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Mary B. Prescott

University of South Florida, mary@bsn01.bsn.usf.edu

Craig Van Slyke

University of South Florida, cvanslyk@bsn01.bsn.usf.edu

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The Internet as an Innovation

[Mary B. Prescott](#), University of South Florida
mary@bsn01.bsn.usf.edu

[Craig Van Slyke](#), University of South Florida
cvanslyk@bsn01.bsn.usf.edu

The Internet, along with Internet resources such as the World Wide Web (web), is receiving much attention from both individuals and organizations; sites, users, and volume of packets sent throughout the world are growing exponentially (Berghel, 1996). Frequently raised issues include providing Internet access to employees, managing the breadth and scope of that access, using Internet resources productively, using Internet resources strategically, and determining appropriate information content. Consideration of the Internet as an information technology innovation is easily accepted, but studies based on traditional innovation diffusion theory have not yet appeared.

Using traditional innovation diffusion theory to study the Internet raises thorny questions which should be resolved before empirical work is undertaken. This paper considers the Internet from the perspectives of traditional innovation theory research, suggests additional appropriate perspectives, and concludes that the Internet is an arresting example of a technology cluster innovation (Chin & Moore, 1991). Expectations about cluster innovations are considered with respect to the Internet and problems with using traditional innovation diffusion theory to study such innovations are suggested.

First, we define the innovation. Then we relate previously identified dimensions of innovations to the Internet. Last, we discuss the concept of cluster innovations and why this may hold the most promise for understanding the Internet as an innovation.

Defining the Innovation

Using Tornatzky & Fleischer's (1990) definition of an innovation as "the situationally new development and introduction of knowledge-derived tools, artifacts, and devices by which people extend and interact with their environment" (p. 10), the Internet can be considered an information technology (IT) innovation for many adopters. The innovation appears to be in an early stage of diffusion. Even in areas where the Internet has long been available, such as universities, a relatively small percentage of professors have actually used the Internet (Berghel, 1996).

The Internet is a communication mesh of networked computers with their associated resources, including but not limited to email, ftp, gopher and the web. Organizations and individuals may adopt and use varying subsets of the Internet. We provide a more detailed discussion of Internet resources later.

Although all Internet adopters use the communications backbone of the Internet, limiting our definition to this backbone is not satisfying. The Internet has expanded far beyond the original boundaries of government and university linkages. The development of gopher, web browsers and the concept of the home page dramatically increased the Internet's appeal. The Internet differs from previous innovations in that it is an extraordinarily dynamic innovation; its most recently developed capabilities include animation and extended interactivity (e.g. Java applets). Now companies are installing internal "Intarnets" based on Internet technologies, but confined within organizational boundaries (Sprout, 1995). This phenomenon demonstrates how a dynamic technology such as the Internet may adapt to areas beyond those originally intended.

Innovation Dimensions

Traditionally, researchers have categorized innovations in several ways. In this section, we briefly discuss some of these dimensions, and relate the characteristics of the Internet to these dimensions. For a more detailed discussion of the diffusion of innovations, see Prescott and Conger (1995).

This paper considers two stages of innovation diffusion, adoption and implementation. An organization adopts an innovation when it decides to commit resources to it. The implementation stage includes development and installation activities that take place as the organization begins to use the innovation (Grover & Goslar, 1993). Our discussion of the Internet as an innovation is applicable to both stages.

It should be noted that adoption and implementation take place on at least two levels--organizational and individual. For example, an organization may implement Internet Web browsers throughout the organization, but individuals may not choose to use the technology. The opposite is also true. Individuals may adopt and use Web browsing to complete some aspect of their job before the organization makes the decision to adopt. Among the many interesting questions worthy of consideration is the degree to which individuals drive Internet adoptions. Initial studies of the Internet as an innovation should give careful thought to level of analysis issues.

Radical versus Incremental Innovations. Innovations which are so new to the organization that they require extensive changes in business practices are radical innovations, while those that can be implemented with minor changes in business practices are considered to be incremental (Nord & Tucker, 1987). Classifying an innovation along this dimension is contextually dependent. In the case of the Internet, organizations which have existing computer communications systems may find the Internet to be an incremental innovation. Others may find the Internet to be a radical innovation which, for example, introduces email and changes the organization's communications channels.

Product versus Process Innovations. Adopters find value in product innovations in and of themselves, while process innovations have value because they provide a means to some end beyond themselves (Tornatzky & Fleischer, 1990). Again, this distinction is shaped by the organizational context surrounding the innovation. The Internet can function as both a product and process innovation for organizations and users. Users who gather information over the Internet may perceive it as a product innovation. Those who try to gain a strategic marketing advantage by creating home pages and interactive sessions with potential customers would be more likely to see the Internet as a process innovation. For a given user, the Internet, with its many different resources, may be both a product and process innovation, depending on the intended use at the moment. Therefore, any diffusion-based study of the Internet must explicitly draw a distinction between product and process orientation.

Voluntary Innovation Use versus Involuntary Use. Diffusion patterns for innovations whose use is mandated are very different from those whose use is volitional. Most innovation research focuses on voluntary innovations. Because of the complexity of the Internet and its wide variety of features and functions, it may not be possible to classify Internet use as entirely voluntary. For example, organizations which establish email systems via the Internet may mandate its usage. However, it appears that most Internet use is voluntary, so use of the traditional diffusion of innovation model should be acceptable for preliminary research.

Push/pull considerations. Another dimension of interest in studying IT innovations has been the determination of whether the diffusion is occurring as a result of technology push or business pull. Again, due to its complex nature, the Internet has been affected by both technology push and business pull. The technology push came first, as the Net was developed and browsers followed, which made the innovation accessible to a much wider circle of organizations and people. Once that accessibility was achieved, however, the technology has appeared to diffuse with increasing rapidity. It seems that there is now a business pull which has affected the diffusion process, as businesses race to establish marketing presence on the Web, journal and paper articles proliferate, and on-line services offer instant Web access.

Marketplace versus Marketspace Innovations. Last, the fundamental nature of the Internet as an innovation needs to be considered. Rayport and Sviokla (1995) have suggested that *marketplace* innovations, those which have a physical presence, have different characteristics than *marketspace* innovations, those which exist electronically. They suggest that *marketspace* innovations differ from *marketplace* innovations in several ways. Conventional economies of scale are not relevant to *marketspace* innovations because they are implemented on a backbone to which everyone has potential access. Providing a *marketspace* innovation for one user is no easier than providing access to the whole world. The flow of information and substitution of electronic information for physical information creates a new channel to customers and employees as the *marketspace* develops. Thus, it is questionable to approach the Internet as another IT innovation for which our understanding will be illuminated by applying traditional innovation diffusion theory.

Technology Cluster Innovations

An additional dimension considered in some innovation studies is that of single innovations versus technology cluster innovations. Most information technology studies treat innovations as a single innovation, with well defined features and functions (Prescott & Conger, 1995). Rogers (1983) suggests the existence of technology cluster innovations. Technologies may have a complementary relationship; in the case of the Internet, benefits of information residing on the Internet have been realized as a result of the development of browsers such as Netscape. Or technologies may cluster because they address a similar function; many Internet surfers use multiple browsers. Or technologies may cluster because they share a common platform; the Internet communications backbone has resulted in a cluster of innovations, such as the web, browsers, and gophers, which share that backbone. Empirical evidence of the existence of technology clusters has been demonstrated by Chin and Moore (1991).

Studying each individual innovation without considering the context of the related innovations is likely to result in dubious understandings. As demonstrated by Silverman and Bailey (1961), adoption of the various technologies included in a cluster may be necessary in order to achieve the anticipated relative advantage of adopting one or more of the clustered innovations. In that case, adoption of thicker planting methods resulted in lower crop yields unless hybrid seed corn and fertilization were also adopted. We propose taking a systems theory approach to studying cluster innovations, studying all of the related innovations as parts of a whole rather than as individual innovations. As noted above, the development of the Internet appears to have been dramatically affected by the development of related innovations which have improved both ease of Internet use and the usefulness of the Internet. Thus, we suggest that diffusion studies of the Internet will profit from treating the Internet as a technology cluster innovation.

Conclusion

The results of relating traditional innovation diffusion theory approaches to the Internet illustrate the potential pitfalls of applying existing research results to the Internet. Other researchers have raised the issues of treating *marketspace* innovations as though they were *marketplace* innovations (Fichman & Kemerer, 1994; Prescott & Conger, 1995). The additional complication of dealing with a cluster innovation should encourage researchers to proceed cautiously, as little empirical work has been conducted using such innovations. The Internet is an unusually dynamic innovation and very deserving of study, but its dynamic nature and complexity require care.

Although applying traditional innovation diffusion theory to the study of the Internet is possible, such studies must be very carefully weighed. The Internet, as a cluster innovation, cannot be easily thrust into any one existing innovation classification box. Even more than most innovations, the Internet may be a different type of innovation for each user and organization. Researchers must be very sensitive to the context within which each Internet adoption occurs.

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