Innovation Diffusion

Net Forecasts – Peter J. Sevcik
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My summer reading list included a very informative book called "Diffusion of Innovations," by Everett M. Rogers. His research into understanding and documenting the way a new idea or thing gets adopted is the definitive treatment of the topic since his first edition in 1962. Many of us in high tech have had some role in getting a new technology built or deployed, so you might think that there is little to be learned from studies of how new technologies become a success. It turns out there is lot to learn.

The inventor of an innovation sees an obviously better way to do something. I have heard many product presentations that conclude with, "This is clearly a superior product so people will certainly buy it." Wrong. Getting an innovation adopted is a complex process. Understanding that process is very useful to projecting whether a new technology will succeed.

Not All Good Ideas Get Adopted

Not all innovations, even very good ones, get adopted. Or if they do, it may take an extraordinarily long time to take hold.

The Dvorak typewriter keyboard is a good example of an improvement that was successfully fought off by incumbent interests. The typewriter companies liked the Qwerty keyboard layout, which was designed to slow down a typist so that the keys would not jam. Subsequent better typewriter designs like Dvorak permitted the innovation of a keyboard layout that made typing faster and less stressful on the hands. But typewriter companies, typing teachers, and typewriter stores fought the change. Today we type on the Qwerty and have carpel tunnel syndrome: Vested interests can set up sufficient barriers to thwart an improvement.

Resistance to change may not stop an innovation, but can slow it down. The most striking example is how it took the British Navy 194 years to adopt the use of citrus as a cure for scurvy.

The navy had evidence of the first successful controlled experiment, conducted by a doctor on board a voyage from England to India in 1601. Then, 150 years later, another doctor performed a similar experiment. Then it took an additional 44 years for the well organized, technically competent navy to finally adopt the innovation. And it took the British Board of Trade an additional *seventy* years to adopt it for the merchant marine. A total of 264 years to achieve full acceptance of an obviously life-saving and economically beneficial technology!

The Innovation Diffusion Process

Rogers makes a compelling case that the diffusion process is a very social phenomenon. His definition is: "Diffusion is a process by which innovation is communicated through certain channels over time among members of a social system."

The social system includes several players including the *change agent*. I learned that most of my career I have been a change agent – an individual who influences clients' innovation decisions in a direction deemed desirable. However, don't confuse change agents with marketing people. In fact, Rogers never uses the word marketing anywhere in the 500-page book!

Change agents are members of the social system who have early knowledge of an innovation and can educate clients about how it can be adopted to "reduce uncertainty in the cause-effect relationships involved in achieving a desired outcome." Certainly engineering consultants are change agents.

The book describes the well-known S-curve of adoption that starts with early adopters, followed by the early and late majorities, finally adding the laggards. The most important point in the process is when critical mass occurs. This is the point at which enough individuals have adopted an innovation that its further adoption becomes self-sustaining.

In network and communication technology, this critical point occurs when the adopters assume that everyone in the population is an adopter, which forces the non-adopters to cope with the change. A good example was the fax machine. At critical

mass, businesses with a fax machine assumed that every other business with which they interacted certainly had one as well. The question, "What is your fax number?" forced the remainder to adopt.

Predicting The Success Of An Innovation

The biggest value of understanding this process is to be able to predict the rate of adoption based upon factors known at the start. Rogers identifies five critical attributes that greatly influence the rate of adoption. I have tried to adapt them to key factors that are required for the success of a new technology or product in the enterprise network market:

1. *Relative Advantage* – Is the innovation perceived to be better than the status quo? New technologies that make up communication networks need to improve some aspect of the network. There are at least the following major improvement categories:

- Enabling a desired new application or terminal.
- Expanding the number or geographic reach of users for an existing application.
- Improving application performance.
- Saving cost to the application supplier or its users.

Notice how heavily these categories depend upon the application. A communications innovation must provide an advantage to the thing that is being communicated.

Many of the network innovations which have succeeded in the past 20 years were essentially forced upon the enterprise as a result of new terminals or applications. The best example is LANs that sprang up because local departments bought personal computers. LANs quickly became a "must-have" technology which started a cascade of necessities: bridges, routers, firewalls, etc.

But now that enterprises are not adding completely new terminals, an innovation has to show relative advantage in the remaining improvement categories. *Reach* is easily expanded by connecting to the Internet or going wireless. The other two improvement categories deal with something that's already being done, but doing it better (*performance*) or cheaper (*lower cost*).

Many of the performance and cost advantages of an innovation are justified as problem avoidance. Interestingly, Rogers points out that preventative innovations that are justified by avoiding a problem (e.g., not contracting AIDS by adopting "safe sex") are particularly slow in adoption because individuals have difficulties in perceiving the relative advantage.

2. *Compatibility* – Compatibility is the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters. This is an area where Rogers shows how strongly the adoption process is governed by individuals operating within a social structure. However, I think that it has two direct applications to enterprise networks.

First, the new thing must be technically compatible. Does it adhere to protocol and interface standards that the enterprise has adopted? In other words, will it plug into or fit inside the existing network? This is a clear show-stopper for many great ideas.

Second, the new product or service needs to be organizationally compatible. Does it fit the way in which the network is operated? This is particularly relevant for network management tools and services. For example, management systems that are owned an operated by the network group typically do not gather information on the servers because that is another department. Adding a server management innovation to a network tool would not be compatible with the enterprise organization and reporting structure.

If the innovation is intended as a new way for the enterprise to operate, organize or report, then it forces out-of-the-box thinking that will require education. The culture change required will create resistance to the innovation. However, smart inventors may be able to find enterprises that are undergoing such change for other reasons, and use these as a beachhead for the innovation. The critical term here is *other reasons*, not change merely to accommodate the innovation.

3. *Complexity* – Complexity is the degree to which an innovation is perceived as difficult to understand and use. Of course, the level of perceived complexity is inversely proportional to the rate of

adoption. Again, enterprise network product vendors can learn a lot in this area.

In the early days of enterprise data networks, the relative advantage story was simple: "Buy *this box* to connect *these things*." The vendors of the boxes were eager to explain how their devices worked. There were seminars, handbooks and very descriptive brochures on the products. So if you owned *those things*, you bought the box. Even though the technologies of bridging and routing were new and complex, the vendors worked hard at reducing the barrier presented by the perception of complexity. The early adopters were comfortable with their understanding of the new technologies.

Today, as described above, the relative advantage of many new technologies is improved performance or reduced cost. Interestingly, the actual complexity of the new devices is much higher. The reason is that the new device often performs subtle, complicated changes to the way that the network or application operate in order to accomplish the relative advantage. Some packets are modified, blocked, re-routed, combined, indexed, or delayed some of the time for some of the flows.

One would expect the need for an even greater level of education by the vendors on how their product works. The opposite is true. Vendors of performance-enhancing and cost-reducing innovations tend to explain very little about how their products operate. In fact, many of the vendors do not have a complete understanding of all the effects that the devices have on all of the customer's traffic. Also, the reality is that the device or service will often provide significantly beneficial effects but may not improve performance or save costs for some of the traffic some of the time. So instead of explaining how the device works, many vendors focus on presenting benefits in the subset of scenarios with the greatest effect.

So it is not surprising that vendor statements like, "Applications run twice as fast for half the cost" are not convincing to users. It turns out that worse than the skepticism this engenders is the fact that it keeps *how* the innovation works mysterious. Early adopter technologists do not buy technologies they don't understand. The benefits statement is processed afterwards or may not be processed at all (see "observability" below). The current pattern of vendor secrecy raises the complexity quotient, thus inhibiting adoption.

4. *Trialability* – Trialability is the degree to which an innovation can be experimented with on a limited basis. There is good news in this area. In the early days, connecting LANs and offices required defining an architecture, specifying many details, and spending a lot of money in order to build enough of a network for the result to be understood, evaluated and ultimately justified.

In contrast, many of the current network innovations are easily introduced. Often there are both service and product alternatives. Many performance techniques can be applied to a very narrow subset of users, locations, applications, and even portions of an application or content. The effect can be monitored to support decisions for gradual expansion of the innovation.

5. *Observability* – Observability is the degree to which the results of an innovation are visible to others. There are two key terms in that sentence: visible and others.

Again, as we move to innovations with more subtle performance and cost improvements, measuring the change may be difficult. The more general benefits statements offered by the vendor earlier in the process are not sufficient at this stage. The enterprise must be able to directly observe (measure and document) the beneficial effect on its particular applications, users, or infrastructure. And these advantages are often realized over time. The longer it takes to make the case for an innovation, the longer it will take to be adopted even in an enterprise that is already trying it.

Another problem facing current network innovations is that the measured improvement must also be translated into a business improvement that *others* outside the IT department can appreciate. This is the classic problem of coupling the technology to the business. Technologists are often ill equipped to perform this critical translation. The impact of these issues is that many new innovations will spread more slowly.

Conclusion

As network innovations move from obvious connectivity to more subtle features, vendors will have to pay closer attention to the adoption process. There needs to be a commensurate change in how a new technology is introduced and promulgated within the marketplace. The two things that stand out are the need for better education on how the innovation works and the necessity to creatively incorporate change agents into the process.

Enterprise technical staff will also benefit from understanding that they are players in this process to constantly improve communications networks. On one hand they are adopters of innovation and on the other hand they are the innovator who uses the new technology to change his or her company for the better. Learn how to use this process to succeed in the next big change you want to bring to your enterprise.

Peter Sevcik is president of NetForecast and is a leading authority on Internet traffic, performance and technology. Peter has contributed to the design of more than 100 networks, including the Internet, and holds the patent on application response-time prediction. He can be reached at peter@netforecast.com.