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TECHNOLOGY PRICING IN JOINT VENTURES

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No Magic Involved

Pricing technology is no different than placing a value on other assets, with the exception that people are generally more familiar with how other assets are priced, value is negotiated and market values arrived at. For example, most of us have sold a house or a car. In looking at the pricing of these assets one often turns to some analyses of transactions of comparable assets. This is easy to do because there are a large number of 1989 Chevy Cavaliers sold, there are numerous substitutes for that model of car, and databases listing the resale prices of the 1989 Cavalier are readily accessible. With all of this information available, buyers and sellers can easily negotiate to a reasonable price with a minimum of transaction time and cost. With real estate, there is information on sales of property similarly situated with comparable features, generally available through a real estate broker. The comparability of real estate is usually a little bit lower than in the car market, due to the lower number of "truly similar" transactions, but is still very high in relative terms.

Technology on the other hand is most likely not as highly comparable as autos or real estate. This fact seems to have two primary effects on pricing efforts; one is to cause the negotiators to give up, try to pick a value similar to values on other unrelated technologies and hope the negotiation works out, or second to increase the effort spent to understand the technology in the hopes that the effort will raise/lower the price in a cost justified fashion. What most licensing professionals seem to want is a table of values that can be used to find the royalty rate, the royalty base, and other terms to put into their agreement and to be done with the "nasty" aspect of pricing the technology. This would seem to me to be spending the least time on one of the most important aspects. Overpricing a technology because one doesn't understand how the technology relates to value or underpricing what may be a large source of future profits seems shortsighted. Neither leads to long run success.

In my experience, pricing technology effectively is often more a means of extracting a fair share of the technology's value than one of putting a fixed dollar sum today on the potential future benefits to be derived from the technology. Techniques of finding means to fairly split the value given a range of potential risks and possible outcomes are those that will produce the best long term results.

Level of Effort

Pricing any asset is subject to some general considerations, first and foremost being that the benefit to be received from the analysis exceed the cost of performing the analysis. This is often an important issue because the person in charge of the technology transfer may not be an expert in the areas to be evaluated to properly price the technology. For example, a university technology transfer manager may need to understand the implications of the chemistry to understand the innovation (chemistry degree), the market advantage the innovation will convey to a chemical company (marketing experience), the capital necessary and the cost of that capital (finance and accounting experience), and the risks and manufacturing challenges to the chemical companies (industry experience). Even if the technology transfer manager has all of this experience on today's deal, tomorrow they will be working on a deal in an area where they are not nearly as versed. Clearly the answer on a limited budget cannot be to call in experts every time an analysis is to be done. In some cases this may make sense, and in others it will be impractical. How can one begin to evaluate when it will make sense?

Generally two factors have a significant impact on the importance of the effort spent on the valuation:

- The expected impact of the technology in terms of profits
- The availability of information regarding the technology and its applications

In terms of the expected impact of the technology, some of the questions to ask are:

- Is the technology a small improvement, or a breakthrough invention?
- How big is the potential market for the technology?
- Does the technology provide competitive advantage that can be translated to profits?

In terms of the availability of information, some of the questions to ask are:

- Is the technology basic research, a new product, or a replacement product? What is known about the potential product or the potential markets?
- Is the work of other researchers and competitors generally known?

- Can the technology be analogized to other already developed technologies?

Determining Level Of Effort

AVAILABLE INFORMATION			
High	Low Effort	Medium Effort	Maximum Effort
Medium	Low Effort	Medium Effort	High Effort
Minimum	Minimum Effort	Low Effort	Medium Effort
	Low	Medium	High

EXPECTED VALUE OF TECHNOLOGY

Figure 1

It is safe to say that in general more effort is expended in valuing the sale of a building such as the Sears Tower in Chicago, than goes into the valuation of the asking price the average private residence in Chicago. The reason is abundantly clear, there is more at stake in the sale of the Sears Tower than in the average private residence. Figure 1 is a matrix of some of the potential efforts based on various combinations of inputs. For situations where the expected impact of the technology on profits is significant, that is, where a percentage point in a royalty or an equity share might translate into a great deal of money, it makes more sense to concentrate efforts than it does in situations where the likelihood of success does not bring with it as large a future benefit. This is simply prioritization of efforts whether you are General Motors or a State College.

Approaches To Technology Pricing

There are numerous methods used to price technology. They range from simple to complex, mathematical to intuitive, market related to averages of other peoples deals. What all these techniques have in common is that in some instances they work and in some they do not. Understanding how the techniques work, and how they can be used to "extract" value is a key to bringing about successful transfers of technology either through licens-

ing or joint ventures. To this writer's knowledge there is no substitute for research, creativity, hard work and willingness to be a problem solver in the pricing of technology.

While the rest of this paper will be dedicated to detailing methods of technology pricing, as often as not, considerations having little to do with value can at times dominate those which have to do with value. When I first began in the area of valuation of technology, I was told that valuation was easy, it was simply what the market will bear. This is of course true, but it may not be easy to figure out what the market will bear. What market participants will agree on is often affected by past deals which failed, pressures to make this quarter's targets, greed and arrogance among others. Getting by these issues involves negotiating skill, and for the purposes of this paper the assumption will be that while obviously important to the ultimate outcome, the parties will be able to see past these issues.

Definition of Value

Webster's Ninth New Collegiate Dictionary defines value as "a fair return or equivalent in goods, services, or money for something exchanged." A principle of technology valuation is that the optimum value of a technology transferred (in / out) is a fair percentage of the cash flow generated by the competitive advantage of the technology (sold / purchased).

What are the real issues in the pricing of technology in a joint venture? Let's start with the most obvious, is the market opportunity real? What are the risks related to the opportunity, and which party bears them? The ultimate deal will most likely be determined by the negotiating strengths of the parties. The primary questions with respect to analyzing the parties negotiating strengths are:

- Is the market opportunity available with other technologies?
- Is the market opportunity available with other people's capital?

Cost Basis

Unfortunately, cost is often viewed as a measure or indicator of "value". Cost based considerations are often based on events in the past. These events may be indicative of what it might cost someone else to design an alternative to the technology in the future and may have an impact on the competitive advantage of a technology, but costs that have already been spent are not generally relevant to future cash flow from a

technology. Costs may be indicative of the risks taken previously by a party and will often affect perceptions of what is "fair".

A good example of the relationship of cost to value would be to ask how much it "cost" Robert James Waller to write the Bridges of Madison County or what did it "cost" Picasso to make a "Picasso"? Cost based analyses ignore the value of the technology to the ultimate consumer and, thus, often bear little correlation to the commercial value of the technology.

Auction

Another well known method of determining "what the market will bear" is the technique of the auction. The process is well established from the County Fair to the New York Stock Exchange. This technique both determines the market value and effects a transfer of the asset in one step. Unlike cost based methods, the auction has a direct correlation to the participants perceptions of commercial value. Successful auctions require an adequate number of educated bidders to maximize the market price. Having educated bidders is of paramount importance, as without a deep understanding of the benefits of the technology, bidders may discount for unknown risks, or not see how the technology fits with their business strategy and fail to bid to maximum levels. On a simpler level, as Monte Hall would say "how much would you bid for the box Carol Merrill is holding" (being only able to know the size of the box!). On the other hand, the auction process allows the egos of the bidders to play a part in possibly overvaluing the asset to the benefit of the seller and sometimes to the benefit of the unsuccessful bidders.

Industry Standards / Rules of Thumb

Utilization of industry standards and rules of thumb attempts to determine competitive licensing fees for similar technologies at similar stages of development. These methods work best when the deals being considered as comparable can be compared as to the totality of their circumstances. This is often hard to do as terms which in one deal appear as small irrelevant details can have significant impacts on value not appreciated by the persons making the comparison. As an example, a few years ago I worked for a consulting firm purchased by a large overseas advertising firm for a large cash payment, and additional payments based on future operating results. A number of other consulting firms were also purchased at approximately the same time by this overseas firm. A cursory review of the terms of the sale would appear to give the value placed

on the firms by their original owners. However, at least one small clause was different between the contracts signed by the original owners. Without access to the entire contracts and a careful scrutiny of the terms, one might not have noticed the small clause which our firm inserted into our contract. That clause was worth tens of millions of dollars two years later when the overseas company wanted to sell all of its recent acquisitions and was basically forced to sell the company back to the original owners at a fire sale price. One could not determine the value the original owners put on their companies without understanding the significant terms of each deal.

The use of industry standards can work well if the bases for the development of the standards are well known to both parties, still applicable generally, that is market circumstances haven't changed, and are applicable to the specific situation at hand. Some drawbacks to the methods are:

- How old are the standards?
- Is the segmentation of the industry adequate? (Health Care?)
- Is the connection between the grant of technology rights similar?
- Is the strength of the intellectual property position similar?

Other standards often employed revolve around what is referred to as the 25% rule (33% rule if you are the licensor). Essentially this rule states that 25% of the expected profits from the venture should go to the licensor for contributing the technology. The other 75% of the profits would go to whoever contributed other items such as manufacturing, distribution, marketing etc. Licensing professionals often justify this split on the assumption of risk by the parties. One assumption is that at the time of product introduction approximately 50% of the risk still remains, so in effect the 25% rule reflects a 50-50 split of the premarket risk. As a place to start one's analysis of the proportionate contribution of technology, this method is relatively widely known. Unfortunately, it is often not well understood which makes it a dangerous tool in the wrong hands. As an example, I was recently listening to a university technology manager explain the use of the method to someone unfamiliar with licensing. When I asked why he used 25-33% rather than some other number, his response was that "it is a tried and true method that everyone uses". When pressed further on why 25% of the profits made sense, he reverted back to the answer that "it was a tried and true method". If 25-33% of profits to the technology owner makes sense given the specific technology at issue, then by all means use it as a guide. At least the other side is likely to have

heard of the concept. In most cases though, the proper split given the specific risks faced will be different, sometimes much different. If that is the case, why not analyze the situation from the ground up and either support or refute the 25% split with facts, reason and logic rather than blindly following folklore regarding what seems to have worked for others in different situations.

Market Based Financial Analysis

Market based financial analysis looks to create a flexible financial model to be used in negotiations, based on whatever inputs the parties believe will have a significant impact on the ultimate cash flow from the technology. The knowledge and perceptions of both sides to the negotiation are important. Often one party has a much better understanding of different components of value than does the other. For example, the technical nuances and likelihood of technical difficulties with the technology will more often than not be the province of the inventor (who may be more forthcoming with the upside for the technology than the downside). The challenge of manufacturing, distributing, marketing, etc. will often be better understood by licensee/purchaser (who may paint a dim picture of the time and effort needed to create customer acceptance for the product).

By quantifying the knowledge and assumptions relating to value, the parties are better able to value their contributions to the joint venture given the risks each is undertaking. Some major factors in valuing a technology are:

- The competitive advantage offered by the technology
    - Availability/acceptability of other alternative technologies
    - Quality of the intellectual property portfolio offered
    - Useful life of the technology
- The stage of the product development
    - Research - prove the concept
    - Development - Reduce the concept to practice
    - Application testing - product performance and economics
    - Pilot Product - Scaleup, specification development, quality, regulatory, etc.
    - Commercial - Proven documented product or process

- The market status
  - Strength/size of the unmet market need
  - Competitive situation
  - Cost situation
    - Manufacturing
    - Operating
    - Capital

Competitive advantage generally comes in three major types: lower operating costs, generation of a new product, generation of related products and services. Lower operating costs allows freedom of pricing. If prices are maintained at current levels, then lower costs equate to higher profits. If prices are lowered to increase market share, then overall advantage flows from the increase in market share. Sales of related products and services, while sometimes hard to measure can be significant contributors to value. For example, new product sales may drive sales of repair parts, tickets to Major League Baseball games carry sales of concessions, parking etc.

Competitive advantage is at the heart of the value of a technology's contribution to an enterprise. If without the technology, no profits can be made, then the contribution of the technology is high. If the profits made by the venture without the technology would be 90% of those made with the technology, then the contribution of the technology alone would generally not be worth more than 10% of the value.

The stage of the development of the product is directly related to an analysis of the risks associated with the receipt of future profits. As will be discussed in detail later, this has an effect on the amount of value which should be credited to each party to the deal. The fair percentage of the cash flow to be credited to each party will be directly related to the risks taken by each party. With embryonic technologies, development risks are important to consider. Ultimately, the bargaining strength of the parties will determine the exact point where value is split between the parties.

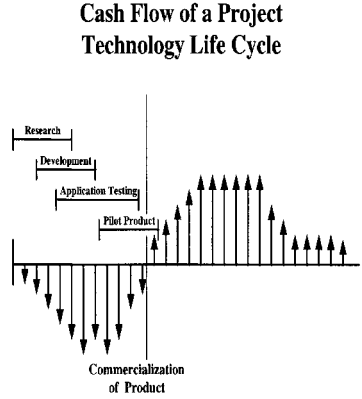


Figure 2

Often the variables to the equation relating to; the market share to be achieved, the price to be charged, and the costs to be incurred, will either be the easiest variables or the most difficult to quantify. This will depend primarily on the stage of development of the technology, that is are we talking about an embryonic process, or a product ready to go to market. When these variables are the most difficult to quantify is the time when the terms of the agreement can be used to get around the problems.

Remember that just because a technology is embryonic, doesn't mean that cash flow is an irrelevant concept. Rational licensees/purchasers of the technology are unlikely to pay money or put money into a venture without a belief in future positive cash flow. The more difficult a variable is to quantify, the more likely a candidate the variable is for disagreement between the parties. This can sometimes be solved by using more sophisticated analytical techniques such as option theory and monte carlo analyses, but sometimes can be solved by how the deal between the parties gets structured.

The terms of agreements used to get around uncertainties are fairly commonly known. When a royalty is calculated as a % of sales, the predictions of sales level become less important. That is no sales - no royalty payments. Sales based royalties have the problem that they do not "adjust" for changes in profitability. Equity shares in joint ventures can solve that problem. No profits - no value to the equity (present day IPO's not withstanding). Equity, combined with options, or other methods of targeting success, can be exceedingly flexible in helping the parties over uncertainties regarding the contribution of various inputs to enterprise value. Figure 3 shows the interrelationship between various drivers of the value of an enterprise being analyzed.

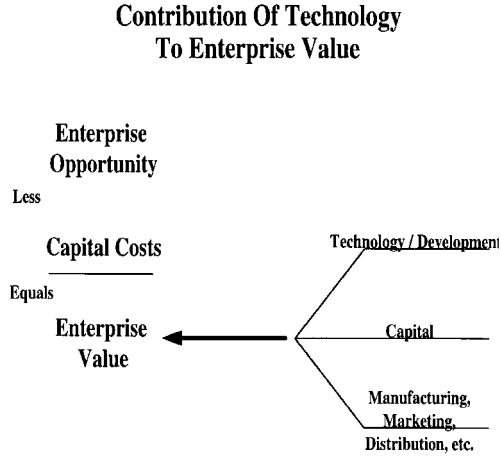


Figure 3

A Sample Of Market Based Financial Analysis

As a beginning point for the analysis performed here we should start with the assumptions being made regarding the transaction.

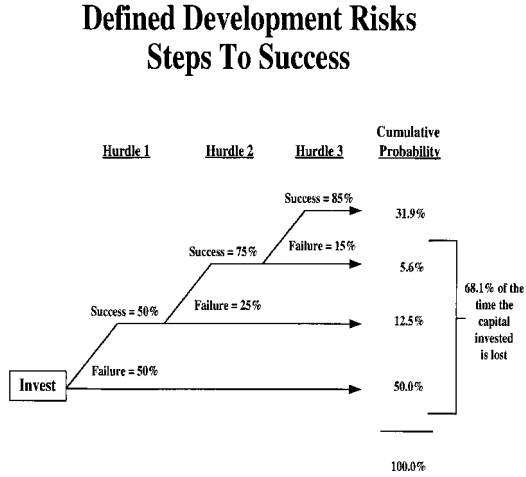
- The opportunity is in the development stage with the expected time to develop the product being 3 years followed by 4 years of significant sales.
- There are technical risks to be overcome each year during the 3 years of development.
- The cost of capital for a business similar to the one contemplated is 15%

- Each party could "reluctantly" engage in the market opportunity without the other party. That is they could find another partner.

An analysis of the technical risks associated with the technology development of the potential joint venture are analyzed. These consist of three primary hurdles which the technology must achieve from today if a successful product is to be developed.

- Hurdle 1 - 50% chance of success
- Hurdle 2 - 75% chance of success after passing hurdle 1
- Hurdle 3 - 85% chance of success after passing hurdle 2

Figure 4 shows how these hurdles affect the likelihood of success of the



project. In effect the likelihood of the technology ever getting to market is about 32% if each step is successfully completed. An important corollary to this is that the provider of capital will lose their investment to date 68% of the time and needs a return from the successful opportunities to equal what might be earned without the risk. It is this overall concept which can often explain why venture capitalists require such high rates of return on their investments in a business. So too, with the providers of capital to a joint venture.

Figure 4

While in some joint ventures both parties can contribute capital to achieve a fair split of the risk, in this analysis one party is providing the capital to fund development of the technology and provide for down-

stream manufacturing, marketing and distribution of the product, while the other party is providing the technology as it is currently developed as well as the additional technical skills necessary overcome each development hurdle.

Contribution Of The Technology Owner

The competitive advantage brought to the venture by the technology owner results in reaching the market at least one year sooner, with less development expense and increases the likelihood of jumping over the first technical hurdle by 5%. These benefits are as compared to the financial partner teaming with the next best technical partner (of course the technology owner thinks that the market cannot be exploited without their invention). The tool of discounting cash flow to its net present value may be foreign to some readers, if so, the simplest explanation is that investment / profits made in the future are not as valuable as those made today. Because, for example, money in a bank earns interest, one doesn't have to put a dollar in today to have a dollar a few years from now. Determining how much a future dollar would be worth today is the process of discounting. The process is graphically depicted in figure 5.

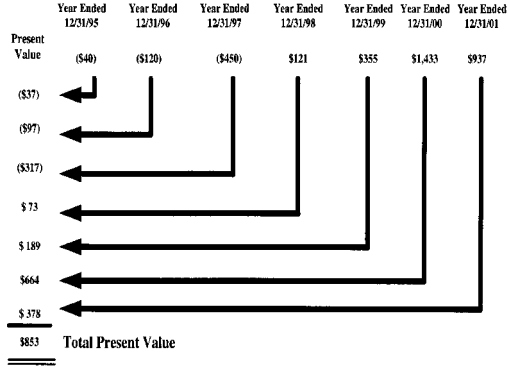


Figure 5

By comparing the differences between the net present value of the deal in each scenario (Figure 6) the financier can see that the technology contributes $186 of the $853 of total net present value, or approximately 24%.

Net present value with technology partner (Appendix A)	$853
Net present Value with next best alternative (Appendix B)	$667
Difference attributable to competitive advantage of Partner and Technology	$186

Figure 6

However, a straight analysis of the net present value may ignore a major issue present in most development stage ventures. The development risk issue in this case needs to be considered. There are two ways to deal with that risk. One is to increase the discount rate on the project to account for the additional risk. Justification of the specific rationale behind a 40% vs. a 50% discount rate can often be problematic for an early stage venture, and can be mistakenly be used in parts of the analysis where the risks are considerably different. Another way is to identify the specific risks and make informed estimates regarding the effect those risks have on the outcome of the venture. Figure 7 is a simplified graphic of the components of the cost of capital.

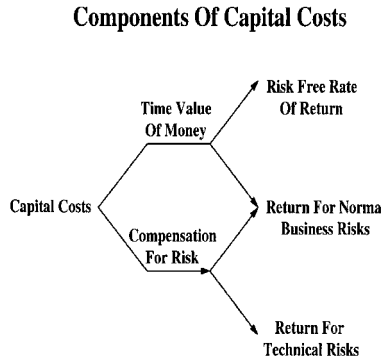


Figure 7

In this analysis the risks were looked at individually and quantified. As discussed earlier the cumulative risk is fairly significant, with approximately 68% of the time the outcome will be failure and a loss of capital invested. More importantly to the analysis the technology partner is expected to decrease the risk of failing at the first hurdle by 5%. Thus, the contribution of the technology partner to the venture is not just an increase in the net present value of the investment, but a reduction of the risk of failure. The cumulative risk of failure without the technology partner is approximately 71%.

Another important aspect of this analysis that is not found in the traditional discounted cash flow analysis, is that the capital partner does not have to put all of the capital into the project without regard to the success of jumping over each hurdle. If any hurdle is not cleared, the losses can be contained to the capital invested to date. This option to be in or out of the venture based on the success of each hurdle is not captured in the traditional discounted cash flow analysis. A study of option valuation techniques may in fact be used if the facts allow, but the technique and its appropriate application is beyond the scope of this paper.

Expected Outcome With Technology Partner

Figure 8

	Net Present Value	**Cumulative Probability**	**Risk Adjusted Value**
Success	$853	31.9%	**$272**
Fail At Hurdle 3	($452)	5.6%	($25)
Fail At Hurdle 2	($135)	12.5%	($17)
Fail At Hurdle 1	($37)	50.0%	($19)
Total		100.0%	**$211**

Similarly, the analysis of the risk without the technology partner and with the next best alternative is as follows:

	Expected Outcome Without Technology Partner		
	Net Present Value	**Cumulative Probability**	**Risk Adjusted Value**
Success	$667	28.7%	$191
Fail At Hurdle 3	($475)	5.1%	($24)
Fail At Hurdle 2	($135)	11.3%	($15)
Fail At Hurdle 1	($37)	55.0%	($21)
Total		100.0%	**$132**

Figure 9

Thus, the added value of the technology on a risk adjusted basis is the difference of $79 between the $132 expected profit without the partner and the $211 expected profit with the partner. Instinctively, one would suggest that the technology contributes $79 out of $211 or 37%. However, the value of the venture is made up of the probability of successful ventures and the probability of unsuccessful ventures. If the venture is a flop the provider of capital will bear the entire loss. As such, the technology partner needs to get at least $79 out of the expected $272 or 29%. After earning this amount the technology owner is repaid for the net incremental contribution of the technology. Accepting less than this amount given access to other sources of capital and absent other considerations undervalues the assets contributed.

Contribution Of Capital Provider

Often the provider of capital provides much more than capital. Management skills, contacts with potential customers, ability to provide downstream financing etc. often justify a much more significant role than just a provider of capital. For the purposes of this analysis, the focus will first be on the contribution to the deal based on the capital alone.

By reverting back to Figure 8 we can see that the expected losses of the failures to clear specific hurdles total $61. Thus, out of the $272 expected to be generated by the successful venture, $61 must be returned to achieve a breakeven with respect to capital. Thus 61/272 equals approximately 22% share of the venture. We have thus far accounted for 29% plus 22% or 51% of the venture. Beyond this, the capital provider needs to earn a return adequate to compensate for the efforts. As mentioned before, the ability of the technology partner to shop for the cheapest funds will have the most significant affect on the ultimate deal struck. It is instructive to understand just how much of the deal is necessary to allow the provider of capital to break even.

Conclusion

One of the reasons to approach a joint venture is the ability of both parties to contribute in a way that "shares" the benefits. We have viewed how the venture might proceed without the technology partner and we saw that the contribution was at least 29%. In many cases the owner of the technology may want much more than 29% for their share.

Because failure of the technology to clear the hurdles gives the provider of capital a 100% share of the financial loss, the share demands of the capital provider will need to be significant to achieve enough return on the successful ventures to continue to attract risk capital. In this situation the provider of capital needs 22% of the venture just to break even.

The remaining 71% share of the venture after accounting for the minimum acceptable to the technology partner, gives an internal rate of return of approximately 54% to the provider of capital. The deal has a chance of getting done as long as that rate or a lower rate is acceptable to the providers of capital.

Additional Resources

Valuation Measuring and Managing the Value of Companies, Tom Copeland, Tim Koller and Jack Murrin, Second Edition 1994, John Wiley and Sons Inc., New York.

Intellectual Property Licensing and Joint Venture Profit Strategies, Gordon V. Smith and Russell L. Parr, 1993, John Wiley and Sons Inc., New York.

Valuation Fallacies; A Better Way, Joseph R. Wager, *les Nouvelles,* September 1994, Licensing Executives Society, Alexandria VA.

Valuing Potential Returns, Steven M. Walters, *les Nouvelles,* March 1996, Licensing Executives Society, Alexandria VA.

	1995	1996	1997	1998	1999	2000	2001	2002	TOTAL
Net Cash Flow With Technology Partner	($37)	($97)	($317)	$74	$189	$664	$378	0	$853
Cash Flow from Investme	($37)	($97)	($317)			$46	$194	$0	($212)
Cash Flow From Opportu	$0	$0	$0	$74	$189	$618	$184	$0	$1,065
Net Cash Flow Without Technology Partner	($37)	($97)	($117)	($224)	$64	$165	$576	$338	$667
Cash Flow from Investme	($37)	($97)	($117)	($224)			$40	$179	($256)
Cash Flow From Opportu	$0	$0	$0	$0	$64	$165	$535	$159	$923

Appendix B

Cash Flow Analysis Without Technology Partner (Utilizing Best Alternative)

	1995	1996	1997	1998	1999	2000	2001	2002	TOTAL
Sales					$2,000	$3,723	$8,167	$4,557	$18,447
Cost Of Sales					($1,400)	($2,606)	($5,717)	($3,190)	($12,913)
Gross Margin	$0	$0	$0		$600	$1,117	$2,450	$1,367	$5,534
Overhead Costs			($13)	($63)	($350)	($400)	($425)	($375)	($1,626)
Research and Development	($50)	($150)	($100)	($100)	($20)				($420)
Pre Tax Profit Before Taxes and Interest	($50)	($150)	($113)	($163)	$230	$717	$2,025	$992	$3,488
Taxes	$20	$60	$45	$65	($92)	($287)	($810)	($452)	($1,450)
After Tax Profit Before Interest	($30)	($90)	($68)	($98)	$138	$430	$1,215	$540	$2,038
Adjust Income To Cash Flow									
Depreciation			$13	$63	$113	$125	$113	$63	$488
Capital Expenditures			($100)	($300)	($100)			$150	($350)
Change In Working Capital	($10)	($30)	($10)	($30)	($30)	($200)	$100	$210	$0
Net Cash Flow	($40)	($120)	($165)	($365)	$121	$355	$1,428	$963	$2,175
Discount Factor @15%	0.93	0.81	0.71	0.61	0.53	0.46	0.40	0.35	
Present Value Of Cash Flow	($37)	($97)	($117)	($224)	$64	$165	$576	$338	$667

Appendix C

Expected Outcomes

	Expected Outcome With Technology Partner			Expected Outcome Without Technology Partner		
	Net Present Value	**Cumulative Probability**	**Risk Adjusted Value**	**Net Present Value**	**Cumulative Probability**	**Risk Adjusted Value**
Success	$853	31.9%	**$272**	$667	28.7%	$191
Fail At Hurdle 3	($452)	5.6%	($25)	($475)	5.1%	($24)
Fail At Hurdle 2	($135)	12.5%	($17)	($135)	11.3%	($15)
Fail At Hurdle 1	($37)	50.0%	($19)	($37)	55.0%	($21)
Total		100.0%	**$211**		100.0%	**$132**

Appendix D

Assumptions Used In The Model

Assumptions:

Cost Of Capital	15%
Tax Rate	40%
Hurdle 1 Success Rate with Technology Partner	50%
Hurdle 1 Success Rate without Technology Partner	45%
Hurdle 2 Success Rate with Technology Partner	75%
Hurdle 2 Success Rate without Technology Partner	75%
Hurdle 3 Success Rate with Technology Partner	85%
Hurdle 3 Success Rate without Technology Partner	85%