

## Chapter 2

# Technological Availability: Structural and Macro Factors

Cindy loved to travel and she loved to read. When she was young, she was an armchair traveler, watching travel-related programs on TV, voraciously reading travel books, and poring over travel brochures. While still a student, she traveled with her family to various places within the United States—Disney World in Florida, the Newport mansions in Rhode Island, the Air and Space Museum in Washington, DC, and other places that held the interest of her family.

Now that she was on her own with a steady job and free from responsibilities, Cindy was considering traveling farther afield to those places she had only read of. As she browsed the Internet to read about exotic destinations, tours, prices, and travel experiences, she wondered if she could travel with her eBook. With all the restrictions on luggage placed by airlines, she knew she had to pack wisely and lightly.

But would the eBook work outside the U.S.? Some of her friends, who lived in more remote areas where the communication network was less extensive, had experienced difficulties. Some suggested she download all her reading material on to her eBook before she traveled so she would be free from worries about the state of the technological infrastructure while traveling abroad. Should she spend the time and money loading up the eBook at one time? She wondered how she should approach this problem.

The above scenario describes some of the conditions necessary for technologies to work. While Cindy lived in a dense urban area in an advanced economy, where the telecommunications infrastructure supported the convenient use of the latest technology—an eBook; not all consumers are equally fortunate. A quick examination of Amazon.com's *Kindle* coverage, which relies on 3G networks, suggests that it is available in 100 countries (as of February 2010) but the coverage within a country varies. For instance, in the U.S., coverage is better in the densely

populated northeastern states; but even within this region, the coverage is not as extensive in the larger or more rural states such as Pennsylvania or Vermont. The newest *Kindle* can be used wherever there is Wi-Fi connection but additional costs are incurred when 3G networks are used to access resources.

Network coverage and speed as depicted in the coverage maps for various cell phone carriers in the U.S. (see [www.deadcellzones.com](http://www.deadcellzones.com), for instance) suggest that quality of the network and therefore quality of service is determined by where you live. In emerging countries, where cell phone penetration is frequently higher than landline phone penetration, there are issues of coverage and cost because of lower density of usage (<http://tier.cs.berkeley.edu/wiki/wireless>). To understand consumer adoption behavior, we have to consider the extent and quality of technology infrastructure deployed at a particular time or a particular geography which shapes both the supply and demand of specific technologies.

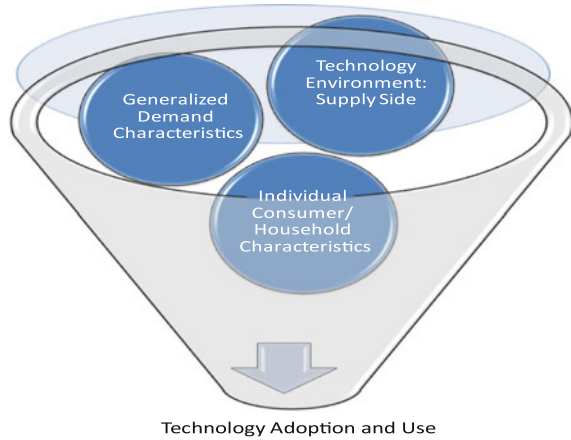
As described in the opening scenario, the ability to use a specific technology such as an e-reader or mobile phone is dependent on macro environmental factors such as the level of infrastructure development. Recent hacking of the SONY Playstation network exposed millions of online gamers; since service restoration was geographically staggered, not all gamers could resume the service at the same time. Restrictions on social networking and micro blogging sites such as Facebook or Twitter during the political upheavals in the Middle East revealed how governments can control access to these technologies even when they are available in any particular market. A recent incident in the San Francisco Bay Area, when its rapid transit authority (BART) interrupted cell phone service, bypassing the actual cell phone carriers, indicates some of the limitations that can be arbitrarily imposed on use of various technology-based services even in democratic societies.

In this chapter we examine the macro level factors that influence the availability of technologies. We begin with the environmental context within which technologies are made available in the markets. The environment may be viewed at two different levels of specificity, starting with the larger technological environment consisting of the regulators and suppliers of technologies, followed by the social and cultural context that create generalized demand characteristics. These two forces influence individual consumers and household spaces, where technologies are placed for use. These broad, macro level forces have transformed consumer behaviors along several major dimensions. The following pages in this chapter focus on these broad forces (Fig. 2.1).

## Technology Environment: Supply Side Characteristics

Technology choices available to consumers have expanded significantly over the last century. In 1900, 18% of American families used ice to cool their food items; by 1930, 40% used ice but 8 % had adopted mechanical refrigerators. At the same time, washing machines (24%), vacuum cleaners (30%), and dishwashers (1%)

**Fig. 2.1** Macro factors affecting demand for technologies



were also present in U.S. families (Lebergott 1984). As described in the previous chapter, not only did consumers have a greater choice among different household technologies (such as washing machines, refrigerators, TV, etc.) but also choices within each technology expanded as new and improved features were continuously innovated to increase the functionality and status appeal of each.

In recent years, remarkable changes in the creation, transmission, processing, storage, and display of information have characterized the supply side (Dholakia and Dholakia 1995). Table 2.1 captures some of the developments till about 1995. In 1950, for instance, the typewriter was used to process text; by 1995, the computer had replaced the typewriter as the primary text processor. Similarly, storage of video was primarily on celluloid film in 1950; digital disks had become the video storage device by 1995.

Technological advances continue to accelerate. Today, content creation is not limited to specialized individuals; consumers have become creators and use the latest transmission technology to post and share text, audio, and video. Blogs, YouTube, Twitter have become important communication platforms. Storage and display choices have grown as well allowing anytime, anywhere consumption from hand-held devices, accessing digital files stored in cloud servers. These advances have expanded the ways in which consumers conduct their lives. In terms of reading text, we have a choice to read the “old fashioned way” via printed pages, online on a screen of a laptop or desktop computer, or on hand-held specialized devices such as Amazon’s *Kindle*, Barnes and Noble’s *nook*, or Apple’s *iPad*. It is no longer necessary to access files stored in physical format or in fixed locations. Similar choices exist in most spheres of our lives—shopping, banking, communicating with each other, and entertaining ourselves.

Since consumer adoption and use is a function of the available choice set at any one point in time, it is important to understand the factors that influence the size and composition of the choice set. The role of the supply side may be understood in terms of structural theory at the economic system and industry levels. The two

**Table 2.1** Classifying the information business

	Creation	Transmission	Processing	Storage	Display
Text	Author	Teleprinter	Typewriter	File cabinet	Printed page
	Author and hypertext	E-Mail	Computers	Chips	High-resolution color monitor
Graphics	Artist	Mail	Blueprint	Chart rack	Drawings
	Artist and CAD	Fax	Computer graphics	Disks	Color printer
Data	Researchers	Mail	Calculators	Punch cards	Printed page
	Researchers and sensors-scanners	File transfer	Computers	Magnetic tape	Laser printer
Audio	Musicians, performers	Telephone	Amplifiers	Vinyl records	Gramophone
	Musicians and synthesizers	Digital radio	Computerized recording studio	Audio CD	Concert-quality music systems
Video	Scriptwriters, performers	Broadcast television	Early TV studio	Celluloid film	Black and white television
	Writers, performers, special effects	Broadcast/cable TV	Computerized multimedia studio	Digital disks	High definition TV

Information business circa 1950 shaded—information business circa 1995

Source Dholakia and Dholakia (1995)

major components of the supply side are the regulatory and infrastructure environment of the economic system created or facilitated by the government. The other, more direct component of the supply side, is the number and nature of technology providers themselves. The two components are inter-related in several different complex patterns.

## Regulatory Environment

An innovation cannot be adopted and used if it is not available to consumers. Of interest to us is the influence of the regulatory environment on the availability of the nature and patterns of technologies in various markets. For many technologies, macro factors such as government policies, regulations, and incentives determine availability and therefore, adoption paths/patterns and diffusion rates. A national electric grid, for instance, was created in England after the passage of the Electric (Supply) Act of 1926. Twelve years later, by 1938, 72% of homes in England and Wales were supplied with electricity which created necessary conditions for household acceptance of electrical appliances (Bowden and Offer 1996).

In the U.S., a government-permitted monopoly created a nation-wide, wired telecommunications infrastructure. Although competition at the local level was

lacking, industry's focus on connecting every household and every business customer to the network was financially rewarded under the rubric of the guaranteed rate of return. In 1984, the competitive landscape altered as a result of the Modified Final Judgment (MFJ) and the market emphasis shifted from providing universal basic service to segmented, enhanced services (Dholakia 1998). Not only dial tone to allow voice calls, but also services such as call waiting, call forwarding, 3-way calling allowed residential users to make varied use of the landline telephone service.

The growth of the wireless industry in the U.S. can be similarly attributed to the Federal Communications Commission's (FCC) support for a single wireless standard instead of multiphysical standards (Maeda et al. 2006, p. 591). In Japan, the growth of the mobile Internet resulted from the Japanese government's effort to lower the cost of data flow over the mobile network and NTT's DoCoMo's iMode services (Stout 2001). Today, the current state of regulations is much more complex that encompasses fixed-line, wireless, local, intrastate, and interstate calls which even regulators find difficult to monitor and creates an uneven playing field for different types of service providers. Regulatory policies will continue to affect the potential of the next innovations.

## **International Differences in Regulatory Environment**

The willingness of a country's political system to enact laws and regulations that facilitate (or inhibit) technological availability is an important part of the macro environment. Specific ways in which a government has helped or hindered have changed over the years. The history of postal service in England and U.S. is illustrative. In the early days of postal service, cost was paid by the recipient, not the sender, and postage was calculated based on distance. In 1839, Britain introduced the adhesive postage stamp, shifting the payment burden to the sender, increasing postal traffic but mostly from commercial users. In the U.S., the postal rate stimulated "free file sharing" as it was common to mail out newspapers to friends and family in 1800s: "Postal rates favored the practice, as newspapers could be remailed in their entirety for about what a single-sheet letter would cost—and the sender was spared the obligation of writing an actual letter" (Stross 2010, p. BU4).

Globally, vast differences exist in political support for investments in technological infrastructure. Some have argued that specific technologies are more compatible with certain types of societies. High Internet penetration rates in countries such as U.S., Israel, and Japan have been attributed to the positive role of civil liberty while its lack has been seen as a contributor to lower penetration rates in countries such as Cuba, Pakistan, and China (Dholakia et al. 2004). Political theorists have found authoritarian governments to have less favorable attitudes toward communication technologies such as the telephone and the Internet (Groth and Hunt 1985; Kshetri and Dholakia 2001).

Recognizing the need for political support, greater concerted efforts are being made to create a more encouraging political and regulatory environment. For example, encouraged by the World Trade Organization (WTO), 60 developing countries made commitments to promote competition in the telecom sector in 1997. When diffusion of specific technologies such as the Internet is impeded, international agencies have tried to step in. The United National Development Program (UNDP) connected the Internet in 15 countries to the global network and helped create over 40,000 web sites for governments and civil society stakeholders (UNDP 2001). The United Nations Conference on Trade and Development (UNCTAD) launched the Global Trade Point Network (GTPN) in 1992 to facilitate SMEs in accessing global markets, and attracted 20,000 trade organizations worldwide to connect to the system by 2000 (Dholakia et al. 2004).

In addition to political differences, there are many other societal characteristics that influence the regulatory environment as well as the private initiatives to invest in technology development and consumption. The Technology Achievement Index (TAI), developed as a measure of national “capacity to participate in the network age”, emphasized the network age because of the profound changes in the creation and diffusion of technological innovations; the concept included not only the capacity to innovate but more importantly the capacity to understand, adopt, and adapt new technologies (Desai et al. 2002). Using TAI, 72 countries (for which data was available) were categorized into four groups: leaders, potential leaders, dynamic adopters, and marginalized. Leader countries include Finland, US, Sweden, and Japan. As a result of emphasizing both creation and adoption of technologies, Finland, for instance, ranked higher as a leader country than U.S. because the “Internet is more widely diffused (in Finland) and more is being done to develop a technological skill base throughout the population” (p. 99). Leader countries have similar levels of human skills as the next group of potential leaders but differ in terms of innovations. Dynamic adopters such as Brazil, China, and India have made significant investments in technology infrastructure but are yet to have widespread diffusion to benefit the country as a whole.

Global differences in technological capacity have been measured in other ways as well. Among 161 countries examined on global differences with respect to personal computer and Internet penetration over the 1999–2001 period, computer penetration varied from a high of 62.50 per 100 people (US) to a low of 0.05 (Niger) and Internet users varied from 51.63 per 100 people (Sweden) to 0.02 (Myanmar). A whole set of factors—economic, demographic, infrastructure indicators, telecom pricing measures, and regulatory quality—is incorporated in the analysis (Chinn and Fairlie 2006). While income differentials contribute most to the explanation of the global digital divide, telephone density and regulatory quality are next in importance. “For instance, while 53.4% of the gap between the United States and Sub-Saharan African PC use is accounted for by income differentials, fully 40.7% of the gap can be attributed to the disparity in telecommunications infrastructure” (Chinn and Fairlie 2006, p. 40). Quality of regulation is seen as critical to investments and diffusion of technology (Koss 2001).

Direct government investments or regulations and incentives for private investments in infrastructure are important influences on technological availability for household adoption. Like many other countries, the U.S. government has been directly involved in the postal system which has influenced the development of the newspaper, magazine, and advertising industries. In 1790, there were only 75 post offices. As the population moved south and west, and from rural areas to urban and suburban areas, postal distribution points increased to serve the population. By 2009, the number of post offices had increased to 27,161 and various other types of distribution points were added to make sending and receiving mail easier and cheaper.

It was noted earlier that creation of a national electric grid created conditions necessary for household acceptance of electrical appliances in the U.K. Similar patterns are evident among U.S. consumers. In 1900, only 3% of U.S. families had electric lighting and no other appliance; electricity penetration increased to 68% of U.S. families by 1930 supporting mechanical refrigerators (8%), washing machines (24%), and vacuum cleaners (30%). By 1989, all families had electric lighting and refrigerators and washing machines were available in 75% of U.S. families (Lebergott 1993).

A country's level of electrification and income explains the diffusion of refrigerators and television around the world but washing machines and air conditioners are influenced by the country's level of income alone (Letschert and McNeil 2010). Adoption of electric appliances shows 100% adoption of refrigerators by 1989 but not of washing machines (Lebergott 1984). We know from research on the hierarchy of adoption of household durables reviewed in Chap. 1 that television and refrigerators are adopted much earlier in the hierarchy while washing machines and air conditioners are more discretionary and are adopted much later.

Investments in the basic infrastructure influence adoption of products that are located earlier in the order hierarchy or of basic services; once built and accessible to consumers, other variables such as household income become more important and additional durables become more discretionary. A nonlinear relationship between per capita electricity consumption and computer penetration has been similarly observed (Chinn and Fairlie 2006); per capita electricity consumption above 6,000 kWh did not affect computer penetration rates. Furthermore, as the first durable requiring a specific infrastructure (e.g., electricity, broadcast) is adopted, subsequent technologies are adopted at a faster rate. It took black and white TV 8 years, color TV 17 years but VCR only 10 years to reach 50% of American homes (Carey 1999).

## Industry Structure and Competitiveness

In concert with government regulations, industry structure—number, size, relationships—of technology providers determines the consumers' choice set. The traditional, landline telecom firms have been slow to innovate; as a result,

mobile telecom developed rapidly with new players coming from outside the entrenched landline carriers (Gruber 2001). In contrast, innovations in four technologies—desktop memory, display monitors, desktop printers, and data transfer—have come from larger enterprises than smaller ones, among both incumbent and new firms, possibly because “innovation has become far more complex. The deeper pockets of large firms enable incumbents to maintain state-of-the-art facilities to conduct research, and incumbency provides them with opportunity and resources for developing and introducing platform innovations” (Sood and Tellis 2005, p. 161).

When the (US) Telecommunications Act of 1996 redrew the competitive boundaries, market initiatives emerged from several directions, including traditional and non-traditional phone companies. In the early years, a fever of new initiatives raged in the country. In Rhode Island, for instance, Brooks Fiber Communications from St. Louis, Missouri used its own fiber network to compete with the established telephone company, but offered services only to the profitable business customers. In Denver, Colorado, Brooks Fiber joined with a local newspaper to offer ISDN phone services to its subscribers (Barmann 1997). The explosion of digital technologies created market opportunities and led to many new enterprises, partnerships, and mergers. Not all survive today. As one commentary on the TIME Warner and AOL collapse notes, AOL executives at the time of merger were ecstatic: “I don’t think it’s too much to say this really is a historic moment. From books to videos to financial services to travel to communications, you name it, the possibilities from combining our brands are endless” (Moon 2009).

Although the specific merger of TIME Warner and AOL failed, consumers today have many other sources of content, telecom services, and devices. Changes in the supply sides—in regulations as well as in industry structure—have increased the number of new technologies available to consumers. We can choose to watch videos using TV, computer, mobile phone, and other devices, often simultaneously, a choice vastly different from the one only a few decades ago. A phone call can be made over the landlines, using the cellular phone, or via the Internet using VOIP. The hand-held device can range from phone sets sold by traditional manufacturers such as Nokia and Motorola as well as smartphones newly launched by Apple and Google. Furthermore, the rate of technological change has also accelerated. The gestation period—the time taken to convert a patent to a commercial product—has decreased from an average of 25 years pre-1970 to 7.8 years post-1970 (Sood and Tellis 2005).

## Technologies Old and New

With technological advancements, the nature of functions derived from any particular technology has also been altered. The entertainment function was at one time only available from specialized technologies such as audio (radio and CDs) and video (TV), each requiring greater bandwidth. Information and



communication functions, on the other hand, could be accomplished over lower bandwidth networks using specialized devices such as the telephone or the computer-based e-mail applications (Noll 2007). With integrated technologies such as the Internet and the Web, text, audio, and video are being used and broadband technology—wired and wireless—has become an utility, just like electricity.

The faster pace of technological innovations has meant an accelerated array of consumer choices but not all technologies are accepted at the same rate nor do all households accept specific technologies at the same time. One major determinant of the differing rates of adoption and diffusion is the degree of newness of a technology. When it first appears, a technology is appropriately labeled an innovation, i.e., something new. In emphasizing the intrinsic characteristics of a technology, the focus is on the production of the innovation. Innovations in the desktop memory, display monitors, desktop printers, and data transfer have been in three types of technological change—platform, component, and design (Sood and Tellis 2005).

Commercial success of an innovation, however, is determined by consumer perceptions. *Secondary* or perceived attribute is important for actual adoption behaviors and “there can be no primary attribute of an innovation. Perceptions are always evaluated in reference to some internalized system of values or cognitive framework; the result is a subjective rating of the significance of the ‘fact’ (Tornatzky and Klein 1982, p. 28). This is consistent with views that emphasize the consumer and consumer perceptions; a product or service is new only if the consumer perceives it to be new.

Since perceived newness vary, innovations have been categorized as *continuous*, *discontinuous*, or *radically discontinuous* (Robertson 1971) based on the overlap with existing product categories and features and effects on established behavior patterns. A *continuous* innovation is a product or service which demands minor adjustment in consumer behavior (e.g., video game application played on a hand-held device now available as a mobile phone application) and a *radically discontinuous* innovation which is more disruptive of existing behaviors (e.g., written e-mail retrieved as voice messages or vice versa). The diffusion process has been found to differ depending on the type of innovation (Dickerson and Gentry 1983; Ganesh et al. 1997).

Sometimes the changes in the production system overlap the required changes in the consumption system. For instance, when music storage and listening moved from vinyl to magnetic tape and compact disk (CD) to laser optics, not only did the production system change but it also involved a great deal of change in the equipments and accessories needed by consumers to secure the benefits of the changes.

Everett Rogers (1962, 1986) identified specific attributes of an innovation and their relationships to adoption and diffusion. These include:

- *Compatibility*, which refers to the extent to which an innovation fits in with existing ways of doing things. For instance, the microwave oven when first introduced had low compatibility with pre-existing cooking utensils and behaviors. In general, lower the compatibility, greater the resistance of an innovation by potential consumers.

- *Trialability* offers the consumer an opportunity to use an innovation without making a full commitment—money as well as effort—through actual purchase. Some technologies are more easily tried; for instance, it is possible to select and listen to a specific song in a music album in a store like the Virgin mega store before its purchase. For other products or services, trials are encouraged by various means. *Onstar*, the emergency assistance service, is pre-installed in select GM automobiles to allow new owners to try the service free of cost for a limited period of time.
- *Complexity* in understanding and using an innovation hinders its adoption. Despite the potential time savings, online grocery shopping is perceived to be more complex in assessing product freshness and quality of grocery products. Perceived complexity in order and delivery planning has also stymied greater acceptance of grocery shopping online. Endt (2004) reports on the perceived complexity of consumer electronics that has led consumers either to delay purchases or return products previously purchased.
- *Observability* allows a potential consumer to determine the benefits of adoption by observing its use by others rather than directly using it. The cell phone, first introduced as a car phone, allowed its use to be observed by other automobile drivers and passengers and helped its widespread adoption. The touch screen of the iPhone contributed greatly to the observability of the new phone and led to the excitement about this specific feature.
- *Relative Advantage* is determination of benefits that are perceived to be superior to existing alternatives. Placing phone calls as VOIP, by using services such as Skype, are seen to be less advantageous than using the landline or cellular phone. It is leading Skype to consider broadening its availability through established mobile service carriers such as Verizon.

Additional characteristics of an innovation include divisibility, communicability, profitability, and social approval. In a meta-analysis of studies that examined innovation characteristics and innovation adoption and implementation, compatibility (+ve), relative advantage (+ve), and complexity (−ve) of the innovation were found to be most strongly related to consumer adoption (Tornatzky and Klein 1982).

In addition to these innovation characteristics, it is important to consider the relationships between clusters of innovations. Consumption in the material world does not change marginally or linearly; instead “it takes a discontinuous form, requiring leaps to new consumption clusters. Movement *within* the cluster is continuous.... But movement *between* clusters is a different matter. One does not drift into a new cluster by inadvertence; the change requires an element of strategy, typically effected at the household level” (deVries 2008, pp. 35–36).

Consistent with this perspective on clusters of innovation, owners of backyard satellite dishes in the rural Midwest were more likely to also own a VCR, a CD, and a PC (Litman et al. 1991). Greater willingness to try a new movie-on-demand service (Tele-cinema) was similarly noted among those consumers who have already invested in related video technologies such as VCR, video rental

**Table 2.2** Adoption time for new consumer technologies

	Number of years to reach 50% of American homes
Color TV	17 <sup>a</sup>
VCR	10 <sup>a</sup>
Personal computer	17 <sup>a</sup>
Web-based Internet	10 <sup>b</sup>

Source Adapted from <sup>a</sup> Carey 1999; <sup>b</sup> Thierer 2000

memberships, and subscription to premium cable channels such as HBO (Dholakia 1996).

Both innovation characteristics as well as the relatedness of alternative technologies explain some of the differences in time taken to adopt new technologies. As the following table suggests, it took 17 years for color TV to reach 50% adoption among U.S. households. VCR, on the other hand, took only 10 years to reach the same level of penetration. Similarly, it took longer for personal computers to reach 50% of U.S. homes but Web-based Internet diffused much faster (Table 2.2).

Demand-Side, Macro Level Orientations to Technology

The Technology Achievement Index (TAI) and other measures of innovativeness show that creation of new technologies is still concentrated in a few countries in the world. For consumption of technology, market availability is necessary. Not all technologies are available in various markets at the same time. Microwave ovens, for instance, were first introduced in the western states in the U.S. and sales spread eastward (Oropesa 1993). Decisions to make a technology available are influenced greatly by demand characteristics such as economic potential of the market (per capita income, infrastructure development), cultural factors (language, women’s role), etc. In addition, firms follow different strategies—“waterfall” (sequential) or “sprinkler” (simultaneous)—to introduce new products to multiple markets.

National and Cultural Values

The importance of economic factors, particularly income per capita, has been well established in the adoption of technologies. Income differentials contribute most to the digital divide (Chinn and Fairly 2006) and income differences explain a country’s level of adoption of washing machines and air conditioners.

Cultural factors are also important; as members of a specific national culture, consumers share certain values, beliefs and practices. Investigations of country-

specific cultural factors have relied upon Hofstede's (1980) classification of cultural dimensions. National cultural values are important in helping explain differences in innovative tendencies among consumers in various countries. In a study of the antecedents of consumer innovativeness at the national and individual levels, three dimensions—individualism, uncertainty avoidance and masculinity—were used to investigate 11 European Union countries using a mail survey; the results support the significant positive effects of individualism and masculinity and the negative influence of uncertainty avoidance (Jan-Benedict et al. 1999).

The national differences in consumer innovativeness explain why some markets are more attractive as lead markets and are the first to experience a new technology. Germany, for instance, had early introductions of VCR (1970), microwave oven (1974), home computer (1981), and CD player (1984) while Spain and Portugal were late adopters. A country's cosmopolitanism, for example, increased its propensity to innovate (Kumar et al. 1998). Cultural similarities between two countries in terms of characteristics such as power distance, masculinity/femininity, uncertainty avoidance, and individualism influence diffusion patterns: "diffusion of an innovation is faster in lag countries that are culturally similar to the lead country" (Ganesh et al. 1997). While influence from the lag to the lead country exists, the influence is greater from the lead to the lag country (Kumar and Krishnan 2002).

## Macro Ideological Orientations

In addition to general national and cultural values, there are several specific macro orientations to technology that influence consumer demand for technologies. The semiotic square was used to present four alternative ideologies—Techtopian, Green Luddite, Work Machine, and Techspressive—that represent consumers' macro orientations (ideologies) toward technology; the latter two ideologies expand on the basic binary opposition between the former two ideologies. (Kozinets 2008).

The Techtopian is a consumer who is most likely to advocate and adopt new technologies that signal social progress. To many of them, the pull of new technologies is hard to resist. As Shaviro (2003) comments, the Internet is "even cooler than television" because it draws the consumer in, addressing not only his eyes and ears, but also his entire body, making Web surfing a tactile, physical experience, offering experiences in multiple, overlapping speeds, times, and spaces. Those looking at technology as work machine, see and use technology for productive purposes, always connected, always 'on', viewing it positively as contributing to economic efficiency. Others emphasize the 'pleasurable' aspects of technology, seeing and using it to extract hedonic values.

The Luddites, on the other hand, emphasize the destructive side of technology. Rattle (2010) sees the more recent Internet and Communication Technologies (or ICTs) continuing the trajectory of destroying ecological diversity—in terms of

disappearing cultural values and social practices. “The application of ICTs to empower and learn from other cultures manifests a tangible likelihood that they may draw these peoples into the consumer society with all its cultural baggage: consumer and producer lock into materialistic growth processes and structured inequality”, “creating a set of globally conforming cultural values, institutional structures, and social norms—a new global worldview within which only minor aberrations are permitted?” (p. 124).

Different societies and periods of history have emphasized one of these ideologies more than the other, creating a macro environment within which technologies are produced and consumed: “the late twentieth and early twenty-first century, the Techtopian Gospel of Progress has been ubiquitous in the mainstream and business press, expounded and evangelized by a plethora of writers, analysts, politicians, and businesspeople” (Kozinets 2008, p. 869). But the contradictions inherent in each ideological node prevent any one ideology to prevail; instead, there is dynamism in the model as consumers attempt to make sense between the alternative ideological nodes.

Part of the shifting balances can be attributed to emotional entanglements—both positive and negative—of the conflicting and complementing ideologies. Mick and Fournier (1998) identified eight different paradoxes associated with technology, some at the very concrete level which are widely experienced and easily articulated; others more abstract and subtle and not easily expressed by consumers. A paradox “*is both X and not-X at the same time*” and unlike cost-benefit analysis, “the paradox perspective highlights the friction, indeterminacy, and required vigilance that accompany ongoing activities or interactions with anything in daily life that harbors a paradoxical nature” (Mick and Fournier 1998, p. 125). These paradoxes influence emotional states as well as coping strategies adopted by consumers. For instance, technology can be seen as both freedom and enslavement and these conflicting ideologies create both positive and negative emotions as well as use and withdrawal. Alternative ideologies and paradoxes coexist in the lives of consumers, making “technology consumption (is) a complex affair, laden with history, driven by industry, supported by society” (Kozinets 2008, p. 878).

## Conclusion

The macro level factors—at the supply and demand levels—greatly influence the adoption and diffusion of household technologies. Government forces through regulations, incentives, and standards shape the environment within which specific technology developers and providers emerge and compete. Commercial success, however, depends on how the choices available in a market relate to the demand forces at the societal and group levels.

The contradictions and paradoxes have not held back the household adoption of technologies even if they may affect the timing of purchases or extent of use.

The average household today is filled with technologies—technologies that promise to make our work easier and our leisure more enjoyable. In 1950, only 10% of U.S. households owned a TV set. By 2003, an average American home had two color TV sets, a dishwasher, a microwave oven, a VCR and DVD player, a personal computer, a cell phone, a cordless phone, and an answering machine (Editors of New Strategist Publications 2003).

The next level of explanation has to focus on differences at the individual consumer level and that topic is elaborated next. Chapter 3 elaborates upon individual-level variables that influence consumer decisions to evaluate, acquire, and utilize various technologies. The discussion is at a general level. In succeeding chapters (Chaps. 4–7), specific consumer activities that have been transformed by technological advancements are addressed.

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