Chapter 2

Technology and people

Introduction

The evolution of the Internet is a story of radical technological change and diffusion on a large scale. Over the course of time, the Internet became a national and then international framework for technological innovation. Innovations tend to follow technological trajectories[1] or vectors[2] but the shape and character of these development agendas is a function of people using (adopting and adapting) the technology. In the case of Internet development, we have seen (and this will be reinforced in later chapters) that network innovations are evolving through demands that are placed on Internet services by people in the workplace and everyday life. To understand the Internet more deeply, we need to understand the relationship between people, innovation and diffusion because technological change is basically a gradual and cumulative learning process. It is important therefore to understand the Internet in relation to the existing knowledge, attitudes and beliefs of people who are using the network and its technologies.

Technology acceptance

Diffusion of innovations occurs out of the cumulative decisions of individuals to accept and use a technology[3]. There has been a lot written in our technological age about the acceptance and adoption of technologies by individuals and why some accept and others reject technological innovation. Some writers have examined the determinants of

information technology acceptance[4] and others have focused on developing theoretical models for technology acceptance. A model of particular interest to the user's view of the Internet is the theoretical construct called personal innovativeness[5]. This construct identifies individuals who are likely to adopt innovations earlier than others and also serve as the opinion leaders and change agents so necessary for wider technology acceptance and diffusion. Personal innovativeness has played a central role in the evolution of the Internet and requires further elaboration but before doing so, we should introduce some of the other theories that help us to explain the acceptance and use of technology by people.

One such theory, the *Theory of the Diffusion of Innovations*[6] takes an information centric view of technology acceptance by individuals and identifies a series of steps that people follow when adopting a new innovation. These steps are knowledge, persuasion, decision, implementation, and confirmation.[7] It is important to note that adopters are seen as situated in social systems where information about innovation flows and they perceive this information and then drive innovation adoption decisions. In this theory, there are five attributes of innovations that are perceived by individuals and ultimately influence adoption:

> *Relative advantage*: the degree to which an innovation is perceived as being better than its precursor
> *Compatibility*: the degree to which an innovation is perceived as being consistent with the existing values, and past experiences of potential adopters
> *Complexity*: the degree to which an innovation is perceived as being difficult to use
> *Observability*: the degree to which the results of an innovation are observable to others; and
> *Trialability*: the degree to which an innovation may be experimented with before adoption.[8]

Over time, the *Theory of the Diffusion of Innovations* has been validated [9] and augmented [10] so that the construct now includes:

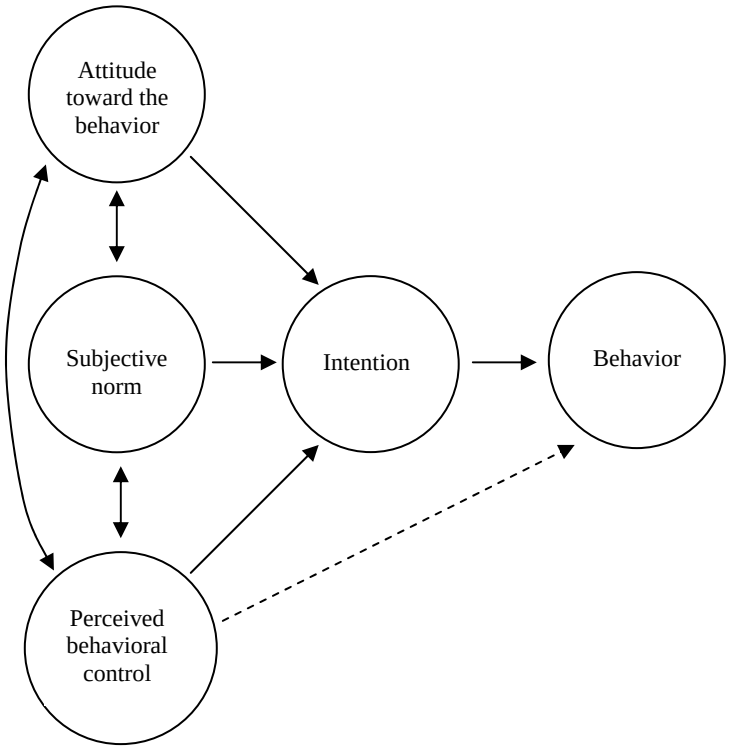
> *Image*: the degree to which use of an innovation is perceived to enhance one's image or status in one's social system; and
> *Voluntariness of use*: the degree to which use of the innovation is perceived as being voluntary or of free will.[11]

There is some evidence that these innovation characteristics have played a role in the adoption of the Internet and Internet technologies by people in workplace settings. An instance of the influence of image, for example, is shown by data emerging from research that reveals academic faculty adopting and using the Internet because they see this as a professional obligation. [12] Voluntariness of use has also been identified as a characteristic of Internet adoption by academic faculty. Increased use of the Internet in the academic setting has tended to be as much an outcome of the wider adoption of this technology within a school, department or university, as apposed to the personal endorsement and diffusion of Internet use by individual faculty.[13]

Recent augmentations of the *Theory of the Diffusion of Innovations* emphasize that the earlier construct was based on perceptions of the innovation, not perceptions of using the innovation.[14] We therefore find in the expanded construct the phrase "use of the innovation" included and this phrase should be transposed into the definition for relative advantage, compatibility, complexity, observability and trialability.

Use of an innovation is the key to innovation diffusion but it is important to note that there is a distinction between attitudes toward an innovation and attitudes towards using an innovation. The importance of attitude is explained by the *Theory of Reasoned Action* and later by the *Theory of Planned Behavior*.[15] [16] These theories were designed to predict and explain human behavior in specific contexts. The Theory of Planned Behavior was developed when it was noted that its predecessor, the Theory of Reasoned Action, did not deal with behaviors over which people have incomplete volitional control. As we have already noted, the issue of volitional control can affect Internet diffusion in the workplace where acceptance of Internet technology may be as much an artifact of these technologies being imposed, as it is an indication of technology adoption by the workers themselves.

Figure 2.1: Theory of Planned Behavior



Source: Ajzen (1991), p. 182.

Theory of Planned Behavior focuses on the individual's intention to perform a given behavior or the motivational factors that influence a behavior. The general rule is that the stronger the intention to perform a particular action, the more likely it will be performed by the individual. The caveat to this relationship is the extent to which a person can decide at will whether to perform this behavior or not. While some behaviors are prescribed by the choices that an individual can make, many behaviors depend on a range of non-motivational factors within the overall context of use like resources, time, money, other people and so on. These conditions describe or qualify the level of *actual control* that an individual has over his or her choice to exhibit a behavior or not. The level of *actual control* is of course important, but it is the concept of *perceived behavioral control*, that is, what the individual thinks

about the level of control he or she has, that plays the more significant role in determining intentions and actions.

The Theory of Planned Behavior states that the performance of a behavior is a joint function of intentions and perceived behavioral control. The predictive validity of this theory depends on three factors:

1. The measures of intention and of perceived behavioral control must correspond to, or be compatible with, the behavior that is to be predicted.

   In the context of our discussion of the Internet this means that the intentions and perceptions of control must be assessed in relation to the behavior of interest and the specific context in which this behavior will occur. If the behavior to be predicted is use of the Internet to purchase a book, for example, then we must assess intentions to buy a book using the Internet not simply intention "to use of the Internet" or intention "to buy a book".

2. Intentions and perceived behavioral control must remain stable between the time when they are assessed and the time the behavior is observed.

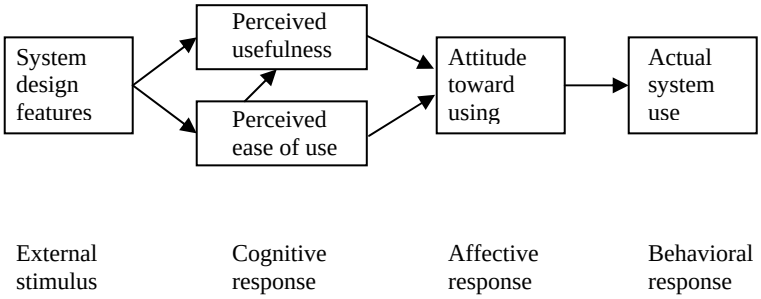
   In this case we need to be conscious of the impact that intervening events in terms of changing intentions or altering perceptions of behavioral control. If the original measures for these variables change then accurate prediction of behavior is no longer possible.

3. The extent to which perceptions of behavioral control realistically reflect actual control.[17]

The relative importance of intentions and perceived behavioral control vary across situations and behaviors. The Theory of Reasoned Action has been used to explain the influence of attitude on a range of behaviors including the acceptance and use of information technology. It underpins the Technology Acceptance Model (TAM)[18], for example. The Technology Acceptance Model posits that an individual's acceptance of information technology is based on beliefs, attitudes, intentions and behaviors. It pays particular attention to the affective response by individuals to technological innovation. The attitude that an individual has towards technology use and adoption decisions is the key mediating construct and an individual's attitude is determined by beliefs about the perceived usefulness of the innovation. This is a subjective judgment by the individual of the measure of utility offered by the innovation.

The second attitude relates to the individual's perception of the ease of use of the innovation. The individual in this case is estimating the amount of cognitive effort required to adopt the technology or use it in a particular work context. Two other features of the TAM model draw on the relationship between use and behavioral intention to use. In this case, attitude towards use relates to an individual's perception of how desirable it will be to use a particular innovation. Behavioral intention to use, on the other hand, is a measure of the actual likelihood that a person will use the innovation or technology.

Figure 2.2: Technology Acceptance Model



Source: Davis (1993), p. 476.

Personal Innovativeness

With this background in mind, let us now return to our discussion of personal innovativeness. The significant recurring theme that appears in theories of technology acceptance is that individual perceptions of the innovation or technology are critical. These are the perceptions that the individual has about the characteristics of the technology or innovation and secondly, the perceptions that the individual has concerning how the innovation might be used. It is important to accept both constructs but the next step towards our objective of a better understanding of technology acceptance by individuals is the valuing of individual dif-

ferences. In particular, it has been argued that technology acceptance can depend on an individual difference variable called personal innovativeness. [19] Personal innovativeness can predict how perceptions of a technology or innovation are formed and the role these might play in the formation of usage intentions. [20]

Personal innovativeness has been the focus for work exploring technological innovation for some time but it has generally been used as an "ex post descriptor of behavior."[21] We need methods to explicate and measure this concept and the first step towards achieving this goal is to see the distinction between global innovativeness and domain specific innovativeness.[22] Global innovativeness is a characteristic that all individuals possess to some degree. It refers to a level of "willingness to change." In the context of the Internet, the general impact of this characteristic has been manifest in the levels of adoption of Internet technology by what we call the "general public." Global innovativeness has been criticized however as having low predictive power when applied to specific adoption decisions.[23] Domain specific innovativeness, by contrast, can be measured (like attitude and personality variables) and exerts a significant influence within a domain of activity, for example, a professional context. This is demonstrated by research into the innovation and application of Internet technologies in a wide range of professional settings. A detailed discussion of domain specific innovativeness occurs in Chapter 4 of this book, where research data are analyzed to reveal how members of various professional groups are using the Internet and its technologies.

The theoretical construction called *Personal Innovativeness for Information Technology Adoption*[24] focuses on domain specific innovativeness. This construct describes "a relatively stable descriptor of individuals that is invariant across situational considerations" within the domain of information technology. It is "the willingness of an individual to try out any new information technology."[25] Personal innovativeness influences both the causes and consequences of individual perceptions of technology. The characteristic behaviors of innovators in the domain of information technology are that these individuals tend to:

- Have greater mass-media exposure
- Place less reliance on the subjective evaluation of information technologies by other members of their social system
- Cope with higher levels of uncertainty and take risks
- Require fewer positive perceptions of an information technology for adoption[26]

Conclusion

In conclusion, the diffusion of innovation through the beliefs, attitudes and actions of individuals and the interactions of people with other people (in contexts and across contexts) has been observed empirically and described theoretically. We have a rich set of frameworks that justify and explain our focus upon the attitudes and actions of people as the building blocks for understanding the phenomenon of the Internet.

There are just two more foundational pieces to the theoretical puzzle that we call the user's view of the Internet. In the next chapter, we turn our attention to explaining the framework that is guiding practice in a number of the professional fields that have a keen interest in the way the Internet is shaping our lives. This framework applies some of the social psychology that has been at the heart of our discussion of technology acceptance and diffusion. It is called the user oriented paradigm. Some of the professional fields that are informed by this perspective are business and education, technology fields such as computer science and engineering, and the spectrum of professions that serve the expanding information industry including librarians, information managers and information system designers. These professional fields are key stakeholders in the social formulations, individual and professional applications and technological manifestations of the Internet. They are the practical and theoretical beneficiaries but also the shapers of *the user's view of the Internet*.

The second foundational aspect that we need to address is finding and explaining the metatheoretical abstractions that justify our focus on Internet users. We need to explain why and how our focus on Internet using by people provides us with a deeper level understanding of the Internet phenomenon. We reach this objective at the end of Chapter 3 and this sets the scene for the detailed synthesis of research data that appears in Chapter 4.

Notes

[1] Giovanni Dosi, "Sources, Procedures, and Microeconomic Effects of Innovation," *Journal of Economic Literature* 26, no. 3 (1988).

[2] Stephen E. Arnold, *Publishing on the Internet: A New Medium for a New Millennium* (Calne, England: Infonortics Ltd., 1996).

[3] Gary C. Moore and Izak Benbasat, "Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation," *Information Systems Research* 2, no. 3 (1991).

[4] e.g., Shirley Taylor and Peter A. Todd, "Understanding Information Technology Usage: A Test of Competing Models," *Information Systems Research* 6, no. 2 (1995).

[5] Ritu Agarwal and Jayesh Prasad, "A Conceptual and Operational Definition of Personal Innovativeness in the Domain of Information Technology," *Information Systems Research* 9, no. 2 (1998).

[6] Everett M. Rogers, *Diffusion of Innovations*, 3rd ed. (New York: Free Press, 1983).

[7] Fareena Sultan and Lillian Chan, "The Adoption of New Technology: The Case of Object-Oriented Computing in Software Companies," *IEEE Transactions on Engineering Management* 47, no. 1 (2000).

[8] Moore and Benbasat, "Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation," 195.

[9] L.G. Tornatzky and K.J. Klein, "Innovation Characteristics and Innovation Adoption-Implementation: A Meta-Analysis of Findings," *IEEE Transactions on Engineering Management* EM-29, no. 1 (1982).

[10] Moore and Benbasat, "Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation."

[11] Moore and Benbasat, "Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation," 195.

[12] Bruce, *Internet, AARNet and Academic Work: A Longitudinal Study*.

[13] Bruce, *Internet, AARNet and Academic Work: A Longitudinal Study*, 59.

[14] Moore and Benbasat, "Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation."

[15] Icek Ajzen and Martin Fishbein, *Understanding Attitudes and Predicting Social Behavior* (Englewood Cliffs, N.J.: Prentice-Hall, 1980).

[16] Icek Ajzen, "The Theory of Planned Behavior," *Organizational Behavior and Human Decision Processes* 50 (1991).

[17] Ajzen, "The Theory of Planned Behavior," 185.

[18] Fred D. Davis, "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly* 13, no. 3 (1989).

[19] Agarwal and Prasad, "A Conceptual and Operational Definition of Personal Innovativeness in the Domain of Information Technology"; Ritu Agarwal and Jayesh Prasad, "Are Individual Differences Germane to the Acceptance of New Information Technologies?" *Decision Sciences* 30, no. 2 (1999).

[20] Agarwal and Prasad, "A Conceptual and Operational Definition of Personal Innovativeness in the Domain of Information Technology."

[21] Agarwal and Prasad, "A Conceptual and Operational Definition of Personal Innovativeness in the Domain of Information Technology," 206.

[22] Agarwal and Prasad, "A Conceptual and Operational Definition of Personal Innovativeness in the Domain of Information Technology."

[23] Dorothy Leonard-Barton and Isabelle DesChamps, "Managerial Influence in the Implementation of New Technology," *Management Science* 34, no. 10 (1988).

[24] Agarwal and Prasad, "A Conceptual and Operational Definition of Personal Innovativeness in the Domain of Information Technology."

[25] Agarwal and Prasad, "A Conceptual and Operational Definition of Personal Innovativeness in the Domain of Information Technology," 206.

[26] Agarwal and Prasad, "A Conceptual and Operational Definition of Personal Innovativeness in the Domain of Information Technology," 207.