

Model Helps Set Value Of Technology

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Adoption of Diffusion Model provides method for valuing technology in new applications

How do you value a technology if it cuts costs and raises like elsewhere? Easy! One arm and one leg, thank you very much.

But what if your technology is more ordinary? Let's say that you know it can make a difference in the way an industry solves a problem, but the industry is different than the one you worked in last year and the which you have valuation numbers. How do you come up with a formula to put a value on a technology in a new application?

Developing an accurate valuation of a technology is extremely important in order to develop mutually beneficial licensing arrangements. And, beyond the direct financial issues involved, such technology valuations can also tell senior managers where to invest resources to achieve the greatest returns for their shareholders.

Many valuation models exist to reach numbers and arrive at values for a technology. Two of the most common are discounted cash flows and net present values. But these two models alone don't work well with either a new technology or a new application, or both. They rely on future cash flows that are very difficult to predict when selling something new to new markets in new markets at some time in the future. TMC would like to share its approach to valuing technology where the chief uncertainties are "Will the customer buy it?" and "When will the customer buy it?"

The trick lies in understanding how a new technology will affect an customer's business and then in predicting how rapidly groups of

customers, that is, markets, will buy it. Some new technologies revolutionize an industry and are adopted quickly. Other new technologies offer users an improved way of conducting their business and are adopted over longer periods, say 10-15 years. But some new technologies simply offer users an alternative way to conduct their existing operations. Obviously, these three technologies have very different values. The key is to understand how quickly and how extensively they will be adopted and how much value added the provider can capture.

ADOPTION-DIFFUSION MODEL

We use a tool called the Adoption-Diffusion Model as a framework for estimating the value of new technologies. The A-D Model was developed in the 1980s by the U.S. Department of Agriculture and is based on extensive research.

The research was conducted to determine why farmers would not adopt dramatically better technologies or methods of farming. For example, crop rotators and animal husbandry had been developed but were not being utilized. The A-D Model helps identify who will adopt new technologies and predicts when they will do so. We have found these questions of who and when to be essential in new technology valuation.

The research showed that when farmers would adopt a new technology they would not adopt it all at the same time. Only the farmers that were the most comfortable with trying new methods would utilize a brand new technology. All of the other farmers would wait to see what the outcome of these test trials would be.

The model that emerged from this research was a Behavioral Model, the Adoption-Diffusion Model. It describes five different categories of people, distributed along a bell-shaped curve, based on the behavior they display when faced with a new method or technology. These five categories are the Innovators, the Early Adopters, the Early Majority, the Late Majority, and the Laggards. (Figure 1)

The Innovator category is composed of people who are first comfortable with change. They are eager to try new products, methods, and technologies. They want to be the first. They don't care if the product is not perfect. They know it won't be. They are the "test pilots." This category was using portable telephones when they were so big and heavy that you practically needed a backpack to carry one around.

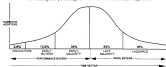
• Early Adopters •

Once the innovators have tried, tested, and adopted a new product, the Early Adopters will share their interest. The Early Adopters are interested in trying new products, methods or technology, but they do not want to be the first to do so. As long as you can demonstrate that a product has been used successfully somewhere, the Early Adopters will be eager to try it. They want to know that it works.

The Early Majority category matches the Early Adopter category very closely. The Early Majority must know ahead of their competitors but they don't want to take too big a risk on new, unproven tech-

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THE ADOPTION-DIFFUSION CURVE
(Including the percentage of the total market in each segment)



CHARACTERISTICS OF THE ADOPTION-DIFFUSION SEGMENTS

INNOVATORS	EARLY ADOPTERS	EARLY MAJORITY	LATE MAJORITY	LAGGARDS
<ul style="list-style-type: none"> • Find the highest performance in a class. • Not interested in profitability, more independent. • Will buy an unproven concept. • Enjoy let new relations, want to be leaders. • Don't need to see it done to buy it. 	<ul style="list-style-type: none"> • Want to be leaders. • Want to see it done first before they buy it. • Among the most profitable buyers. • Interested in new relations. • Hesitant to be the very first to buy. 	<ul style="list-style-type: none"> • Want to stay ahead. • Want to buy from established, accessible suppliers. • Must be sure to try and use to incorporate. • Want to know you have sold lots of it. • Watch the Early Buyers. 	<ul style="list-style-type: none"> • Don't want to fall too far behind. • Want no glitches, want a thoroughly proven product. • Buy in price blocks. • Want to buy locally. • Demand division, suppliers of purchase and use. 	<ul style="list-style-type: none"> • Reluctant to make change. • Most hostile of new technology. • Least interested about their business. • Adopt innovations when they can't be avoided no longer. • Often the least profitable.

Figure 1

nologies. They want to buy from established suppliers and they want those products or technologies to be easy to operate. When the Early Majority begins to buy, the first signs of larger volume sales appear.

The "pioneer buyers" enter the market about the first half of the market has already entered. The first segment of the price buyers is known as the Late Majority. These buyers want established products and services that have been on the market for some time and have been thoroughly proven. The last Late Majority buyers are just now buying discretionary items because they can't find good carrying alternatives for conventional items.

The last segment of buyers are the Laggards. These buyers are the most risk averse and most afraid of change. They are also the ultimate price buyers. The Laggards are buying their first color television sets now because they can no longer

find good black and white sets.

APPLYING THE ADOPTION-DIFFUSION MODEL

The key benefit of the Adoption-Diffusion Model is its ability to take the uncertainty out of new technology valuation. It helps answer such questions as who will buy a new technology and when. Once you understand the model conceptually, you can apply it to your technology and your situation.

To use the model, you need to develop a system that is specific to your technology and your industry. Once you have developed your own model, you can apply it to your market size and timing estimates. (We show you how to build your own model below.) The result will then be revenue estimates that can be fed into your discounted cash flow models. In the end, you will have significant-

ly increased the accuracy of your new technology valuation by including in your analysis the critically important behavioral component of new technology adoption.

EXAMPLE ONE

A firm we know in the chemical business had developed a new technology for use in pharmaceutical research, development, and production. Before it spent the money to commercialize this new technology, the firm wanted to value the new technology to determine what its ultimate returns would be.

To value this new technology, we set out to develop an Adoption-Diffusion Model for this particular situation. Pharmaceutical firms are on the leading edge of technology and innovation. Therefore, we expected to find that the industry would be eager to adopt this new technology and that they would do

so quickly. Instead, we learned that the model that would apply was significantly different than the one we had anticipated developing.

We held discussions with pharmaceutical firms to determine their interest in this new technology and their overall adoption characteristics. First, we categorized each firm we spoke with based on their adoption segment. Then, based on our discussions, we estimated the time lag between the adopter segments. To our surprise, and the chemical firm's, we found that the time lag was approximately five years.

Since the innovator had not yet adopted the technology, it would be approximately 30 years before the significant volume of product based on this new technology could be sold. It would take that long before the bulk of the buyers, beginning with the Early Majority segment, would adopt it. When we applied the Adoption-Diffusion Model, we determined that the potential revenue stream was much flatter and lag much further out in the future than the chemical firm had expected. Therefore, our valuation of the technology led to a calculated return on investment that was significantly less than what the firm needed. They have subsequently decided not to pursue this new technology.

EXAMPLE TWO

Another type of firm we know had developed a new technology that it wanted to sell to the graphic arts market. Though the technology was eight years in development, the firm suspected that the best way to generate revenue from it was to sell through original equipment manufacturers.

Upon discussions with market participants, we determined that the market was ready and waiting for this new technology. The time lag between adoption segments was months rather than years. The Adoption-Diffusion Model that we developed for this firm was also significantly different than they had expected. In this case, however, the model brought extremely good news.

The subsequent valuation of this

new technology showed a much higher value than the firm had anticipated. We recommended that the firm seek new distribution channels and get the product out into the market much faster than it had planned. The firm has since realized approximately \$10,000,000 in revenue with more than 75% gross margins by getting its technology out into the market before competitors could respond.

BUILDING YOUR OWN MODEL

There are seven steps to building and applying the Adoption-Diffusion Model to determine the value of a technology. (Figure 2)

STEPS TO MODEL



Figure 2

STEP 1 — Conduct a broad, executive-level assessment of the fit of your technology in your target markets. Understand how your target customers will use the technology and how it will affect their businesses.

STEP 2 — Build an open estimating routine that will give you a first-pass estimate of the total market opportunity for your technology. We have developed a procedure for estimating market sizes for even the broadest of technologies. You can probably develop one for the market you are evaluating. It can be done.

STEP 3 — Apply a series of filters to your total market estimate to arrive at a likely market opportunity for your technology. Consider such issues as competition, pricing, regulatory environment, ways the technology will be used, technological enhancements, distribution channels, etc. Be realistic and factor in as many variables as possible.

STEP 4 — Using your broad assessment in Step 1, estimate the timing of the adoption of your technology. Who are the innovators? Are they using your technology

now? If not, when will they? How about the Early Adopters? And so on. By asking yourself these questions, you will be able to estimate the standard deviation, that is, the duration of the adoption time consumed by each segment on the S-D curve.

STEP 5 — Apply your likely volume and timing estimates to the A/D curve percentages. This will give you the approximate revenue to be realized over the time horizon you have provided.

STEP 6 — Determine the gross margin your technology generates right now. Then, estimate the decline in those margins over your projected time horizon. I usually

assume always occurs. The value for questions are how soon and how fast.

STEP 7 — Finally, determine the appropriate discount rate, apply it to your projected revenues, and arrive at your discounted cash flows.

As with any model, the Adoption-Diffusion Model must be applied properly to be effective. We have found that a focused, executive-level assessment of the effects a new, available technology would have on a given industry generates the best data to work with. Analyzed carefully, patterns emerge that can help you estimate the market potential and adoption timing for a new technology, providing a base for better valuation of the licensing opportunity.

In negotiating licensing deals, correctly valuing a technology strengthens your position irrevocably. Potential partners need to do their homework effectively to ensure that they negotiate a mutually beneficial deal. Using the Adoption-Diffusion Model will help any firm significantly increase the accuracy of its new technology valuations.