

Time lag between innovation and useable product

We are all taught at school that Alexander Fleming discovered penicillin in 1928. He was working in his lab trying to kill a deadly bacteria, when he noticed a blue mould growing on the petri dish. He noticed that the bacteria around the mould was dissolving. But, for almost 10 years, nobody could purify the mould. Finally, in 1938, a team of scientists led by Howard Florey (Australian born) and Ernst Chain (German born) helped to develop penicillin. It was first used in the Second World War where it was mass produced by the US Department of Agriculture. But it did not become widely available until after 1945. So, we have a period from 1928 from the invention, to 1943 when we have a useable product – 15 years. Interestingly, the Nobel Prize for medicine was won in 1945 by all three: Florey, Chain and Fleming. Clearly, the Nobel Foundation recognises their equal contribution. Chain and Florey are not so widely remembered. This partly helps to explain the misunderstanding we have with innovation: that we fail to acknowledge the 15 years of work turning the idea into a commercial product.

Adoption is defined as the relative speed at which participants adopt an innovation. Rate usually is measured by the length of time required for a certain percentage of the members of a social system to adopt an innovation (Rogers, 1962). In general, individuals who first adopt an innovation require a shorter adoption period (adoption process) when compared to late adopters. Within the adoption curve, at some point the innovation reaches critical mass. This is when the number of individual adopters ensures that the innovation is self-sustaining.

Innovation and the market

We have explored the reasons why some state that contexts are more conducive to deeper levels of entrepreneurial activity and innovation, whilst others promote ‘petty entrepreneurialism’ with short-term, accumulation-ridden intentions. This chapter also tries to explain how some nations achieved a strong transformation from basic industries and joined the vanguard of technology development. In that respect, it was suggested that, although knowledge accumulation is a socially and spatially focused process, geographical shifts have occurred throughout history when ‘state-societal arrangements’ were conducive and there may be possible openings for late-developing nations in the future. This, however, is by no means a simple process.

Chapter 1 emphasised the inclusion of commercialisation within the process of innovation. It is this part of the innovation process that proves so extremely difficult for many firms. There have been many exciting scientific advances, such as Alexander Fleming’s discovery of penicillin (1928) and Crick and Watson’s discovery of DNA (1953) but, in both cases, it was over 20 years later that commercial products emerged from the science and technology: antibiotics in the first case and numerous genetic advances including genetic fingerprinting in the second. Commercialising technology and new products, in particular, then, is one of the key challenges within innovation. We now turn our attention to this process and, in particular, the diffusion of innovations and market adoption.

Innovation and market vision

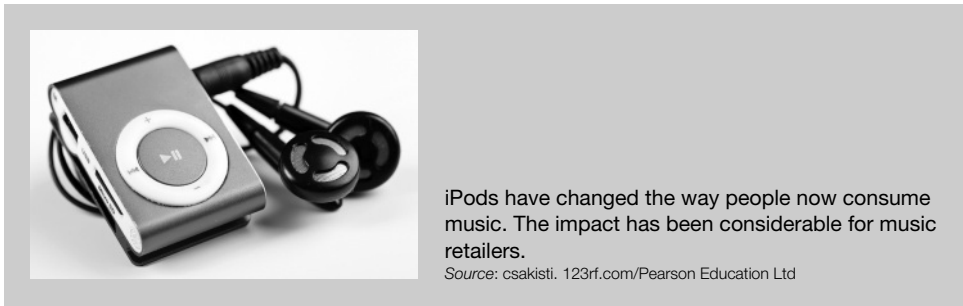
We all respond differently to different types of innovations. It is because of this that the role of marketing is so valuable to firms developing new products and services. For example, in the context of disruptive innovations, which require a greater change in existing patterns of behaviour and thinking, consumers would perceive a higher level of risk and uncertainty in their adoption decisions relative to continuous innovations that depend on established behavioural patterns and perceptions. Take internet banking as an example: this is a type of service that necessitates changes in perceptions and the established patterns of behaviour and requires the formation of new consumption practices. Indeed, the underlying internet technology itself is a disruptive innovation. Yet, herein lies the problem: highly innovative products have an inherent high degree of uncertainty about exactly how an emerging technology may be formulated into a usable product and what the final product application will be. **Market vision**, or the ability to look into the future and picture products and services that will be successful, is a fundamental requirement for those firms wishing to engage in innovation. It involves assessing one's own technological capability and present or future market needs and visioning a market offering that people will want to buy. Whilst this may sound simple, it lies at the heart of the innovation process and focuses our attention on the need to examine not only the market but the way the new product offering is used or consumed.

Analysing internet search data to help adoption and forecasting sales

Recently, researchers have used internet search traffic to analyse the immense body of information made available by hidden traces left behind by consumers. Jun et al. (2014) used search traffic to analyse the adoption process of a new technology, specifically hybrid cars. The research compared technology searches that specified the technology name with searches that specified the brand name. The results showed that the traffic of searches that specify a product's brand name was significant for explaining sales. Significantly, brand-focused search traffic showed a superior ability to forecast sales volume compared to macro-indicators, such as GDP growth or oil prices that had been used previously to forecast car demand.

Innovative new products and consumption patterns

Consumption pattern refers to the degree of change required in the thinking and behaviour of the consumer in using the product. Products involving consumption pattern changes, such as internet banking or MP3 players, can require customers to alter their thinking and habits and this may affect their willingness to embrace a new product. A product can be familiar or novel in the way it requires users to interact with it. The nature of the change involved with respect to this aspect of a new product can play a significant role in product evaluation and adoption (Veryzer, 2003). It is this dimension that Apple Inc. successfully



addressed in its MP3 player, the iPod. Apple was not the first to develop an MP3 player. Indeed, five years after launch, its capabilities were still fewer than its rivals (for example, in 2006 it did not have an FM radio). Yet, in terms of ease of use, it was considerably ahead of its nearest rival. In considering highly innovative products, it is crucial to take the customer's view and experience of the product into account. A technology-focused approach to innovation that does not consider the customer's perspective would, surely, result in a product that is at odds with the market's perception of it. Even though technology is the means for enabling an innovation, new products are more than simply bundles of technology, as Apple has demonstrated with its iPod. Innovative new products must deliver benefits and be used by people who can enjoy them and the advantages that they can bring about.

This introduces another variable that needs to be considered by the firm developing innovative products. In addition to new technology within the product and product capabilities, the firm must also consider how these will affect consumption of the product. Figure 3.1 illustrates the relationship between these three key variables that the firm needs to consider as it develops new product ideas. Sometimes, whilst the technology has been proven and the capabilities of the product demonstrated to be superior to existing products, if the extent of change in the pattern of consumption by the consumer is too great, the product may yet fail or take a long time to succeed.

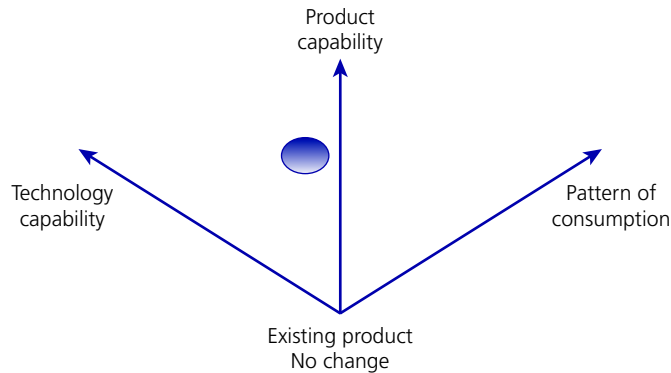


Figure 3.1 Three critical dimensions of change-of-technology intensive products

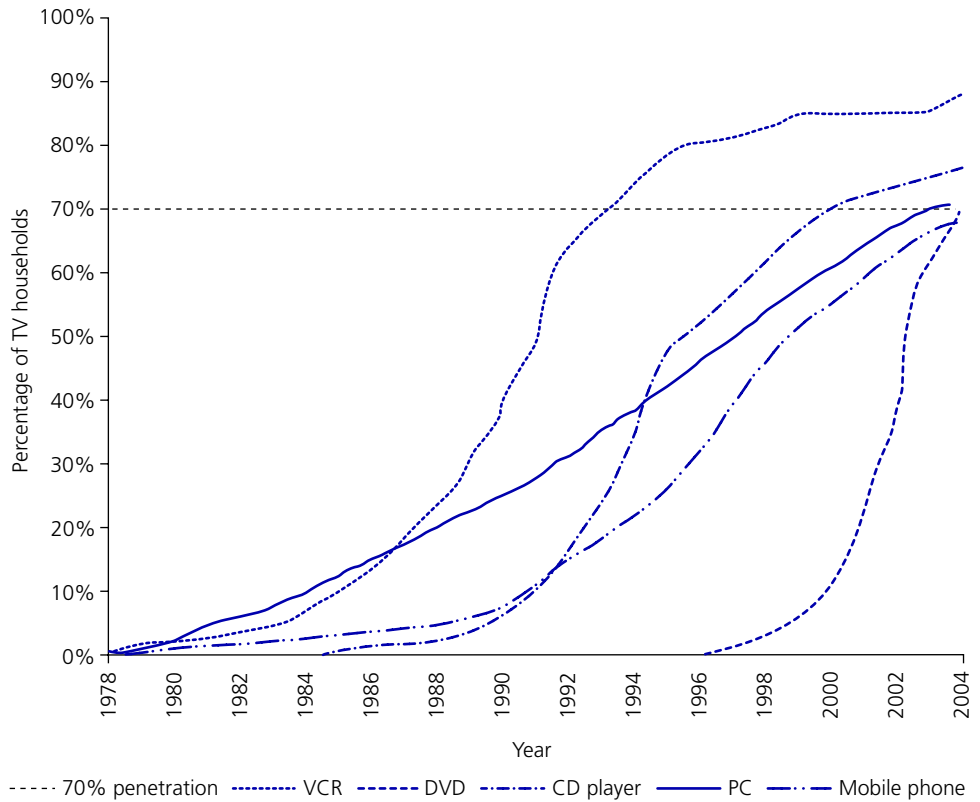


Figure 3.2 Penetration of consumer electronics, 1978–2004

A good example of this would be the failed Apple Newton (personal digital assistant) or even the personal computer which, as Figure 3.2 illustrates, took over 20 years to achieve a 70 per cent market penetration rate.

Pause for thought



If consumers are unwilling to embrace new products that impose a high degree of change in the consumption pattern for consumers, does this mean that firms should introduce only products that are similar to existing products?

Marketing insights to facilitate innovation

Marketing can provide the necessary information and knowledge required by the firm to ensure the successful development of innovative new products and the successful acceptance and diffusion of new products. In both cases, it is usually the insights with respect to understanding potential customers that marketing supplies. Uncovering and understanding these insights is where effective marketing is

extremely valuable. The Viagra case in Chapter 9 illustrates this very clearly. The deep insights necessary for truly innovative products requires great skill, as much of the information gained from customers for such products needs to be ignored (Veryzer, 2003). Research within marketing has shown for many years that gaining valuable insight from consumers about innovative new market offerings, especially discontinuous new products, is extremely difficult and can sometimes lead to misleading information (Veryzer, 2003; King, 1985; Tauber, 1974; Martin, 1995; Hamel and Prahalad, 1994). Indeed, frequent responses from consumers are along the lines of ‘I want the same product, only cheaper and better’. Von Hippel (1994) has suggested that consumers have difficulty in understanding and articulating their needs and has described this phenomenon as ‘sticky information’. That is, information that is difficult to transfer (similar to the notion of tacit knowledge). User toolkits have been shown to facilitate the transfer of so-called ‘sticky information’ and have enabled firms to understand better the precise needs and desires of customers (Franke and Piller, 2004). The greater uncertainties involved with discontinuous innovations demands both insight and foresight from firms. Advanced technology presents significant technical and market uncertainty, especially when the technology is emerging and industry standards have yet to be established. Appreciating and understanding the potential new technology and uncovering what the market will and will not embrace is a key challenge for marketing. Indeed, bridging the technology uncertainty and the market need is critical for a commercially viable new product. Figure 3.2 illustrates the penetration over time of a range of consumer electronic products from DVD players to mobile phones. The penetration rates differ considerably with some achieving a 70 per cent market penetration within a few years, such as DVD players, whereas PCs, as we have seen, took over 20 years.

Highly innovative or discontinuous new products are particularly demanding in terms of early timely information, if they are to avoid being judged harshly later by the market. Whether this information and knowledge is provided by marketing personnel or by R&D scientists and engineers does not matter, but its input into the new product development process is essential. The product development team need to determine (Leifer et al., 2000: 81):

- What are the potential applications of a technology as a product?
- Which application(s) should be pursued first?
- What benefits can the proposed product offer to potential customers?
- What is the potential market size and is this sufficient?

Beyond consumer concerns that are relevant to the development and marketing of innovative products are more macro influences that can affect adoption and thus need to be considered. The substitution of one technology for another is an obvious concern (the case study in Chapter 7 discusses this in more detail with regard to screw-caps replacing cork). Along with this, the issue of product complementarity, or when there is a positive interrelationship between products (e.g. a computer printer and a computer), can also be important with respect to product adoption. Thus, in addition to displacing products, new technological innovations often modify or complement existing products that may still be diffusing throughout a given market. This has significant implications for market planning decisions for both products, since their diffusion processes are interlinked (Dekimpe et al., 2000;

Norton and Bass, 1987, 1992). In such cases, e.g. new electric motor vehicles, the following need to be carefully considered:

- whether there is a positive interdependence between a new product and existing products;
- whether the old technology will be fully replaced by a newer product;
- how the size of the old technology's installed base will affect the speed of diffusion of the new product or product generation.

Lead users

Considering users as innovators has gained considerable support over the past 30 years. Eric von Hippel's work in this area (1977) forms a significant part of the theoretical underpinning and evidence behind the concept (**lead-user theory**). Many further studies have been undertaken to support it (e.g., Urban and von Hippel, 1988; Shah and Tripsas, 2007). It has contributed to our understanding of innovation management in general and new product development in particular. Clearly, whilst lead users can contribute to the innovation process, this contribution should not be overstated and it should be noted that arguably significant technology-based innovations remain driven by scientific advancement.

In their review of users as innovators in the *Journal of Management*, Bogers et al. (2010) explain that 'intermediate users are firms that use equipment and components from producers to produce goods and services' whereas 'consumer users – users of consumer goods – are typically individual end consumers' (Bogers et al., 2010: 859). They further illustrate that intermediate users that develop innovations have been shown to occur in the following industries: semiconductors (von Hippel, 1977), printed circuit CAD software (Urban and von Hippel, 1988), library information systems (Morrison, Roberts and von Hippel, 2000). Consumer users have been found mainly in consumer products and, somewhat surprisingly, in sports-related consumer goods, such as mountain biking (Lüthje, Herstatt and von Hippel, 2005), and kite surfing (Tietz, Morrison, Lüthje and Herstatt, 2005).

When it comes to explaining why users innovate, it is argued that they possess the distinctive knowledge and expertise necessary. For example, the development of kite surfing was possible only because of the expertise gained from years of experience of windsurfing (Franke and Shah, 2003). Indeed, in his later research, von Hippel (2005) argues that, when one compares innovations from producers with those of users, frequently those from users are distinctive because of the unique tacit knowledge they have gained from extensive use of the products (Bogers et al., 2010).

The lead-user school further contends that, whilst many users modify products for their own use, for example, computer hardware and software for industrial processes and high-end sports equipment (Haavisto, 2014), these innovations are concentrated amongst the lead users. The example of surfers is cited as an illustration: they developed an experimental surf board with foot-straps that enabled them to leverage the energy of waves to make controlled flights. Lead users are characterised as being ahead of the majority of users with respect to an important market trend and they expect to gain relatively high benefits from the solution to the needs they have encountered: '. . . lead users are users whose present strong needs will become general in a marketplace months or years in the future' (*idem.*, 107). Further, it is

argued that, by focusing on working with lead users, companies can increase the probability that they will discover innovative solutions that they can leverage and sell to their other customers. For companies seeking to increase their capacity to innovate, the lead-user school argues that it provides a firm foundation for a strategy of innovating with selective customers; and that it is a much more effective basis for an innovation strategy than the more traditional technology-centred approach, where scientific exploration and technology development lead to opportunities for firms to exploit. This approach led to the growth of a whole new sport, kite-surfing: ‘Clearly this had little to do with surfboard manufacturers who did not discover this innovation; rather it was innovative surfers’ (Franke et al., 2006).

When it comes to technology-intensive products, it is so-called lead users that form the basis for much insight into products and also help with the diffusion process. Lead users are those who demand requirements ahead of the market and, indeed, often are involved themselves in developing product ideas because there is nothing in the market at present to meet their needs. For example, Stephan Wozniak co-founded Apple Computer with Steve Jobs in 1976 and created the Apple I and Apple II computers in the mid-1970s. He was a lead-user computer engineer, ahead of the general population. Such lead users can help to codevelop innovations and are, therefore, often early adopters of such innovations. The initial research by Eric von Hippel in the 1970s suggested that lead-users adopt an average of seven years before typical users. In a recent study Morrison et al. (2004) identified a number of characteristics of lead users:

- recognise requirements early;
- expect high level of benefits from the product;
- develop their own innovations and applications;
- perceived to be pioneering and innovative.

Illustration 3.1

Shimano

Shimano product sales constitute 50 per cent of the global bicycle component market. Its products include drivetrain, brake, wheel and pedal components for road, mountain and hybrid bikes.

Shimano has consistently adopted an approach based on the introduction of innovation only at the high-end level of its products and then trickled the technology down to lower product levels as it became proven and accepted. This has helped Shimano deliver innovative new products for over 91 years. Shimano has, for many years, worked with elite athletes (i.e. lead users) to develop new product ideas. This has led to a wide variety of new product areas for the firm to exploit, such as specialist sports cycling clothing.



Source: Andrew Paterson/Alamy Images

Lead users are particularly significant for products that are using technology at the frontiers of development and those within technology-intensive industries, such as software, engineering and science. In a study of over 50 years of product innovation in the whitewater kayaking field, Hiennerth et al. (2014) found users in aggregate were approximately three times more efficient at developing important kayaking product innovations than were producers in aggregate. The researchers believe this was due to ‘efficiencies of scope’ in problem-solving, where users benefited from higher economies of scale in product development.

Users as innovators in the virtual world

Recent research by Chandra and Leenders (2012) shows user innovators in the virtual life broadly resemble those in the real life, as reported in the literature. Their study shows that ‘Second Life’ as a virtual world breeds opportunities leading to entrepreneurial acts in the ‘real’ world as well as further opportunities in the Second Life.

Crowdsourcing for new product ideas

Using the talent of the employees within organisations is one of the most fundamental challenges facing firms. Those firms that have been able to get their talented employees to work together have often been the same firms that have developed and launched exciting products and services. Most firms know this, but making it happen is difficult. For example, employee suggestion schemes have led to new product ideas and changes to the way firms operate to bring huge cost reductions. Over the past few years, two different firm concepts have developed and gained popularity amongst the business community. These are open innovation and crowdsourcing. Software manufacturers have spotted an opportunity to bring these two concepts together in the form of an innovation management tool for large firms with many thousands of employees. Essentially, this software allows employees to post an idea for others to see and comment. Other features exist to allow ranking and leaderboards for ideas. The software also allows firm managers to track the development of these ideas and to add resources and recognition. One of the main advantages of such software is the opportunity it provides for employees to share ideas and engage in product-centred discussions. One of the most successful is HYPE Innovation Management, a German software product. It is, essentially, an idea capture and rating system (see www.hypeinnovation.com).

Crowdsourcing is a method of getting ideas, content, support or other types of solutions from a group of people. The term was coined by *Wired* magazine in 2005. Effectively, it is outsourcing solutions to crowds through social media. Research by Poetz and Schreier (2012) suggests that, at least under certain conditions, crowdsourcing might constitute a promising method to gather user ideas that can complement those of a firm’s professionals at the idea-generation stage in NPD.

Crowdsourcing sites, such as Kickstarter and Indiegogo, allow fans to give financial support in exchange for incentives, so people can complete their projects. There are many other businesses that incorporate the idea of getting input from the masses

into their business model. Applause (formerly uTest) is a technology application-testing site that enables crowd beta-testing worldwide. Local Motors brings crowd-sourcing to new vehicle innovations. Businesses around the world can build consensus, get instant product feedback and listen to and incorporate customers' input. Engaging crowds to make products better is getting easier, thanks to social media and consumers' desire to have their voices heard. Many firms provide contests to encourage participation. Four of the most common techniques are illustrated below:

- 1 *Ask which product customers would like produced.* This toy store needed to know which LEGO product would sell the fastest, so it set up a simple vote contest and asked its customers directly. It motivated people to vote by running a giveaway of the winning LEGO set to a contest participant.
- 2 *Ask which products customers prefer.* The shoe company, Crocs, for example, hosts a 'new release shoesday' contest on Facebook. It engages its fans by asking them what their favourite new shoe is that week, and fans who participate have a chance to win Croc shoes. Crocs then gains relevant consumer insights about market preferences.
- 3 *Ask customers to name the new product.* In 2014, Sony looked to the public to help develop a name for its new wireless speaker product. The speakers are small balls in pink, white and black. Sony posted the contest on its blog and promoted it on all of its social sites, through media and other promotional methods. Participants entered their suggested names by commenting on the blog post.
- 4 *Ask customers for new product variations.* Walkers Crisps (Lay's) has been hosting contests to engage the public by creating new crisp flavour ideas. And the Lay's 'Do Us a Flavour' contest is one of the most successful new product crowd-sourcing campaigns. Participants can access the contest through Facebook or their contest landing page.

Illustration 3.2

Crowdsourcing product ideas for baby products

Generating ideas for new products used to be the exclusive domain of marketers, engineers, and/or designers. Whereas some have attributed great potential to outsourcing idea generation to the 'crowd' of users (crowdsourcing), others have clearly been more sceptical. Research by Poetz and Schreier (2012) undertook a comparison of ideas actually generated by a firm's professionals with those generated by users in the course of an idea generation contest. Both professionals and users provided ideas to solve an effective and relevant problem in the consumer goods market for

baby products. Executives from the underlying company evaluated all the ideas (blind to their source) in terms of key quality dimensions, including novelty, customer benefit and feasibility. The findings showed that the crowdsourcing process generated user ideas that score significantly higher in terms of novelty and customer benefit, and somewhat lower in terms of feasibility. Even more interestingly, it is found that user ideas are placed more frequently than expected amongst the very best in terms of novelty and customer benefit.

Frugal innovation and ideas from everywhere

The bottom of the pyramid is the largest, but poorest socio-economic group. In global terms, this is the three billion people who live on less than US\$2.50 per day. The phrase ‘bottom of the pyramid’ is used in particular by people developing new models of doing business that deliberately target that demographic, often using new technology (see Innovation in action below). Thus, developing no frills products and services is not new; one only has to look at airlines, retailing and automobiles. So, what is frugal innovation? In their book *Frugal Innovation*, Navi Radjou and Jaideep Prabhu (2015) argue it is more about the process of reducing the complexity and cost of a good and its production. Usually, this refers to removing non-essential features from a durable good, such as a car or phone, in order to sell it in developing countries. Designing products for such countries may also call for an increase in durability and, when selling the products, reliance on unconventional distribution channels. These are business ideas that have long been used before. However, it is the emphasis on so-called ‘overlooked consumers’, where firms hope large volume will offset small profit margins that may prove key. In many developing countries, rising incomes may also drive frugal innovation. Such services and products need not be of inferior quality, but must be provided cheaply (Bhatti et al., 2013).

For example, India’s Mahindra & Mahindra sells lots of small tractors to US hobby farmers. This, of course, raises concerns for US tractor manufacturer John Deere. China’s Haier has undercut Western competitors in a wide range of products, from air conditioners and washing machines to wine coolers. Some Western companies are turning to emerging markets first to develop their products. For example, Diagnostics for All, a Massachusetts-based start-up, developed small paper-based diagnostic tests. Interestingly, it chose to commercialise its idea first in the developing world so as to circumvent the USA’s slow approval process for medical devices.

Other examples abound. The chairman of the Chinese computer-maker Lenovo argued that it is the best company in the world at balancing innovation and efficiency. By keeping costs down, it has stolen market share from its big Western rivals. Lenovo has recently ousted HP to become the world leader in desktop computers. One may argue that the Chinese firm is not an imaginative innovator like Apple, whose radical designs transform whole markets. Rather, it is able to execute design and innovation economically and be a frugal innovator.

Frugal innovation has also been applied to public service design and delivery. In India and other developing economies, creating frugal solutions to deliver improved or previously non-existent public services has given more people access to a wider range of services.

Innovation in action

Bottom of the pyramid diffusion: toilets in India

India leads the world in open defecation. Over 600 million Indians lack toilets, according to the latest census data, a crisis that contributes to disease, childhood malnutrition, loss of economic output and, as highlighted recently, violence against women.



For generations, most of the 750 families in Katra, in Uttar Pradesh, northern India, have lived without toilets. They have grown used to holding their bladders and bowels, being stalked by wild boars and hyenas and, during the rainy season, watching out for snakes. But, since May 2014, when two girls, 14 and 15, were found gang raped and hanged after they went to relieve themselves in the dark, Katra's residents have been gripped by a new fear.



Source: think4photop/Shutterstock.com

Sanitation is a good example of product innovations for the poor at the so-called bottom of the income pyramid. Research by Ramani et al. (2012) has examined why and how sanitation entrepreneurs are succeeding in India to diffuse toilets – an innovation for rural households, which never had access to one before. Their findings show that progressive sanitation entrepreneurs are succeeding because of their adoption of a 'market-based approach'. There are market failures stemming from the demand side, due to problems in knowledge, expression of demand and its mismatch with the perceived value of the innovation. To overcome these informational asymmetries and sluggish market demand, sanitation entrepreneurs use creative offers and pricing to ensure sustained use of toilets.

Source: <http://www.theguardian.com/global-development/2014/aug/28/toilets-india-health-rural-women-safety>; Ramani, S.V., SadreGhazi, S. and Duysters, G. (2012) On the diffusion of toilets as bottom of the pyramid innovation: lessons from sanitation entrepreneurs, *Technological Forecasting and Social Change*, vol. 79, no. 4, 676–87.

Innovation diffusion theories

Technological diffusion is the process by which innovations, whether they are new products, new processes or new management methods, spread within and across economies. Diffusion involves the initial adoption of a new technology by a firm (inter-firm diffusion) and the subsequent diffusion of the innovation within the firm (intra-firm diffusion), the latter being the process by which the firm's old technologies and facilities are replaced by new ones.

Innovation diffusion theories try to explain how an innovation is diffused in a social system over time; the adoption of an innovation is, therefore, a part of the wider diffusion process. Such theories tend to be more comprehensive relative to

their **adoption theory** cousins. This is because they investigate the reasons for adoption at the aggregate level. Perceived innovation characteristics theory, which is a part of the innovation **diffusion theory** of Rogers (1962), is similar to adoption theories, such as the theory of reasoned action (TRA), the theory of planned behaviour (TPB) and the technology acceptance model (TAM), as it includes analysis down to the individual level. Yet, diffusion of innovation theories, in general, includes many more factors, such as the influences of psychological or personal features, technology perceptions, communication behaviour and socio-demographic attributes on diffusion or adoption process. It is worth saying at this point that the study of how and why consumers purchase goods and services falls within the arena of consumer buyer behaviour and there are lots of very good textbooks that explore this subject in great detail. The purpose of introducing some of these concepts here is to ensure the reader is aware of the important influence of this body of research on explaining how and why some new product innovations are successful and why others are not.

Everett Rogers is usually credited with introducing the concept of diffusion theory to the business community. Rogers' work was undertaken initially in developing countries where he studied the diffusion of new ideas amongst communities (Rogers, 1962). He later developed his work and applied it to new product innovations in the market and was able to illustrate different consumer categories on the basis of its relative time of adoption. Rogers (1983) stated that the adopter categorisation in relation to adoption time requires the determination of the number of adopter categories, the percentage of adopters in each category, and a method to define these categories. Rogers' (1962) adopter categorisation is based on a normal distribution curve that shows the adoption of an innovation over time on a frequency basis, which takes the form of an 'S' when plotted on a cumulative basis (see Figure 3.3). Indeed, the diffusion curve is much related to the concept of the product life cycle, which shows the level of total sales over time. The close relationship between these two concepts would be expected to the extent that sales are proportional to cumulative adoption.

In this model, Rogers (1962) classified different adopter segments in terms of their standard deviation positions from the mean time of adoption of the innovation

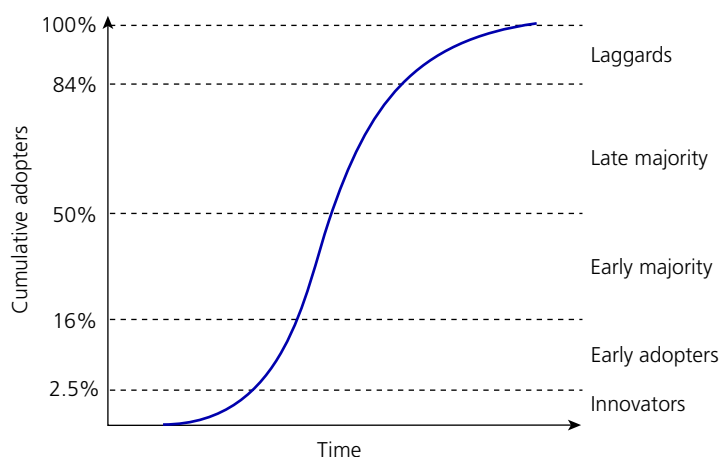


Figure 3.3 S-curve of cumulative adopters

for the entire market. In this way, he utilised the average and a normal distribution of adopters in order to group them into five categories and obtain the percentage of individuals to be included in each of these categories (see Figure 3.3). Rogers stated that innovators comprise the adopter segment, which adopts an innovation earlier than the other adopter groups. Innovators are followed by early adopters, early majority, late majority and laggards. In this context, Rogers assumed that these five diverse adopter segments differ on the basis of their demographical features, personality-related characteristics, communication behaviour and social relationships.

Rogers classifies stages in the technology life cycle by the relative percentage of customers who adopt it at each stage (Rogers, 1995). Early on are the innovators and early adopters (who are concerned with the underlying technology and its performance). Then come in succession the early majority pragmatists, the late majority conservatives and, lastly, the laggards (all of whom are more interested in solutions and convenience). In a contribution to this debate, Geoffrey Moore depicts the transition between the early adopters and early majority pragmatists as a chasm that many high-technology companies never successfully cross (see Figure 3.4) (Moore, 2004). Moore's contribution to the diffusion debate helped create new approaches for marketing in high-tech industries. His successful book *Crossing the Chasm* has proved popular for helping firms bring cutting-edge products to progressively larger markets. Clayton Christensen prefers to look at the phenomenon of technology take-up from the perspective of the level of performance required by average users (those in the early and late majority categories in Figure 3.3) (Christensen, 1997). He argues that, once a technology product meets customers' basic needs, they regard it as good enough and no longer care about the underlying technology.

Beacon products

Research by Peng and Sanderson (2014) on digital MP3 players suggests that, sometimes, a specific product model has great appeal to customers and sends a strong signal about what they want. They found that Apple's first iPod model triggered widespread appeal and that many competitors tried to emulate the original iPod

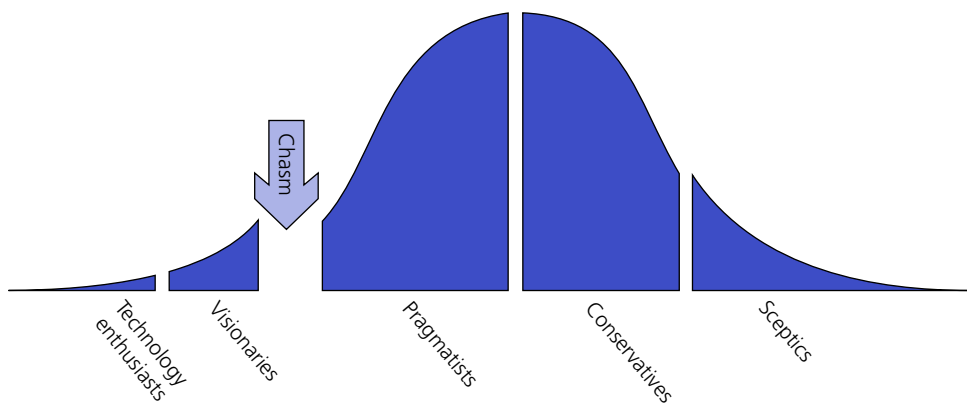


Figure 3.4 Adopter categorisation on the basis of innovativeness

Source: Adapted from Moore, G.A. (1991) *Crossing the Chasm*, Harper Business.

design, leading to convergence around its key design features. But it took the iPod/iTunes store combination, a new ecosystem for the legal download of digital music, to bridge the gap between early MP3 adopters, primarily young people, to mainstream markets. The iPod/iTunes ecosystem proved more difficult for competitors to copy and many of the firms that had pioneered the MP3 category, such as Creative, RCA and Dell, exited the industry or were relegated to small niches. By subsequently introducing new models at lower prices and expanding iTunes Store offerings, Apple effectively pre-empted competitors from gaining a share in this growing market (Peng and Sanderson; 2014).

In terms of demographical characteristics, earlier adopters, such as innovators and early adopters, are presumed to be younger, wealthier and better educated people. When personality-related characteristics are considered, the most distinguishing features of earlier adopters are that they are more eager to take risks and they hold more positive perceptions towards technology in general. Communication behaviours of earlier adopters are assumed to differ on the basis of their media usage behaviour and interpersonal communications with the rest of the consumer segments. Therefore, these people are supposed to be opinion leaders in their social relationships throughout the diffusion process.

Diffusion may also be examined from an even more macroperspective and, in some instances, it can be particularly important to do so. For example, researchers like Dekimpe et al. (2000) have investigated the global diffusion of technological innovations. In their work, they focus on issues concerning the two-stage (implementation stage and confirmation stage) nature of the global diffusion process as defined by Rogers (1983), the irregularity of a diffusion pattern due to network externalities and/or central decision makers, and the role of the installed base of older-generation technologies that an innovation replaces (Dekimpe et al., 2000: 51). As they point out, 'For most innovations, the adoption process of each country starts with the implementation stage, which is followed by the confirmation stage.' However, they point out that, for technological innovations, within-country diffusion might be instantaneous – due to network externalities (e.g. established standards) or central decision makers – and, as such, the confirmation stage for certain countries may have a zero duration. As previously discussed, a good example of this was the introduction of digital television within the UK. The UK Government, through the BBC, invested considerable sums of money to educate and inform the population about the advantages of digital television over analogue and to explain that the country will eventually stop transmitting television over analogue signals.

The mobile handset market was once highly profitable; it seems now it has become a commodity. As technologies diffuse within an economy, firms face declining marginal profits, especially in a saturating market. If this is then coupled with proliferation of competitors, over-estimation of demand and diminishing margins, those once attractive markets soon turn ugly. Hence the need for firms to continually adopt new technologies and cling on to their attractive margins: this is the fickle world of market adoption.

Pause for thought



Given that the internet, and now mobile banking, has been available for over 20 years, do you think internet banking has crossed the chasm? Is it always just a matter of time and, so long as you are patient, products will always eventually succeed?

Seasonality in innovation diffusion

Firms have recognised, for some time, how seasons affect diffusion. It appears that cosmetics are affected by the seasons, as weather conditions and emotional changes affect consumers' beauty habits and regimes and offer manufacturers the chance to capitalise with products for specific needs. The ability to forecast new product growth is especially important for innovative firms that compete in the marketplace. Today, many new products exhibit very strong seasonal behaviour, which deserve specific modelling, both for producing better forecasts in the short term and for better explaining special market dynamics and related managerial decisions (Guidolin and Guseo, 2014).

The Bass Diffusion Model

The Bass Diffusion Model was developed by Frank Bass and it contributed some mathematical ideas to Rogers' concept. Frank Bass's model consists of a simple differential equation that describes the process of how new products get adopted in a population. The basic premise of the model is that adopters can be classified as innovators or as imitators and the speed and timing of adoption depends on their degree of innovativeness and the degree of imitation amongst adopters. The Bass Model has been widely used in forecasting, especially new products' sales forecasting and technology forecasting. For example, Turk and Trkman (2012) use the Bass Diffusion Model to analyse broadband diffusion for European OECD member countries. Their research shows that, if the present trends continue, broadband services will not reach the 100 per cent penetration rate in the near future.

Adopting new products and embracing change

Diffusion is, essentially, consumer willingness to embrace change. But change can be simple and complex. These range from a change in perception to a significant change in required behaviour in order to use the product. For example, dishwasher appliances require a significant shift in the way people behave in the kitchen and their approach to using cutlery and crockery; similarly for iPods with regard to storing and collecting music. Consumers' reactions to innovative new products and their willingness to embrace them are also, of course, driven by the benefit they expect to derive from the products. For discontinuous innovations, such products, which often involve new technologies, frequently require changes in thinking and behaviour and hence require more from the consumer. Unsurprisingly, these products carry a high risk of market failure. When it comes to technology, consumers have a love-hate relationship with it and this is because of the paradoxes of technological products. For example, products such as appliances that are purchased in order to save time, often end up wasting time. In their codification of the various paradoxes discussed across the technology literature, Mick and Fournier (1998) present a typology of paradoxes of technological products. These are captured in Table 3.1. These paradoxes play an important role in shaping consumers' perceptions of innovations as well as determining their willingness to adopt new products.

In the world of mobile communications, user interface, as the interactive layer between user and information systems, has a great role in system adoption. Research

Table 3.1 Paradoxes of technological products

Paradox	Description	Illustration
Control – chaos	Technology can facilitate order and it can lead to disorder	Telephone answering machine can help record messages but leads to disorder due to uncertainty about whether the message has been received
Freedom – enslavement	Technology can provide independence and it can lead to dependence	The motorcar clearly gives independence to the driver but many drivers feel lost without it
New – obsolete	The user is provided with the latest scientific knowledge but this is soon outmoded	Computer games industry
Efficiency – inefficiency	Technology can help reduce effort and time but it can also lead to more effort and time	Increased complexity in Smart TVs has led to many wasting time in setting recordings
Fulfils needs – creates needs	Technology can help fulfil needs and it can lead to more desires	The internet has satisfied the curiosity of many but has also stimulated many desires
Assimilation – isolation	Technology can facilitate human togetherness and can lead to human separation	Email and social media help communication but, in some cases, heavy users can become isolated
Engaging – disengaging	Technology can facilitate involvement but it can also lead to disconnection	Advances in mobile phone memory means that many people no longer need or have the skills to discover the telephone number from a telephone directory

Source: Adapted from Mick and Fournier (1998).

by Basoglu et al. (2014) shows acceptance of a system can be explained as a function of perceived usefulness (PU) and perceived ease of use (PEOU).

In addition to the various trade-offs or paradoxes that affect consumers' willingness to embrace innovative products – an aspect of a new product offering that should be considered in the design stage as well as the later product launch stage – consumers develop their own ways of coping with innovations and these can impact diffusion as well. Potential customers may ignore a new technology altogether, delay obtaining the new product, attempt to try an innovative new product without the risk of outright purchase, embrace the product and master it, and so on (Carver et al., 1989; Mick and Fournier, 1998). Furthermore, in evaluating discontinuous new products, there are certain factors that are likely to come into play more than they do for less innovative products. Lack of familiarity, irrationality, user–product interaction problems, uncertainty and risk, and accordance or compatibility issues may play a decisive role in customers' evaluations of products in either the development and testing stages or once the product is introduced into a market (Veryzer, 1998a: 144). For example, during the course of one radical innovation development project, managers were struck by how irrational customers were in that they often focused on things that the product development team thought to be unimportant, and test customers ignored aspects of a prototype product that the team had expounded a great deal of effort and money on. Even though this type of irrationality may frustrate product development teams, in the domain of highly innovative products, assumptions must be checked against those who will be the final arbiters of success (Veryzer, 1998b).

Generally, radical innovations are not easily adopted in the market. Potential adopters experience difficulties to comprehend and evaluate radical innovations due to their newness in terms of technology and benefits offered. Consequently, adoption intentions may remain low. A study by Reinders et al. (2010) shows that product

bundling enhances the new product's evaluation and adoption intention, although it does not increase comprehension of the radical innovation. Thus, offering a radical innovation in a product bundle could be a fruitful strategy for companies that target customers with little or no prior knowledge of the product domain.

Recent research on the general factors related to the adoption of mobile services suggests firms still lack precise information about consumer adoption factors and their weightings. In an ideal scenario, firms would allocate their limited resources to the most important factors and draw appropriate strategies to improve the content and quality of their mobile services. Research in Taiwan with Chunghwa Telecom, a leading telecommunication company, suggests such a position remains elusive (Shieh et al. 2014).

Market adoption theories

There is a considerable amount of confusion with regard to adoption and diffusion. This is due largely to differences in definition. Most researchers in the field, however, view adoption of innovations as a process through which individuals pass from awareness to the final decision to adopt or not adopt; whereas diffusion concerns the communication over time within a wider social system. The adoption research is derived mainly from social psychology and focuses on the individual. This includes such models as the theory of reasoned action (TRA), the theory of planned behaviour (TPB) and the technology acceptance model (TAM). The diffusion of innovations theory combines both adoption and the wider societal issues derived from sociology (see Yu and Tao, 2009). As previously mentioned, the study of how and why consumers purchase goods and services falls within the arena of consumer buyer behaviour and is beyond the scope of this book.

Case study

How three students built a business that could affect world trade

This case study tells the story of how three MSc students at the Technical University of Delft in The Netherlands had an idea for a folding shipping container and went about building a business. There are many examples of university students starting businesses, but few of these have the potential to revolutionise world trade.

Almost all containers today that you see on ships, trains or on trucks are 20 ft or 40 ft in length. The reason for the massive change in both transportation and the global economy is because of this simplicity of size – a small set of standard sizes that allowed ships, trucks, receiving bays, and all of the related logistical systems to easily adapt to an industry-wide standard. Prior to standardisation, there were major inefficiencies in commercial shipping: packaging and crating

was inconsistent. But, what about empty containers? Are there ships travelling the world with containers that are empty? If so, is this a business opportunity?



Source: Pearson Education Ltd/Photodisc