UNIT-I

INNOVATION MANAGEMENT

INNOVATION MANAGEMENT:

Innovation is one of those words that suddenly seems to be all around us. Firms care about their ability to innovate, on which their future allegedly depends (Christensen and Raynor, 2003), and many management consultants are busy persuading companies about how they can help them improve their innovation performance.

There is extensive scope for examining the way innovation is managed within organisations. Most of us are well aware that good technology can help companies achieve competitive advantage and long-term financial success. But there is an abundance of exciting new technology in the world and it is the transformation of this technology into products that is of particular concern to organisations.

Importance of Innovation:

Businesses operate with the knowledge that their competitors will, inevitably, come to the market with a product that changes the basis of competition. The ability to change and adapt is essential to survival. But can firms manage innovation? The answer is certainly yes, as Bill Gates confirmed in 2008: The share price is not something we control. We control innovation, sales and profits. (Rushe and Waples, 2008).

Table 1.1 Market leaders in 2015

Industry	Market leaders	Innovative new products and services
Cell phones	Samsung; Apple	Design and new features
Internet-related industries	Google; Facebook	New services
Pharmaceuticals	Pfizer; GlaxoSmithKline	Impotence; ulcer treatment drug
Motorcars	Toyota; BMW	Car design and associated product developments
Computers and software development	Intel; IBM and Microsoft; SAP	Computer chip technology, computer hardware improvements and software development

Illustration 1.1

Apple Watch app designers scramble ahead of launch

Apple has invited small groups of developers to its Silicon Valley offices to help them prepare their apps for its Watch, as it gears up for the launch at the end of this month.

Their creations range from exercise trackers and car-hailing services such as Uber, to a digital version of a painter's palette board and an app for sending a tweet to astronauts passing overhead on the International Space Station, all from a user's wrist.

In addition to its own messaging and fitness services, Apple is hoping a vibrant App Store will help persuade customers to spend between $350 and $17,000 on the Watch, its first new device since the iPad.

Developers say the technical and creative challenge is greater than when they had to rejig their iPhone apps for the iPad five years ago, due to the Watch's tiny screen and control scheme.

Some developers are able to draw on their experience with other smartwatches, such as the pioneering Pebble or Google's Android Wear. Many are using much more rudimentary techniques, such as taping paper mock-ups to their arms, to figure out what might work best on the Watch's 38–42mm screen.

Source: Neil Fraser/Alamy Images

Before March's press event, only top-ranking iPhone developers such as Uber and Facebook were invited to Apple's offices to test their Watch apps. In the

Table 1.2 World's most innovative companies

2014 Rank	Company	Revenue growth 2012–13 % change	R&D spending 2012–13 % change
1	Apple	9.2	32.4
2	Google	19.2	17.1
3	Samsung	17.0	27.8
4	Microsoft	5.6	6.1
5	IBM	–4.6	–1.2
6	Amazon	21.9	43.8
7	Tesla Motors	387.2	–15.3
8	Toyota	–3.9	–6.9
9	Facebook	54.7	1.1
10	Sony	–5.7	–18.8

Source: www.bcgperspectives.com/content/interactive/innovation_growth_most_innovative_companies_interactive_guide/, The Boston Consulting Group

Innovation Process:

Innovation needs to be viewed as a process. If one accepts that inventions are new discoveries, new ways of doing things, and that products are the eventual outputs from the inventions, that process from new discovery to eventual product is the innovation process.

The varying emphasis placed by different disciplines on explaining how innovation occurs is brought together in the framework in Figure 1.1. This overview of the innovation process includes an economic perspective, a business management strategy perspective and organisational behaviour, which attempts to look at the internal activities. It also recognises that firms form relationships with other firms and trade, compete and cooperate with each other. It further recognises that the activities of individuals within the firm also affect the process of innovation.

Each firm's unique organisational architecture represents the way it has constructed itself over time. This comprises its internal design, including its functions and the relationships it has built up with suppliers, competitors, customers, etc. This framework recognises that these will have a considerable impact on a firm's innovative performance. So, too, will the way it manages its individual functions and its employees or individuals. These are separately identified within the framework as being influential in the innovation process.

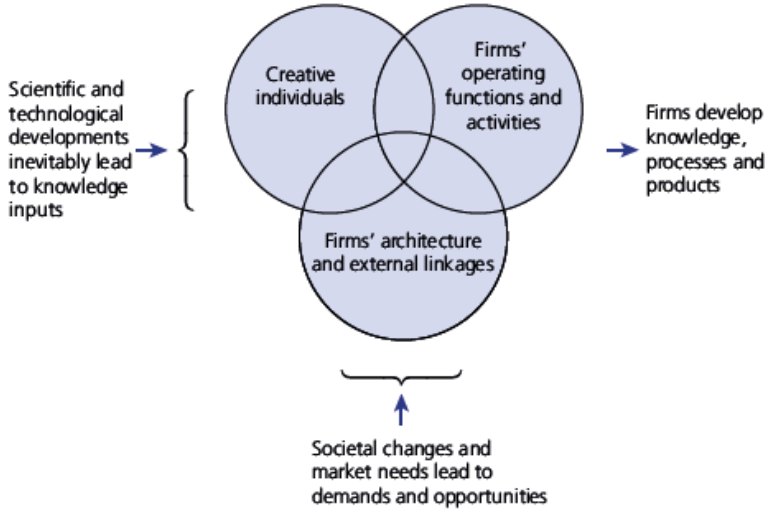

Figure 1.1 Overview of the innovation process

Table 1.4 Twentieth-century technological innovations

Date	New product	Responsible organisation
1930s	Polythene	ICI
1945	Ballpoint pen	Reynolds International Pen Company
1950s	Manufacturing process: float glass	Pilkington
1970/80s	Ulcer treatment drug: Zantac	GlaxoSmithKline
1970/80s	Photocopying	Xerox
1980s	Personal computer	Apple Computer
1980/90s	Computer operating system: Windows 95	Microsoft
1995	Impotence drug: Viagra	Pfizer
2000s	Cell phones	Motorola/Nokia
2005	MP3 players	Creative; Apple

Figure 1.4 Conceptual framework of innovation

Need for the Innovation:

Innovation is strongly associated with **growth**. New business is created by new ideas, by the process of creating competitive advantage in what a firm can offer. While competitive advantage can come from size, or possession of assets, and so on, the pattern is increasingly coming to favour those organizations that can mobilize knowledge and technological skills and experience to create novelty in their offerings (product/service) and the ways in which they create and deliver those offerings.

Economists have argued for decades over the exact nature of the relationship, but they have generally agreed that innovation accounts for a sizeable proportion of economic growth. In a recent book, William Baumol [2] pointed out that "virtually all of the economic growth that has occurred since the eighteenth century is ultimately attributable to innovation."

Innovation and invention Definitions:

Many people confuse these terms. It is true that innovation is the first cousin of invention, but they are not identical twins that can be interchanged. Hence, it is important to establish clear meanings for them.

Innovation itself is a very broad concept that can be understood in a variety of ways.

Definition of Innovation:

One of the more comprehensive definitions is offered by Myers and Marquis (1969):

Innovation is not a single action but a total process of interrelated sub processes. It is not just the conception of a new idea, nor the invention of a new device, nor the development of a new market. The process is all these things acting in an integrated fashion.

It is important to clarify the use of the term 'new' in the context of innovation. Rogers and Shoemaker (1972) do this eloquently:

It matters little, as far as human behaviour is concerned, whether or not an idea is 'objectively' new as measured by the lapse of time since its first use or discovery . . . If the idea seems new and different to the individual, it is an innovation.

Innovation differs from invention such a way that innovation is concerned with the commercial and practical application of ideas or inventions. Invention, then, is the conception of the idea, whereas innovation is the subsequent translation of the invention into the economy.

The following simple equation helps to show the relationship between the two terms:

Innovation = Theoretical conception + Technical invention + Commercial exploitation

The conception of new ideas is the starting point for innovation. A new idea by itself, whilst interesting, is neither an invention nor an innovation; it is merely a concept, a thought or collection of thoughts. The process of converting intellectual thoughts into a tangible new artefact (usually a product or process) is an invention. This is where science and technology usually play a significant role. At this stage, inventions need to be combined with hard work by many different people to convert them into products that will improve company performance. These later activities represent exploitation. However, it is the complete process that represents innovation. This introduces the notion that innovation is a process with a number of distinctive features that have to be managed. This is the view taken by this book. To summarise, then, innovation depends on inventions, but inventions need to be harnessed to commercial activities before they can contribute to the growth of an organisation. Thus:

Innovation is the management of all the activities involved in the process of idea generation, technology development, manufacturing and marketing of a new (or improved) product or manufacturing process or equipment.

This definition of **innovation as a management proces**s also offers a distinction between an innovation and a product, the latter being the output of innovation.

Different types of Innovation

- Innovation was defined earlier in this section as **the application of knowledge**. It is this notion that lies at the heart of all types of innovation, be they product, process or service. It is also worthy of note that many studies have suggested that product innovations are soon followed by process innovations in what they describe as an industry innovation cycle.

- Furthermore, it is common to associate innovation with physical change, but many changes introduced within organisations involve very little physical change. Rather, it is the activities performed by individuals that change. A good example of this is the adoption of so-called Japanese management techniques by automobile manufacturers in Europe and the United States.
- Hence, technological innovation can be accompanied by additional managerial and organisational changes, often referred to as innovations. This presents a far more blurred picture and begins to widen the definition of innovation to include virtually any organisational or managerial change. Table 1.5 shows a typology of innovations.

Table 1.5 A typology of innovations

Type of innovation	Example
Product innovation	The development of a new or improved product
Process innovation	The development of a new manufacturing process such as Pilkington's float glass process
Organisational innovation	A new venture division; a new internal communication system; introduction of a new accounting procedure
Management innovation	TQM (total quality management) systems; BPR (business process re-engineering); introduction of SAPR3*
Production innovation	Quality circles; just-in-time (JIT) manufacturing system; new production planning software, e.g. MRP II; new inspection system
Commercial/marketing innovation	New financing arrangements; new sales approach, e.g. direct marketing
Service innovation	Internet-based financial services

*Note: SAP is a German software firm and R3 is an enterprise resource planning (ERP) product.

Sources of Innovation:

Finally, the generation of ideas is shown to be dependent on inputs from three basic components (as outlined in **Figure 1.4**):

1. Technological developments;
2. The needs of the marketplace;
3. The science and technology base.

Recent research confirms the validity of this concept today. Research by Stefano et al., (2012) updates the debate on the sources of innovation. They show and confirm that:

- The market is a major source of innovation;

- Firm competences enable firms to match technology with demand; and
- External and internal sources of innovations are important.

All of which are necessary for value creation and capture.

Figure 1.4 Conceptual framework of innovation

Figure 5.1 indicates a wide range of stimuli that could be relevant to kick-starting the innovation journey, and we will explore some of the important sources.

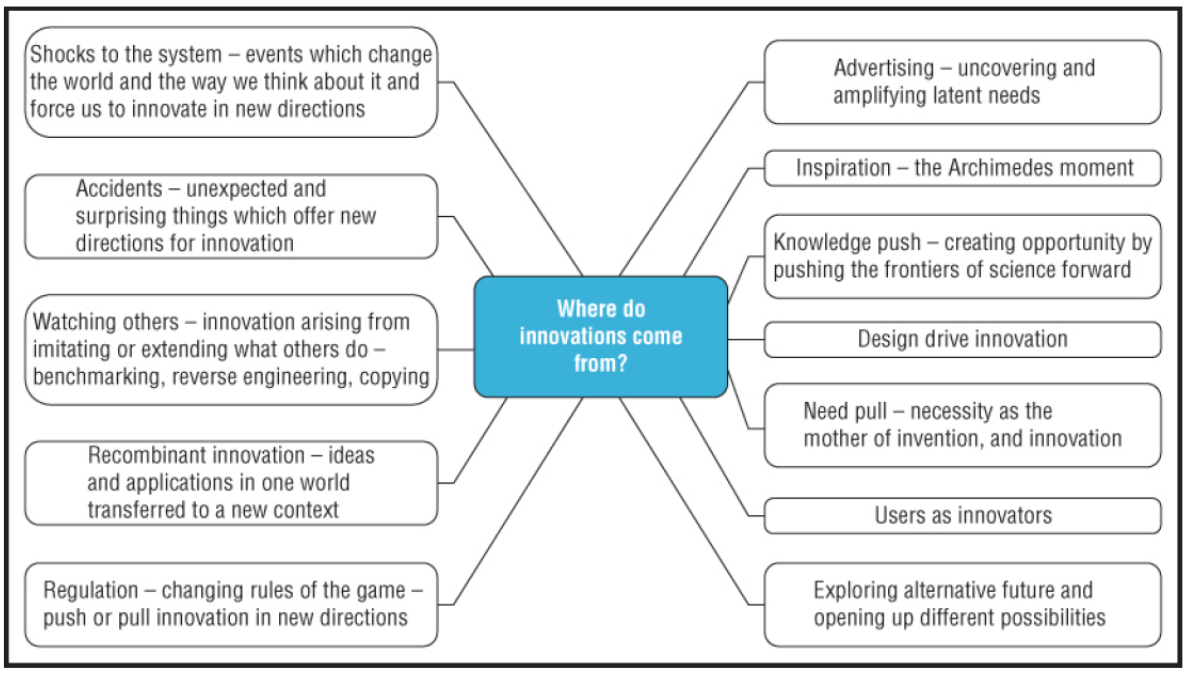

FIGURE 5.1 Where do innovations come from?

The sources of innovations are explained in detail below.

1. Knowledge Push

Although there have always been solo researchers, from a very early stage, the process of exploring and codifying at the frontiers of knowledge has been a systematic activity involving a wide network of people sharing their ideas.

This model of "knowledge push" has a strong track record. In the twentieth century, the rise of the modern large corporation brought with it the emergence of the research laboratory as a key instrument of progress. Bell Labs, ICI, Bayer, BASF, Philips, Ford, Western Electric, and Du Pont – all were founded in the early 1900s as powerhouses of ideas. They produced a steady stream of innovations that fed rapidly growing markets for automobiles, consumer electrical products, synthetic materials, industrial chemicals – and the vast industrial complexes needed to fight two major wars.

Their output wasn't simply around product innovation – many of the key technologies underpinning process innovations, especially around the growing field of automation and information/communications technology, also came from such organized R&D effort. **Table 5.1** gives a few examples of knowledge-push innovations, each of which has been the source of a wave of subsequent innovative activity.

TABLE 5.1

Some Examples of Knowledge-push Innovations

Nylon	Radar	Antibiotics
Microwave	Synthetic rubber	Cellular telephony
Medical scanners	Photocopiers	Hovercraft
Fiber optic cable	Digital imaging	Transistor/integrated circuits

Knowledge push has long been a source of innovative start-ups where entrepreneurs have used ideas based on their own research (or that of others) to create new ventures. This model underpins the success of many high-tech regions – for example, Silicon Valley and Route 128 in the United States, "medical valley" around the city of Nuremburg in Germany, or the Cambridge area in the United Kingdom, where giant technology businesses such as ARM (whose chips are at the heart of most mobile phones) were founded as spin outs from the university.

2. Need Pull

Knowledge creation is a field of possibilities for innovation. But simply having a bright idea is no guarantee of adoption. Knowledge push creates a field of possibilities – but not every idea finds successful application and one of the key lessons is that innovation requires some form of demand if it is to take root. Bright ideas are not, in themselves, enough – they may not meet a real or perceived need and people may not feel motivated to change.

We need to recognize that another key driver of innovation is needed – the complementary pull to the knowledge push. In its simplest form, it is captured in the saying that "*necessity is the Mother of invention*" – innovation is often the response to a real or perceived need for change. Basic needs – for shelter, food, clothing, security – led early innovation as societies evolved, and we are now at a stage where the need pull operates on more sophisticated higher level needs but via the same process. In innovation management, the emphasis moves to ensuring we develop a clear understanding of needs and finding ways to meet those needs.

Need-pull innovation is particularly important at mature stages in industry or product life cycles when there is more than one offering to choose from – competing depends on differentiating on the basis of needs and attributes and/or segmenting the offering to suit different adopter types. There are differences between business to business markets (where emphasis is on needs among a shared group, e.g., along a supply chain) and consumer markets where the underlying need may be much more basic – food, shelter, and mobility – and appeal to a much greater number of people.

It is also a key source of opportunity for entrepreneurial start-ups. Identifying a need that no one has worked on before or finding novel ways to meet an existing need lie behind many new business ideas.

For example, Jeff Bezos picked up on the needs (and frustrations) around conventional retail and has built the Amazon Empire on the back of using new technologies to meet these in a different way.

- Air BnB ("I need to find somewhere to stay"),
- Next Bike, Zipcar ("I need easy short-term access to transport"), and
- WhatsApp ("I need to communicate with my friends") are other well-known examples.

3. Making Processes Better

Of course needs aren't just about external markets for products and services – it can be seen that the same phenomenon of need pull working inside organizations, as a driver of *process innovation*.

Process improvement is of particular relevance in the public sector, where the issue is not about creating wealth but of providing value for money in service delivery. Many applications of "lean" and similar concepts can be found that apply this principle – for example,

- in reducing waiting times or improving patient safety in hospitals,
- in speeding up delivery of services such as car taxation and
- passport issuing, and even
- In improving the collection of taxes!

Once again, we can see the pattern – most of the time such innovation is about "doing what we do better," but occasionally it involves a major leap.

It's also important to recognize that innovation is not always about commercial markets or consumer needs. There is also a strong tradition of social need providing the pull for new products, processes, and services. A recent example has been the development of innovations around the concept of "*micro-finance"*

4. Crisis-driven Innovation

Sometimes, the increase in the urgency of a need or the extent of demand can have a forcing effect on innovation – the example of wartime and other crises supports this view.

Example-1:

For example, the demand for iron and iron products increased hugely in the Industrial revolution and exposed the limitations of the old methods of smelting with charcoal – it created the pull that led to developments like the Bessemer converter.

Example-2:

The origins of "lean thinking" – an approach that has revolutionized manufacturing and large parts of public and private sector services – lie in the experience of Japanese manufacturers like Toyota in the immediate post-war period. Faced with serious shortages of raw materials, energy, and skilled labour, it was impossible to apply the resource intensive methods associated

with mass production and instead they were forced to experiment and develop an alternative approach – which became known as "lean" because it implied a minimum waste philosophy.

5. Whose Needs? The Challenge of Underserved Markets

When considering need pull as a source of innovation, we should remember that one size doesn't fit all. Differences among potential users can also provide rich triggers for innovation in new directions.

Disruptive innovation – a theme to which it is often associated with entrepreneurs working at the fringes of a mainstream market and finding groups whose needs are not being met. It poses a problem for existing incumbents because the needs of such fringe groups are not seen as relevant to their "mainstream" activities – and so they tend to ignore them or to dismiss them as not being important. But working with these users and their different needs creates different innovation options – and sometimes what has relevance for the fringe begins to be of interest to the mainstream.

Clayton Christensen in his many studies of such "disruptive innovation" shows this has been the pattern across industries as diverse as

- computer disk drives,
- earth moving equipment,
- steel making, and low cost air travel

But somewhere else there is another group of potential users who have very different needs – usually for something much simpler and cheaper – which will help them get something done.

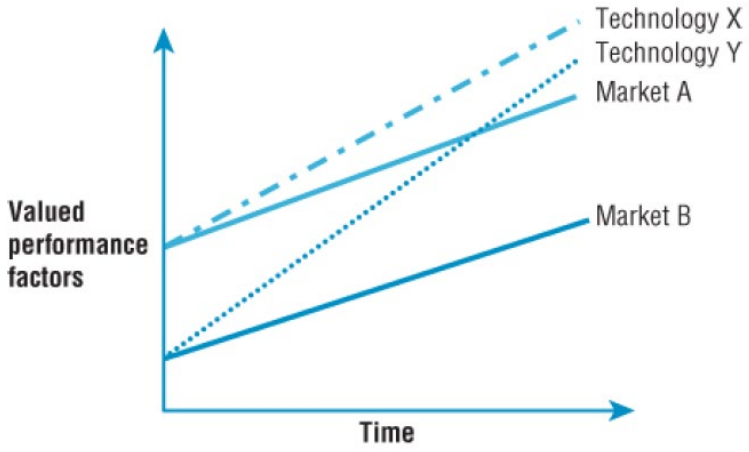

FIGURE 5.3 The pattern of disruptive innovation.

This pattern is essentially one of *disruption* – the rules of the game changed dramatically in the marketplace with some new winners and losers. Figure 5.3 shows the transition where the new market and suppliers gradually take over from the existing players. It can be seen in many industries – for example, think about the low-cost airlines. Here the original low cost players didn't go head to head with the national flag carriers who offered the best routes, high levels of service, and prime airport slots – all for a high price. Instead, they sought new markets at the fringe – users who would accept a much lower level of service (no food, no seat allocation, no lounges, no frills at all) but for a basic safe flight would pay a much lower price.

6. Emerging Markets

One powerful source of ideas at the edge comes from what are often termed "emerging markets" – countries such as India, China, and those in the Latin American and African regions. These are huge markets in terms of population and often very young in age profile, and while there may be limited disposable income they represent significant opportunities.

The writer C.K. Prahalad first drew attention to this idea in his book "The fortune at the bottom of the pyramid" arguing that nearly 80% of the world's population lived on less than $2/day but could represent a huge market of unserved needs for goods and services. Table 5.2 gives some examples of this challenge.

The idea of "reverse innovation" where innovations migrate back from these emerging markets is of growing interest – for example, General Electric developed a simple low-cost version of its ultrasound scanner for use in the emerging market context of rural India. Designed to be easy to use and rugged enough for traveling midwives to carry round on their bicycles from village to village, the unit was not only very successful in those markets but attracted considerable attention elsewhere in the world.

TABLE 5.2

Challenging Assumptions About the Bottom of the Pyramid

Source: Prahalad, C.K., *The Fortune at the Bottom of the Pyramid.* 2006, New Jersey: Wharton School Publishing.

Assumption	Reality – and Innovation Opportunity
The poor have no purchasing power and do not represent a viable market	Although low income the sheer scale of this market makes it interesting. Additionally, the poor often pay a premium for access to many goods and services – for example, borrowing money, clean water, telecommunications, and basic medicines – because they cannot address "mainstream" channels such as shops and banks. The innovation challenge is to offer low cost, low margin, but high-quality goods and services across a potential market of 4 billion people.
The poor are not brand-conscious	Evidence suggests a high degree of brand and value consciousness – so if an entrepreneur can come up with a high-quality low-cost solution it will be subject to hard testing in this market. Learning to deal with this can help migrate to other markets – essentially the classic pattern of "disruptive innovation."
The poor are hard to reach	By 2015, there are likely to be nearly 400 cities in the developing world with populations over 1 million and 23 with over 10 million. About 30–40% of these will be poor – so the potential market access is considerable. Innovative thinking around distribution – via new networks or agents (such as the women village entrepreneurs used by Hindustan Lever in India or the "Avon ladies" in rural Brazil) – can open up untapped markets.
The poor are unable to use and not interested in advanced technology	Experience with PC kiosks, low-cost mobile phone sharing and access to the Internet suggests that rates of take-up and sophistication of use are extremely fast among this group. In India, the e-choupal (e-meeting place) set up by software company ITC enabled farmers to check prices for their products at the local markets and auction houses. Very shortly after that the same farmers were using the web to access prices of their soybeans at the Chicago Board of Trade and strengthen their negotiating hand!

7. Toward Mass Customization

Markets are not made up of people wanting the same thing – and there is an underlying challenge to meet their demands for variety and increasing customization. This represents a powerful driver for innovation – as we move from conditions where products are in short supply to one of mass production so the demand for differentiation increases. There has always been a market for personalized custom made goods – and similarly custom configured services – for example, personal shoppers, personal travel agents, personal physicians, and so on. But

until recently, there was an acceptance that this customization carried a high price tag and that mass markets could only be served with relatively standard product and service offerings.

A combination of enabling technologies and rising expectations has begun to shift this balance and resolve the trade-off between price and customization. “Mass customization” (MC) is a widely used term that captures some elements of this.

MC is the ability to offer highly configured bundles of non-price factors configured to suit different market segments (with the ideal target of total customization – that is, a market size of 1) – but to do this without incurring cost penalties and the setting up of a trade-off of agility vs. prices.

There are different levels of customizing – from simply putting a label “specially made for (insert your name here)” on a standard product right through to sitting down with a designer and co-creating something truly unique. Table 5.3 gives some examples of this range of options.

Examples of Customization:

Assembly customization	Customers are offered a number of predefined options. Products/services are made to order using standardized components	Buying a computer from Dell or another online retailer. Customers choose and configure to suit your exact requirements from a rich menu of options – but Dell only start to assemble this (from standard modules and components) when your order is finalized. Banks offering tailor-made insurance and financial products are actually configuring these from a relatively standard set of options.
Fabrication customization	Customers are offered a number of predefined designs. Products/services are manufactured to order	Buying a luxury car like a BMW, where the customer are involved in choosing (“designing”) the configuration that best meets your needs and wishes – for engine size, trim levels, color, fixtures and extras, and so on. Only when they are satisfied with the virtual model they have chosen does the manufacturing process begin – and they can even visit the factory to watch their car being built. Services allow a much higher level of such customization since there is less of an asset base needed to set up for “manufacturing” the service – examples here would include made to measure tailoring, personal planning for holidays, pensions, and so on.

Design customization	Customer input stretches to the start of the production process. Products do not exist until initiated by a customer order	Cocreation, where end-users may not even be sure what it is they want but where – sitting down with a designer – they cocreate the concept and elaborate it. It's a little like having some clothes made but rather than choosing from a pattern book they actually have a designer with them and create the concept together. Only when it exists as a firm design idea does it then get made. Cocreation of services can be found in fields like entertainment (where user-led models like YouTube are posing significant challenges to mainstream providers) and in health care where experiments toward radical alternatives for healthcare delivery are being explored.

8. Users as Innovators

Understanding what it is that customer's value and need is critical in pursuing a customization strategy and it leads, inevitably to the next source of innovation in which the users themselves become the source of ideas.

Indeed history suggests that users are sometimes ahead of the game – their ideas plus their frustrations with existing solutions lead to experiment and prototyping and create early versions of what eventually become mainstream innovations.

Example:

The example of the pickup truck – a long-time staple of the world automobile industry. This major category did not begin life on the drawing boards of Detroit but rather on the farms and homesteads of a wide range of users who wanted more than a family saloon. They adapted their cars by removing seats, welding new pieces on, and cutting off the roof – in the process prototyping and developing the early model of the pickup. Only later did Detroit pick up on the idea and then begin the incremental innovation process to refine and mass produce the vehicle.

- A growing range of Internet-based applications make use of communities – for example, Mozilla and its Firefox and other products, Propellerhead and other music software communities, and the emergent group around Apple's iplatform devices like the i-Phone.

9. Using the Crowd

Not everyone is an active user, but the idea of the crowd as a source of different perspectives is an important one. Sometimes people with very different ideas, perspectives, or expertize can contribute new directions to our sources of ideas – essentially amplifying. Using the wider

population has always been an idea, but until recently, it was difficult to organize their contribution simply because of the logistics of information processing and communication. But using the Internet, new horizons open up to extend the reach of involvement as well as the richness of the contribution people can make.

Crowd sourcing of this kind can be enabled via a number of routes – for example, innovation contests, innovation markets, innovation communities. But it is worth commenting here that opening up to the crowd can not only amplify the volume of ideas but also the diversity and evidence is emerging that it is particularly this feature that makes the crowd a useful additional source of innovation.

One example is Goldcorp – a struggling mining company that threw open its geological data and asked for ideas about where it should prospect. Tapping into the combined insights of 1200 people from 50 countries helped them find 110 new sites, 80% of which produced gold. The business has grown from $100 million in 1999 to over $9 billion today.

10. Extreme Users

An important variant that picks up on both the lead user and the fringe needs concepts lies in the idea of extreme environments as a source of innovation. The argument here is that the users in the toughest environments may have needs which by definition are at the edge – so any innovative solution that meets those needs has possible applications back into the mainstream.

An example:

Antilock braking systems (ABS) which are now a commonplace feature of cars but which began life as a special add-on for premium high performance cars. The origins of this innovation came from a more extreme case, though – the need to stop aircraft safely under difficult conditions where traditional braking might lead to skidding or other loss of control. ABS was developed for this extreme environment and then migrated across to the (comparatively) easier world of automobiles.

11. Prototyping

Innovations are made rather than born – and this means we need to think about modifying, adapting, and configuring the original idea.

"Prototypes allow you to quickly get a feel for things and uncover subtle design flaws …"

Prototyping offers some important features to support sourcing innovative ideas:

- It creates a "boundary object," something around which other people and perspectives can gather; a device for sharing insights into problem dimensions as well as solutions.
- It offers us a stepping stone in our thought processes, making ideas real enough to see and play with them but without the lock-in effect of being tied into trying to make the solutions work – we can still change our minds It allows plurality – we don't have to play with a single idea, we can bet on multiple horses early on in the race rather than trying to pick winners.
- It allows for learning – even when a prototype fails we accumulate knowledge which might come in helpful elsewhere
- It suggests further possibilities – as we play with a prototype, it gives us a key to open up the problem, break open the shell, and explore more deeply
- It allows us to work with half-formed ideas and hunches – enables a "conversation with a shadowy idea"
- It allows for emergence – sometimes we can't predict what will happen when different elements interact. Trying something out helps explore surprising combinations

12. Watching Others – and Learning From Them

Another important source of innovation comes from watching others – imitation is not only the sincerest form of flattery but also a viable and successful strategy for sourcing innovation.

For example, reverse engineering of products and processes and development of imitations – even around impregnable patents – is a well-known route to find ideas.

13. Recombinant Innovation

There is plenty of scope for crossover – ideas and applications which are commonplace in one world may be perceived as new and exciting in another.

- This is an important principle in sourcing innovation where transferring or combining old ideas in new contexts – a process called "recombinant innovation" by Andrew Hargadon – can be a powerful resource.

Example:

The Reebok pump running shoe, for example, was a significant product innovation in the highly competitive world of sports equipment – yet although this represented a breakthrough in that field it drew on core ideas which were widely used in a different world. Design Works – the agency which came up with the design brought together a team which included people with prior experience in fields like paramedic equipment (from which they took the idea of an inflatable splint providing support and minimizing

shock to bones) and operating theatre equipment (from which they took the microbladder valve at the heart of the pump mechanisms).

- Thomas Edison's famous "Invention Factory" in New Jersey was founded in 1876 with the grand promise of "a minor invention every ten days and a big thing every six month or so."
- They were able to deliver on that promise not because of the lone genius of Edison himself but rather from taking on board the recombinant lesson – Edison hired scientists and engineers (he called them "muckers") from all the emerging new industries of early twentieth-century USA.
- In doing so, he brought experience in technologies and applications such as mass production and precision machining (gun industry) telegraphy and telecommunications, food processing and canning, automobile manufacture, and so on. Some of the early innovations that built the reputation of the business – for example, the tele-printer for the NYSE – were really simple crossover applications of well-known innovations in other sectors.

14. Design-led Innovation

"Market? What market! We do not look at market needs. We make proposals to people". – Ernesto Gismondi, Chairman of Artemide, quoted in Verganti

- One increasingly significant source of innovation is what Roberto Verganti calls "design-driven innovation."
- **Examples include** many of the recent successful Apple products, where the user experience is one of surprise and pleasure at the look and feel, the intuitive beauty of the product.

As Verganti points out, people do not buy things only to meet their needs – there are important psychological and cultural factors at work as well.

For example, Apple's i-phone changed the meaning of the phone from a communication device to the core of a highly interactive social system, while Nintendo's Wii changed the meaning of computer gaming from a largely solitary activity to an interactive family pursuit.

Figure 5.4 shows a map in which both knowledge/technology push and market pull can be positioned – and where design-driven innovation represents a third space around creating radical new concepts which have meaning in people's lives.

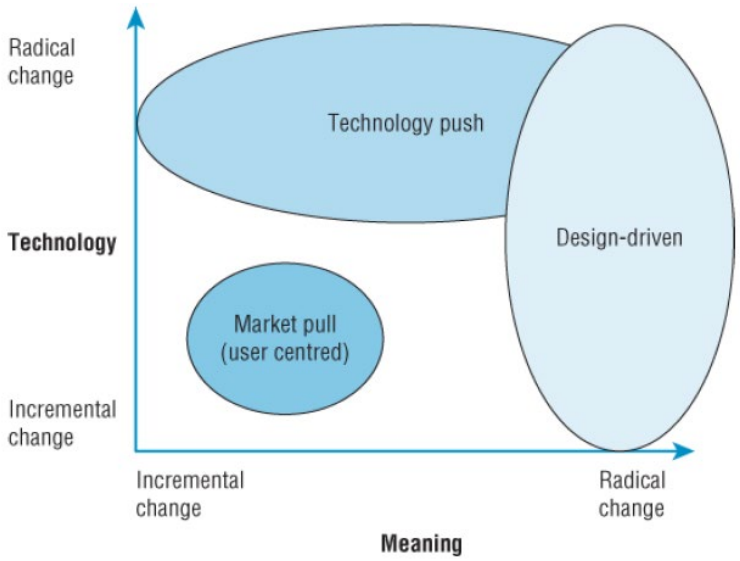

FIGURE 5.4 The role of design-driven innovation.

15. Futures and Forecasting

Another source of stimuli for innovation comes through imagining and exploring alternative trajectories to the dominant version in everyday use. Various tools and techniques for forecasting and imagining alternative futures are used to help strategy making – but can also be used to stimulate imagination around new possibilities in innovation.

For example, Shell has a long history of exploring future options and driving innovations, most recently through its Game changer program

16. Accidents

Accidents and unexpected events happen – and in the course of a carefully planned R&D project, they could be seen as annoying disruptions. But on occasions accidents can also trigger innovation, opening up surprisingly new lines of attack.

Ex-1:

The famous example of Fleming's discovery of penicillin is but one of many stories in which mistakes and accidents turned out to trigger important innovation directions.

Ex-2:

Roy Plunkett was working on chlorofluorocarbons in DuPont's labs in 1938 trying to improve refrigeration materials. While returning to examine the results of his latest experiment, he was bitterly disappointed to find one canister no longer contained the gas he expected but some white flaky material. But he took time to play with it and realized its incredible properties as a

lubricant with a very high melting point – perfect for a host of military applications and, eventually, for making omelettes in frying pans coated with Teflon.

Summary on Sources of Innovation:

- Innovations don't just appear perfectly formed – and the process is not simply a spark of imagination giving rise to changing the world.
- Instead innovations come from a number of sources and these interact over time.
- Sources of innovation can be resolved into two broad classes – knowledge push and need pull – although they almost always act in tandem. Innovation arises from the interplay between them.

Technology Adoption

It becomes important to look at how technology develops, particularly from the point of view of the interaction with the business environment. The model of the technology cycles dictates that the next state of technology in an industry arrives through long periods of incremental change and continuous improvement;

A technology cycle consists of four phases: technological discontinuities (variation), eras of ferment, dominant designs, and eras of incremental change. The phases of technological discontinuities and dominant designs mark the transitions between eras of ferment and eras of incremental change, as illustrated in Figure 3.7.

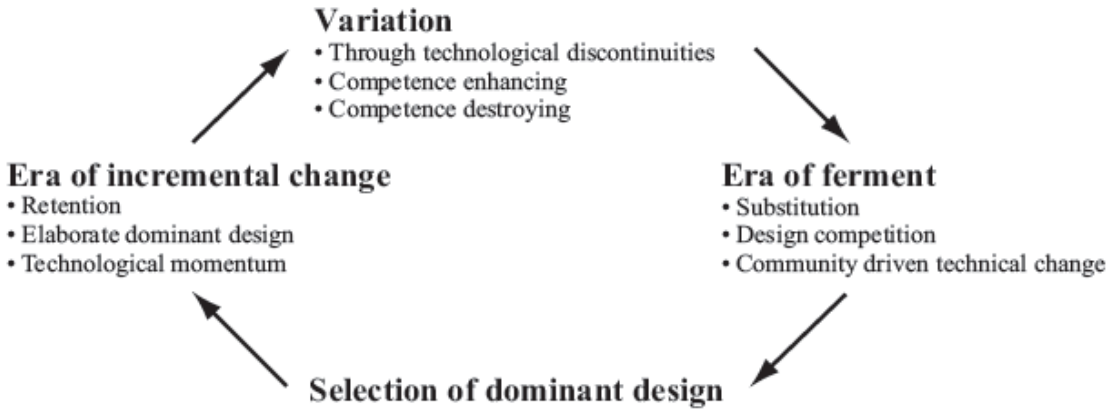

Figure 3.7. Technology cycle.

Acceptance (Adoption) of Technologies:

Within the technology cycle, the acceptance of technologies within a market or product-market combination is key to their success.

There are several models about how consumers accept (new) technologies and innovations. The most known are the **technology adoption life-cycle mode**l and **technology acceptance model**; the latter is particularly popular in software engineering.

The prevalent dominant design that results and the business models that allow companies to generate revenue streams; the technology adoption life-cycle describes this process. It is a model originally published as the diffusion process by Beal, Rogers, and Bohlen (1957).

The technology adoption life-cycle model, as it is called now, describes the adoption or acceptance of a new product or innovation, according to the demographic and psychological characteristics of defined adopter groups. The process of adoption over time is typically illustrated as a classical normal distribution or bell curve, though in practice this is not followed to the letter;

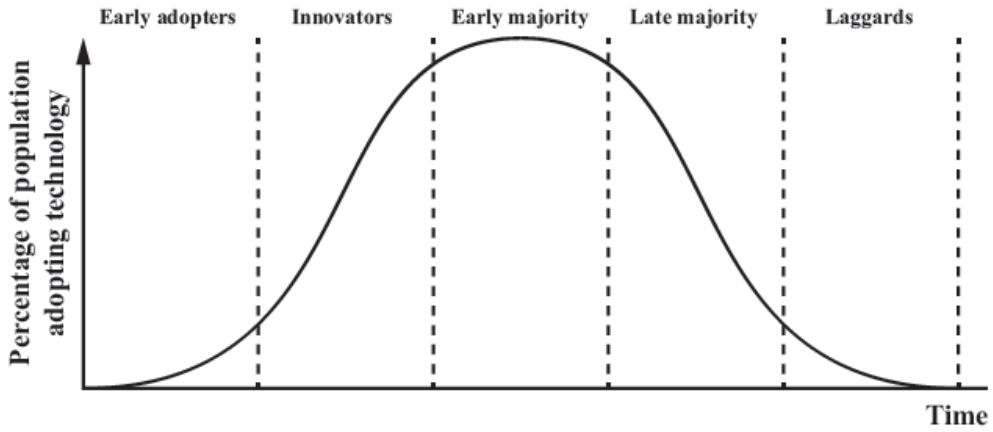

Figure 3.10. Technology adoption life-cycle model.

- The model indicates that the first group of people to use a new product or service is called innovators; these innovators are characterized by willing to take risks, having a highest social status, having resources at their disposal, and having access to others and sources of knowledge.
- Early adopters as the next group to adopt a new service or product are also influential. This will be a customer who, in addition to using the product or technology, may also provide feedback to firms about its next releases as well as distribution, service, and support.
- Next come the early and late majority, and the last group to eventually adopt a product are called laggards.

- Sometimes, an additional category is recognized: leapfroggers; these customers skip several generations of a technology. It is important to recognize these different groups because they have different motivations for adopting a new technology, product, or service, and, therefore have to be approached differently by marketing activities.

Another model for the acceptance of technologies by users comes from information systems: **The Technology acceptance model**:

This model is based on the theory of reasoned action, coined by Azjen and Fishbein (1980); it predicts how individuals will behave based on their pre-existing attitudes and behavioral intentions. The technology acceptance model suggest that when users are presented with a new technology, a number of factors influence their decision about how and when they will use it, notably:

Perceived usefulness: This is the degree to which a person believes that using a particular system would enhance his or her job performance.

Perceived ease of use: This is the degree to which a person believes that using a particular system would be free from effort.

Barriers to Innovation:

1. Reactions coming from elected or appointed experts who are predisposed to 'thoroughly examine'-in order to delay-innovations.

2. Innovation fails due to resistance to change: the failure of courage and imagination may prove to be significant barriers to innovation.

3. Feeling of 'comfort': Why should I press myself and disrupt my comfortable habits? Conservatism in multiple forms, e.g. 'do not change the status quo' syndrome, 'no risk policy', 'lack of no certified alternative solutions', 'do not omit the pre-determined course'.

4. Lack of courage by government executives to deal with the challenges and the problems, fear of losing the support of voters accompanied by a lack of long term vision (focus only on short term benefits), instability and widespread reshuffling of executives in their positions.

5. Lack of courage by general managers and the team of heads of directorates in the private sector to accept change and make a long term estimate pressure by those having interests to increase their benefits per share on a short term basis-fear of losing support by individuals harbouring high interests if they do not respond positively to their pressure for short term

results-frequent restructuring for a short time to make up and execute initiatives for long term development.

6. The way innovation is introduced is a decisive factor and a message heralding its success rate: innovations of gradual change have lower impact on hierarchy relations and as a result, are treated with a more moderate reaction and inertia compared to the more radical ones. The 'hazardous innovations' resisting the most are the ones with a dividing nature and have the tendency to change structure, in order to affect only positively the system's functionality.

7. Rigid hierarchy structures and lack of results management. Instability in the roles of the game (bias), corruption and lack of transparency. Poverty and political struggle. Central red tape, prosperity-decay policies and governmental control for the sake of control.