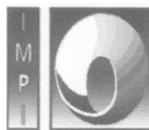


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**ASSESSMENT AND EVALUATION OF INVENTIONS AND RESEARCH RESULTS
FOR THEIR USE AND COMMERCIALIZATION**

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I. INTRODUCTION

1. First I am going to refer to Inventions and Research Results as “intellectual property,” or as “technology.” The valuation concepts that I will discuss apply equally to trade secrets, patented or unpatented technology or, in fact, any form of intellectual property.
2. Second, I am going to assume that we are focused here on technology in its embryonic stage of development.
3. Third, my remarks are not limited to any particular form of commercialization. I am sure that other presenters will fully explore all of the means for exploiting technology and again, the valuation principles that I am presenting can be applied to any form of transaction.

II. PRIMARY VALUATION METHODS

4. Value is the representation of all future benefits of ownership, compressed into a single payment. Therefore, value is continually changing as the future benefits increase or decrease, either with the passage of time or with changing perceptions of what the future will bring. Value does not exist in the abstract and must be addressed within the context of time, place, potential owners and potential uses.
5. For our purposes here today, I suggest that you think in terms of the following definition of value:

Market value is defined as the present value of the future economic benefits of ownership.

A. Cost Approach

6. The cost approach seeks to measure the future benefits of ownership by quantifying the amount of money that would be required to replace the future service capability of the subject property. The starting point in this method is either the cost of reproduction of the property or its replacement cost. Depreciation is then deducted from these amounts:

Cost of Reproduction New (CRN)
or
Cost of Replacement (COR)

Less: Physical Depreciation
Less: Functional Obsolescence
Equals: Cost of Replacement Less Depreciation (CORLD)
Less: Economic Obsolescence

Equals: MARKET VALUE

7. The cost approach is rarely useful in the valuation of early-stage technology, indeed I would caution you against considering it. The cost of developing technology is seldom relevant to its value. Think of the important inventions that have been made as a result of fortuitous insight, and the costly research projects that have ended in failure.

B. Market Approach

8. The market approach is the most direct and the most easily understood appraisal technique. It measures the present value of future benefits by obtaining a consensus of what others in the market place have judged it to be. There are two requisites: (1) an active, public market, and (2) an exchange of comparable properties. These requisites are difficult to meet with respect to embryonic technology:

a) Active Market

The ideal situation is to have a number of property exchanges to use in this analysis; one sale does not make a market. There is simply not an active market for intellectual property assets and most often, when they happen to be exchanged, the transaction details are not publicly available.

b) Public Market

To be useful, the exchange consideration must be known or discoverable. The prices of common stock in the primary exchanges are known in minute detail. For other types of property, it becomes more and more difficult to discover the exchange price.

c) Comparable Properties

The requirement for comparability is a substantial barrier to the use of the market approach for intellectual property. This property, by its nature, tends to be unique, and sales of similar properties are very difficult to find. We do however sometimes use the royalty rates from licensing transactions as a benchmark for a hybrid, market/income approach.

9. The market approach, while leading one directly to market value, is therefore often used for intellectual property.

C. Income Approach

10. The income approach focuses on a consideration of the income-producing capability of property. The underlying theory is that the value of property can be measured by the present worth of the net economic benefit (cash receipts less cash outlays) to be received over the life of the property. The mathematics of the various present value calculations are discussed in detail in Smith & Parr.¹

11. The three essential ingredients of the income approach are:

- (i) The amount of the income stream that can be generated by the property, and the pattern by which it will be received;
- (ii) An assumption as to the duration of the income stream;
- (iii) An assumption as to the risk associated with the realization of the predicted income.

¹ Gordon V. Smith and Russell L. Parr, "Valuation of Intellectual Property and Intangible Assets," John Wiley & Sons, Inc., New York, Third Edition 1999.

12. We depend on the income approach in intellectual property valuations. Its effectiveness is a mixed blessing, however, since “the arithmetic is easy, but the inputs are hard.” As an example, it is relatively easy to forecast the earnings and net cash flow of a mature business enterprise; it is much more difficult to forecast the net cash flow that can be attributed to a single technology, especially one in the embryonic stage.

13. We find that more and more of our valuation engagements are consumed in market research. We need to consider all reasonable exploitations of intellectual property in question. That translates into all reasonable markets and all reasonable forms of exploitation (license, self-exploitation, joint venture, etc.).

D. Amount of Income

14. Estimating the amount of income that intellectual property is capable of producing in the future can be the most difficult element in a valuation. It can involve much detective work and a good knowledge of the marketplace. Generally speaking, intellectual property usually provides either revenue enhancement or expense reduction. Either (or both) will produce profits, which is the objective. We must also decide what form of exploitation is likely to be the “greatest and best use” of the property.

15. Examples of the economic benefit that can result from the exploitation of technology include the following:

- It allows less material, or lower cost materials to be used;
- It lessens the amount of production labor;
- It increases speed of production;
- It improves quality;
- It eliminates or lessens environmental or safety hazards;
- It results in premium pricing;
- It acts as the basis for a new product or business.

16. Please remember however that we do have to use the NET cash flow as the basis for valuation. Therefore we must also consider the costs of commercialization, which can include:

- Research to “scale up” the technology to commercial levels;
- Design and construction of prototypes, pilot plants and full manufacturing facilities;
- Testing, clinical trials, market research;
- Government approvals;
- Advertising for a new product or service;
- Development of employee infrastructure.

17. Finally, we must estimate the TIMING of both the economic benefit and costs, because the present value is very sensitive to when benefits will be received and when costs will be borne.

E. Duration of Income

18. It is far easier to estimate the economic life of a building or machine than that of intellectual property. First, it is tempting to fall into the trap of focusing on the legal life of intellectual property:

- Trademark rights are perpetual, if continually used in commerce;
- Patent rights last 20 years;
- Copyright remains in force for the author's life plus 70 years;
- Proprietary technology is in force for as long as it is secret.

19. We must however be concerned with the economic life of the intellectual property, or the period during which the intellectual property can be expected to afford its owner an economic benefit. This is usually not the same as legal life:

- The average life of a U.S. patent is about five years. Two-thirds of U.S. patents have not been renewed by the 11 1/2-year stage. Technology moves on; in some sectors such as the semiconductor industry, the technology is obsolete before a patent application can be prosecuted;
- With the mobility of people and information, proprietary technology can be very difficult to retain.

20. We must also realize that the decline in value of most intellectual property over time is not linear², so the economic benefit may vary greatly from year to year.

F. Risk of Income

21. The elements of risk are many, and to engage in a detailed discussion is beyond the scope of this paper.³, but there are some basic and critical questions to ask about the realization of future income:

- Will we receive it?
- Will we receive it in the expected amount?
- Will we receive it when expected?
- How long will we have to wait before receiving it?

22. As to costs:

- Do we have to invest at all?
- Do we have to invest in "big lumps"?
- Are there milestones in the development, or do we have to complete the whole project before receiving any indication of success or failure?

² For a more complete discussion see Smith and Parr, "Valuation", Chapter 10 and Appendix B, or Reilly, Robert F., "Remaining Useful Analysis of Intangible Assets", Valuation Strategies, Warren, Gorham & Lamont, New York, New York, May/June 2001, Volume 4, No. 5.

³ For an extensive discussion of intellectual property exploitation risks, see Gordon V. Smith and Russell L. Parr, "Intellectual Property: Licensing and Joint Venture Profit Strategies", John Wiley & Sons, Inc., Second Edition, 1998, Chapter 8. See also Richard Razgaitis, "Early Stage Technologies – Valuation and Pricing", John Wiley & Sons, Inc., New York, 1999.

- When should we invest?

23. Should these factors have eventually to be condensed into a percentage discount rate. Guidance for this rate comes from the marketplace:

Treasury Bills, Certificates of Deposit	3.5%	-	4.0%
30-Year Treasury Bonds	5.9%		
30-Year Mortgage Commitments	6.8%		
Corporate Bonds	7.0%	-	10.0%
Prime Rate	7.0%		
High-Yield Bonds	9.0%	-	12.0%
Large Company Equities	9.9%	-	10.9%
Small Company Equities	11.9%	-	13.9%
2nd or 3rd Stage Venture Capital	20.0%		
Early Commercialization Venture Capital	40.0%		
Early Stage Venture Capital	50.0%		

Treasury Bills, Certificates of Deposit	Liquid, interest and return of principal assured
30-Year Treasury Bonds	Interest assured, return of principal assured, but delayed
30-Year Mortgage Commitments	Interest and return of principal solid, but not assured
Corporate Bonds	Interests solid, liquidity and return of principal dependent on market
Prime Rate	A benchmark, not an investment opportunity
High Yield Bonds	Interest and return of principal at moderate to high risk
Large Company Equities	Return largely depends on market appreciation, cash return low
Small Company Equities	Return depends entirely on market appreciation, more risk
2nd or 3rd Stage Venture Capital	Start-up has established short commercial track record
Early Commercialization Venture Capital	Start-up has not track record, but has survived development stage
Early Stage Venture Capital	Start-up in the concept stage, no assurance of success

24. After carefully examining the property - specific elements of risk, we seek a surrogate from the marketplace.

III. COMMENT ON THE INCOME APPROACH

25. We are often told that the income approach is impossible to use for early -stage technology because the necessary economic benefit forecasts are too difficult to make. Forecasts are difficult, to be sure, but if the income approach is abandoned there is no valuation method available, and estimating value becomes an unsupported speculation. The development of technology typically moves through several stages:

- Untested idea - outcome completely unknown;
- Benchtop - shows some promise in the laboratory, further development is justified;
- Prototype or pilot plant - small -scale feasibility has been demonstrated, but full -scale commercialization still questionable;
- Commercialized - full market success still unknown.

26. We all agree that it may be impractical to perform a valuation at the “Untested idea” stage. At each subsequent stage, however, the application of the income approach becomes more feasible. If it is necessary to enter into a transaction at the “Untested idea” or “Benchmark top” stage, then it may be advisable to structure the deal so that renegotiations can take place in the future when the economic benefits become clearer.

IV. SOMETHOUGHTSONLICENSING

27. Licensing is, in many cases, the preferred form of exploitation for embryonic technology. In a license, the technology owner and the licensee divide the future economic benefit according to the terms of the license. How the rights are divided and the relative risks to be borne by licensor and licensee determine how the economic benefit will be shared. The licensee typically pays for these rights in the form of a royalty, and this royalty arrangement is usually an important feature of the license.

28. There are a number of analyses that can be used to estimate an appropriate royalty:

a) Cost approach – The licensor may structure the royalty so as to recover, and achieve a return of the cost of developing the technology. This is a very poor method for the reasons given above. Development cost is irrelevant to the economic benefit that the technology might be able to produce.

b) Market approach – It is very common for the parties to a license transaction to depend on “industry standards” or other transactions for guidance. Information on licensing royalties is available.⁴ It is very important to recognize, however, that technologies and licenses are very fact-specific and unique. Reliance on what others may have done in non-comparable transactions can lead to an unsatisfactory result.

c) Income approach – As in valuation, this is the preferred method. Estimate the economic benefit to the licensee, consider the parties’ relative risks, consider the costs of exploitation and who will bear them and calculate the present value of the benefit to which the licensor is entitled. Armed with this, the royalty can be structured in any way that yields that present value.

29. And also be guided by this concept:

The licensing transaction is controlled by the economics of the licensee’s business.

⁴ AUS Consultants maintain such a database – RoyaltySource[®] – available through royaltysource.com.

V. ADDITIONAL REFERENCES

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5. *Damodaran on Valuation*, Aswath Damodaran, John Wiley & Sons, Inc., New York, 1994.
6. *Cost of Capital*, Shannon P. Pratt, John Wiley & Sons, Inc., New York, 1998.
7. *Trademark Valuation*, Gordon V. Smith, John Wiley & Sons, Inc., New York, 1997.
8. *Intellectual Property Infringement Damages*, 2nd Edition, Russell L. Parr, John Wiley & Sons, Inc., New York, 1999.

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