Easy to use methods for Valuation of Intellectual Property should facilitate open innovation, knowledge diffusion and have implications for private and public sectors.

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The defensive model of managing IP is changing. Recently, some big companies are making available most of their not used patents. This is defined as open innovation. Most of these patents are going to be transferred to small companies and start-ups that should receive new technologies in change of royalty payments when the technology enter the market. Universities should be part of this process and some new models for collaboration are emerging. In this context, the number of available technologies that need valuation by subjects looking to new technologies is higher than in the past and easy to use methods should facilitate and increase efficiency in the process of technology transfer.

Valuation is a prediction of an asset's price where price is the amount actually paid for an asset in an arm's length exchange. Asset liquidity affects valuation. Less liquid asset have farther apart valuation and price, Intellectual property is an intangible, highly non-liquid asset. In the logic of open innovation, between others, there is also the consideration that intellectual property is a perishable asset.

Technology value is extracted over time by deal makers and valuation may occur at many different points in the invention cycle. Objective input about an invention's likely value becomes more available over time, as one moves through each phase. However, it should be necessary to assess value of technologies at very beginning of the cycle.

The importance of intangible assets has created an urgent need to value these assets in many contexts including intellectual property management, acquisitions, sales, joint ventures, and licensing. Many Subjects may need to value technologies: Universities, Start-ups, Big companies, willing sellers and buyers in general, Investment Bankers, Secured creditors. Technology is valued prospectively by deal makers and retrospectively by litigators.

In the technology transfer, the royalty rate for a biotechnology license deal depends on a large number of factors. One important factor that determine the royalty rate is the strength and scope of Intellectual Property (IP) protection. The economic value of a patent depends fundamentally upon the nature and extent of non-infringing substitutes. Stronger patent protection translates to higher royalties: For example, a technology fenced using multiple patents will generally command higher licensing royalties than one covered through a single weak patent.

A number of methods are available to value technology: Look back Cost, Look around Industry Standards – Comparables, Look at the pieces Ranking/Rating, Look down Rules of Thumb, Look forward Discounted Cash Flow, Look to the dice Monte Carlo, Look to others Auction, Look no farther Common sense, Look to the market Equity. Normally a mix and mach is used. The IP valuation methods that have been developed are either inexpensive, but yielding very coarse results, or expensive, but yielding more detailed valuation results.

Additional techniques as the Competitive Advantage Valuation® (CAV) are available. The CAV method was specifically developed to strike a unique balance between cost and precision. This method measures the principal determinants of IP value in an affordable, easy-to-use way. The major premise of the CAV method is that intellectual property assets have no inherent value; the value of intellectual property assets resides entirely in the value of the tangible assets which incorporate them. The minor premise of the CAV method is that the value of a given intellectual property asset can best be measured by the competitive advantage which that asset contributes to a product, process, or service. In comparison to other valuation methods, the CAV method combines a number of unique features: it is easily understandable, is affordable in terms of time and cost, is flexible and scalable, precise and repeatable.

Not expensive and easy to use methods for technology valuation should be useful for small companies and start ups, Universities, technology brokers and other subjects involved in technology transactions to valuate the high number of technologies that become available in the context of open innovation.

Introduction

It is an established notion that technology innovation plays a vital role in building national competitiveness, and every state and corporation is concentrating on fortifying their global competitiveness with high technology development capability that is difficult to imitate. In order to facilitate the advancement and development process of high technology, a market for technology transfer must be promoted.
Institutional support such as technology brokerage and exchange is necessary for active trade and transfer of technology, but information, especially reliable information on the value of technology is as important. The problem arises because information on technology cannot be provided like general goods, and, thus the role of a technology valuation as a complementary measure becomes very important. There is a special need to evaluate the value of a specific technology from an objective perspective in order to encourage technology transfer. As the market price is used for the basis on price negotiation in trading goods, an objective value of a specific technology must be presented in advance for the negotiation to be carried between buyers and sellers of technology. Accordingly, much attention need to focused on evaluating the objective value of technology.

Technology valuation is the method of valuing technology acquisitions which, in addition to the purchase price and startup costs, also include current market value adjustments and the risk premium of the acquisition.
Many organizations have been using various valuation models to perform evaluations for aiding decisions regarding investment. Valuation models thus far have assessed the value of technology from the perspective of the firm in possession of the technology, but such assessment is greatly influenced by the firm's technological capability, capitalization, brand, and human resources. However, what the market needs is the worth of technology as a product to be traded in the market, and this calls for an impartial and objective value that is not influenced by the specific company that owns it.
The systems that encourage technology transfer can be classified into two in general: a simple system that just builds and offers data on the information about the technology to transfer and the other one that encourages technology transfer by making evaluations of technologies in various perspectives.

This paper's objective is to present a summary of the most relevant methods for technology valuation, with the scope of educate non-economist people involved in technology transfer on the methods that should be used for technology valuation.

Concept of technology valuation

Technology, which becomes the object of technology valuation, is divided into broad and narrow definition of technology. Narrow concept of technology refers to intellectual property including patent, utility model patent, and trademark in addition to disparate technology such as know-how, trade secret, and computer software. Broad concept is not limited to individual technology, but covers the firm's total technological capability as well.

Technology is valuable as an asset and is identified as an intangible asset. Valuation is a prediction of an asset's price where price is the amount actually paid for an asset in an arm's length exchange. Asset liquidity affects valuation: less liquid asset have farther apart valuation and price and Intellectual property is highly non-liquid asset. Intangible assets with technical basis are varied in character and include patent rights, trade secret, knowhow, computer software, database, and operations guide. Intellectual property (IP) alludes to those whose possession is recognized and protected by the law, and it is comprised of patent, patent application, registered trademark, common law trademark, trademark application, registered copyright, unregistered copyright, copyright application or domain name. Payments for a technology should be made by cash with upfront and milestones payments or through royalties or equity (in stock of a company). Up-front fees are a lump-sum payment that represent the "present" or "now" value of the technology. Running royalties represent a "future" payment for the technology. In the technology transfer, the royalty rate for a biotechnology license deal depends on a large number of factors. One important factor that determine the royalty rate is the strength and scope of Intellectual Property (IP) protection. The economic value of a patent depends fundamentally upon the nature and extent of non-infringing substitutes. Stronger patent protection translates to higher royalties: For example, a technology fenced using multiple patents will generally command higher licensing royalties than one covered through a single weak patent.

Technologies that are not defined as intellectual properties are mostly those that are difficult to recognize or difficult to assess their value independent of the owner (company, individual), and it is rare for such technology to become the object of valuation. Economically speaking, the value refers to the opportunity cost, which

becomes the standard of the transaction, while the market price becomes the exchange value when a perfect market is assumed. However, as the market for technology cannot be created easily, a difficulty arises in determining the exchange value of technology through the market mechanism efficiently. Accordingly, additional effort in estimating the fair market value, supposing a competitive market, is required. Generally, the fair market value is defined as 'the price at which willing parties, who have not been coerced and possess rational information, have agreed to trade their asset' (Seol, 2000). It is really difficult, however, to come across such a perfect deal in reality, and, thus this value assumes a transaction between virtual buyer and seller. Particularly, it presupposes an economic or market condition occurring at a specific point of evaluation. Such fair market value is at times simply called the market value, and it assumes that the capital market is in its advanced stage where it remains in a nearly perfectly competitive form. The technology valuation attempts to estimate this market value.

Methodology for technology valuation

Many different methods for technology valuation have been used: Cost Analysis (look back), Industry Standards–Comparables (look around), Ranking/Rating (look at the pieces), Rules of Thumb (look down), Discounted Cash Flow (look forward), Auction (look to others), Equity (look to the market). Normally a mix and mach is used. Additional techniques are available.

First, the cost approach methods estimates the cost of recreating the future utility of the technology being valuated, and assumes this value to be the future returns from the technology (Smith and Parr, 2000). Technology assessment is done by calculating the reproduction cost of acquiring the same technology or the substitute cost of acquiring a similar asset, and then reflecting depreciation. The cost approach method is useful when assessing intangible assets such as software, but its weakness lies in that equal amount of investment does not always result in the same level of technology and that it does not take into account important elements such as future risks and economic benefits that can be obtained from the assets.

The Industry Standards–Comparables (look around) is probably the most important method for academic licensing. Source of comparable transactions are: internal databases (licenses previously done by the same institution), published survey, public announcements (ie required disclosures such that contained in the SEC filing for public companies), documents from litigations.
The Ranking/Rating method is based on panels of expert reviewing technology from various perspectives (ie market size, patent protection, stage of development, probability of success). This method need scoring criteria and decision tables. Pros are that it prepare for license negotiations and allow for comparison of technologies. Cons are that it need a comparable to which to apply the results and is highly subjective.

The Rules of Thumb (ie the 25% rule) is based on the Goldscheider Principle: "the Licensor should receive 25% and the Licensee 75% of the pre-tax profits from a licensed product" (Goldscheider, 1980). It is expressed in % of net sales in license royalty rate (25% of expected profit margin). Normally, this should be the starting point for negotiation, turning up or down based on the significance of Intellectual Property (IP) portfolio and who bears principle burden of risk. IP means a patent, patent application, registered trademark, common law trademark, trademark application, registered copyright, unregistered copyright, copyright application or domain name. The economic value of a patent depends fundamentally upon the nature and extent of non-infringing substitutes. Stronger patent protection translates to higher royalties: For example, a technology fenced using multiple patents will generally command higher licensing royalties than one covered through a single weak patent. This method has a limited value in academic licensing negotiations because of uncertainty of ultimate profitability: academic technologies are generally very early stage and it is almost impossible to do realistic cost of good or selling price projections at time of licensing.

The Discounted Cash Flow/Net Present Value is widely used. It takes into account the facts that: expenses are certain and early, return is later and uncertain (product may not succeed and/or market may not be there). This method is based on the time value of the money (ie getting 1,000$ next year is not the same of getting 1,000$ today). The discounted cash flow first subtracts expenses from the cash flow received from the usage of assets, and then this net cash flow is adjusted at a proper discount rate. This method, while suitable for patents, registered trademarks, copyright, and other intellectual properties that can create a future profit, it has the disadvantage of being unable to accurately reflect the value of technology that does not create a direct profit but, nevertheless, bring value to the company, or technologies where future profits are hard to estimate. A typical R&D Project in the biotech that should looks like a good deal: $10 mm invested over 6 years with sales start in

year 7, peak profits of $15 mm in years 12-14 over by year 19, a Total Net Income of $136 mm and Net Profits exceed expenses by $126 mm.

The Auction is growing in the interest of sellers and buyers of technologies. It only works for a hot technology with seller's market. Need at least 3 bidders. The technology must be readily understood and evaluated and if unacceptable bids, technology will be perceived as damaged, because of visibility of the process. The case of Rockefeller University/Leptin should be an example. Jeffrey Friedman, a HHMI investigator cloned the *ob* gene, which codes for leptin, in 1994. Friedman was a founder of Millennium, who wanted a license; HHMI insisted on an auction. On August 1994 a patent was filed with USPTO and in October the Rockefeller University announced the intention to license *ob*. In December *Nature* paper appeared (Y.R. Zhang et al., *Nature*, 372:425-32, 1994) and in January 95 the Rockefeller University invited final bids selecting 3 finalists. On February 28, 1995 the University announced Amgen winner. Terms of the transfer were $20 mm upfront and $50 mm additional via milestone payments (total $ 70 mm). Stock price of Amgen increased 5.4% on February 28, increasing company value by $451 million. So far, technology hasn't panned out.

Equity is another possibility to make value from a technology. In a license, Equity should substitute for one or more cash components, generally the upfront fee: can allow to pay early milestone payments in stock. Some consideration on Equity payment of technologies: the value of equity in a start-up can escalate rapidly; equity gives a return if licensed technology fails but company succeeds with something else; hedges the risk to licensor; is illiquid till IPO or acquisition. An example is Allegra, fexofenadine (terfenadine carboxylate), a metabolite of terfenadine (Seldane). A US patent filed on August 1992 was then obtained by James Young (Sepracor) and Raymond Woosley and Yiwang Chen (Georgetown University). Georgetown University exclusively licensed its interest to Sepracor in October 1990 and January 1993 for some royalties and assigned the patent on August 25, 1998 for $10 mm in cash and 100,000 shares of stock. On June 1993 in the transaction between RPR, Marion Merrell Dow (MMD) and Sepracor, MMD had the patent for $7.5 mm upfront, $10 mm stock purchase and future royalties. The FDA Approved Allegra on June 1996. Sales of Allegra are now $2 billion and 10% royalty to Sepracor are $200 million per year. Georgetown reported royalty income of $26 million in 2000 survey. If Georgetown got 25% of Sepracor's income this accounted for $50 million/year.

New, easy to use method.

Competitive Advantage Valuation™ (CAV) is a new method to value intellectual property assets. The CAV method was developed over a many years through a scores of research projects undertaken in the Technology Commercialization Research Center at Syracuse University on behalf of a variety of client organizations. These research projects assessed the commercial potential of many different types of early-stage technologies by analyzing the scientific and engineering, marketing, licensing and intellectual property advantages and disadvantages associated with these technologies. (Hagelin, 2002)

The major premise of the CAV method is that intellectual property assets have no inherent value; the value of intellectual property assets resides entirely in the value of the tangible assets which incorporate them. The minor premise of the CAV method is that the value of a given intellectual property asset can best be measured by the competitive advantage which that asset contributes to a product, process, or service.

In comparison to other valuation methods, the CAV method combines a number of unique features: it is easily understandable, is affordable in terms of time and cost, is flexible and scalable, precise and repeatable: (a) the CAV method is easily understandable to the broad cross-section of professionals practicing in the fields of licensing and intellectual property management. The easier a valuation method is to understand, the lower the transaction costs of negotiation and the quicker the parties can know whether an agreement can be reached. (b) The method is affordable in terms of the time and cost of obtaining necessary information and performing the valuation analysis. More affordable a valuation method is, the more broadly it can be adopted and the more likely it can be standardized. This method is the only intellectual property valuation method that is implemented in a software program. The software makes intellectual property valuation analyses quicker, easier and even more precise. (c) The method is flexible and can be used to value any type of intellectual property as well as licenses, prospective research and development investments, and pre-market products. The more flexible a valuation method is, the more it can be shared across business divisions and used as a common benchmark. (d) The CAV method is scalable. A simple analysis can be performed using built-in default formulas to calculate values and more advanced analyses can be performed using statistical software tools to calculate values. The more scalable a valuation method is, the greater the user's ability to choose the trade-off between the time and

cost of the valuation, and the desired degree of accuracy of the result. (e) The method is precise and it can be used to determine the exact dollar value of individual intellectual property assets and to calculate differences in dollar value within a group of related intellectual property assets. The more precise a valuation method is, the more useful it is in managing intellectual property assets and in comparing intellectual property asset values. (f) The CAV method is repeatable and not dependent upon the subjective choices of individuals or groups. The more repeatable a valuation method is, the easier it is for parties to focus their attention on the variables and value inputs on which they agree or disagree.

The CAV method is a novel combination of the income and disaggregation approaches to valuation. In its most general form, the CAV method consists of seven basic steps:
(1) The intellectual property asset to be valued is associated with a pre-market product and the net present value of the total profits in the pre-market product's intended application market is calculated.
(2) The net present value of the total profits in the pre-market product's intended application market is then disaggregated to determine the percentage of these profits attributable to technical intellectual property assets. (There are three classes of assets - tangible assets, intangible assets and intellectual property assets. There are three types of intellectual property assets: technical [utility patents, functional software copyrights and technical trade secrets]; reputational [trademarks, service marks and brand names]; and operational [business method patents and proprietary business processes]).
(3) A set of price and performance parameters are selected that determine success in the intended application market, and the pre-market product's competitive advantage relative to an average substitute product is calculated based on these price and performance parameters.
(4) The pre-market product's predicted market share and is calculated from the pre-market product's relative competitive advantage and the pre-market product's present value is calculated from net present value of the profits in the intended application market attributable to technical intellectual property assets.
(5) The pre-market product's present value is adjusted for technical, market and intellectual property risks.
(6) A single, lump-sum payment for the intellectual property embodied in the pre-market product is calculated which provides the licensor and licensee a risk-adjusted, equal rate of return on their respective investments in bringing the pre-market product into the application market. This single, lump-sum payment is also used to calculate a running royalty rate on net sales of the pre-market product.
(7) The decrease in the running royalty rate on net sales is calculated in the case where a portion of the payment is received as an upfront payment and the remainder is received as running royalties.

Conclusion

A number of new methods to value intellectual property have been developed in recent years. Although each of these methods has certain limitations, together they have provided intellectual property and technology transfer managers a very useful new set of decision-making tools. As with the valuation of tangible assets, no single method for valuing intellectual property assets is definitive. Also, as with the valuation of tangible assets, the methods for valuing intellectual property assets will be subject to continuing research and refinement.

The development of valuation methodologies has no terminal completion point, but is an ongoing, evolutionary process. Not expensive and easy to use methods for technology valuation should be useful for small companies and start ups, Universities, technology brokers and other subjects involved in technology transactions to valuate the number of technologies that become available in the context of open innovation.

The Competitive Advantage Valuation™ (CAV) is a new easy to use method to value intellectual property assets. The CAV method is proposed as an important step in this evolutionary process. This method is not a definitive valuation method and further research will be required to refine the method. However, the unique features of the CAV method make it an extremely useful addition to the existing methods.

References

Boer, F.P. (1999) The Valuation of Technology. New York: John Wiley & Sons.
Burgelman, R.A., Kosnik, T.J. and Poel, M. (1988) Toward an innovative capabilities audit framework. In Burgelman, R.A. and Maidique, M.A. (eds), Strategic Management of Technology and Innovation. Homewood, IL: Irwin, pp. 31–44.
Copeland, T. and Antikarov, V. (2001) Real Options: A Practitioner's Guide. London: Texere.

Goldheim, D., Slowinski, G., Daniele, J., Hummel, E. and Tao, J. (2005) Extracting value from intellectual asset. Research Technology Management, 48, 2, 43–48.
Goldscheider R. and Marshall J.T. (1980) "The Art of Licensing -- From a Consultant's Point of View", 2, The Law and Business of Licensing 645
Hagelin T. (2002) A New Method to Value Intellectual Property. American Intellectual Property Law Association Quarterly Journal, 30, 353
Hagelin T. (2003). IDEA: The Journal of Law and Technology, 44, 79
Hagelin, T. (2004) Valuation of patent licenses. Texas Intellectual Property Law Journal, 12, 423–441.
Heo, E.N. (2000) Recent developments on economic valuation method: CVA MAUA and ral option pricing. Journal of Korea Technology Innovation Society, 3, 1, 37–54.
Lee, J.O. (2001) A comprehensive model of economic valuation for technology. STEPI Journal of Science & Technology Policy, 11, 2, 21–35.
Lee, S.P. (1999) Valuation Model for Individual Technology, Small and Medium Business Administration Research Paper.
McGrath, R.G. and MacMillan, I.C. (2000) Assessing technology projects using real options reasoning. Research Technology Management, 43, 2, 35–49.
Moed, H.F. (1989) Bibliometric measurement of research performance and Price's theory of differences among the sciences. Scientometrics, 15, 5–6, 473–485.
Moon, Y.H. (2000), How assess the value of technology?, KINITI Research Paper BW112.
Reilly, R.F. and Schweihs, R.P. (1998) Valuing Intangible Assets, McGraw-Hill, New York.
Remer, S., Ang, S.H. and Baden-Fuller, C. (2001) Dealing with uncertainties in the biotechnology industry: the use of real options reasoning. Journal of Commercial Biotechnology, 8, 2, 95–105.
Seol, S.S. (2000) A theoretical framework for the valuation of technology. Journal of Korea Technology Innovation Society, 3, 1, 5–21.
Simon, H.A. (1960) The New Science of Management Decision. New York: Harper and Row.
Smith, G.V. and Parr, R.L. (2000) Valuation of Intellectual Property and Intangible Assets (3rd ed). New York: John Wiley & Sons.
Yang, D.W. (2000) Valuation for technology on the practical viewpoint. Journal of Korea Technology Innovation Society, 3, 1, 68–84.