Pricing the Intellectual Property of Early-Stage Technologies: A Primer of Basic Valuation Tools and Considerations

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ABSTRACT

This chapter introduces technology managers to certain key issues and to six methods of valuation and pricing. The value of a technology to a buyer (licensee) depends upon how it is to be commercially employed, taking into account the cost of development, the time the technology takes to generate returns, the extent of such financial returns, and the risk involved in the process. At the time of a licensing/sale transaction of an early-stage technology many, perhaps all, of such factors need to be assessed and quantified by making judgments about how the future will unfold with respect to the technology being developed. This assessment and forecast assessment are the essence of all pro forma business models. Valuing license rights for early-stage technologies is in this sense no different than making other future business forecasts, though the details may differ because the forecast time horizon may be longer, the uncertainties may be greater as to the market size and profitability, the operating performance of the technology as it will be used in commercial operation may be less well defined, and other factors. The price paid for a technology transferred between parties is the amount of money (present and future) and/or the financial value of noncash assets given in exchange for the transfer of the technology, which can only occur if both the seller (licensor) and buyer (licensee) have by some process reached a common, present understanding of value that makes agreement possible.

A key consideration in valuing a technology and arriving at a price is determining what is to be provided or transferred between the parties. This may include exclusive or nonexclusive rights to specified patents, know-how, and copyrights (IP [intellectual property] rights), technical data, rights to future-seller improvements, rights to sublicense, and the like. The price can consist of any combination of a variety of types of consideration, including running royalties, fixed payments, common stock (equity), R&D funding, lab equipment, consulting services, grant backs, or access to other proprietary buyer resources.

Although sometimes used, cost-basis pricing is a poor basis of valuation, because it fails to consider a technology's value based on future commercial applications: the market pays for value to be received, not the cost to create. This chapter introduces and explains six methods for valuation and pricing that are based, to one degree or another, on the market's expectation of value.

- Method I: The Use of Industry Standards Method looks at the range of published royalties (and other forms of payment) from technology licenses within an industry category and uses that information to guide valuation of a technology currently under consideration.
- Method II: The Rating/Ranking Method looks at several existing license agreements for similar technologies, comparing and ranking a technology currently under consideration against the existing license agreements in terms of stage of

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development, scope of IP protection, market size, profit margins, and other such factors.
- Method III: The Rules of Thumb, such as the 25% Rule (and Other Rules) Method, which apportions anticipated profits from the commercial use of the technology between the seller and buyer.
- Method IV: The Use of Discounted Cash-Flow Analysis with Risk-Adjusted Hurdle Rates Method seeks to split expected returns but adjusts basic profit and loss accounting terms to take into account the timing of investments and returns and the risks borne by both parties. The method introduces a discussion of the different possible structures of payments that are possible, as they affect both timing and risk.
- Method V: The Advanced Tools Method applies statistical methods, such as Monte Carlo simulations, to discounted cash-flow models to test the influence of various value assumptions and license terms on the possible outcomes of a deal.
- Method VI: The Auctions Method allows interested parties to bid on the technology, based upon their own independent efforts at valuing the technology, thus comparing their respective valuations, identifying the highest valuation, and striking a price based on that highest valuation.

PREFACE

Although we will consider each of the valuation methods one at a time, doing so does not suggest that only one method is to be used in any given valuation, nor does having six methods mean that all should be used in every situation. Depending on the circumstances it is likely to be advantageous to consider more than one method in any particular valuation. Yet, not all methods work equally well in all circumstances, and there is always the practical consideration of the commensurate level of valuation analysis appropriate to the magnitude of the potential licensing opportunity.

The context of the valuation and pricing discussed in this chapter and with the valuation methods is licensing (sale) generally known as *opportunity licensing*, as distinct from licensing in litigation contexts. In litigation matters there is normally a very narrow focus on certain claims of certain patents that have been infringed as of a particular date with respect to specified products and which patents are known to be valid, enforceable and infringed. On the other hand, opportunity licensing of early-stage technology is normally performed prior to a licensee's commercial use, includes deal elements other than a narrow enumeration of certain patent claims, and anticipates the potential future use for a range of products, applications, and markets.

This chapter is necessarily a short introduction to a complex subject. The author has written three published books that give a much fuller treatment of these valuation and pricing matters than is possible here. Two of the books are currently in print and available from online sources such as Amazon® and are recommended for those who are charged with valuation and pricing of technology.

- *Valuation and Pricing of Technology-Based Intellectual Property*, Dr. Richard Razgaitis, published by John Wiley & Sons, 2003.
- *Dealmaking Using Real Options and Monte Carlo Analysis*, Dr. Richard Razgaitis, published by John Wiley & Sons, 2003.
- *Early-Stage Technologies: Valuation and Pricing*, Dr. Richard Razgaitis, published by John Wiley & Sons, 1999 (now out of print, and supplanted by the 2003 valuation and pricing book).

Finally, the views expressed here, as in my above writings, are solely those of the author, and are not intended to represent the views of CRA International or that of any professional society of which I am a member or officer.

1. INTRODUCTION

One of the most interesting and challenging tasks facing a licensing manager is determining the value and price of its specific opportunities. This chapter provides an overview of useful tools and methods for this purpose and offers general observations on licensing practices.[1] Because each valuation situation depends on numerous, case-specific factors, such generalizations may not apply universally, so readers are encouraged to be cautious when drawing parallels or imagining similarities.

Pricing, of course, is a crucial issue in the commercialization process. The customer for early-stage technologies can be viewed as a value-added reseller. Resellers will be induced to buy (license), if and only if they believe that they can conduct all the value-added activities needed and sell the result to *their* customers at a price significantly greater than what they paid to acquire the rights.

When selling rights to early-stage technologies, there are (usually) significant uncertainties facing both the owner of the technologies and the licensee. These uncertainties include important issues such as:

- Does the technology really work in a production setting as opposed to inside a cloistered laboratory?
- What product development and manufacturing activities will need to be conducted—and at what cost—to bring the technology to commercial maturity?
- Will there be any commercially valuable patent protection to bar copycats?
- What product do end users really want from the technology, and how much will they be willing to pay?
- What regulatory requirements will need to be satisfied?
- How much better is this technology than what is already available?
- Will competitors develop an even better way of meeting the end user's needs?

One way to begin to get around the pricing issue is to use royalties. The advantage of the royalty (and equity) concept is that it spreads, to some degree, these uncertainties and risks between the parties. Under a royalty (or equity) arrangement, technologies that ultimately become wildly successful in the marketplace will return high financial rewards to both the licensee and the licensor in some direct proportion to the degree of commercial sales achieved. This helps remove some of the anxiety of determining the right price—but not all of it.

Technologies that lead to highly profitable outcomes for a licensee typically warrant a higher royalty *rate* on behalf of the licensor. Similarly, smaller returns (with all relevant factors considered) warrant a lower rate. By fixing a royalty rate, an equity split, or any combination of royalties and equity, the technology transfer manager is apportioning the total financial reward between the creating organization and the commercializing organization. That split should depend on the relative value-creating contributions of both parties.

Determining a fair royalty depends on a present understanding of the commercial use and economic impact of the licensed technology. From this perspective, it is better, when feasible, to defer setting the royalty rate to the time, or closer to the time, of commercial introduction. When licensing early-stage technology, this means that the license or option agreement would leave the royalty rate unspecified. The parties would commit to engage in good-faith negotiations on this matter at a later date, preferably when a projected income statement based on more robust market and manufacturing projections was available.

But prospective licensees generally look at this approach with disfavor. They argue that the royalty rate is an important factor in reaching a decision about licensing the technology in the first place. Further, the licensees argue that they cannot commit substantial product- and market-development investments and risk facing a carnivorous licensor seeking unreasonable compensation at the eleventh hour. And there are also some good reasons why a technology seller might not prefer to defer royalty negotiations. Depending on the final royalty values, the seller might have elected to pursue a different commercialization approach (taking equity in a spinout or pursuing industry-wide nonexclusive licensing) or to find a different licensee willing to pay more for the opportunity.

Further, if a market window has closed, a reversion of rights back to the seller because of an inability to agree on financial terms may be of little business value. Clearly, it is in the interest of both parties to conduct royalty negotiations based on accurate projections of a license's economic impact. Agreements reached before the impact is known are more likely to be disappointing to either the licensee or licensor. A disappointed licensor will normally not have any recourse as long as the licensee fulfills its end of the deal. A disappointed licensee, however, can come back to the licensor and threaten to drop the license unless it gets some relief from a royalty rate that the licensee later perceives as too high. The licensor can decline such a request, but it could be put in a difficult bargaining position because of the cost, delay, and risk associated with finding another licensee, and because the term of years remaining under the patents may have been reduced significantly while in the hands of the original licensee. A royalty rate determined well before commercial introduction can thus be viewed as a royalty cap by the buyer, regardless of what is called for in the agreement. Of course, the buyer cannot count on a seller agreeing to such a downward renegotiation in royalty rate; the buyer may face the choice of proceeding to commercialization under the agreed terms, or dropping its license and losing its own investment in the technology.

Parties seeking win-win arrangements should seek ways to make these negotiations as fair as possible, even while each party is looking out for its institution's interests. This requires as much economic information as possible and some tools for using that information. Presented in the sections below are tools and considerations in determining such splits of the commercial reward. To set the stage, consider the following excerpt from an actual letter received by a venture capitalist:

"… *we are asking for Forty Million Dollars ($40,000,000), which will provide the capital needed … . As planned, at the end of the two-year period, we will have ramped up to 100% with an expected pre-tax profit of $211,832,258.*"[2]

Now, is this a good deal? Even more importantly, what methodology could be used that would lead to a fair price for such an opportunity and form the basis for a rational decision?

Although the general principles in this chapter apply to both a licensee (buyer) and a licensor (seller), this chapter primarily looks at these matters from the point of view of the *licensor*. The *form* of an agreement is not detailed in this chapter; many differing approaches as to royalties and equity are possible. This topic is sufficiently complex to warrant coverage in other chapters in this *Handbook*.[3]

2. GETTING STARTED

Prior to delving into this discussion, it is helpful to review the definitions of two key, related terms.[4]

- *value:* an amount considered to be a suitable equivalent for something else
- *price:* the sum of money or goods asked or given for something

In this chapter, *price* will mean the quantification or specification of *value*. Price should be the expression, in monetary and other forms of consideration, of what the technology manager believes is an appropriate starting point for discussions and ultimately represents a fair exchange for the institution's willingness as a licensor to enter into a commercial agreement.

This requires that the technology transfer manager determine, from the outset, what the institution is willing to provide as its end of the bargain. Table 1 summarizes ten *sources* of value, from the perspective of a licensor of early-stage technologies.

Item No. 1 is the key source of value provided by the licensor for a typical early-stage technology agreement—the right to practice the technology described by the intellectual property (IP). The licensor may also provide something within the categories of Item Nos. 2, 3, and 4. Item No. 5 is usually a left-pocket/right-pocket grant: if the licensor agrees to pay the patent costs for the licensee, then the licensee reimburses the licensor for these costs, dollar for dollar.[5]

From the perspective of licensors of early-stage technologies, Item Nos. 6, 7, and 8 are strictly the responsibility of the licensee and are, thereby, *not* part of what is granted. Although the costs associated with these boxes may be small on average, the risks of a very significant cost associated with them on a given deal are both so large, and primarily or solely under the control of the licensee, that it is imprudent for a licensor to bear them (this is discussed in greater detail in Section 6.4).

The last two Items, Nos. 9 and 10, may involve the licensor in some way; most often, however, the licensor will grant only a willingness to assist the licensee in these activities on a cost-reimbursement basis.

Generally, therefore, the licensor of early-stage technologies is offering Item No. 1 and, possibly, Item Nos. 2–4. Within each of these boxes, figuratively speaking, are yet smaller boxes that further define the contents of the grant. For example, in Item No. 1 the license may be exclusive for all fields and territories for all patents in the technology package, for a specific application, for a specific territory, for a specific term (such as five years, after which time the licensor can license others), or exclusive but for one other licensee (a limited exclusivity, sometimes referred to as a second-source approach), and so on in a limitless array of possibilities and combinations. Each of these options will have a different economic value; accordingly, each should bear a different price. Such issues are sometimes referred to as *aspects* of value (see Section 6.2).

As the licensor, a technology transfer manager needs to determine what boxes (and contents thereof) the institution is offering as its package.

Table 1: Ten Sources of Value Relating to IP (Intellectual Property) Rights

1. Rights to practice the technology (patents, trade secrets, copyrights, trademarks)	• IP rights included • Field/territory • Degree of exclusivity • Duration
2. Commercial data	Production drawings, material balances, operating statements, training or technical assistance
3. Future improvements	From licensor, from licensee, from other licensees, rights to, payment(s) for
4. Right to sublicense	Conditions for, split of fees, improvements/grant backs
5. Patent expenses	Maintenance costs, patent prosecution, foreign filing
6. Defense of patents	Oppositions, interferences, declaratory judgment actions, claims of ownership
7. Infringement issues	Studies and opinions, freedom to practice, suits against infringers, suits by third parties
8. General indemnity	Product liability, ownership issues
9. Quality control	Testing, laboratory services, trademark policing
10. Regulatory approval	National regulatory agencies and listings such as the FDA,[a] and EPA,[b] and TSCA[c]

a U.S. Food and Drug Administration
b U.S. Environmental Protection Agency
c Toxic Substances Control Act

It is a very good practice to document the contents of the package in some detail for internal purposes, and perhaps in a more succinct fashion for initial discussions with prospective licensees. For example, part of a licensing package could include product prototypes or customized test or development fixtures, as well as data unpublished or not yet published that provides additional information on potential applications, costs, or areas of potential improvement.

Similarly, the technology professional should document in detail what the institution is seeking from the licensee as fair exchange. Some items to consider in determining this exchange are:

- royalties (often termed *running royalties*)
- other cash payments (an upfront cash payment, progress payments, or annual minimums)
- common stock or partnership interests (as partial or total offset for royalties)
- R&D funding at the institution to advance the technology or other R&D objectives
- lab equipment
- consulting agreement(s)
- improvements to inventions (so-called grant backs)
- access to proprietary and/or technical data related to the invention

There is a long list of sources of consideration that the institution may wish to seek from the licensee. By thinking through these items and writing down those that are desirable from the institution's point of view, the technology transfer manager can develop a rational framework for expectations. From a negotiating perspective, following this process can prevent the institution from being perceived as a nibbler: that is, an organization that is always thinking of something more that it should get for the deal.

3. THE CONTEXT OF PRICING

The seller's pricing expresses belief about value. Such belief arises from considering the innate economic benefit associated with the use of the technology being offered, the competitive alternatives available to a prospective buyer, and an overall negotiation strategy.

As mentioned earlier, there are an unlimited number of combinations that could be agreed to by the licensor and licensee. It is impractical to price all these combinations and offer a price list. Instead, a price is needed for what is considered to be a basic deal that is of interest to the institution and that the technology manager believes will be of interest to a licensee.

In the process of discussing an opportunity with prospective licensees, a licensing professional will learn that there are different items that each licensee wants and different values that each licensee places on what it has to grant (surprisingly, not all companies view money the same way; there can be a big difference between funding R&D and upfront cash, or between upfront cash and royalties, and so on). As new information is learned, the technology transfer manager should be prepared to reenter the pricing methodology and reconsider assumptions and elections. The technology transfer manager will also learn about the competitive alternatives that prospective licensees have use of the institution's technology. At the same time, the manager will analyze the institution's alternatives should the licensee say no.

In a free market, all participants can decide what they think a product is worth and communicate this to others. From this process, the technology transfer manager should be able to learn relevant facts that may cause the price to be reassessed. It should be remembered that participants in a free market do not consider themselves compelled to communicate what is good or undervalued about what the institution has to offer. In most instances, a technology transfer manager will only hear (or primarily hear) the bad news related to a product; some of it may be true, and some may even be relevant.

Negotiating strategy is also important. Although this subject is outside the scope of this chapter, two pricing negotiation-strategy poles illustrate the significance of negotiating strategy:

- **fixed-price seller:** The seller has made a best effort at determining a value that represents what it believes is a fair value to both parties. This price is its bottom line, and it offers the product to all prospective buyers as a here-it-is, here-is-what-it-costs, take-it-or-leave-it proposition.

- **price maximizing seller:** The seller seeks to identify only those prospective buyers who express interest in the opportunity, which is initially priced at or near the maximum reasonably conceivable value because it is expected to be adjusted downward, perhaps substantially, due to the back and forth of what are likely to be extensive negotiations.

There is, of course, a continuum of perspectives between these polar positions. The fixed price approach (as an idealization), has the appeal of deal simplicity and speed, but may have as its result (a) no buyers and therefore no deal or (b) a deal with a buyer who would have been readily willing to pay more had it just been asked. The price-maximizing approach is really about a seller offering some flexibility on price and deal elements to attract potential buyers to engage in a negotiation that leads to mutual learning. In some respects this second approach could be better described as the deal-probability-maximizing approach because it offers an adjustability of pricing and deal elements not available in the fixed-price approach. However, the initial pricing of this second approach has to be within a range that buyers can conceivably find reasonable; otherwise buyers can be dissuaded from even initiating due diligence. The most important point to remember is that *pricing is a process*, not a one-time event.

4. COST AS A BASIS FOR PRICE

Cost is a very poor basis for pricing, although it is sometimes used. To get a sense of using cost of development as the deal price, consider the following: suppose an institution and its sponsors have invested $10 million in a particular technology that at long last has been determined not to work well enough to be used commercially. What are the chances of going out into the world of commerce and saying: Have I got a bargain. Because this technology doesn't really work, we are not going to ask for any profit. It is yours for only the $10 million we have sunk into it. The market will not value what the institution paid to develop the technology, not because it is unsympathetic to the institution's investment (and plight), but because what is important to the market (the buyer) is the value of the product, not the costs of development. If the product does not work, it has no value. What the institution has invested in its development is gone.

Consider the other extreme: An individual buys a lottery ticket for $1. It turns out to be the sole winning ticket in a $10-million lottery. Now, someone shows up and says: I'll give you $2 for your winning ticket, which will double your money. Is this a good deal? Again, the cost of the lottery ticket is irrelevant in this example. Rather, its worth after selection is what some willing party would pay to gain the benefits of ownership. For all the losing tickets together, no rational buyer would pay even a dime. For the one winning ticket, in this example, a rational buyer would offer millions of dollars, but not more than $10 million.

In the world of manufactured-commodity goods, costs and price are often closely related. Historically, pricing in such circumstances was determined by multiplying the costs of manufacture by an industry-standard multiplier. A typical historic multiplier was simply the factor *2*, so the price would be double the cost of manufacture.[6]

But in the case of high-cerebral content products, such as intellectual property, cost is an inappropriate basis. If Picasso was alive and you approached him to buy a painting, would you ask: What did it cost you to make this painting? Consider another example. The late Sammy Cahn received (it is believed) approximately US$40,000 for granting the producers of the movie, *Die Hard II,* the right to play his song "Let it Snow" in the movie's opening scenes to set the mood for the holiday season. Cahn had sold rights to "Let It Snow" many times. Cahn did not write any new music for the movie; he probably did not even provide the producers a copy of the sheet music. So what did the producers get for their $40,000? They bought merely the right to use something already existing. How was the

$40,000 determined? That is what the two parties dealing at arm's length said it was worth, not an amount based on a person-hours of labor calculation as Cahn's appropriate value for the rights to use the song.

The market pays for value, not cost. In retail software sales, the actual cost of the CD, the manual (if not on the CD), and the packaging is typically less than 10% of the price. Why are software companies seeking and able to sell their products for more than 10 times their costs? The answer again is that it is value, not cost, that the market buys.

Cost, however, does come into play when considering a prospective licensee's alternatives to entering into an agreement. A prospective licensee could seek to develop its own technology by inventing around the institution's protection to accomplish the same purpose. If the prospective licensee was convinced that it could do so in a very short period of time with a parity outcome for, say, $1 million, then the licensee would reasonably determine that the institution's technology was not worth much over $1 million, which is what *its costs* would be to get what the institution has without buying what the institution is selling.[7]

When it comes to cost, it is the costs for the prospective licensee that are considered. Whether the seller's costs for developing the technology were $10 or $10 million is basically irrelevant. Another important, usually misunderstood, point is how to determine the seller's costs. In the lottery ticket example, the costs are easily known—it is printed on the ticket. But in the case of technology development, such costs are very difficult to estimate. Consider the variety and range of questions to be answered: Have we collected all the direct costs back to the very beginning of the development? Do we even know how to define the *beginning*? Did we include the value of all the contributions made to the project by products, services, insights, intellectual property, and so on, that were contributed at no recorded cost to the project? Have we excluded costs associated with development efforts that are not being offered to prospective licensees? Have we deducted "bad judgement" costs (which no reasonable R&D program should have spent)? Or should such "misspent" costs be recognized as a natural part of R&D? When parties talk about the seller's costs, they are usually talking about a number residing in some seller cost account used to track certain kinds of investments, and not the result of a carefully considered analysis of all the activities and value invested by the seller.

5. PRICING METHODS

If cost is not a good way to determine price, what is? Sections 5.1–5.6 of this chapter consider methodologies for answering this question. These methodologies include:

- Method I: The Use of Industry Standards
- Method II: The Rating/Ranking Method
- Method III: Rules of Thumb, such as the 25% Rule (and Other Rules)
- Method IV: Use of Discounted Cash-Flow Analysis with Risk-Adjusted Hurdle Rates
- Method V: Advanced Tools
- Method VI: Auctions

The goal of these following discussions is to develop tools and thinking. Producing an "answer," to the question posed at the beginning of this section is not the goal of this discussion, because the world of technology rights makes it impossible to determine a price in the abstract.

5.1 *The Use of Industry Standards Method*

Having dismissed cost as a basis for pricing, the next most logical approach is to use industry standards; the reason for this is that such an approach serves decision makers well in many other areas of experience.

Suppose you want to rent office space. The coin of that realm is commonly expressed as dollars per square foot per year (DSFY). Ranges for DSFY in the United States are from about US$1 to more than US$50. However, when consideration is restricted to a particular city and a region within that city (downtown/prime, downtown/periphery, outer belt, suburbs, inner-city warehouse district, and so on), the DSFY range will shrink remarkably, say to US$6 to $12. Then, when one further specifies level of amenities (Bigelow® carpets versus linoleum), and what is included in the rate (utilities, janitorial services, parking, security, partitioned office layout versus open and bare) the range narrows even further, say US$10.25 to $11. So it is with many other goods and services, from haircuts to paper clips.

Why can't this approach work for rights to early-stage technology? The problem is primarily the absence of a track record for comparable products bought and sold under known (or knowable) terms. In the office space example, there are many properties, many buyers (lessees), and many sellers (lessors). This results in many transactions of relatively standardizable terms agreed to by parties that had numerous alternatives to entering into the agreement, which were considered and evaluated before signing. It is the tangibility of what is purchased, the frequency of purchases, and the public knowledge of the purchase that makes it possible to apply industry standards.

In the case of early-stage technology licensing, it is often unclear what products can or will be ultimately introduced. The number of similar transactions on which to determine price are too few, and frequently it is impossible (or difficult) to know what price other licensees/licensors have paid in similar deals. Nonetheless, there does exist *some* public and private data on early-stage-technology licensing and in many instances something useful can be learned from it.

One example of published financial data for licensing agreements is that obtained by surveying. Among the more famous examples are tables published based upon transactions between a Japanese company and a non-Japanese company. Prior to liberalization of Japanese foreign exchange regulations in the 1980s, foreign parties licensing technology to Japanese parties were required to receive government approval of licensing terms. The Japanese government published annual statistics related to licensing. A typical table is shown in Table 2. In some respects, this table is more complete than most since it includes upfront payments and minimum royalties. As is typical of such tables, there is a frequency of occurrence entry for selected royalty-rate ranges for each of several categories of technology licensed. The best way to assess how useful such a table might be is to think about how its existence would lead a technology transfer manager to reach some decision about the price of something.

Consider the pricing of a medical device such as a blood glucose monitor. Reviewing Table 2, the closest category is probably electrical, but is this really what was meant by electrical? What does this table reflect for upfront payments? Half of the agreements contained a provision for upfront payments, and half did not.[9] Now what? What guidance does this table give about whether to have such a payment and its amount? What is the modal (most common) value for running royalties? None! Now what? Should the royalty be priced at zero? The percentage of cases the royalty was negotiated within the shown ranges can also be determined using Table 2, but where does the institution's product fit? Finally, look at the minimums row. What can a technology transfer manager do with this information?

The problem is actually even worse. The agreements that comprise the table each included a whole panoply of exchanges, only some of which were summarized in Table 2. How can a technology transfer manager shrink all of these different considerations down to just one number, a royalty rate, and compare the institution's opportunity with these published outcomes? Further, there can be instances of royalty base ambiguity. Staying with the hypothetical medical-device example and our bold assumption that "electrical" data may have some relevant teaching, we can envision instances where the entire device being sold is covered by the licensed subject matter, whereas in other cases the license could be about a limited feature or function within a much more extensive device. In such cases, how was the *royalty-rate* data used by the parties? Did they agree in both of these cases to use the selling price of the complete medical device, or did they in the second instance agree to use as the royalty base some smaller amount than the full selling price of the device because of the limited application to a single feature or function? There is no way to tell from the table. There are also other concerns about this table. It is limited to technology transferred into Japan in the early/mid-1970s. And what relevance would these rates have for licensing technology to be used in the U.S.?

A more recent industry standard survey is available, which also offers more distinguishing categories.[10] One of the tables is shown in Table 3—does it provide the technology office manager more useful information?

Again, use the test. How would this data help a technology transfer manager make a decision? Consider the categories of pharmaceuticals, general manufacturing, and other. Each royalty-range category has an entry for each of these. Unfortunately, all that can be discerned is that most royalties are in the range of 0%–10% and that pharmaceuticals are generally higher than manufacturing. One wonders about the category of telecommunications. Does this mean that all royalties for this industry fall in the range of 10%–15%? (No, as it turns out: there was only one survey respondent.) The paper from which Table 2 has been prepared contains a lot of good information, but a technology transfer manager should recognize its limitations as a guide for setting a royalty.

None of this discussion is intended to disparage the efforts of those gathering and publishing this data. Determining effective ways of

Table 2: Use of Industry Standards to Determine Royalties
(Data set obtained from review of all agreements filed in Japan)

		Industry Type				
Terms of Payment	Classification of Technology	Chemical	Metal	Machinery	Electrical	Others
Initial payment	Required	100	54	223	119	231
	Not required	65	37	187	119	220
Running royalties	< 2%	5	6	16	32	28
	2% > x < 5%	42	24	119	55	126
	5% > x < 8%	12	8	112	24	119
	> 8%	7	4	24	11	17
	Others	48	28	80	54	69
	None	51	21	59	62	92
Minimum payment	Required	38	19	116	35	186
	Not required	127	72	294	203	265
Subtotal		165	91	410	238	451
No fee, royalty		16	4	11	2	15
Total		181	95	421	240	466

Source: Science & Technology Agency[8]

valuing (pricing) technology is extremely difficult, and this author cherishes every scrap of information found. Everyone's efforts to extricate and publish anything that might help technology professionals in this valuation process are applauded. The goal here is simply to caution the reader about the limitations of using industry standards for setting royalties and other license considerations.

Let us now consider, as examples, other sources of financial information about license agreements. The references that follow should not be taken as recommended norms or standards, but illustrations of information that can be found by investigation.

Lita Nelsen of M.I.T. has published a table of standards that is an example of more useful data than the above broad Japanese license agreements. The table below represents a narrower class of licensors (M.I.T. and similar universities) and provides a narrower distinction of categories as well as a narrower range of typical royalties. A recast version of data she has published is shown in Table 4.

Table 3: A Recent Royalty Data Set Obtained by Survey
(Licensing-out royalty rates by industry royalty rate category)

Primary Industry	0%–2%	2%–5%	5%–10%	10%–15%	15%–20%	20%–25%	Over 25%
Aerospace		40.0	55.0	5.0			
Automotive	35.0	45.0	20.0				
Chemical	18.0	57.4	23.9	0.5			0.1
Computer	42.5	57.5					
Electronics		50.0	45.0	5.0			
Energy		50.0	15.0	10.0		25.0	
Food/Consumer	12.5	62.5	25.0				
General Manufacturing	21.3	51.5	20.3	2.6	0.8	0.8	2.6
Government/University	7.9	38.9	36.4	16.2	0.4	0.6	
Healthcare Equipment	10.0	10.0	80.0				
Pharmaceuticals	1.3	20.7	67.0	8.7	1.3	0.7	0.3
Telecommunications				100.0			
Other	11.2	41.2	28.7	16.2	0.9	0.9	0.9

Clearly Nelsen's data covers wide ranges in royalty rates, from 0.1% to 20%, a factor of 200. Even within one category, the range between the high and low ends can be a factor of five or more. Further, it is likely that there exist "outliers" from such ranges that M.I.T. would license at rates below the bottom end of the range and perhaps, for major breakthroughs and extensive IP portfolios, may expect values above the top of the range. The data illustrates another trend that appears in other examples: those products and industries with traditionally high operating margins (profits), such as pharmaceuticals and software tend to exhibit higher royalty rates compared with, say, the materials industry.

Other authors have published tables of royalties for the purpose of establishing reasonable expectations of both licensors and licensees. Table 5 is a table published by Corey and Kahn for the medical industry.[12]

The table's context is well defined (early-stage technologies out of research labs), the categories are comparatively precise (diagnostics in vivo), and it includes guidelines on up fronts and minimums. However, note that there is an important economic difference between the ends of the royalty ranges given: 1% versus 3% or 2% versus 10%, and so on. Unless the technology transfer manager understands where the institution's opportunity fits in the range identified, it is difficult to know where to begin. Further, not *every* opportunity falls within even these broad ranges. Some opportunities will have only negligible value; others could be unusually valuable opportunities.

Tom Kiley has published another medical industry table that deals with exclusivity granted (Table 6).[14]

Kiley appears to suggest that for nonexclusive rights, the royalty should be about half of the exclusive royalty. (See section 6.3.2 for more on the 50% rule.) According to Kiley, inventions in support of a pharmaceutical (drug) warrant higher royalties (7%–15%, as his generalization) than drug delivery, diagnostic and therapeutic monoclonal antibodies (2%–7%), perhaps reflecting another two-to-one ratio.

Published price lists are another source of industry standards for pricing. Sometimes a company simply announces its royalties. One example, shown in Table 7, was published by one licensor for nonexclusive licenses for its LCD display patent.

Another example of such published rates is, or was, IBM's licensing terms. In the 1980s and early 1990s, IBM established a licensing practice—essentially a price list—that offered to license essentially all of its 34,000 patents worldwide for a 1% royalty each for computer uses (patents only, nonexclusive only), up to a maximum of 5% for all 34,000.[17] This practice does not establish 1% as a minimum per patent royalty; rather it reflects IBM's practice at one time that a licensee can *choose* any one from IBM's massive portfolio for a rate of 1%, any two for 2%, and so on. Further, because IBM does not make public its license agreements it is unknown what payment structure or amount was finally agreed to with licensees.

The main point about the LCD and IBM examples is that such published lists can lead to expectations and, to the degree that the opportunity the technology transfer manager is pricing fits any published examples, this may influence the thinking of prospective licensees. In some cases, such proposed pricing can create a widely accepted norm in the respective industry, making it difficult for the seller to price above such a norm if the subject matter is perceived to be in a similar category. Licensees, like licensors, look to this method of industry standards (or norms or comparables). However, they may look to a different population of examples such as their own internal catalog of extensive deals that they have completed in the past to establish their expectations for financial terms.

Yet another source of industry standards are court determinations of reasonable royalties awarded in patent infringement lawsuits. Table 8 offers a summary from a paper by Mike Carpenter who analyzed a series of judgments.[18]

The main limitations of such data are that the result is very specific to the litigated subject. In addition, the maturity state of the technology is normally far beyond what may be considered as early-stage technology. Further, adjudicated reasonable royalty rates are almost

Table 4: Example Table of Royalties Developed by Experience by a University Licensing Office[11]

Product	Royalty (%)	Comments
Materials processes	1–4	0.1%–1% for commodities; 0.2%–2% for processes
Medical equipment/devices	3–5	
Software	5–15	
Semiconductors	1–2	Chip design
Pharmaceuticals	8–10	Composition of materials
	12–20	With clinical testing
Diagnostics	4–5	New entity
	2–4	New method/old entity
Biotechnology	0.25–1.5	Process[a]/nonexclusive
	1–2	Process[a]/exclusive

a Expression systems, cell lines, growth media/conditions

Table 5: Royalty Rates for the Medical Industry[13]

Technology/Industry	Earned Royalty (%)	Upfront Payments (in US$)	Minimum Payments (in US$)
Reagents/process	1–3	Patent costs	2,000–10,000
Reagents/kits	2–10	Patent costs	2,000–10,000
Diagnostics in vitro	2–6	5,000–20,000	2,000–60,000
Diagnostics in vivo	3–8	5,000–20,000	2,000–60,000
Therapeutics	4–12	20,000–150,000	20,000–150,000
Medical instrumentation	4–10	5,000–150,000	5,000–20,000 (yr. 1) 10,000–25,000 (beyond yr. 1)

always unrepresentative of arm's-length rates, as they represent royalties for patents known to be valid and infringed—conditions not typical of early-stage technologies. This litigation-particular outcome example is also quite dated, but datedness is a factor here in all of the prior examples as well, and is innate to any historical collection of data.[20] Still, a court case usually contains a wealth of information about how such rates were determined, and of course, the information is in the public record. Einhorn has published a much more current summary of reasonable royalty determinations by a court.[21] One can also search LEXIS® for even more current data. The key is to find a comparable technology, stage of development, market impact, and so on. When something comparable exists and is published, this can be very helpful.

The most valuable tool for determining industry standards for this method are published agreements for similar technologies licensed by similar institutions. As Ashley Stevens explains, publicly-traded companies will file license agreements that may have a significant economic impact on the value of the company with the U.S. Securities and Exchange Commission (SEC).[22] The Internet now enables very effective searching of disclosures made by publicly-traded companies.

Table 6: Proposed Standard Royalties[15]

	Exclusive (%)	Nonexclusive (%)
Development rDNA[a] drug	7–10	3–4
Approvable rDNA[a] drug	12–15	5–8
Therapeutic mAb[b]	5–7	3–4
Diagnostic mAb[b]	3–4	1–2
Drug delivery component	2–3	0.5–2

a Recombinant DNA
b Monoclonal antibodies

Table 7: Price List for an LCD Display Patent[16]

Vehicles	0.125%
VCRs, and so on	2%
Meters, gauges, and so on	3%
Telephones, and so on	4%
Calculators, and so on	5%

Several organizations offer, as a service, summaries of categories of such filings and copies of specific agreements. An example, taken from a talk by Mark Edwards, is shown in Figure 1.[23]

These data are unusual in that they show many of the forms of upfront consideration received by universities for having licensed their biotechnology. Underneath such summaries, however, are specific agreements now numbering in the thousands, copies of which can be found with some research. It is from such published agreements that one can gain a better understanding of what was agreed to, at least once, by two parties for something similar to what is being offered.[24]

One example of such a specific agreement is the license between the University of Houston (UH) and DuPont for the so-called 1-2-3 superconductors developed by Professor Wu of UH. The State of Texas required that this agreement be placed in the public domain. The agreement details the payments DuPont agreed to make to gain rights to UH's superconductor technology: US$1.5 million in cash upon execution of the agreement, an additional US$1.5 million upon issuance of the U.S. patent, and a third US$1.5 million upon the second anniversary of the U.S. patent. The agreement has many other interesting details, and it would be wise to study this agreement and learn as much as possible about its background and current status.

To sum up, using this industry standards method of setting prices has both positive and negative aspects:

Positive aspects of the industry-standards method include:

- The values used as the basis are based on the market.
- No calculations are required (beyond perhaps taking averages and medians or other statistical methods).
- One has some confidence of being in the range of some believed-to-be comparable reference points.

Potential negative aspects include:

- Published information is inevitably dated, and such datedness could have a material effect on the present value of a similar deal.
- The segmentation provided by surveys is normally too coarse (electrical, mechanical, telecommunications, and so on).

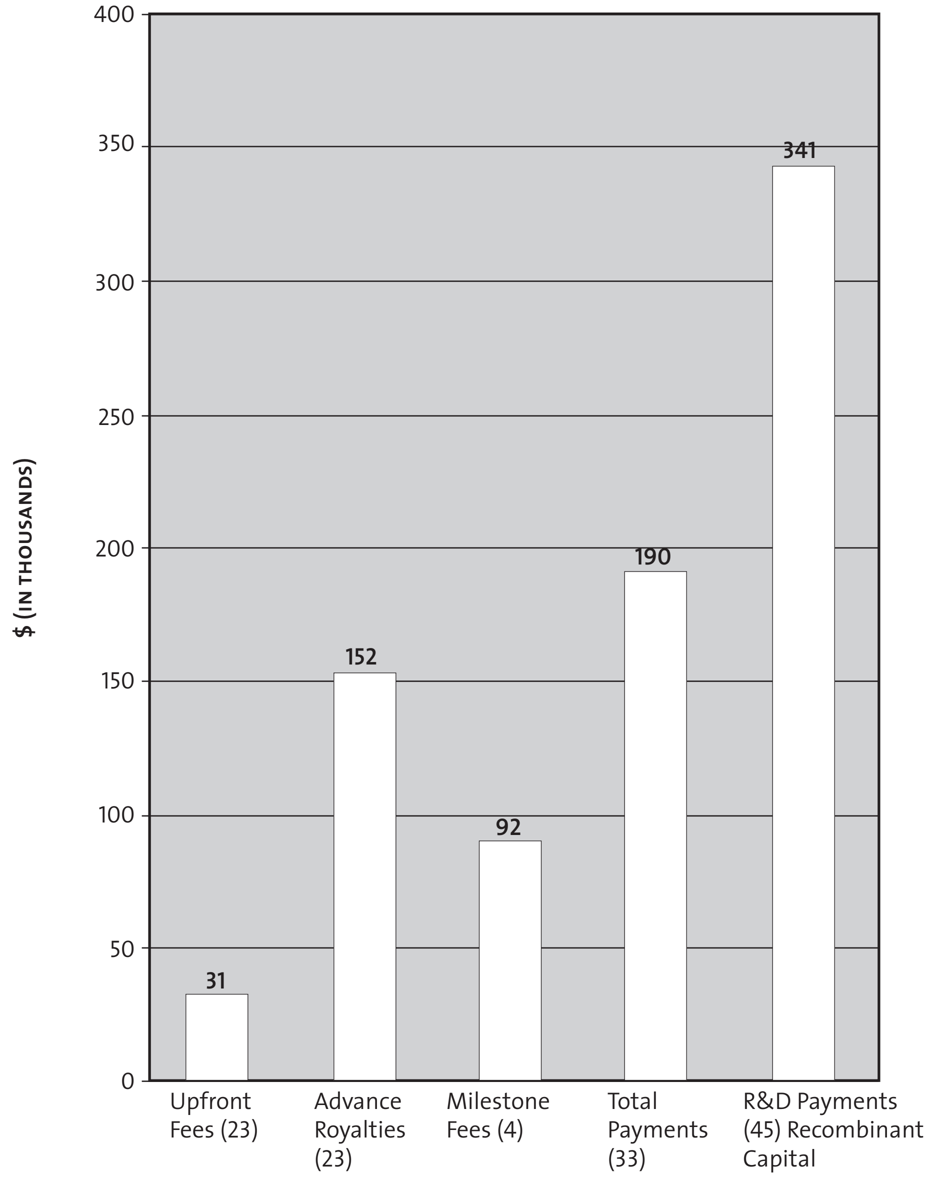
Table 8: Other Tables of Royalty Rates Based on Litigation Outcomes[19]

Product	Royalty (%)	Date	Citation
Rotary wing aircraft	2	1976	192 USPQ 612
Sleeping bag	5	1967	156 USPQ 403
Digital data transmitter	7.5	1978	200 USPQ 481
Oscilloscope	10	1977	193 USPQ 385
Computerized teaching aid	12	1978	199 USPQ 178
Toilet paper perforator	20	1977	195 USPQ 125
Airline baggage cart	100[a]	1977	196 USPQ 129

a of profit

Figure 1: Royalty and Other IP Revenue Data Based on SEC-Filed and SEC Agreements

Average Pre-Commission Payments: University/Biotechnology Licenses



Source: Recombinant Capital (Mark Edwards). AUTM presentation 1993.

- The values published normally do not provide sufficient information to determine what IP rights were provided, or to determine their significance or their strength.
- The royalty *basis* (or base) is not always explicitly defined.
- The connection of the license to the size and margins of the buyer's market opportunity is not explicitly known.
- A wide range of royalties is reported for each classification, with no clear means of discerning why some opportunities were higher valued and some lower.
- Often no information on upfront payments, minimums, or due-diligence provisions is available, all of which can be important components of value.
- The licenses often contain other provisions that directly affect the total value of the deal and are reflected in the royalty rate.
- One cannot uncover a historical agreement for exactly the same technology as that of current interest, between comparable parties, at a comparable stage of development. So one is commonly performing some interpretation of available data to apply to one's present situation.

The industry standard method works best when one deals in one technology/industry segment, especially when there are a significant number of deals involving multiple buyers and competitive sellers, much as in the real-estate rental market discussed above. The examples given here are not intended to provide representative technology values but to illustrate some of data sources that exist.

In summary, price is a very tricky idea. It occurs "between the ears" of the technology transfer manager, as well as between the ears of prospective licensees. As you can see, it is affected by all the other things that affect a person's judgment. For those who doubt this, an experiment has been published that illustrates this point.[25] Two groups of students were asked to review identical notebooks containing descriptions of seven consumer products. They were each asked to respond to each product by specifying what they would be willing to pay for the item. A summary of the findings is shown in Table 9.

Everything was identical in the two settings (A and B), except for one small thing. In setting B, there were Mastercard® logos left lying on the table. Even though all the participants understood that they were not buying the items in the book,

Table 9: Price is a Tricky Idea: What Would You Be Willing to Pay?[26]

Consumer products book	Mean in setting A	Mean in setting B	(B-A)/A
Dress 1	$27.77	$41.50	49%
Dress 2	$21.09	$33.91	61%
Tent	$69.95	$77.73	11%
Men's sweater	$13.91	$20.64	48%
Lamp	$28.36	$40.41	42%
Electric typewriter	$131.45	$165.36	26%
Chess set	$35.29	$43.15	22%

and there was no discussion as to how such items could or should be paid for, the mere presence of the logos influenced the group B students significantly.

The point of relating this experiment is that *everything* about the technology transfer manager, the institution, the inventors, and so on, are potential influences on what a licensee will conclude is a fair price.

Consider these two different settings for the same invention. In setting A, the prospective licensee goes to Nowheresville, has to drive four hours because there is no air service, steps in cow dung as he gets out of his car, meets the inventor who has no front teeth and exhibits an annoying habit of scratching his underarms, and discusses the invention in the Greasy Spoon Cafe. In setting B, the prospective licensee goes to Mostfamousuniversity, where he is introduced to the distinguished inventor (who has previously won a Nobel Prize) at the exclusive faculty club and a well-known, well-respected, high-ranking public official stops buy and says hello during lunch.

Remember, in this thought experiment the institution is selling the same invention in both settings. Even though the prospective licensee is not a student and is not buying consumer products as in the example above, the principles are the same. The licensee will likely be influenced by the setting and circumstances, which may be completely unrelated to the underlying value of the opportunity.

In the first act of a wonderful play by Arthur Miller called *The Price*, the owner of a house full of furniture is frustrated when the dealer he has invited to bid on all of it delays giving him a price. Instead, the dealer spends a lot of time understanding the context of the sale (and learns that the building is about to be demolished and that the seller has no time or patience to sell the items piece by piece). He intermittently (and politely) points out certain blemishes in objects that would otherwise have been perceived as very valuable. When the seller finally demands to hear the price, the very old man who plays the buyer simply says, "*Because the price of used furniture is nothing but a viewpoint, if you don't understand the viewpoint, it is impossible to understand the price.*" The view from the buyer's position always affects the price he is willing to pay.

One other point needs to be made about price. It is often the lever used in negotiations. Often each party to a negotiation uses price as a lever to get other things. There is a wonderful ancient saying on how buyers tend to negotiate, "Bad, bad says the buyer, but then he goes his way, then he boasts."

5.2 *The rating/ranking method*

This method applies the elements of any definition: the specification of a *genus* plus the distinction of a *differentiator.*

First, the technology transfer manager must find the genus (or family) for the institution's technology that he or she is seeking to price. Places to look include the published agreements discussed earlier, friends in the network of the Association of University Technology Managers (AUTM) and the Licensing Executives Society (LES), consultants, and the institution's files of negotiated deals. Ideally, a technology transfer manager should find at least one or possibly two or three comparable deals from such a search.

Second, this method uses some form of rating table to score (differentiate) the deal that is now being priced based on the known price of the comparable deal(s). To do this, a technology transfer manager must select a list of relevant factors. Tom Arnold and Tim Headley published a useful, extensive list of 100 possible factors in an article in *Les Nouvelles*.[27] One hundred factors, however, are far too many to evaluate, which is perhaps why the most well-known enumeration is the Georgia Pacific factors, so called because the factors were annunciated in a lawsuit involving the Georgia Pacific company and have since been widely cited with respect to litigation matters. The results of a survey published by LES asked respondents which of the primary Georgia Pacific factors they used to assess an opportunity when either licensing in or licensing out. Table 10 gives a summary of these findings.

Other approaches may use only three or four factors to simplify the analysis, such as (1) comprehensiveness of the IP protection, (2) the stage of development (or, conversely, the magnitude of licensee investment) to bring the technology to the market, (3) the size and value of the market that is expected to be won by the licensee, and (4) the sustainability of the innovation wrought by the subject technology in view of competitive alternatives both present and anticipated.

Once one has chosen the key factors, the technology transfer manager, or preferably a commercial assessment team, scores the subject opportunity compared to the reference agreement found above for each factor selected on some scale. This can be done by employing a 1 to 5 scale, with a 3 as being indistinguishable to the comparable agreements, 4 meaning the subject opportunity is better (more valuable) with regard to this particular factor, 5 meaning much better, and so on. It is usually a good idea to also include a weighting factor so that each consideration is not treated equally. This is illustrated in Table 11.

The result is a weight-averaged score. Anything greater than 3.0 would suggest that the subject opportunity is better than the examples being considered as a standard, anything less than 3.0 suggests it is worse. If a technology transfer manager has two or three standards available, it may be possible to use this method to bracket the opportunity.

Although this method is straightforward, there are some important limitations. What is a true comparable? Each agreement is a snapshot in time, no two technologies are really identical, the market is almost never the same, and the negotiators and organizations will likely be

Table 10: Example of Georgia Pacific Factors Used in Rating/Ranking[28]

Importance of Factor	Licensing In[a]	Licensing Out[A]
1. Nature of protection	4.3	4.2
2. Utility over old methods	4.2	4.2
3. Scope of exclusivity	4.1	4.1
4. Licensee's anticipated profits	3.0	3.4
5. Commercial success	3.7	3.4
6. Territory restrictions	3.7	3.5
7. Comparable license rates	3.6	3.7
8. Duration of protection	3.3	3.1
9. Licensors' anticipated profits	2.6	3.1
10. Commercial relationship	2.6	3.6
11. Tag-along sales	2.1	2.1

a A ranking of 5 corresponds to most important; 1 to least important.

different. In addition, there are many tradeoffs and exchanges in every agreement; a technology transfer manager cannot simply compare one single aspect, such as a royalty rate, and look at it without considering what else was in the agreement. What about the differentiating factors selected? Does a technology transfer manager really know what the important ones are for this opportunity? What does a 4 really mean in economic terms? Finally, what does a technology transfer manager do with the result? Suppose the technology transfer manager determines that the institution's opportunity scores a 3.8 compared to the standard. Now what? Does the technology transfer manager set expectations for the royalty at 27% better than the standard, as determined by ((3.8–3.0)/3.0)? Is the up front now 127 instead of 100? Are the minimums 64 instead of 50? Does the diligence requirement provide that the licensee must be on the market in 31 months instead of 40 months? Is the premium on late payments 3.8% instead of 3%? There are no simple answers to any of these questions. Still, performing this ranking against multiple standards and thinking through the results generally allows one to better understand

Table 11: Method II: The Rating/Ranking Method

Factors	Score (1 to 5)	X Weighting Factor	= Weighted Score
Stage of development			
Scope of IP protection			
Market attractiveness			
Sustainability of protection			
Profit margins			
Etc.			
			Average Weighted Score Compared to 3.0

the helpfulness of this rating/ranking method in a specific circumstance.

The approach also yields at least two other benefits. First, it prepares the technology transfer manager for marketing, negotiating, and sharpening his or her thinking about what the important economic factors are relating to the opportunity. It gives the manager a greater self-awareness. A second benefit is that it provides a way of dialoguing with the internal stakeholders and beneficially incorporating some of their insights.

The rating/ranking method can also be used for selecting a commercialization path. When developing a commercialization strategy, there are countless possibilities: exclusive versus nonexclusive licenses, licensing versus equity in a new start-up, going with a company in industry A as the exclusive licensee or in industry B, commitment to the industry leader versus a small company who seeks to upset the industry, and so on. The rating/ranking method can help a manager sort out the advantages and disadvantages of each of the alternatives. It can also be used with respect to different potential licensees/partners by taking into account the particular benefit(s) of the technology to such licensee; the method can help a seller differentiate among multiple potential candidates to identify those who would appear to have the most to gain from the license and would therefore be the likeliest to enter an agreement and possibly pay the most. These and other criteria can help a technology transfer manager decide upon the best commercialization path.

5.3 *Rules of thumb, such as the 25% rule (and other rules)*

5.3.1 *The 25% rule*

One of the most widely cited tools of valuation is the 25% rule. It has various manifestations, but when most managers invoke it they usually mean either of the following:

1. The royalty in dollars should be one fourth of the *savings* in dollars to the licensee by the use of the license subject matter.
2. The royalty in percent of the net sales price should be one fourth of the *profit*, before taxes, enjoyed by the licensee as a result of selling products incorporating the licensed subject matter.

Although this looks simple, it is not. One of the key issues is the degree to which the licensed subject matter accomplishes the savings or produces the profit. For example, an invention incorporated into a process may produce a savings of $1 a unit. However, when one examines in detail how such savings are attained, it may be that several other technologies developed and possessed by the licensee need to be exploited in order to realize the full $1. In such a case, does the licensor deserve 25 cents, or should the savings be discounted in some way before the one-fourth fraction is computed? The issue seems to hinge on whether the invention opens the door to an otherwise locked room called: I can save you $1, or whether the invention is a link in a multilink chain that together combine to save $1.[29]

In the second (profit) manifestation of the rule, things get even more complicated. Although net sales is generally a straightforward term to apply, profit before tax is subject to many interpretations. Normally, the royalty rate is applied to the royalty basis defined by net sales as follows: net sales price is the gross invoice price charged minus allowances for returns, and minus cash and other discounts granted, charges for packaging and shipping, and sales and excise taxes.[30]

For the purposes of this rule, there is no comparable generally accepted definition of *profit before tax*. Indeed, one of the basic problems is determining what an appropriate income statement should look like. Typically, they have the following categories:

Gross sales	
Less:	returns/allowances
=	net sales
Less:	cost of goods sold (COGS)[31]
=	gross margin (or gross profit)
Less:	overheads (or G&A, for general and administrative)
Less:	sales (or sales and distribution)
Less:	other
Less:	R&D
=	Profit before tax (or EBIT, earnings before interest and tax)

The trouble usually starts below the gross-margin calculation. What overheads should be attributable to this opportunity? Should all the overhead costs currently being experienced by the licensee be included in the calculation, even though including these may reward the licensee's inefficiencies? Will the cost-of-sales allocation, which is across many products now being sold, overcharge the appropriate sales allocation for the subject opportunity? What is "other," and why is it being used to draw down the profitably before the application of the royalty? And finally, what constitutes R&D, and should it draw down profits as calculated for determining a reasonable royalty?

Underneath these questions is the difficulty of obtaining reasonable estimates for each of the numbers. Annual reports from companies that sell products like the one the institution is licensing are good places to start. Table 12 shows summaries of two large materials companies, one U.S. company and one European company, based on their income statements published in annual reports. Although the numbers reflected in Table 12 represent real data, for the purposes of this illustration, the company names have been noted as U.S. Co. and Europe Co., respectively.

As discussed earlier, one of the issues in applying the 25% rule is where to apply it. If it is applied to the EBIT line ($18,352,000, in the United States company example), it is asserted that the deductions above that line (COGS, SD&A, and R&D) are appropriate for determining the true profitability associated with the commercialization of the new opportunity being licensed.

Consider whether it is appropriate to subtract R&D from available profit. If it is not subtracted, we would get, by this rule, one fourth of 12% (11+1) or a 3% royalty. This is a lot better for the licensor, since it is 12 times the 0.25% one gets by using what remains after R&D is subtracted. But should R&D be included in the subtraction? The argument for including it is that R&D is a necessary business expense for the enterprise; without such investments, the licensee would not have the high-value, competitive products it needs to sustain its operations, and, by implication, would be unable to successfully commercialize the subject opportunity.

On the other hand, these expenses are investments for future payoffs to the company for which the licensor may not enjoy the benefits. Suppose the U.S. company had elected, in the year reported, to increase its R&D investment by $18,351,000 to pursue an antigravity invention. This would have left the grand sum of $1,000 on the EBIT line, corresponding to one-ten-thousandth of a percentage point (of sales). Why should a licensor's fair share of profits depend on the company's management pushing an R&D project to develop an antigravity material or, for that matter, any other product?

Above or below the EBIT line are even more subjective costs. If they are associated with the company's core operations, they may be appropriate. But what if they are associated with buying that new hunting lodge in Montana? Or buying up Brazilian rain forests? What about restructuring, which may be synonymous for the present cost of past folly? Again the same kinds of arguments exist on both sides. And again, what about that favorite term in accounting statements: "other." Other than what?

If the licensor agrees that all of the expenses shown are appropriate allocations against earnings, it leads in this particular year to a negative number. Now what? Does the institution pay the *licensee* a royalty to commercialize the institution's product? The point of this discussion is that each cost below the sales line should be analyzed in the context of the subject technology to determine if the EBIT percentage shown reasonably predicts the licensee's profitability in the present case. If not, adjustments to such costs should be made to correct the base on which the rule is applied.

The second example in Table 12 (European Co.) presents other problems. For competitive reasons, many companies conceal details in their statements. They may also use different terminology. In Europe, sales is normally called turnover, interest can be finance charges, and so on. This example shows a gain from investments.[32] Should the licensor receive the benefit of a higher royalty because the Europe-based company made money in one year on a good investment? Probably not. But if the company had lost money on investments, wouldn't the licensee argue that such loss should be subtracted as an appropriate business expense? So, what about the gain?

Another way to obtain income statements is to use Ibbotson and Associates[33] and Robert Morris Associates (RMA) publications.[34] RMA, for example, annually publishes income statements of categories of companies by Standard Industrial Classification (SIC) code. Continuing with our two materials company examples, Table 13 shows the data available from the 1991 edition for SIC #2395.

In the first two columns are shown summaries for 11 smaller companies and 17 larger companies, based on assets. The right three columns provide three years of data for all of the companies in the database. Even when focusing on just the operating profit row, this gives five choices on which to apply the one-fourth rule: 4.1%, 4.7%,

Table 12: Example Applications of the 25% Rule

	Annual Report, 1991 U.S. Co.	
	US$, in thousands	%
Sales	1,249,512	100
COGS[a]	643,357	52
Gross margin	606,155	48
"S,D,&A"	447,607	36
R&D	140,196	11
EBIT[b]	18,352	1
Interest	8,090	
Restructuring	3,697	
Other	9,674	
EBT[c]	(3,109)	(0.25)

Now what? 0.25%? (0.06%)?

	Annual Report, 1991 Europe Co.	
	UK £ in millions	%
"Turnover"	454.0	100
Other Inc.	2.2	
	456.2	
"Operating costs"	405.0	89
EBIT	51.2	11
"Investments"	(1.4)	
"Finance charges"	8.7	
EBT	43.9	10

Now what? 2.5%?

a Cost of goods sold (all "direct" costs of making the product)
b Earnings before interest and taxes
c Earnings before tax

7.8%, 8.4%, and 10.4%. How does a technology transfer manager choose? Taking an average yields about 1.5% as the royalty. Is this fair? Unlikely.

The root problem is getting good numbers for the profitability associated with the subject opportunity. A prospective licensee will almost surely make such a calculation. Yet a licensor will find it very difficult to get access to such information. The problem with published numbers of business enterprises—such as annual reports, 10Ks, RMA publications, Ibbotson, and other sources—is that the numbers are "smeared" over many different products, each with widely varying profitability. And once a product has been introduced, a company is inclined to keep it in the marketplace as long as it contributes to overhead, meaning it at least covers its cost of goods sold (COGS). In short, dogs in the company's profit portfolio bring down the returns of the stars. Basing a valuation on such numbers will therefore always be a very tricky business. It also ignores a company's willingness to pay more for a new opportunity, such as licensing a particular technology from which new products can be made. As a technology transfer manager becomes more experienced in various business sectors, he or she will better understand the economics of such variables—especially the company's interest in the opportunity of a new technology—allowing for better valuations (see Method IV: Discounted Cash-Flow Analysis with Risk-Adjusted Hurdle, section 5.4).

One possible remedy to these difficulties is to request that the licensee provide a pro forma (predictive) income statement for the subject opportunity. In many cases, the licensee will refuse on

Table 13: Another Example Application of the 25% Rule[35]

Minerals and Earths, Ground or Otherwise Treated[a] **(SIC #2395)**

	11 Companies $500,000–$2 m Assets	17 Companies $2 m–$10 m Assets	All 1991	All 1990	All 1989
Net sales	100.0	100.0	100.0	100.0	100.0
Gross "profit"	29.9	21.8	25.4	33.8	32.5
"Op-exp"	21.5	17.7	20.7	26.0	22.1
"Op profit"	[8.4	4.1	4.7	7.8	10.4]
"Other"	1.2	0.8	1.0	1.8	1.6
"Profit before tax"	7.2	3.3	3.0	5.9	8.7
	Now what?	1.5%? ←		Average ←	

a Operating without a mine or quarry crushing, grinding, pulverizing, or otherwise preparing clay, ceramic and refractory minerals; barite, and other miscellaneous minerals, except fuels. Also includes crushing slag and preparing roofing granules.

the grounds that such information is trade-secret information and that providing it, even under confidentiality terms, is forbidden. In other cases, the licensee may provide it. If so, it is a virtual certainty that what will be provided is the lower range of possible outcomes. Also, such pro forma statements may have certain cost allocations incorporated by rule or custom that may be arguable (either way) for getting to a figure to which the parties will apply the 25% rule.

Licensors sometimes call the 25% rule the "one-third rule." Licensees, on the other hand, sometimes argue that claiming even one-fourth of the profit is overreaching, given such issues as the technology's early stage of development, weak patent protection, high market risks, the extraordinary value of intangible assets to be applied by the licensee, and so on. Clearly, the many numerous factors that go into value (summarized earlier) must always be considered when applying rules of thumb. Perhaps the high risk associated with commercializing a specific opportunity means that only one-tenth is fair. And if the technology is only a small part of a very complex whole, with many other patents and proprietary technologies required of the licensee and a royalty base on the selling price of such a complex whole product, then a value much less than one-tenth can be reasonable. This last point relates to the always-relevant discussion of the royalty base that is being used with the royalty rate to determine the royalty payment. If the licensor's technology enables substantially the entire product, then the selling price of the entire product is normally the base. If the licensor's technology is only part of the entire product, then the parties may elect to still use the selling price of the entire product, but discount the royalty rate in recognition of that fact. Returning to the issue of whether 25% is the appropriate apportionment, if the commercial introduction of a well-developed, whole technology package for an attractive market opportunity is certain, then a value higher than 25% may be appropriate.

Despite these complexities, the 25% rule is well known and widely cited. One example is a citation by the court in *Gore vs. Internal Medical Prosthetics* where the judge stated, "*As a general rule of thumb, a royalty of 25 percent of net profits is used in license negotiations.*"[36] However, in the famous case of *Polaroid vs. Kodak*, the judge awarded a reasonable royalty that amounted to slightly more than 60% of the infringer's anticipated profits. The "Ten Sources of Value" (Table 1) and the rating/ranking factors must always be kept in mind, as should the overwhelming significance of differing risk perceptions of the same opportunity. If the licensee sees an opportunity as extraordinarily risky, then 25% of the profits will appear far too high. If the licensor sees it as picking the low-hanging fruit of something that can be readily commercialized by a license, 33% or more will seem reasonable. So, one should not take this "rule" suggesting there is a universal agreement that the value of "25%" covers all situations.

For more information, a summary of the history of the 25% rule is included in William (Bill) Lee's paper.[37] Our observations relating to the use of this rule are summarized below:

Positive aspects of the 25% rule method:

- Has a "feel-right" tug in certain circumstances
- Can be the basis (principle) of early agreement
- Appropriately tied to profitability
- Widely accepted (at least in the sense that lots of people have heard of it)

Difficulties with the 25% rule method:

- The lower you go below the top line of an income statement or model, the more subjective (that is, inauditable and arguable) it gets, for example, what is appropriate overhead? What are appropriate sales costs?
- The calculation, depending on how it is performed, can have the effect of rewarding licensee business inefficiency.
- Very difficult to get good income statement numbers that are not smeared over many businesses and products.
- The licensed subject matter (normally) represents only a part of the sales price; complex considerations are needed to decide whether to discount or not.

- There can be significant year-to-year variability in available income statement numbers.
- No help on upfront fees.
- There is no inherent assessment of the potential importance of third party IP and technology to a licensee's use of the subject technology.

One key piece of advice: If you use the 25% (or one-third) rule, use it *only* to develop the calculation of the *royalty rate to be based on sales*—never permit the royalty to be calculated on an as-you-go basis as a percentage of earnings before tax.

5.3.2 *The 50% rule*

Duke Leahey has outlined a 50% rule that is related to the 25% rule:[38]

- At the point of product introduction, about 50% of the total risk of product failure remains.
- If the inventing organization brings the technology to the state of product introduction, it is entitled to 50% of the total reward (profit).
- If the commercializing organization participates in premarket development costs and risks, it is entitled to more than 50% of the total reward.

From this perspective, the 25% rule represents a 50:50 participation in premarket risk. Accordingly, the 50% rule suggests that to determine a fair apportionment of profit one should assess the extent to which the premarket risks and costs will have been borne by the licensor and licensee when the product finally gets marketed. Unfortunately, this is not easy to do.

When did the invention begin? In most cases, the inventing organization and individual inventors endured a long, costly gestation that was the essential primordial ooze from which the invention emerged. It is therefore unfair to the licensor to add a $5,000 patent application and a $10,000 project that fleshed out a few numbers and contend such expenditures are equivalent to the $1 million required cost asserted by a licensee to bring the technology to the market as the basis for determining the relative, premarket contributions of licensor and licensee.

A second version of the 50% rule appears to be applied primarily in the area of software and reflects the very significant pre- and post-commercial involvement by university and R&D organizations in certain situations. When software is commercialized, many activities can be the responsibility of either the licensee or licensor. These include: performing all the bug fixes and compatibility tests of the original code, developing user interfaces, creating software manuals, making copies for distribution, packaging, finding customers, delivering copies, hot-line help for routine questions, resources for in-depth questions, new bug fixes, updates and improvements, product advertising, sales and distribution, more bug fixes, and so on. In some instances, the licensee and licensor will divide these responsibilities so that when credit for cost/risk of creating the product is ascribed to the licensor, then the resulting split is 50:50.

But there is no simple way of saying how such a split in responsibilities warrants 50:50. At one extreme, for example, the owner/developer of the software product could do everything required for commercial use, including advertising and other promotional activities, and elect to hire marketers purely on a commission basis to assist in direct sales. (This is commonly necessary when selling software that costs in excess of several thousand dollars). In such a case, the marketer is playing only a limited role in the commercial process, basically as a manufacturer's rep and may be paid a commission, ranging from 10%–20%. Taking a figure of 15%, this means the revenues from sales have been effectively split 85:15 taken as a percentage of sales in this example of a different rule of thumb.

At the other extreme, the creating organization can enter a license at an early stage in development and turn over a hard drive containing code that works but is not yet complete as a product. In this case, the licensee has to finish the code; develop all the user-friendly tools; introduce the product to the market; perform all the promotions, sales, and distribution; handle the customer; and so forth. Here, the licensee may agree to pay a royalty in the range of 10%–25% (or even much less). Taking again a figure of 15%, this means that the revenues from sales have been split 15:85.

By using the 50% rule, or a 50:50 split of revenues, a licensor agrees to perform an additional 35% share more of services than in the 15:85 example (or the commercial partner is doing an additional 35% share more of services than in the manufacturer's rep example of 85:15). As you can see, it is unhelpful to rely too heavily on such numbers. Indeed, like any other type of licensing, once a technology transfer manager has gone through a significant number of deals, he or she will be able to recognize what deserves a 50:50 split, as well as the appropriate split for the level of involvement in particular cases.

5.4 *Discounted cash-flow analysis with hurdle rates*

Method III introduced the concept of apportioning profit by examining each party's contributions and risks incurred in creating such profit. Method IV is a more sophisticated way of performing such considerations. This method consists of determining future cash flows, then discounting these cash flows by accounting for the time over which those amounts are to be received *and* by the associated risk of receiving such cash flows. For this reason, this method is sometimes known as the discounted cash flow (DCF) method. When all such cash flows have been discounted, they can be added to determine net present value (NPV). The key to this method is the application of the risk-adjusted hurdle rate (hereafter designated by k) or the factor based upon perceived risk that is used to discount the future cash flows and will be referred to here as the "risk-adjusted hurdle rate" (RAHR). In effect, k is used to determine how the profits (or cash) resulting from the commercialization of the subject opportunity should be apportioned.

5.4.1 *Defining risk*

First, let us consider what is meant by risk. There are technical risks, market risks, and the infamous other risks, such as market erosion or the changing tastes of consumers. What are some technical risks? Although it may not be obvious, a key technical risk has to do with whether the technology works. For many reasons, a lot of inventions simply do not work. Sometimes the invention works, but only under very carefully controlled, glacially slow procedures with tiny quantities in clean rooms carried out by very experienced scientists using technicians with dexterity and intelligence that is hard and very costly to duplicate. If a product needs to be made in high volumes at low cost, there is a huge risk in taking something that works in the cleanest of clean-rooms and getting it to work in a factory.

In the category of market risk, a competitor may develop a superior product based on another technology. Customer requirements can also change dramatically. Tastes can change, and anticipated profit margins can erode or disappear. And customers, despite all the market assessment, can simply decide not to like a product. Remember New Coke? Remember Corfam? Sinclair and Commodore computers? An appetite-suppressing candy with the unfortunate name of Ayds?

Finally, all sorts of external events can sink an enterprise. Some raw material that the licensee needs to use or a product that it plans to sell can become illegal or so constrained by regulation that there is no cost-effective way to use it or sell it. Other industries can undergo upheaval to the mortal detriment of a licensee. Remember the oil embargo? The shortage of DRAM chips? Nuclear power? A key trade secret could be stolen. The patent office could deny patentability or grant broad rights to a blocking patent owned by a third party.

5.4.2 *Developing a risk-reward model*

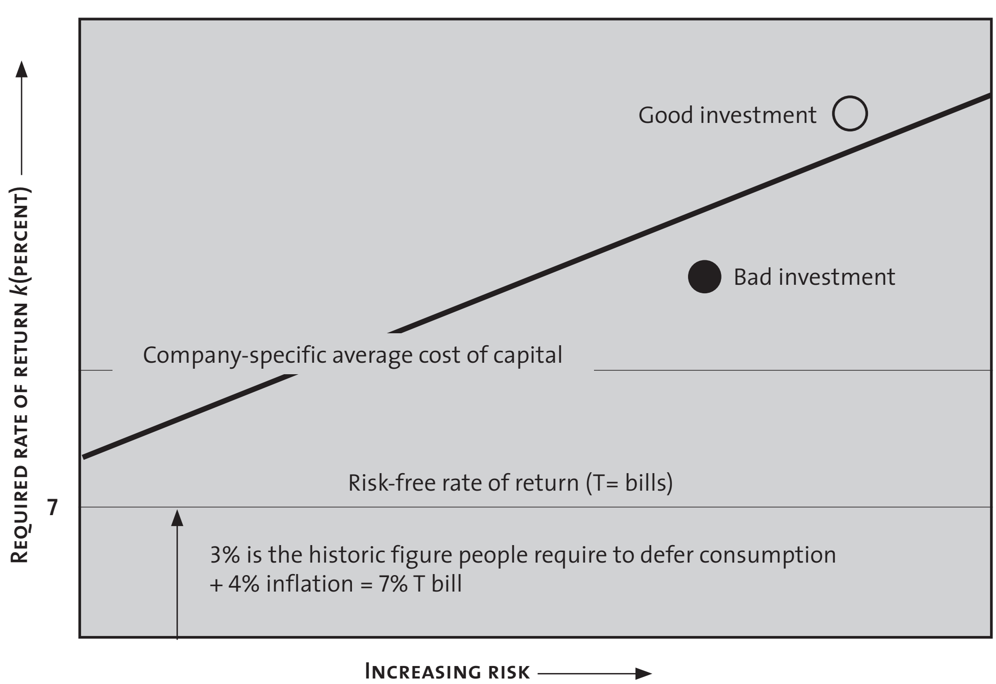
Investors use a risk-reward model to guide their investment decision making. It is commonly expressed in some form of a graph such as the one shown in Figure 2, where increased risk demands an increased required rate of return (k), also known as the hurdle rate. The job of a businessperson is to convert the investments made in the company into returns that equal or exceed the rates of return expected by such investors. So the floor for a businessperson's expected returns is normally the company-specific, average cost of capital (a combination of debt and equity). What makes a particular project investment good or bad at the stage of making the investment is the *perception* of whether the returns will be attractive in relation to its risks, the latter of which are determined by the company's prescribed reward-risk relationship.

From the point of view of the prospective licensee, one of the basic value questions is the degree of risk that has been eliminated by the licensor's R&D and other activities. The greater the risk reduction, the greater the perceived value (or, in other words, it is less likely that a discount will be applied to the perceived potential value of the license). From the perspective of the licensor and, particularly, the professor-inventor, this suggests that additional R&D will increase both the likelihood and the economic value of a license. But this is only true if the licensor's R&D activities are successfully applied to commercial risk-reducing activities. Investment in R&D that is directed toward improved scientific understanding and publication of an invention may or may not reduce risks associated with commercializing a product of interest to a licensee.[39] Not all motion is progress. This is yet another reason why costs are irrelevant in assessing value. Figure 3 summarizes the key steps of this method.

First, a determination must be made of the earnings before interest and tax (EBIT). This is done in the same fashion (and with the same uncertainties) as with Method III (see Table 12). Next, a provision is made for a royalty payment as yet another cost of the licensee. Initially, this value is simply a guess. Later, it will be adjusted to make the overall returns attractive to the licensee. Next, a provision is made for taxes. Throughout the 1980s and 1990s, a value of 40% was typical for combined state and federal taxes; somewhat lower projections are now sometimes made for the future. This results in earnings after tax (EAT—an easy acronym to remember).

But the EAT for a project is rarely the amount of cash it throws off. One reason is that to calculate earnings, we have subtracted from

Figure 2: Return and Risk

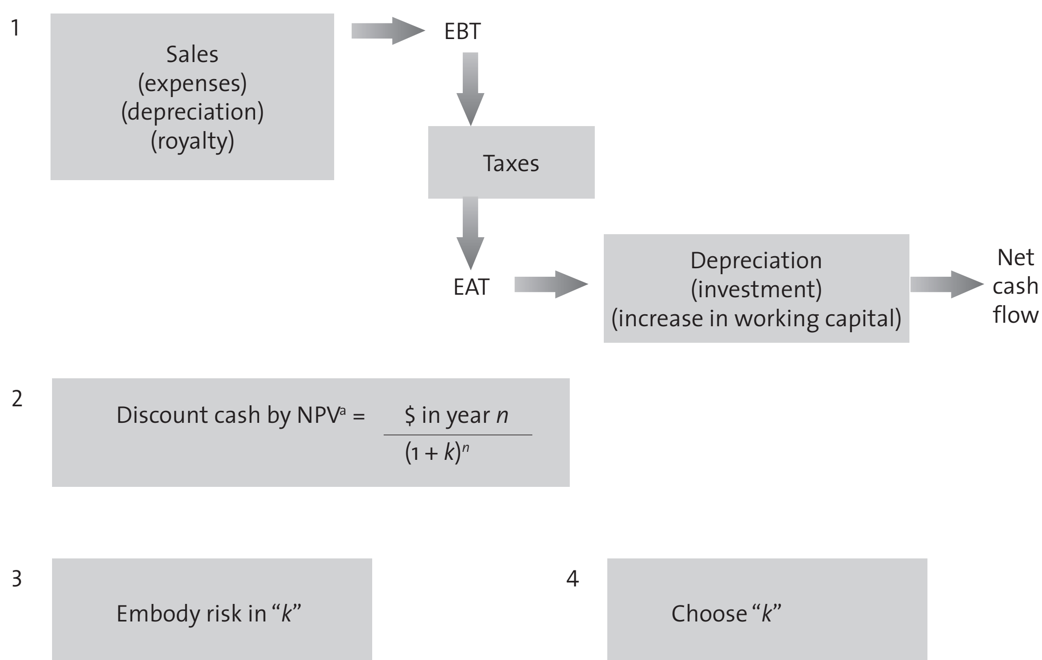


revenues some non-cash costs such as depreciation. To get a cash figure, we need to make three additional adjustments to earnings: (1) the total depreciation expenses deducted from revenues to reach EBT must be added back since they are not a current-year cash expense; (2) the current-year cash investment (such as plant and equipment) needed to produce the revenues flowing from the technology must be deducted; and (3) the year-by-year increase needed in networking capital (current assets, such as cash, receivables, and inventory, less current liabilities, such as payables—all of which tend to increase with increasing sales) must be subtracted. The result is net cash flow in current-year dollars for the projected period, normally at least 10 years of sales, or a total of 15 or more years from the effective date of the license agreement.

Next, each years' cash flow is reduced by dividing each cash flow by the term $(1+k)^n$, where k is the hurdle (or discount) rate, and n is the year from now in which the projected cash flow occurs.[41] In order to perform this calculation, estimates must be made for revenues and all relevant costs and investments year by year. This can be a formidable exercise to a first-timer, but after the technology transfer manager has done this a few times, timidity flees and the manager will find him- or herself boldly arguing about projected costs of sales in the year 2020. Table 14 provides an example calculation taken from Gordon Smith and Russell Parr.[42]

In the example shown in Table 14, a company is considering whether to buy a license for a specialty product to add to an already existing commodity product. The royalty line showing 12.6% of sales is based upon the sales of the licensed, specialty product only. The NPV of the combined net cash is shown as US$19,684. The 12.6% was used because this NPV is identical to

Figure 3: Value: Risk Plus Magnitude and Timing of Future Cash Flows[40]



a Net present value equals "*All the future benefits of ownership compressed into a single payment.*"

TABLE 14: COMMODITY CORP. DISCOUNTED CASH-FLOW ANALYSIS
(US$, IN THOUSANDS)

	%	1991	1992	1993	1994	1995	%
Commodity sales	100	100,000	105,000	110,250	115,763	121,551	
Specialty product sales	100	1,000	5,000	20,000	45,000	60,000	
Total sales		101,000	110,000	130,250	160,763	181,151	
Cost of commodity sales	68	68,000	71,400	74,970	78,719	82,564	
Cost of specialty product sales	45	450	2,250	9,000	20,250	27,000	
Total cost of sales		68,450	73,650	83,970	98,969	109,654	
Depreciation expense		2,632	2,813	3,051	3,446	3,699	
Gross profit	30	29,918	33,537	43,229	58,348	68,198	38
Selling, general and administrative	24	24,240	26,400	31,260	38,583	43,572	24
Royalty payment at 12.6% of sales		126	630	2,520	5,670	7,560	
Operating income	5	5,552	6,507	9,449	14,095	17,065	14
Provision for taxes		2,499	2,928	4,252	6,343	7,679	
Net income	3	3,054	3,579	5,197	7,752	9,386	5
Depreciation expense		2,632	2,813	3,051	3,446	3,699	
Gross cash flow	6	5,685	6,392	8,248	11,198	13,085	7
Less—							
- Additions to working capital		1,200	1,800	4,050	6,103	4,158	
- Capital expenditures		2,632	3,632	4,763	7,901	5,046	
- Net cash flow	2	1,853	960	(565)	(2,805)	3,881	2
- Discount rate		0.9333	0.8115	0.7057	0.6136	4.9718	
- Present value		1,730	779	(399)	(1,721)	19,296	
TOTAL NET PRESENT VALUE (IN US$, IN THOUSANDS)					**19,684**		

the NPV of not taking a license for the specialty product. Therefore, a royalty of 12.6% would be the *most* the company would pay to gain this additional product.

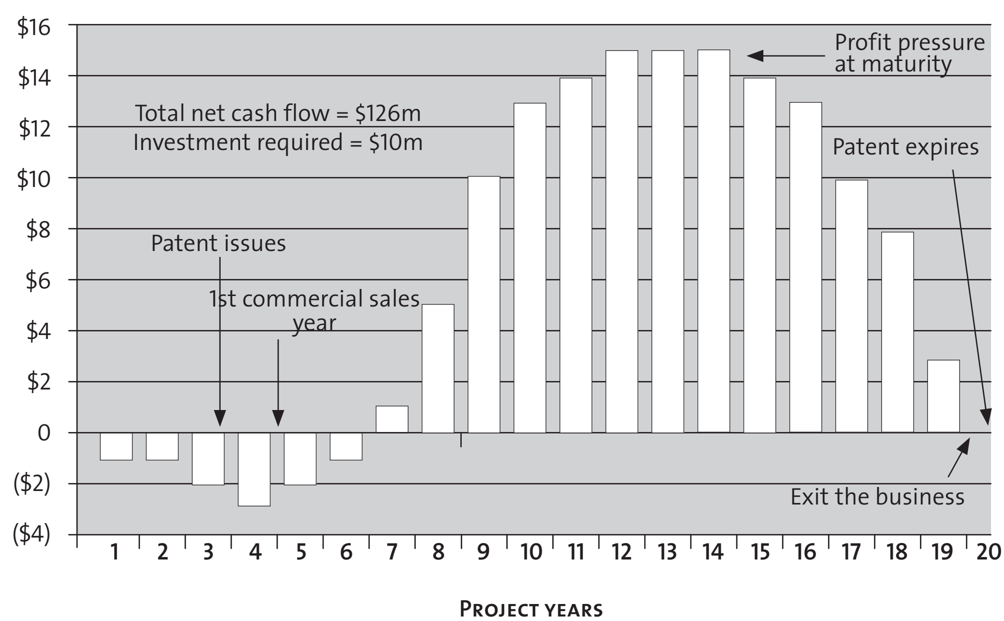
The key aspect of the above calculation is the specification of a value for *k*. Before delving into how a value for *k* might be selected, a better understanding of what *k* does to a calculation is required. Figure 4, which shows a pro forma net-cash-flow projection for a license, can help us take our first steps to understanding *k*.

At time zero, the license agreement is signed. During each of the first and second years, the licensee spends $1 million in combined upfront fees and technology development and project costs. In the third year, these costs grow to $2 million, and in the fourth year, as scale-up and production costs are incurred, they grow to $3 million. So, by the end of the fourth year, and before any sales occur, the licensee has spent $7 million. Although sales begin in the fifth year, there is still a net investment required of $2 million and again of $1 million in the sixth year. At the seventh year, the licensee finally reaches the stage where the technology does not require an additional current-year net cash investment. In this model, the licensee has had to sink a total of $10 million to get to this point (7+2+1), and in the seventh year, the project results in a net cash inflow of $1 million. Note that for most projects, the amounts of initial investment required are generally able to be estimated with more certainty than are the later-arriving profits.

Now, the market for the product is expected to take off and there is a significant growth in expected cash generated until the product peaks in the 12th year. Sales begin to decline in the 15th year, and finally end after the 19th year when the product is withdrawn from the market because it is no longer economically competitive.

Adding all the cash flows above the line, from the seventh through the 19th years, shows a cumulative $136 million. Thus, it took a relatively certain $10 million investment to get an expected return of $136 million.[43] Putting this another way, a $10-million investment starting today and extending over a period of the next six

Figure 4: Example Future Net Cash Flow



years, will yield a substantial $126 million net over the next 19 years.[44]

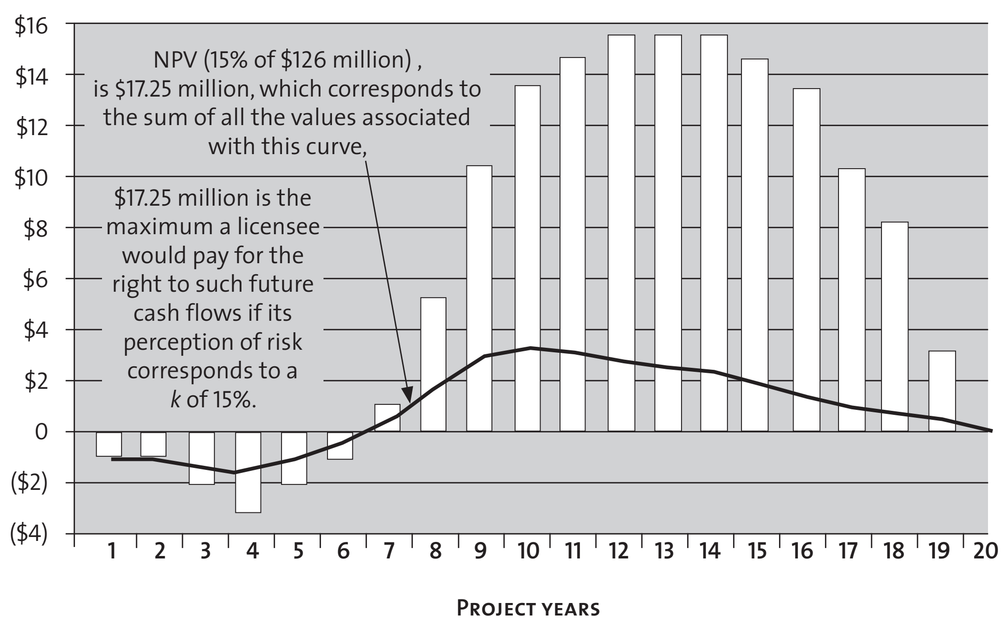
Figure 4 ignores inflation and all the risks associated with the production of those future cash flows. In accounting for inflation, a *k* value of 2%–8% (depending on our views of the future) might be used to reduce all the cash flows to the same basis so that when the return is netted against the investment the calculation is made using same year dollars, at time zero. If a *k* value of 7% is selected, each of the shown cash flows would then be divided by the term 1.07^n, where *n* is 1, 2, 3, and so on, up to 19 for each year of the projection.

However, in addition to inflation, risk must also be assessed and accounted for. The licensee's expenditures of money are comparatively certain. The returns are not. If the licensee takes the view that investments and returns should be discounted by the company's cost of capital, and such cost is, say, 15% (which includes the effects of inflation), then the cash flows of Figure 4 result in the curve shown in Figure 5.

This shows that the early-year cash amounts are reduced slightly (the curve and bars are close in the first and second years). As time progresses, there is a compound discounting of cash amounts until the cash contributions calculated by the 15% discount factor in the 19th year are almost negligible. This is because the mathematics assumes a compounding of risk with each succeeding year (in other words, more things can go wrong as more time progresses). Remember that a *k* of 15% in this model is more than the presumed rate of inflation. This is why the term *hurdle rate* is used for *k*. If the projected cash flows cannot be attractive using 15%, then this investment does not jump this hurdle and should not be made.

What Figure 5 shows is that, for a *k* of 15%, the $126 million of nominal net cash is really only $17.25 million of time zero (now) cash. This $17.25 million value is called the net present value (NPV) at a hurdle of 15%. The NPV means that, for a risk value of 15%, including inflation and all the things that can go wrong, the decision to invest in this opportunity will produce, in time, the equivalent of $17.25 million of today's dollars. By definition, this means it is worth making the investment, unless the licensee

Figure 5: NPV of Net Cash Flow at a Risk hurdle (Discount rate) of 15%



has an even better NPV opportunity at the same or lower level of risk.

Figure 6 shows the impact of various hurdle rates on the same cash values shown in Figure 5.

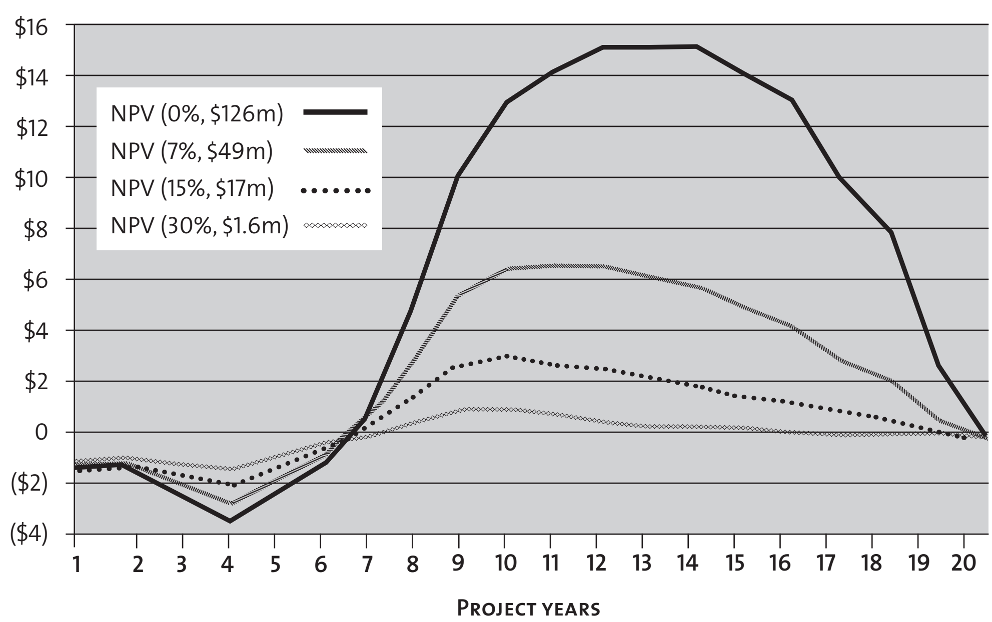
The original cash profile shown was for a hurdle rate of 0% and assessed this opportunity at $126 million net in nominal dollars. If a *k* value corresponding to a near risk-free alternative investment opportunity of 7% is selected over the period, then the opportunity is assessed at $49 million (again, and always, in today's dollars). When a hurdle rate of 15% is selected, corresponding to a low but real risk, this is further reduced to $17 million. Finally, when this opportunity is believed to contain significant technical, market, and other risks corresponding to a risk-adjusted hurdle rate (RAHR) of 30%, the NPV is reduced to $1.6 million.

The key idea of NPV is that, once the appropriate value for *k* has been selected by the licensee, then the licensee should be motivated to acquire rights to any properties that have a positive value of NPV, provided the company has sufficient resources to pursue every positive NPV opportunity. Otherwise, the licensee will select the most positive opportunities available. In any case, the licensee will still want to buy the rights to the opportunity for as little as possible, even less than the values used in computing the NPV in the first place: "Business is about paying tens for fifteens."[45]

5.4.3 *Determining k (the hurdle rate)*

Now, how is *k* determined? The discussion of Method I noted that established market prices exist for certain standard kinds of items, such as office floor-space rentals, and for standard forms of debt instruments, such as federal securities of varying maturity. U.S. Treasury securities, having essentially no "business" risk, have the lowest *k* values. For example, as of 13 April 2001, the *k* value ranged from 4.33% on two-year treasuries to 5.16% on ten-year treasuries. Bonds offered by corporations generally have higher *k* values, depending upon the perceived risk as characterized by various bond-rating agencies. However, all such rates are for broadly based investments, not a specific commercialization project, so they

Figure 6: NPV of Net Cash Flow at Various Risk-Hurdle Rates (*k*)



are normally believed to be substantially less risky (because the companies exist, their markets are known, their competitors positioned, their technology understood, and their businesses typically are somewhat diversified).

Unfortunately, there is no such table of values available for technology licenses. As was the case when contrasting office space rentals and technology commercialization opportunities, the latter do not fall into sufficiently precise categories with large numbers of published values to permit standard *k*s to be established.

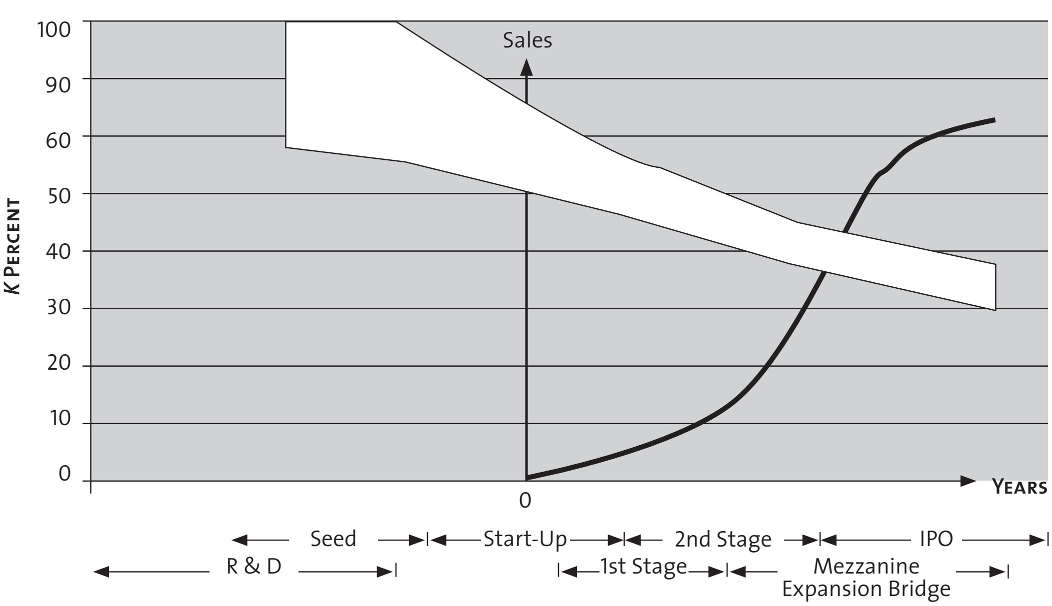
Figure 7 illustrates another type of risk consideration: business start-up risk. This is based primarily on a book by Jeff Timmons.[46]

A number of terms are used to characterize the stages of development; at times, these terms can be confusing and contradictory. In general, for capital sought prior to initial sales, the hurdle rate required by risk-capital providers is very high, 50%–100% (or even more). Once sales exist and a market can be characterized, and assuming the results are favorable, the hurdle rates can decline dramatically down to 30%–40% (depending upon assessments of competitive response, market saturation, cost of expansion, and so on). The hurdle rates used for genuine start-up situations are usually far higher than those used by an existing company, and they reflect the increased risks associated with all the activities needed to create a business ex nihilo.

So, what is a reasonable way to categorize hurdle rates? There is no simple answer to this question. However, to provide some insight the broad generalizations of Box 1 are offered for five categories of risk.[47]

Most licensing situations with existing companies will fall into Categories II and III, corresponding to hurdle rates in the range of 25%–40%. Start-up situations or companies contemplating a spinout structure normally require hurdle rates in excess of 40%, even to 50% or higher. However, as was discussed in connection with the 25% Rule, every licensing opportunity has case-specific factors that affect both value and, our present concern, risk. Just because an

Figure 7: Hurdle Rates for Start-ups



invention relates to an existing manufacturing capability with a known technology area, a potential licensee may see the risk associated with such specific invention as warranting a RAHR higher, or lower, than given in the Box below.

Figure 8 applies these five risk categories to our original cash flow example of Figure 4.

If this opportunity corresponds to Category III, the NPV ranges from a negative $800,000 (for a *k* of 40%) to a positive $1.6 million (30%). So, what originally looked like a simple decision of making a total investment of $10 million to net a total of $126 million is actually a close call. If the risk of this opportunity corresponds to a hurdle of 40%, this investment cannot be justified because the NPV is negative. Recall that, when this model was created, (an unstated) upfront payment and progress payments were assumed by the licensee to the licensor, as were continuing royalties that reduced the cash flows to those shown. Both were part of the $10 million investment. From the point of view of the licensee, this negative NPV should be a stimulus to reconsider all such IP payments to see if the negative NPV can be made positive.

5.4.4 *Reducing risk/enhancing value*

In any event, there are at least two other possibilities for reducing IP payments. First, the perceived risk may be reduced by working with prospective licensees who are either already commercially applying technology similar to the subject opportunity or selling like or similar products. The point here is that companies perceive risk differently depending upon their technology base and their existing customers. If, by this redirecting of marketing activity, a different prospective licensee's assessment of risk is now 30%, then there is the potential to gain as much as an additional $1.6 million beyond those payments embedded in the cash-flow calculation. That is a very dramatic increase in value. Furthermore, the likelihood of getting the royalties is increased because it is more likely that such a licensee will succeed (all other things being equal—and they never are).

A second approach to dealing with negative NPV outcomes is to consider what R&D and/or market development activities can reduce the risk. The real technical risk of some key aspect of the technology may be known by the inventors to be much less than that perceived by prospective buyers. A carefully directed, internally funded R&D program tackling commercial objectives can significantly reduce such risk. Of course, it is always possible that such results will go the other way. The key idea is to spend small amounts of money on critical, commercially relevant experiments—and not just gather ever-more publishable data

Box 1: What Is Reasonable *k*?

Unfortunately, the answer is: whatever the market says it is.

What does the market seem to be saying?

I. Low risk (assuredly fits into an existing manufacturing line and market) 10% to 20%; if required to maintain base product life, then *k* could be much lower, or even discarded

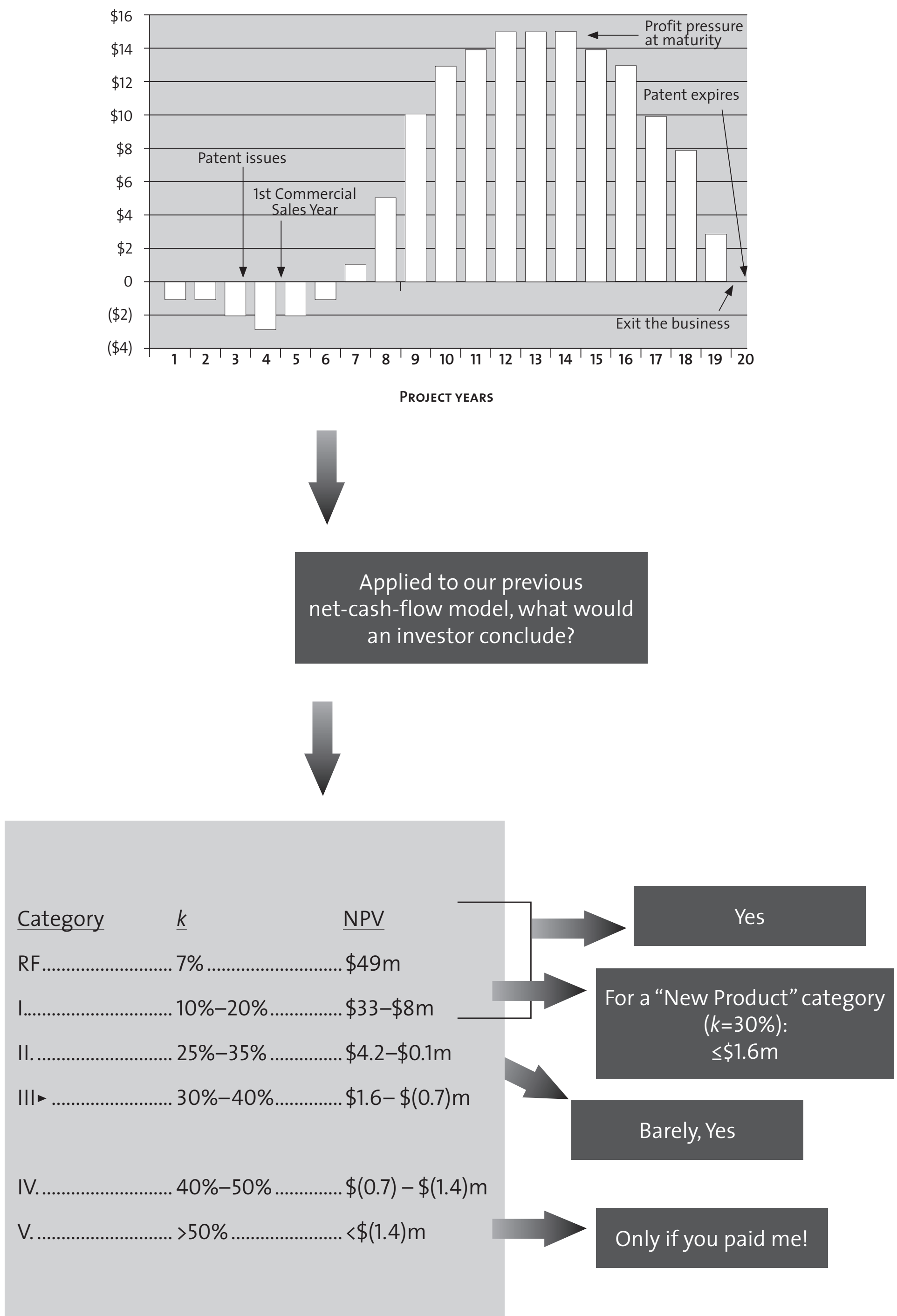
II. New product (existing manufacturing capability, known technology) 25% to 35%

III. New product and technology (still in existing business) 30% to 40%

IV. New business, product ready for sale (no R&D required) 40% to 50%

V. New business, seed funding, R&D stage 50% to 70% (or more)

Figure 8: Who Are Prospective Licensees and What Should They Be Willing to Pay?



sets. Some have described this process as doing the last experiment first. In general, it is a very good idea.

Another tool in such a risk-reduction approach is leveraging government funding. It can be argued that government funding should be used to reduce the risk of significant commercial opportunities so that the private sector can apply it to create high-valued companies and jobs. Commercial funding necessarily has some relatively immediate market application and introduction. However, there are other sources of "research" funding sometimes available that push forward certain knowledge frontiers that could have as a consequence the development of know-how that supports the subsequent commercial development needed for a specific licensing opportunity.

In addition to reducing risk, one can work to directly enhance value. One tool to accomplish the latter is to form partnering relationships with other R&D organizations that, by pooling technology resources and market awareness, can sometimes significantly increase the NPV perceived by prospective licensees. Even when the NPV is already positive and a prospective licensee is interested in negotiating rights, remember that a licensor always has alternatives. For example, the technology could be pushed closer to market either by internal investment or by partnering with another R&D organization to increase the value. The technology transfer manager should make such investment decisions by calculating the prospective increase in value discounted by the risk of success.

This risk-adjusted hurdle rate approach can be used for exclusive and nonexclusive licenses, as well as for licenses by field (or product) and territory. In each case, the cash-flow projections need to reflect the anticipated commercial outcome given the structure of the agreement. For example, if the licensing strategy is to have two competing licensees in all fields and territories, then the magnitude of the total sales attainable by each licensee is probably less than if there were to be one exclusive licensee. However, the gross margins, or profitability, may remain large, since each licensee will not face a large number of competitors. The net result is likely to be that each licensee will pay less royalty, but together they could (and should be if such an approach is considered) pay more total royalties.[48] More details on DCF models are provided in the Wiley-published book by this author.[49]

5.4.5 *Possible payment structures*

Running royalty structures. There are many possible royalty structures. Because the royalty rate depends upon the economic value associated with specific products, if there are multiple products, then a separate royalty could be established for each product or product area within a single agreement. There is also justification for building up a royalty rate based upon the measure of IP protection obtained. For example, a licensee might pay a royalty of 3% on the basic patent and 1% for the use of the two other patents in the package, or 1% for the use of the unpublished technical information and an additional 3% for the patents, and so forth. Of course, this should only be considered if it relates to an economic benefit (lower k, higher margins, and so on).

Many licensees ask for a declining royalty rate with increasing sales, a so-called staircase or wedding-cake royalty structure. One example would be a royalty of 5% on the first $1 million in sales, 3% for the next $9 million, and 1% for all sales above $10 million, based on annual sales. The underlying theory of this approach appears to be an economy-of-scale argument similar to bulk purchasing. If a company buys one box of paper clips, it might conclude that $5 is reasonable; if it buys 1,000 boxes it may expect to pay only $3 each; and if it commits to buying trainloads per year, it may expect to pay only $1 each. Companies commonly leverage volume purchases when they buy, and apply this same kind of thinking when they sell. However, there is no economy-of-scale principle for IP rights. The licensor's costs of providing the grant to the licensee are not relevant, nor do they decline based on sales volume, as would the costs of a paper-clip supplier. In fact, based upon an economic-return model, it can be argued that the profitability to the licensee *increases* with increasing sales, and so, the royalty rate should actually go *up* with increasing sales. For practical reasons, the parties may elect to simply compromise and keep the royalty rate fixed regardless of sales volume.

Developing a staircase royalty structure based on *cumulative* sales or on years from first commercial use may have a rational economic basis. Ordinarily, after the initial introduction, the profitability of a product climbs to a peak and then, as the product matures, pricing pressures tend to squeeze margins. A royalty structure that attempts to model this profile makes sense, providing the rate during the high-profit years has been set to correspond with economic benefits. For practical reasons, parties frequently elect a single rate over the life of the patents that balances all these factors. Regardless of the approach, the rate agreed to tends to act as a cap for the reasons discussed in the introduction to this chapter. The licensor does not have a vehicle for increasing the rate, and the licensee can come back to the licensor and threaten to drop the license because of less-than-anticipated margins unless it gets a reduction in the rate.

Licensees sometimes propose capping the total economic return to the licensor. This may be expressed as some multiple of the licensor's costs (You shouldn't expect to get more than ten times what you've invested in this!) or simply as some statement of moral principle ($10 million should be more than enough, after all you are a public, not-for-profit institution!). This is nonsense. A licensor who is the rightful owner of a portfolio of technologies has a stewardship responsibility to return value to the institution for the transfer of such rights. Furthermore, all portfolios exhibit many losers, a few moderate successes, and only a few agreements that perform really well. If the licensor agrees to caps on the total return of all agreements in the portfolio, then the portfolio will produce only losers and moderate returns. Without the occasional big win (at a fair royalty rate), the portfolio will not produce a fair overall return.

What about the approach of a one-time, paid-up license—that is, setting a higher licensing fee with a zero running royalty? Some licensees push hard for this approach—and not always from a pure heart. There are several common arguments in favor of the approach: (1) it eliminates the administrative burdens (quarterly or annual reports and checks) for both the licensor and licensee and (2) basing royalties on sales may divulge highly sensitive licensee business information, which is against company policy or wishes. Recall the earlier discussion about setting the values of future income streams in well-defined situations such as office rent. When a stream of cash payments is well defined and the risk is low or at least well understood, then two parties can readily agree on the conversion value of the future stream into one present payment (which is really just the NPV of the future stream). However, for early-stage technologies, estimates of the range of possible dollar returns from royalties can vary over several orders of magnitude. This is precisely why a royalty *rate* so effectively deals with such uncertainties. When either the licensee or licensor seeks to reduce such uncertainties to a one-time lump sum, there is greater risk involved in making the conversion. One possible motivation for a prospective licensee is simply to see if the license can be acquired cheaply. Every agreement has associated with it a range of expected outcomes. If a licensee can acquire the license by the one-time payment of the NPV associated with the most conservative outcome, then it is in the licensee's interest to do so.

Rest assured, a licensee is unlikely to agree to an NPV associated with the most optimistic outcome. It should be recognized, however, that sustaining ongoing agreements is both a business cost and a risk. An ongoing payment arrangement could possibly lead to a dispute or even litigation. And there may be situations where the licensor's cash needs are such that the institution is willing to forgo the returns associated with more optimistic possible projections. If this becomes the licensor's practice, however, the overall returns on the licensor's portfolio of technologies will be reduced because the licensor will not experience the rare but important higher-than-projected returns from an exceptional license.

Having said all this, sometimes such an arrangement can be in the interests of both parties (beyond the simple example given above). The licensor may wish to take advantage of the high opportunity value associated with a paid license so that the funds can be used to move further and faster other technology opportunities that will lead to even more substantial returns. Or perhaps the licensees are cash-rich from a current high-outcome year and are simply willing to make a fair and substantial payment to own and control an opportunity because of its perceived strategic importance. Overall, in those cases where the future use and value of an opportunity appears to be reasonably well-bounded, then an NPV calculation can be made that is fair to both parties.

Upfront payments. Upfront payments take many possible forms. As discussed earlier, the extreme case is a one-time payment in lieu of running royalties.[50] A series of payments can also be made, either by calendar (such as annual payments) or by progress (such as upon filing an IND [Investigational New Drug application, a filing with the U.S. Food and Drug Administration], upon first commercial sale or other milestones) in conjunction with or instead of royalties. Or the licensee can commit to R&D to fund certain activities at the licensor's laboratories.

All of these are basically down payments on the NPV opportunity as calculated earlier, and the purpose of any down payment is the same. It combines a form of diligence and commitment, and provides an early return for the original investor, the licensor. In university-industry licensing, the upfront payment will commonly at least exceed the licensee's payment of all the licensor's costs in filing and obtaining a patent or patents incurred to date. If the license corresponded to an NPV of $1.6 million as in the previous example, and the patent costs were $5,000, such an upfront commitment covering only the licensor's costs would be cheap—too cheap.

For well-established transactions such as buying a house or a car, a down payment of 10%, more or less, is common, although for highly motivated sales of, say, certain out-of-popularity automobiles, might be happy with "no money down" deals. For highly speculative opportunities, such as a license to new technology, 10% may be on the high side. Consider in the previous example, that the $1.6 million NPV was computed on the basis of a single, time zero, cash payment of $100,000 and then royalties on sales. Such a figure would then correspond to a down payment of a little more than 6%. This might be quite reasonable. Some negotiators use, as a rule of thumb, one year of projected mature-earned royalties as an appropriate down payment; this is approximately 5%–10% of the NPV.

Minimums. Another form of diligence is the minimum cash payment. Also, agreeing upon such payments increases the likelihood that both parties are looking at the opportunity from similar perspectives. Generally, exclusive licenses contain minimums. Nonexclusive licenses may or may not include minimums. The rule of thumb appears to be an annual payment in the amount of one-fourth to one-half the annual projected reasonable royalty based on sales estimates. Again, the higher the risk and uncertainty of such sales estimates, the lower the minimum royalty, and vice versa.

It is important to realize that the licensee still has significant negotiating leverage on the minimums. If they end up being too high, and it is now five years into the agreement, the licensee can exert a lot of influence on the licensor by threatening to drop the license if the minimums are not reduced in line with the actual sales (assuming the licensee has been diligent in developing the technology and the market). In addition, getting back a five-year-old technology may make it difficult for a licensor to find another party interested in licensing the product. As discussed earlier, the wish, or threat, for better terms, of a licensee in a licensee-initiated negotiation, puts in jeopardy the licensee's investment in the technology (any upfront payments, milestones, annual royalties, and of course its own R&D and market development). So a licensee would have to take a dramatic step to fulfill such a threat and drop its license should the licensor not agree.

Equity consideration. A full treatment of this subject is beyond the scope of this chapter. However, much of what has been discussed above regarding NPV calculations using discounted cash-flow analysis and hurdle rates applies. The reader is referred to the author's Wiley-published books for more information.

5.4.6 *Summary*

Summary observations and valuation principles based on Method IV are given in Box 2 and Box 3.

5.5 *Advanced tools*

Once a DCF model has been established, it is possible to extend such analysis by application of quite complex mathematical modeling tools and gain a better understanding of their economic impact.

The basic tool is sometimes called *probabilistic modeling* and, most commonly, *Monte Carlo analysis*. The complexity of such models used to require mainframe or minicomputers, but at least two such products now run on personal computers. [51]

This tool works by replacing certain cells in a spreadsheet with a probabilistic value rather than a single number as was done in Method IV. Then the model is run over and over again, hundreds of times, to develop a distribution of outcomes. It is much like running the company 1,000 times (or more) and comparing the outcomes. Under the DCF approach, each outcome is the same. However, under a Monte Carlo method, each of the 1,000 runs would produce somewhat different values for those cells that were selected for treatment in this manner. It may sound more complicated, but in many ways it is simpler. In fact, Monte Carlo methods are particularly useful when modeling a start up situation.

Below is an example taken from one of the companies that offers a PC product.[52] This considers a fictitious drug, ClearView, which may be a cure for nearsightedness. The key assumptions are shown in Figure 9.

In this illustration, the impact on profitability will be examined through the probabilistic investigation of five assumptions. These are shown in Figure 10.

First, consider the testing costs. The original model assumed the testing costs would be $4 million. Assume there is an equal probability that the costs will range between $3 million and $5 million but will never be less than $3 million and never more than $5 million. This is shown as the uniform distribution at the top left of Figure 10A.

Next, reconsider the estimate for the number of patients cured: 25 out of 100. Now assume a binomial distribution, a commonly occurring natural distribution, with a mean of 25 as shown in Figure 10B.

Now, adjust the assumption for the marketing costs from simply $16 million to the triangular distribution shown in Figure 10C. The most probable outcome is shown as $16 million, and the minimum and maximum are $12 million and $18 million.

Similarly, the growth rate of the market and the market penetration single values are replaced by the distributions shown in Figure 10D and Figure 10E.

Every simple-value cell in a spreadsheet can be replaced by any of the available probability distributions. As a technology transfer manager gains experience using this tool, it becomes increasingly clear which cells to treat in this manner and which probability distribution makes the most sense. There never is a right answer. In fact, one of the great powers of this methodology is that the model can be run over and over again with changing assumptions to better understand the key assumptions that should be investigated in more detail to reduce overall uncertainty. The result of the Monte Carlo simulation is shown in Figure 11.

This outcome shows what happened when this business venture was run 998 times. The financial outcome ranged from the worst case, when all things broke the wrong way (the highest marketing cost, the fewest number of cured patients, and so on), with a loss of $14.9 million, to the most-favorable outcome (when everything went right) of a net gain of $51.9 million. Half the time, the net gain was less than $9.8 million, and half the time it was more. The big spike to the left on the graph of Figure 11 reflects the severe loss that occurs because the cure rate was so low that U.S. Food and Drug Administration (FDA) approval was never obtained.

Another advanced method of increasing importance is the use of real options (as opposed to financial options). Indeed, an increasing number of books explore the use of real options in business decision making. Their potential application

Box 2: Summary Observations

1. Value is dependent on risk—the risk-adjusted hurdle rate (for the same magnitude and timing of future net cash flows).

2. There is no one right risk model.

3. Price is determined by what a buyer will give for the rights to such cash flows.

4. As a licensor's price aspirations correspond to low (optimistic) values of RAHR, the likelihood of finding such a buyer is reduced (which translates to increased time and resources required to find such a buyer).

5. There is no one right price (providing No. 2 is true).

6. The longer the period of such future cash flows, the wider the risk limits and the greater the uncertainty in price aspiration.

7. For cash streams that meet certain standard categories, such as home mortgages, there are well-established markets that significantly reduce the scatter on risk and price. No such market exists for early-stage technologies.

8. Net-cash-flow models require more work and are subject to significant assumptions about operations and the future (but the licensee is using them to analyze the opportunity and so should the licensor).

Box 3: DCF Valuation Principles

1. Value calculations may have wide limits because of the range of estimates of the magnitude, timing, and risk of future net cash flows.

2. Value is given by a down payment (option/license fee) and a future royalty, which may, in the end, be used to determine the one-time, upfront payment for a fully paid-up license.

3. The down payment for a running royalty license should (normally) be a small fraction of the total estimated value based on one or the other of the following:
    - approximating the higher risk bound (but, nonzero)
    - 5%–10% of the total NPV (best estimate basis)

4. A fair royalty can only be negotiated when reasonable estimates can be made of future net cash flows.

5. The royalty should be uncapped.

6. Royalty scales dependent on total sales, if used, should be based on value not on a quantity discount model.

7. Royalties based on figures below the top line (sales) put the licensor at risk for inefficiency/ineffectiveness of the licensee, which has the effect of double accounting for risk.

to early, high-risk technologies can be useful because real options do not punish substantial but distant future outcomes by high and compounded risk-adjusted hurdle rates. The DCF approach in particular can calculate an almost negligible value to a $1 billion opportunity that occurs, say, 10 years in the future with substantial average risk. Real options can be used to take such risk apart by valuing an opportunity stage by stage, risk by risk, as decisions are reached and investments made. An introduction to such methods is given in the author's Wiley-published books and, in particular, another 2003 Wiley book by the author: *Dealmaking: Business Negotiations Using Monte Carlo and Real Options Analysis*. These resources give a more comprehensive treatment of Monte Carlo and real option methods and negotiation planning and strategy. The 2003 *Valuation and Pricing of Technology-Based IP* also gives a more extensive discussion of various forms of deal structures and financial payments.

5.6 *Auctions*

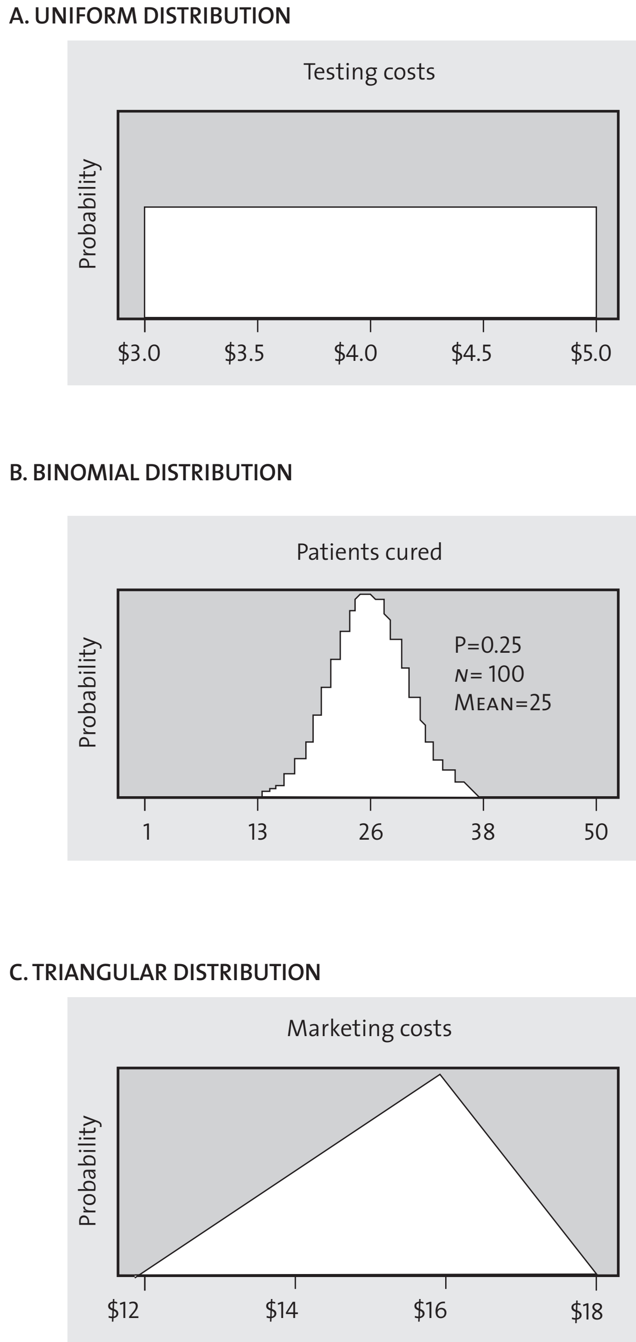
This analysis of methods and tools began by considering the use of industry standards. In a sense, by considering options it ends there as well. An auction is simply a formalized way of obtaining bids from competitive potential buyers. As a method, it dates from antiquity and is the prevalent form of commodity transactions, ranging from the New York Stock Exchange to commodity markets to estate and sheriff sales caused by owner bankruptcies.

Figure 9: Sample Monte Carlo Method—Basic Assumptions

Fictitious new drug, ClearView, for correcting nearsightedness

Costs (in millions):	
Development cost of ClearView to date	$10,000
Testing costs	$4,000
Marketing costs	$16,000
Total costs	$30,000
Drug test (sample of 100 patients)	
Patients cured	.0.25
FDA approved if 20 or more patients cured	
(1 approved, 0= rejected)	
Market study	
Persons in U.S. with nearsightedness today	40,000
Growth rate of nearsightedness	1.00%
Persons with nearsightedness after one year	40,400
Gross profit on dosages sold	
Market penetration	8.00%
Profit per customer in dollars	$12.00
Gross profit, if approved	$38,784
Net profit	($14,000)

Figure 10: Specific Monte Carlo Assumptions for ClearView Example



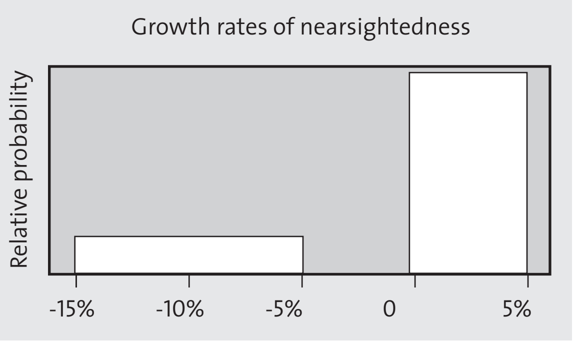
(Continued on Next Page)

Its use in technology licensing contexts, however, has been comparatively rare because of various structural difficulties. One of the most significant barriers is the need for any prospective buyer to perform extensive due diligence and analysis. Imagine the contrast between being on the floor of an exchange and being offered 100 shares of IBM at $100 share or 100 bushels of corn at $3 per bushel. No investigation is needed to determine exactly what is being sold or whether there is a market for it. Contrast this with a vice president of an electronics firm receiving a letter from a university or institute offering to license or sell a portfolio of patents relating to a new approach for making a blue-green laser. For the VP to have any rational idea as to his or her potential interest, he or she will have to substantially invest in learning how this offered technology differs from its own or other published literature, the stage of development, the key benefits, the scope of the intellectual property, and so on.

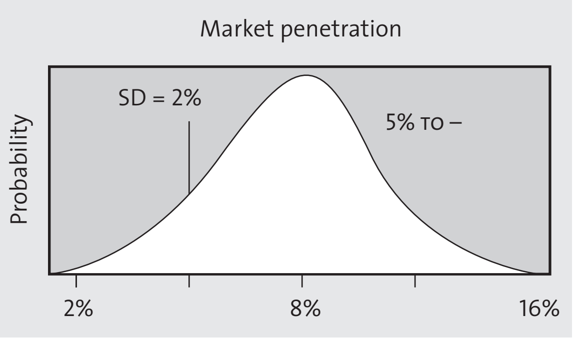
Another barrier to the use of auctions is that the mosaic of the licensing deal is typically much more complicated than a simple cash payment, as in the case of IBM shares or bushels of corn. An upfront payment or payments is to be expected, but so might royalties, additional R&D investments at the discovery institution, and many other deal features. These aspects are not as easily communicated by bidders or compared by sellers.

Figure 10 (continued)

D. CUSTOM DISTRIBUTION



E. NORMAL DISTRIBUTION

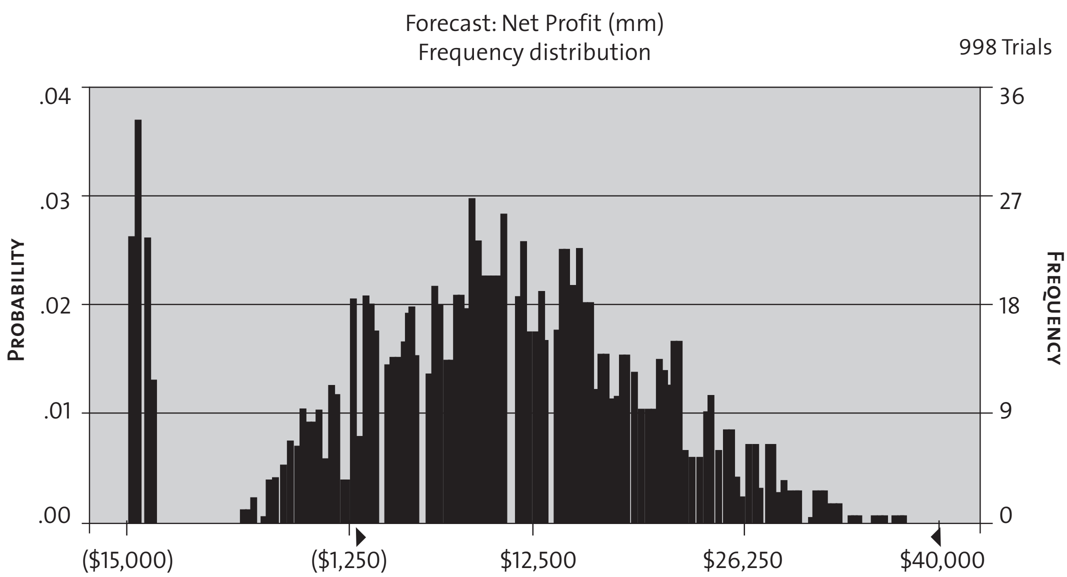


Nonetheless, auctions for intellectual property do occur. Perhaps the most common occurrence is in the context of a shutdown or bankruptcy proceeding, where the investors are seeking to recoup some of the investment and the alternative of continuing as a standalone company no longer exists. All the parties understand that the court has ordered a process, and there will be a sale to the highest bidder.

A famous university example of opportunity licensing is associated with a fat gene discovered at Rockefeller University. According to a *Business Week* article.[53] Rockefeller University and a then recently started biotechnology company initiated discussions; the invention, which has the promise to "cure" obesity by a gene, attracted significant interest by other companies, which led to other, parallel discussions. However, when a large number of companies expressed interest (reportedly more than a dozen), all of them were invited to bid on the opportunity. On 28 February 1995, Rockefeller announced that Amgen had won by agreeing to pay a US$20 million signing fee plus unspecified royalties. According to Rockefeller's vice president for academic affairs, "*Amgen purchased a scientific concept*": a pretty valuable scientific concept.

The very high-perceived potential value of the Rockefeller gene gave the institution enormous bargaining power (some might argue that

Figure 11: Simulation Output (Forecast) for ClearView



Percentile

0% ....US$14.939
10%.................. US$12.933
20%....................US$0.617
30%................... US$4.166
40%................... US$7.402
50% .... US$9.770
60%...................US$12.110
70% .... US$14.968
80%..................US$18.341
90%................. US$22.612
100%................ US$51.917

it created a feeding frenzy). In most licensing circumstances, the seller/licensor is simply not going to be able to attract a sufficient number of simultaneous bidders. This is because the cost of the due diligence, coupled with the reduced likelihood of being the successful acquirer, will encourage already busy companies to do something else with their precious time and energy. Some additional examples of successful and unsuccessful auctions are included in the earlier-cited author's Wiley books.

6. CONCLUSIONS

This chapter started with a letter requesting money for an investment. It will close with another one (again, one actually received by a venture capitalist):[54]

"Hello, How are you doing? My work is necessary for the survival of life of the planet. I need money. Minimum investment $100,000. Profit 25%. Thank you."

This letter has all the basic elements of a good marketing instrument: friendly beginning, statement of mission, expression of need, identification of benefit, friendly close. Now you have the tools to decide whether this is a good deal.

Finally, for those of you whose mind has wandered reading all these pages and looking at all these figures and perhaps now find yourself completely lost, I understand that, you the reader, were hoping that by this time I would lead you to the number. OK, here it is: *3.14156*. It is the best this author can do. Use it with great caution. That is it. That is all you need to know. Happy pricing. ■

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1 The initial version of this chapter was created during the author's tenure with Battelle Memorial Institute, a relationship the author gratefully acknowledges. For more on this topic see Razgaitis R. 1999. *Early Stage Technologies: Valuation and Pricing*, John Wiley & Sons; Razgaitis R. 2002. Technology Valuation. In *The LESI Guide to Licensing Best Practices: Strategic Issues and Contemporary Realities*, chap. 2. John Wiley & Sons, 2002; Razgaitis R. 2003. *Valuation and Pricing of Technology-Based Intellectual Property*. John Wiley & Sons; Razgaitis R. 2003. *Dealmaking: Using Monte Carlo and Real Options Methods*. John Wiley & Sons. For further information about the author, visit www.razgaitis.com.

2 Malone MS. *Upside*. September 1992.

3 See, also in this *Handbook*, chapter 11.11 by D Bobrowicz.

4 *The American Heritage Dictionary*, New Collegiate Edition. 1980.

5 If the licensor has multiple licenses (that is, two for two different applications within the same territory), it is not uncommon to have each licensee pay half the patent costs. When developing the initial agreement with the first licensee, the language can provide that, in the event that there is a second licensee, the cost would be shared.

6 Even for conventional manufacture, this approach to pricing is rapidly being supplanted by value pricing. This is because it has been determined that, in many cases, such pricing shielded manufacturing and overhead inefficiencies that are not being tolerated by a market that can turn to more efficient sellers. In other cases, such a cost-based approach did not capture, for the seller, the high value present in its products.

7 Notice that even in this example there are some important risks and timing issues. The technology, in this example, is in hand, ready, and works. Launching an R&D project always involves risk, no matter how confident anyone may claim to be about the outcome. For example, it may be that no alternative work-around is possible, or that it will take $20 million, or that it will only work 80% as well, or that it will take much longer than anticipated, and so on. Having something in hand today is less risky than attempting an independent solution. On the other hand, there are many examples where a highly sophisticated buyer can invent around an institution's invention cheaply and quickly, even though the institution may have made an enormous investment in developing the invention in the first place.

8 Science & Technology Agency, Japan. Class A Technological Assistance Agreements (1975).

9 Actually, in reviewing the bottom of the table, under electrical, it appears that two agreements had no payments at all. So more than half of the agreements had no upfront fee!

10 McGavock DM, et al. 1992. Factors Affecting Royalty Rates. *les Nouvelles* June 1992. p. 107. The data presented was obtained from the voluntary response to a mailed survey. The authors caution that the number of replies may not be statistically significant. Also, given the nature of voluntary replies, there is no assurance that the survey is not biased.

11 Nelsen L. 1989. University Patents. Presented at the

1989 AUTM Annual Meeting. These rates were not determined by a scientific study; rather, they are typical ranges estimated by Lita Nelsen, Director, Technology Licensing Office, M.I.T, based on extensive experience in this area.

12 Adapted from article published by Corey G and E Kahn. 1991. How to Negotiate Reasonable Royalty Rates for Licensing Novel Biomedical Products. *Genetic Engineering News* July–August 1991. p.4. A related article by the same authors was published in 1990 as Biomedical Royalty Rates: Some Approaches. *Licensing Economics Review* December 1990. p. 13.

13 Adapted from Corey and Kahn (*supra* note 2).

14 Kiley T. 1990. *IPH Newsbrief* April 1990.

15 Ibid.

16 Source: Communication from the seller.

17 Private communication, Emmett Murtha, November 1993.

18 Mike Carpenter presented at workshop given at the 1979 LES Annual Meeting.

19 Ibid.; See also the list of reasonable royalty determinations in Einhorn: *Royalty Patent Licensing Transactions* vol. I, sec 303, pp. 3–11ff; or search DIALOG.

20 There is a widely held perception that royalties determined or negotiated before the mid-1980s, when the Court of Appeals for the Federal Circuit was established, are lower than rates established since.

21 See Einhorn, *supra* note 19.

22 Stevens A. 2000. Finding Comparable Licensing Terms. *AUTM Technology Transfer Practice Manual*. Part VII, Chapter 5. AUTM: Northbrook.

23 Edwards, M. Workshop presented at the AUTM 1993 Annual Meeting. Since these data were published by Mark Edwards there has been an enormous increase in the number of such transactions, especially in the "life sciences/health" area. Examples of such additional data are available at www.recap.com.

24 For more discussion on obtaining copies of comparable agreements see Stevens AJ. 2002. Finding Comparable Licensing Terms. *AUTM Technology Transfer Practice Manual*, Second Edition. part X, chap. 3.

25 Feinber RA. 1982. *APA Proceedings*. Division of Consumer Psychology. p. 28.

26 Ibid.

27 Arnold T and T Headley. 1997. 100 Factors. *les Nouvelles*, March 1987. p. 31.

28 Degnan SA and C Horton. 1997. A Survey of Licensed Royalties. *les Nouvelles*, June 1997. pp. 91–96. Reprinted with permission from *les Nouvelles*.

29 When using a savings approach, the technology transfer manager should build in some inflation factor to avoid collecting 25 cents a unit over a 15-year period when inflation eats into the real value of the royalty. Remember, the $1 savings is $1 in the currency of the year that the royalty is calculated (in this example). Ten years later, with inflation or increasing costs of electricity or a particular raw material, the savings could be $8 in the currency of that tenth year. The agreement should normally have some provision for the calculation of royalty to similarly inflate in dollars so that, as in this example, it would yield $2 in the tenth year.

30 This particular form of the definition is adapted from an article by Sommer EM. 1993. Patent and Technology License Agreements Explained. *The Licensing Journal*, August 1993. p. 3ff. This article and other similar sources also deal with an important but complicated issue of transfer pricing: that is, when a licensee sells or transfers the product made by the practice of the technology to another division or a subsidiary of the licensee.

31 All the materials, labor, electricity, and all other variable costs attributable to the manufacture of the product sold.

32 Because this is a gain in a part of the statement where reductions are applied, it is shown as a negative number; minus a minus means a plus, and so forth.

33 Ibbotson and Associates, Chicago, Ill. www.ibbotson.com.

34 Robert Morris Associates, Philadelphia, Penn.

35 Data from RMA Annual Statement Studies, 1991. published by Robert Morris Assoc.; Philadelphia, Penn.

36 *W.L. Gore and Associates v. International Medical Prosthetics*, 16 USPQ Second. p. 1257.

37 Lee Jr. W. 1992. Determining Reasonable Royalty. *les Nouvelles*, September 1992. p. 24.

38 Duke Leahey has included this point in various talks. The version here was the subject of a private communication in 1993.

39 This is part of a long, impassioned argument between business and science. Science argues that it is unwise to develop and apply technology that is not completely understood. Business says: If we took that view, we would still be sitting on a rock and arguing about the Pythagorean Theorem—so, let's get on with it.

40 Smith and Parr. 1989. Valuation of IP & Intangible Assets. Wiley. p. 125. See also, Razgaitis, *Valuation and Pricing of Technology-Based Intellectual Property* (*supra* note 1); see also, numerous papers and books by Gordon Smith and Russ Parr on DCF methods and ways of separating intangible and tangible values.

41 Some people prefer to use a mid-year convention: that is, the costs and revenues occur on average on one day, halfway through the year. For this convention, it should be 1/2, 3/2, 5/2, and so on, which can be generalized by using a discount factor of $(1+k)^{(2n-1)/2}$.

42 Smith G and R Parr. 1990. Royalty Rate Analysis Techniques. *Licensing Economics Review* November 1990. p. 9ff; also published in the 1991 Supplement to the Razgaitis' *Valuation of Intellectual Property and Intangible Assets* (*supra* note 1). Smith G and R Parr have written extensively on this subject. Their organization publishes the journal *Licensing Economics Review*,

which frequently includes articles on the application of this method, as well as other news and information on valuation, pricing, and other IP matters.

43 This model assumes that the licensor received up-front and minimum payments as part of the $10 million investment by the licensee and a reasonable royalty throughout all the period that the product was in commerce, so that the $126 million cash flow to the licensee was net of all the licensee's expenses, including royalty.

44 Also assumed in this model is that there is no net residual value or cost after the product is withdrawn from the market and the business is exited.

45 A quote heard during a talk by Ray Rogers, finance professor at the University of Michigan Business School.

46 The summary incorporates some of the terms and values by Timmons. (See Timmons JA. 1990. *New Venture Creation)*.

47 Paul Purcell of Battelle, and others, have provided valuable initial insights to negotiating and valuation contexts.

48 Earlier in this chapter, Kiley (see *supra* note 15) proposed nonexclusive royalties as being approximately one-half the royalties paid under an exclusive license. The economic rationale for such a differentiation would need to derive from comparing the NPVs of two DCF scenarios—one as an exclusive license and one as a nonexclusive license. Although it seems obvious that the nonexclusive licensee royalty should be less, it is difficult to generalize what a fair difference should be.

49 Razgaitis R. 1999. *Early-Stage Technologies: Valuation and Pricing*. John Wiley and Sons. Razgaitis R. 2003. *Valuation and Pricing of Technology-Based Intellectual Property*. John Wiley and Sons.

50 However, this author generally recommends that a licensor of early-stage technology not sell out for a one-time, upfront payment. Exceptions to this rule, as to most rules, can be warranted, as discussed in the text.

51 The two products currently available for personal computers are Crystal Ball®, sold by Decisioneering of Denver, Colo., (800/289-2550) and @ Risk®, sold by Palisades, New York (607/277-8000). Both require the use of a spreadsheet program such as Microsoft Excel®.

52 Crystal Ball, sold by Decisioneering of Denver, Colo.

53 *Business Week*, 20 March, 1995.

54 See *supra* note 2.