proposals shows the addition of hundreds of jobs, in a few cases, within five years.<sup>13</sup>

Whether these particular growth claims are reasonable is not the point. The Alliance award criteria clearly tempt an overly optimistic long-term sales forecast which can distort the company's planning. Perhaps worse is the damage to the credibility of both the founders and the Alliance if these growth forecasts prove to be unfeasible. Should the results of the Alliance's program fall short of expectations, skepticism might rise in the legislature and perhaps lead to a future tightening of the funding and the assistance terms of the Alliance.

As is true in the private sector of the venture capital industry, the public endeavors will draw back as some of the first funded ventures fail. Subsequent investments will require lower risks and higher returns. The Alliance is about a year and a half old now and could be entering such a period. There is a likelihood that the state bureaucracy will

be less patient than a true venture capitalist who accepts some losses for the sake of occasional large profits. The state does not seek profits but, rather, desires to cut losses.

Because the Montana Science and Technology Alliance is not first and foremost a profit seeker but, instead, a promoter of new business, it is possible that out of benevolence some less than worthy projects will get funded. As this raises the risk of failures, it throws into doubt the legislature's willingness to fund the Alliance in the future if the successful ventures do not supply fresh capital.

Despite these state programs, capital availability remains a potential problem for a small software company in Montana. The Montana location seems to heighten the importance of travel by the company's senior technical people for promotional and sales activities. Maintaining frequent contact with customers and the scientific community is probably essential to the company's technical integrity and its marketing function. All software suppliers that would aim at the industrial market for software products must establish and maintain their credibility. The company in Montana must be more conscious of its credibility, due to the potential effects of geographical isolation and to the need to answer for the choice of remoteness.

The problems of capital availability, personal contacts, credibility, and technical reputation all seem to coalesce

into the demand that this software company, locating in Montana, either be the relocation of an established company or the start-up creation of founders with proven track records. Probably the relocation option, as a going concern, would have a better chance of obtaining adequate financing. Since it is tangible, assessing its level of risk is far easier. Thus it better surmounts the problem of the lending conservatism of banking and state loan programs. Either option has the potential of bringing the contacts, reputations, and credibility required of the company to this location. Perhaps the real drawback of Montana as a location for software development is the difficulty of building these competitive factors from the ground up, in relative isolation.

## Chapter 7

### CONCLUSION

From this analysis of the situation facing computer software development in Montana, several company models can be drawn. One such model follows.

A company relocating to Montana has the advantage of having had the opportunity to establish contacts in the scientific community and with the government's technical people before coming to the state. Now, less time and money will be spent, away from the company, travelling, to develop these crucial contacts. In other locations the burden of these promotional activities is presumably less taxing--if for no other reason than the closer proximity of these people. Since the company's top technical staff must perform these duties, merely maintaining such outside relationships from Montana is less costly than building them from the ground up.

A fairly broad group of established contacts gives the company selling to an industrial market, a footing on which to build its product development and marketing efforts. With these functions further organized than they would be in a start-up situation, this company is less likely to seek development through a joint venture. Also, with its business



well underway this company is a more promising candidate to acquire scarce capital from conservative lenders whether they be state or private institutions.

This company pursues the large federal government market for software research procurements. With well-conceived research proposals backed up by contacts within the procuring agency, the company can finance some of its most innovative research. The boost that this gives the company in building its credibility, freeing working capital for marketing efforts, and lowering its risk profile (allowing it to more easily obtain short-term debt financing from commercial sources), is worth the effort to cultivate these procurements.

Using this research, the company commercializes software targeted to the growing segments of the software market. These are defined through its market analysis along the lines of software type, equipment, and user. Probably the company is creating products utilizing artificial intelligence for the computer integrated manufacturing or information systems markets. It is using its small size to pursue a strategy of intensive market segmentation; it is finding market niches large enough to provide revenue growth, yet small enough to avoid direct competition with very large competitors. More than likely this is in the area of industry-specific or cross-industry applications programs.

In the planning process the company budgets for travel, understanding that this is a primary function for a company in a remote location, in a highly innovative industry. It must attempt to get the most from these forays by pursuing its market analysis, customer service, personal contacts, sales, and scientific education on these journeys. The benefits derived from Montana's location cannot be permitted to become the source of the company's liabilities.

## ENDNOTES

### Chapter 1

<sup>1</sup>U.S. Department of Commerce: Bureau of the Census, 1982 Census of Service Industries, Geographic Area Series--Montana, p. 3.

### Chapter 2

<sup>1</sup>Stanley Rich and David Gumpert, Business Plans That Win \$ \$ \$, p. 49-51.

<sup>2</sup>Ibid., p. 51-60.

### Chapter 3

<sup>1</sup>Market data in this section are drawn primarily from Office of Computers and Business Equipment, Assistant Secretary for Trade Development, A Competitive Assessment of the United States Software Industry, unless otherwise noted. Specific citations from this document are included below. Hereafter this document is referred to as Competitive Assessment.

<sup>2</sup>Ibid., p. 15.

<sup>3</sup>Ibid., p. 27.

<sup>4</sup>Ibid., p. 50.

<sup>5</sup>Ibid., p. 30.

<sup>6</sup>U.S. Department of Commerce, 1986 U.S. Industrial Outlook, p. 28-3. Hereafter referred to as Outlook.

<sup>7</sup>Ibid.

<sup>8</sup>Office of Computers and Business Equipment, Competitive Assessment, p. 47.

<sup>9</sup> John W. Wilson, "Computers: When Will the Slump End?" Business Week (April 21, 1986), p. 58-61. Hereafter referred to as Slump.

<sup>10</sup>Ibid.

<sup>11</sup>Ibid.

<sup>12</sup>U.S. Department of Commerce, Outlook, p. 28-3.

<sup>13</sup>Ibid., p. 28-6.

<sup>14</sup>Ibid., p. 28-5.

<sup>15</sup>Ibid., p. 28-6.

<sup>16</sup>Wilson, "Slump," p. 59.

<sup>17</sup>Marilyn A. Harris, "A Lingua Franca for Computers," Business Week (February 24, 1986), p. 110.

<sup>18</sup>"AI Helps Boat Business Falloff for Some Computer Companies," Applied Artificial Intelligence Reporter (November 1985), p. 6.

<sup>19</sup>"Software Trends in the Making," ComputerWorld, vol. 20, number 27A (July 9, 1986), p. 13, 14.

<sup>20</sup>Gary Stix, "IBM Muscles Into Micro-Host Links," Computer Decisions, vol. 18, number 17 (August 12, 1986), p. 16, 17, 20.

#### Chapter 4

<sup>1</sup>John H. Haskins, "Designing a Technical Company," The R&D Game, ed. David Allison, p. 263-264. Hereafter referred to as The R&D Game.

<sup>2</sup>David N. Cravens, Gerald E. Hills, and Robert B. Woodruff, Marketing Decision Making, p. 272, 273.

<sup>3</sup>Rich and Gumpert, Business Plans That Win \$ \$ \$, p. 76.

<sup>4</sup>Ibid., p. 83.

<sup>5</sup>Donald Schon, "The Fear of Innovation," The R&D Game, p. 119-127.

<sup>6</sup>Ibid.

<sup>7</sup>Philip H. Francis, Principles of R&D Management, p. 166-170. Hereafter referred to as Principles.

## Chapter 5

<sup>1</sup>Edwin R. Corey, Industrial Marketing, p. 5.

<sup>2</sup>Jonathan B. Levine and John A. Byrne, "Corporate Odd Couples," Business Week (July 21, 1986), p. 100-105.

<sup>3</sup>Corey, Industrial Marketing, p. 5.

<sup>4</sup>Directorate of Small and Disadvantaged Business Utilization, Guide to the Defense Contracting Regulations for Small Business, Small Disadvantaged Business, Women-Owned Small Business. Hereafter referred to as Guide to Defense Contracting.

<sup>5</sup>Francis, Principles, p. 160.

<sup>6</sup>Ibid.

<sup>7</sup>J. Ronald Fox, Managing Business-Government Relations, p. 337. Hereafter referred to as Business-Government.

<sup>8</sup>Francis, Principles, 146-147.

<sup>9</sup>Edward B. Roberts, "How the U.S. Buys Research," The R&D Game, p. 283-286.

<sup>10</sup>Ibid., p. 290.

<sup>11</sup>Fox, Business-Government, p. 337.

<sup>12</sup>Roberts, The R&D Game, p. 289.

<sup>13</sup>Francis, Principles, p. 254-160.

<sup>14</sup>Ibid.

<sup>15</sup>Fox, Business-Government, p. 338.

<sup>16</sup>Directorate of Small Business Utilization, Guide to Defense Contracting, p. 32-34.

## Chapter 6

<sup>1</sup>Montana Legislative Council, Report and Recommendations, The Joint Subcommittee on Business 1982, p. 4-8.

<sup>2</sup> Ibid.

<sup>3</sup>Ibid.

<sup>4</sup>David E. Gumpert and Jeffery A. Timmons, The Insider's Guide to Small Business Resources, p. 166.

<sup>5</sup>Rich and Gumpert, Business Plans that Win \$ \$ \$, p. 60.

<sup>6</sup>Richard Barrett, "Montana's Economic Growth Theories," Economic Conditions in Montana 1984, ed. Phil Brooks, p. 17. Hereafter referred to as Growth Theories.

<sup>7</sup>Montana Legislative Council, Report of the Select Committee on Economic Problems 1981, p. 7.

<sup>8</sup>Barrett, Growth Theories, p. 11.

<sup>9</sup>Montana Department of Commerce, A Guide to Montana's Economic Development and Business Assistance Programs.

<sup>10</sup>The Montana Science and Technology Alliance, The Montana Science and Technology Development Program Description, p. 4-5.

<sup>11</sup>James McNeill Stancill, "How Much Money Does Your New Venture Need?" Harvard Business Review (May-June 1986), p. 122-139.

<sup>12</sup>Ibid.

<sup>13</sup>The Montana Science and Technology Alliance, Investment Commitments (as of October 15, 1986).

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