1.6 Exploring different aspects of innovation

The overall innovation space provides a simple map of the table on which we might place our innovation bets. But before making those bets we should consider some of the other characteristics of innovation which might shape our strategic decisions about where and when to play. These key aspects include:

- Degree of novelty – incremental or radical innovation?
- Platforms and families of innovations.
- Discontinuous innovation – what happens when the rules of the game change?
- Level of innovation – component or architecture?
- Timing – the innovation life cycle.

We will explore these – and the challenges they pose for managing innovation – a little more in the following section.

Incremental innovation – doing what we do but better

A key issue in managing innovation relates to the degree of novelty involved in different places across the innovation space. Clearly, updating the styling on our car is not the same as coming up with a completely new concept car which has an electric engine and is made of new composite materials as opposed to steel and glass. Similarly, increasing the speed and accuracy of a lathe is not the same as replacing it with a computer-controlled laser forming process. There are degrees of novelty in these, running from minor, incremental improvements right through to radical changes which transform the way we think about and use them. Sometimes these changes are common to a particular sector or activity, but sometimes they are so radical and far-reaching that they change the basis of society – for example the role played by steam power in the Industrial Revolution or the ubiquitous changes resulting from today's communications and computing technologies.

As far as managing the innovation process is concerned, these differences are important. The ways in which we approach incremental, day-to-day change will differ from those used occasionally to handle a radical step change in a product or process. But we should also remember that it is the *perceived* degree of novelty which matters; novelty is very much in the eye of the beholder. For example, in a giant, technologically advanced organization like Shell or IBM advanced networked information systems are commonplace, but for a small car dealership or food processor even the use of a simple PC to connect to the Internet may still represent a major challenge.

The reality is that although innovation sometimes involves a discontinuous shift, most of the time it takes place in incremental fashion. Essentially this is product/process improvement along the lines of 'doing what we do, but better' – and there is plenty to commend this approach. For example, the Bic ballpoint pen was originally developed in 1957 but remains a strong product with daily sales of 14 million units worldwide. Although superficially the same shape, closer inspection reveals a host of incremental changes that have taken place in materials, inks, ball technology, safety features, etc. Products are rarely 'new to the world', process innovation is mainly about optimization and getting the bugs out of the system. (Ettlie suggests disruptive or new-to-the-world innovations are only 6% to 10% of all projects labelled innovation.[36]) Studies of incremental process development (such as Hollander's famous study of DuPont rayon plants) suggest that the cumulative gains in efficiency are often much greater over time than those which come from occasional radical changes.[37] Other examples include Tremblay's studies of paper mills,[38] Enos on petroleum refining[39] and Figueredo's of steel plants.[40] For more detailed examples of continuous improvement see Forte, NPI and HBL case studies on web.

Continuous improvement of this kind has received considerable attention in recent years, originally as part of the 'total quality management' movement in the late twentieth century, reflecting the significant gains which Japanese manufacturers were able to make in improving quality and productivity through sustained incremental change.[41] But these ideas are not new – similar principles underpin the famous 'learning curve' effect where productivity improves with increases in the scale of production; the reason for this lies in the learning and continuous incremental problem-solving innovation which accompanies the introduction of a new product or process.[42] More recent experience of deploying 'lean' thinking in manufacturing and services and increasingly between as well as within enterprises underlines further the huge scope for such continuous innovation.[43] See web for example of continuous improvement tools.

Platform innovation

One way in which the continuous incremental innovation approach can be harnessed to good effect is through the concept of 'platforms'. This is a way of creating stretch and space around an innovation and depends on being able to establish a strong basic platform or family which can be extended. Rothwell and Gardiner give several examples of such 'robust designs' which can be stretched and otherwise modified to extend the range and life of the product, including Boeing airliners and Rolls-Royce jet engines.[44] Major investments by large semiconductor manufacturers like Intel and AMD are amortized to some extent by being used to design and produce a family of devices based on common families or platforms such as the Pentium, Celeron, Athlon or Duron chipsets.[45] Car makers are increasingly moving to produce models, which although apparently different in style, make use of common components and floor pans or chassis. Perhaps the most famous product platform is the 'Walkman' originally developed by Sony as a portable radio and cassette system; the platform concept has come to underpin a wide range of offerings from all major manufacturers for this market and deploying technologies such as minidisk, CD, DVD and now MP3 players.

In processes much has been made of the ability to enhance and improve performance over many years from the original design concepts – in fields like steel making and chemicals, for example. Service innovation offers other examples where a basic concept can be adapted and tailored for a wide range of similar applications without undergoing the high initial design costs – as is the case with different mortgage or insurance products. Sometimes platforms can be extended across different sectors – for example, the original ideas behind 'lean' thinking originated in firms such as Toyota in the field of car manufacturing – but have subsequently been applied across many other manufacturing sectors and into both public and private service applications including hospitals, supermarkets and banks.[43]

Platforms and families are powerful ways for companies to recoup their high initial investments in R&D by deploying the technology across a number of market fields. For example, Procter & Gamble invested heavily in its cyclodextrin development for original application in detergents but then were able to use this technology or variants on it in a family of products including odour control ('Febreze'), soaps and fine fragrances ('Olay'), off-flavour food control, disinfectants, bleaches and fabric softening ('Tide', 'Bounce'). They were also able to license out the technology for use in non-competing areas such as industrial-scale carpet care and in the pharmaceutical industry.

If we take the idea of 'position' innovation mentioned earlier then the role of brands can be seen as establishing a strong platform association which can be extended beyond an initial product or service. For example Richard Branson's Virgin brand has successfully provided a platform for entry into a variety of new fields including trains, financial services, telecommunications and food, whilst Stelios Haji-Ioannou has done something similar with his 'easy' brand, moving into cinemas, car rental, cruises and hotels from the original base in low-cost flying.

In their work on what they call 'management innovation' Hamel highlights a number of core organizational innovations (such as 'total quality management') which have diffused widely across sectors.[46]

These are essentially paradigm innovations which represent concepts that can be shaped and stretched to fit a variety of different contexts – for example Henry Ford's original ideas on mass production became applied and adapted to a host of other industries. McDonald's owed much of its inspiration to him in designing its fast-food business and in turn it was a powerful influence on the development of the Aravind eye clinics in India, which bring low-cost eye surgery to the masses.[3]

Discontinuous innovation – what happens when the game changes?

Most of the time innovation takes place within a set of rules of the game which are clearly understood, and involves players trying to innovate by doing what they have been doing (product, process, position, etc.) but better. Some manage this more effectively than others but the 'rules of the game' are accepted and do not change.[47]

However, occasionally something happens which dislocates this framework and changes the rules. By definition these are not everyday events but they have the capacity to redefine the space and the boundary conditions – they open up new opportunities and challenge existing players to reframe what they are doing in the light of new conditions.[48, 49, 50, 51] This is a central theme in Schumpeter's original theory of innovation which he saw as involving a process of 'creative destruction'.[24, 30]

CASE STUDY 1.4

The melting ice industry

Back in the 1880s there was a thriving industry in the north-eastern United States in the lucrative business of selling ice. The business model was deceptively simple – work hard to cut chunks of ice out of the frozen northern wastes, wrap the harvest quickly and ship it as quickly as possible to the warmer southern states – and increasingly overseas – where it could be used to preserve food. In its heyday this was a big industry – in 1886 the record harvest ran to 25 million tons – and it employed thousands of people in cutting, storing and shipping the product. It was an industry with a strong commitment to innovation – developments in ice cutting, snow ploughs, insulation techniques and logistics underpinned the industry's strong growth. The impact of these innovations was significant – they enabled, for example, an expansion of markets to far-flung locations such as Hong Kong, Bombay and Rio de Janeiro where, despite the distance and journey times, sufficient ice remained of cargoes originally loaded in ports like Boston to make the venture highly profitable.[52]

At the same time researchers like the young Carl von Linde were working in their laboratories on the emerging problems of refrigeration. It wasn't long before artificial ice making became a reality – Joseph Perkins had demonstrated that vaporizing and condensing a volatile liquid in a closed system would do the job and in doing so outlined the basic architecture that underpins today's refrigerators. In 1870 Linde published his research and by 1873 a patented commercial refrigeration system was on the market. In the years which followed the industry grew – in 1879 there were 35 plants and 10 years later 222 making artificial ice. Effectively this development sounded the death knell for the ice-harvesting industry – although it took a long time to go under. For a while both industries grew alongside each other, learning and innovating along their different pathways and expanding the overall market for ice – for example, by feeding the growing urban demand to fill domestic 'ice boxes'. But inevitably the new technology took over as the old harvesting model reached the limits of what it could achieve in terms of technological efficiencies. Significantly most of the established ice harvesters were too locked into the old model to make the transition and so went under – to be replaced by the new refrigeration industry dominated by new entrant firms.

Change of this kind can come through the emergence of a new technology – like the ice industry example (see Case study 1.4). Or it can come through the emergence of a completely new market with new characteristics and expectations. In his famous studies of the computer disk drive, steel and hydraulic excavator industries Christensen highlights the problems that arise under these conditions. For example, the disk drive industry was a thriving sector in which the voracious demands of a growing range of customer industries meant there was a booming market for disk drive storage units. Around 120 players populated what had become an industry worth $18 billion by 1995 – and like their predecessors in ice harvesting – it was a richly innovative industry. Firms worked closely with their customers, understanding the particular needs and demands for more storage capacity, faster access times, smaller footprints, etc. But just like our ice industry, the virtuous circle around the original computer industry was broken – in this case not by a radical technological shift but also by the emergence of a new market with very different needs and expectations.[53] See web for patterns of discontinuous innovation exercise.

The key point about this sector was that disruption happened not once but several times, involving different generations of technologies, markets and participating firms. For example, whilst the emphasis in the mini-computer world of the mid-1970s was on high performance and the requirement for storage units correspondingly technologically sophisticated, the emerging market for personal computers had a very different shape. These were much less clever machines, capable of running simpler software and with massively inferior performance – but at a price which a very different set of people could afford. Importantly, although simpler, they were capable of doing most of the basic tasks that a much wider market was interested in – simple arithmetical calculations, word processing and basic graphics. As the market grew so learning effects meant that these capabilities improved – but from a much lower cost base. The result was, in the end, just like that of Linde and his contemporaries on the ice industry – but from a different direction. Of the major manufacturers in the disk drive industry serving the mini-computer market only a handful survived – and leadership in the new industry shifted to new entrant firms working with a very different model.

CASE STUDY 1.5

Technological excellence may not be enough . . .

In the 1970s Xerox was the dominant player in photocopiers, having built the industry from its early days when it was founded on the radical technology pioneered by Chester Carlsen and the Battelle Institute. But despite its prowess in the core technologies and continuing investment in maintaining an edge it found itself seriously threatened by a new generation of small copiers developed by new entrants including several Japanese players. Despite the fact that Xerox had enormous experience in the industry and a deep understanding of the core technology it took them almost eight years of mishaps and false starts to introduce a competitive product. In that time Xerox lost around half its market share and suffered severe financial problems. As Henderson and Clark put it, in describing this case, '*apparently modest changes to the existing technology . . . have quite dramatic consequences*'.[54]

In similar fashion in the 1950s the electronics giant RCA developed a prototype portable transistor-based radio using technologies which it had come to understand well. However, it saw little reason to promote such an apparently inferior technology and continued to develop and build its high-range devices. By contrast Sony used it to gain access to the consumer market and to build a whole generation of portable consumer devices – and in the process acquired considerable technological experience which enabled it to enter and compete successfully in higher value, more complex markets.[55]

Discontinuity can also come about by reframing the way we think about an industry – changing the dominant business model and hence the 'rules of the game'. Think about the revolution in flying which the low-cost carriers have brought about. Here the challenge came via a new business model rather than technology – based on the premise that if prices could be kept low a large new market could be opened up. The power of the new way of framing the business was that it opened up a new – and very different – trajectory along which all sorts of innovations began to happen. In order to make low prices pay a number of problems needed solving – keeping load factors high, cutting administration costs, enabling rapid turnaround times at terminals – but once the model began to work it attracted not only new customers but also increasingly established flyers who saw the advantages of lower prices.

What these – and many other examples – have in common is that they represent the challenge of *discontinuous* innovation. None of the industries were lacking in innovation or a commitment to further change. But the ice harvesters, mini-computer disk companies and the established airlines all carried on their innovation on a stage covered with a relatively predictable carpet. The trouble was that shifts in technology, in new market emergence or in new business models pulled this carpet out from under the firms – and created a new set of conditions on which a new game would be played. Under such conditions, it is the new players who tend to do better because they don't have to wrestle with learning new tricks and letting go of their old ones. Established players often do badly – in part because the natural response is to press even harder on the pedal driving the existing ways of organizing and managing innovation. In the ice industry example the problem was not that the major players weren't interested in R&D – on the contrary they worked really hard at keeping a technological edge in insulation, harvesting and other tools. But they were blindsided by technological changes coming from a different field altogether – and when they woke up to the threat posed by mechanical ice making their response was to work even harder at improving their own ice-harvesting and shipping technologies. It is here that the so-called 'sailing ship' effect can often be observed, in which a mature technology accelerates in its rate of improvement as a response to a competing new alternative – as was the case with the development of sailing ships in competition with newly emerging steamship technology.[56]

In similar fashion the problem for the firms in the disk drive industry wasn't that they didn't listen to customers but rather that they listened too well. They built a virtuous circle of demanding customers in their existing market place with whom they developed a stream of improvement innovations – continuously stretching their products and processes to do what they were doing better and better. The trouble was that they were getting close to the wrong customers – the discontinuity which got them into trouble was the emergence of a completely different set of users with very different needs and values.

Table 1.4 gives some examples of such triggers for discontinuity. Common to these from an innovation management point of view is the need to recognize that under discontinuous conditions (which thankfully don't emerge every day) we need different approaches to organizing and managing innovation. If we try and use established models which work under steady state conditions we find – as is the reported experience of many – we are increasingly out of our depth and risk being upstaged by new and more agile players.

TABLE 1.4 **Sources of discontinuity**

Triggers/ sources of discontinuity	Explanation	Problems posed	Examples (of good and bad experiences)
New market emerges	Most markets evolve through a process of gradual expansion but at certain times completely new markets emerge which cannot be analysed or predicted in advance or explored through using conventional market research/analytical techniques	Established players don't see it because they are focused on their existing markets May discount it as being too small or not representing their preferred target market – fringe/cranks dismissal Originators of new product may not see potential in new markets and may ignore them, e.g. text messaging	Disk drives, excavators, mini-mills.[53] Mobile phone/SMS where market which actually emerged was not the one expected or predicted by originators
New technology emerges	Step change takes place in product or process technology – may result from convergence and maturing of several streams (e.g. industrial automation, mobile phones) or as a result of a single	Don't see it because beyond the periphery of technology search environment Not an extension of current areas but completely new field or approach	Ice harvesting to cold storage[52] Valves to solid-state electronics[57] Photos to digital images

(continued)

TABLE 1.4 **(Continued)**

Triggers/ sources of discontinuity	Explanation	Problems posed	Examples (of good and bad experiences)
	breakthrough (e.g. LED as white light source)	Tipping point may not be a single breakthrough but convergence and maturing of established technological streams, whose combined effect is underestimated Not-invented-here effect – new technology represents a different basis for delivering value, e.g. telephone vs. telegraphy	
New political rules emerge	Political conditions which shape the economic and social rules may shift dramatically, e.g., the collapse of communism meant an alternative model (capitalist, competition as opposed to central planning) – and many ex-state firms couldn't adapt their ways of thinking	Old mindset about how business is done, rules of the game, etc. are challenged and established firms fail to understand or learn new rules	Centrally planned to market economy, e.g., former Soviet Union Apartheid to post-apartheid South Africa – inward and insular to externally linked[58] Free trade/globalization results in dismantling protective tariff and other barriers and new competition basis emerges[58, 59]
Running out of road	Firms in mature industries may need to escape the constraints of diminishing space for product and process	Current system is built around a particular trajectory and embedded in a steady-state set of innovation routines which militate against widespread search	Medproducts[60] Kodak Encyclopaedia Britannica[26]

(continued)

TABLE 1.4 **(Continued)**

Triggers/ sources of discontinuity	Explanation	Problems posed	Examples (of good and bad experiences)
	innovation and the increasing competition of industry structures by either exit or by radical reorientation of their business	or risk-taking experiments	Preussag[25] Mannesmann
Sea change in market sentiment or behaviour	Public opinion or behaviour shifts slowly and then tips over into a new model, e.g., the music industry is in the midst of a (technology-enabled) revolution in delivery systems from buying records, tapes and CDs to direct download of tracks in MP3 and related formats	Don't pick up on it or persist in alternative explanations – cognitive dissonance – until it may be too late	Apple, Napster, Dell, Microsoft vs. traditional music industry[61]
Deregulation/ shifts in regulatory regime	Political and market pressures lead to shifts in the regulatory framework and enable the emergence of a new set of rules, e.g., liberalization, privatization or deregulation	New rules of the game but old mindsets persist and existing player unable to move fast enough or see new opportunities opened up	Old monopoly positions in fields like telecommunications and energy were dismantled and new players/combinations of enterprises emerged. In particular, energy and bandwidth become increasingly viewed as commodities. Innovations include skills in trading and distribution – a factor behind the considerable success of Enron in the late 1990s as it

(continued)

TABLE 1.4 **(Continued)**

Triggers/ sources of discontinuity	Explanation	Problems posed	Examples (of good and bad experiences)
			emerged from a small gas pipeline business to becoming a major energy trade[34] – unquantifiable chances may need to be taken
Fractures along 'fault lines'	Long-standing issues of concern to a minority accumulate momentum (sometimes through the action of pressure groups) and suddenly the system switches/tips over, e.g., social attitudes to smoking or health concerns about obesity levels and fast foods	Rules of the game suddenly shift and then new pattern gathers rapid momentum wrong-footing existing players working with old assumptions. Other players who have been working in the background developing parallel alternatives may suddenly come into the limelight as new conditions favour them	McDonald's and obesity Tobacco companies and smoking bans Oil/energy companies and global warming Opportunity for new energy sources like wind power, cf. Danish dominance[62]
Unthinkable events	Unimagined and therefore not prepared for events which – sometimes literally – change the world and set up new rules of the game	New rules may disempower existing players or render competencies unnecessary	World Trade Center – 9/11
Business model innovation	Established business models are challenged by a reframing, usually by a new entrant who redefines/reframes the problem and the consequent rules of the game	New entrants see opportunity to deliver product/service via new business model and rewrite rules – existing players have at best to be fast followers	Amazon Charles Schwab[61] Southwest and other low-cost airlines[34, 61, 63]

(continued)

TABLE 1.4 **(Continued)**

Triggers/ sources of discontinuity	Explanation	Problems posed	Examples (of good and bad experiences)
Shifts in 'techno-economic paradigm' – systemic changes which impact whole sectors or even whole societies	Change takes place at system level, involving technology and market shifts. This involves the convergence of a number of trends which result in a 'paradigm shift' where the old order is replaced	Hard to see where new paradigm begins until rules become established. Existing players tend to reinforce their commitment to old model, reinforced by 'sailing ship' effects	Industrial Revolution[64–66] Mass production
Architectural innovation	Changes at the level of the system architecture rewrite the rules of the game for those involved at component level	Established players develop particular ways of seeing and frame their interactions, e.g., who they talk to in acquiring and using knowledge to drive innovation – according to this set of views. Architectural shifts may involve reframing but at the component level it is difficult to pick up the need for doing so – and thus new entrants better able to work with new architecture can emerge	Photolithography in chip manufacture[54, 67]

Component/architecture innovation and the importance of knowledge

Another important lens through which to view innovation opportunities is as components within larger systems. Rather like Russian dolls we can think of innovations that change things at the level of components or those that involve change in a whole system. For example, we can put a faster transistor on a microchip on a circuit board for the graphics display in a computer. Or we can change the way several boards are put together in the computer to give it particular capabilities – a games box, an e-book, a media PC. Or we can link the computers in a network to drive a small business or office. Or we can link the networks to others into the Internet. There's scope for innovation at each level – but changes in the higher level systems often have implications for lower down. For example, if cars – as a complex assembly – were suddenly designed to be made out of plastic instead of metal it would still leave scope for car assemblers – but would pose some sleepless nights for producers of metal components! See web for patterns of architecture/component innovation exercise.

Innovation is about knowledge – creating new possibilities through combining different knowledge sets. These can be in the form of knowledge about what is technically possible or what particular configuration would meet an articulated or latent need. Such knowledge may already exist in our experience, based on something we have seen or done before. Or it could result from a process of search – research into technologies, markets, competitor actions, etc. And it could be in explicit form, codified in such a way that others can access it, discuss it, transfer it, etc. – or it can be in tacit form, known about but not actually put into words or formulae.[68]

The process of weaving these different knowledge sets together into a successful innovation is one which takes place under highly uncertain conditions. We don't know what the final innovation configuration will look like (and we don't know how we will get there). Managing innovation is about turning these uncertainties into knowledge – but we can do so only by committing resources to reduce the uncertainty – effectively a balancing act. Figure 1.3 illustrates this process of increasing resource commitment whilst reducing uncertainty.

Viewed in this way we can see that incremental innovation, whilst by no means risk-free, is at least potentially manageable because we are starting from something we know about and developing improvements in it. But as we move to more radical options, uncertainty is higher and we have no prior idea of what we are to develop or how to develop it! Again this helps us understand why discontinuous innovation is so hard to deal with.

A key contribution to our understanding here comes from the work of Henderson and Clark who looked closely at the kinds of knowledge involved in different kinds of innovation.[54] They argue that innovation rarely involves dealing with a single technology or market but rather a bundle of knowledge,

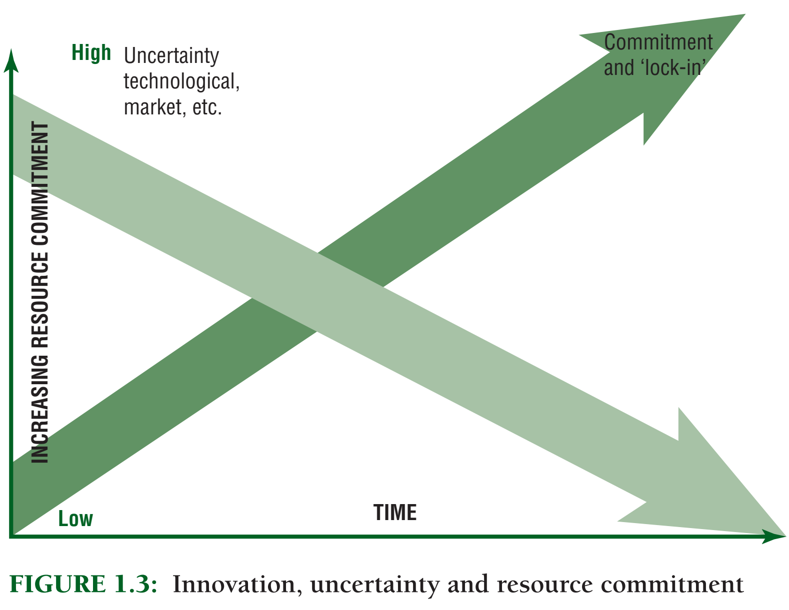

FIGURE 1.3: Innovation, uncertainty and resource commitment

which is brought together into a configuration. Successful innovation management requires that we can get hold of and use knowledge about *components* and also about how those can be put together – what they termed the *architecture* of an innovation.

We can see this more clearly with an example. Change at the component level in building a flying machine might involve switching to newer metallurgy or composite materials for the wing construction or the use of fly-by-wire controls instead of control lines or hydraulics. But the underlying knowledge about how to link aerofoil shapes, control systems, propulsion systems, etc. at the *system* level is unchanged – and being successful at both requires a different and higher order set of competencies.

One of the difficulties with this is that innovation knowledge flows – and the structures which evolve to support them – tend to reflect the nature of the innovation. So if it is at component level then the relevant people with skills and knowledge around these components will talk to each other – and when change takes place they can integrate new knowledge. But when change takes place at the higher system level – 'architectural innovation' in Henderson and Clark's terms – then the existing channels and flows may not be appropriate or sufficient to support the innovation and the firm needs to develop new ones. This is another reason why existing incumbents often fare badly when major system level change takes place – because they have the twin difficulties of learning and configuring a new knowledge system and 'unlearning' an old and established one.

Figure 1.4 illustrates the range of choices, highlighting the point that such change can happen at component or sub-system level or across the whole system.

A variation on this theme comes in the field of 'technology fusion', where different technological streams converge, such that products which used to have a discrete identity begin to merge into new architectures. An example here is the home automation industry, where the fusion of technologies such as computing, telecommunications, industrial control and elementary robotics is enabling a new generation of housing systems with integrated entertainment, environmental control (heating, air conditioning, lighting) and communication possibilities.[69, 70]

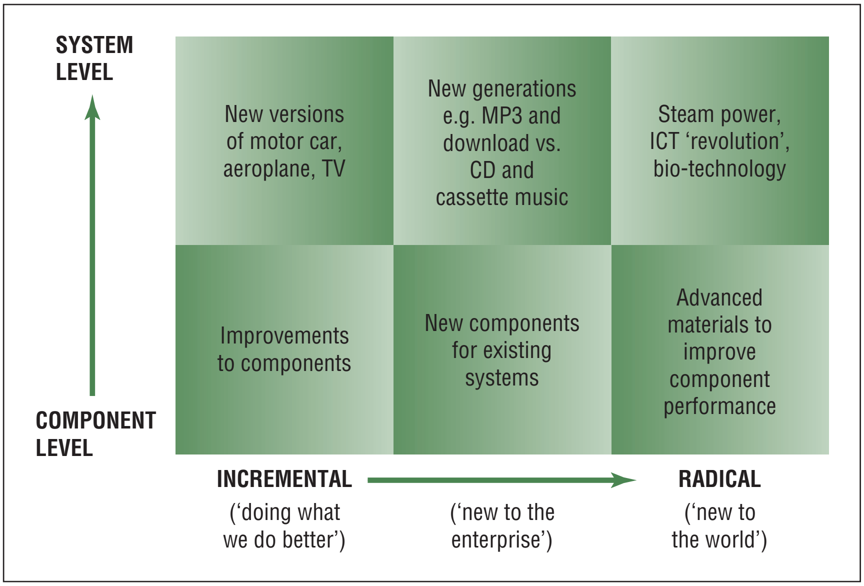

FIGURE 1.4: Dimensions of innovation

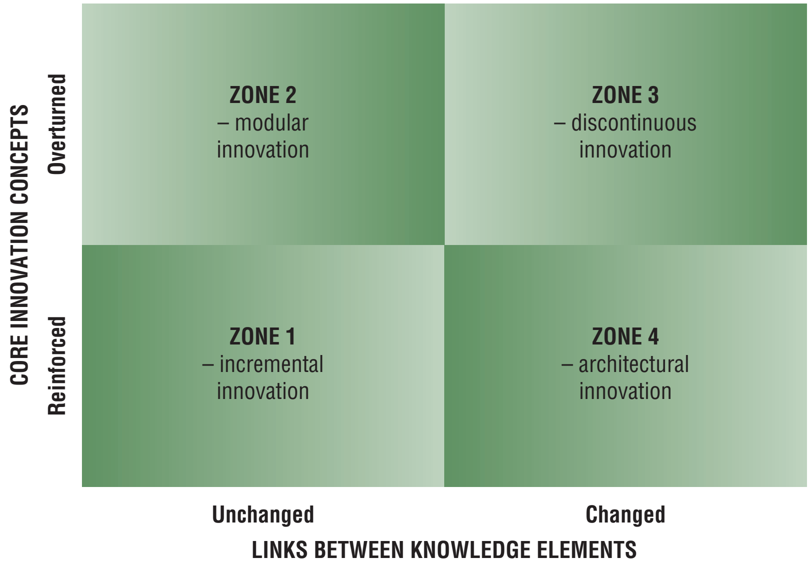

FIGURE 1.5: Component and architectural innovation
Source: Abernathy, W. and J. Utterback (1978) Patterns of industrial innovation. *Technology Review*, **80**, 40–47.

Similarly, a new addition to the range of financial services may represent a component product innovation, but its impacts are likely to be less far-reaching (and the attendant risks of its introduction lower) than a complete shift in the nature of the service package – for example, the shift to direct-line systems instead of offering financial services through intermediaries.

Many businesses are now built on business models that stress integrated solutions – systems of many components which together deliver value to end-users. These are often complex, multi-organization networks – examples might include rail networks, mobile phone systems, major construction projects or design and development of new aircraft like the Boeing Dreamliner or the Airbus A380. Managing innovation on this scale requires development of skills in what Hobday and colleagues call 'the business of systems integration'.[71]

Figure 1.5 highlights the issues for managing innovation. In Zone 1 the rules of the game are clear – this is about steady-state improvement to products or processes and uses knowledge accumulated around core components.

In Zone 2 there is significant change in one element but the overall architecture remains the same. Here there is a need to learn new knowledge but within an established and clear framework of sources and users – for example, moving to electronic ignition or direct injection in a car engine, the use of new materials in airframe components, the use of IT systems instead of paper processing in key financial or insurance transactions. None of these involve major shifts or dislocations.

In Zone 3 we have discontinuous innovation where neither the end state nor the ways in which it can be achieved are known – essentially the whole set of rules of the game changes and there is scope for new entrants.

In Zone 4 we have the condition where new combinations – architectures – emerge, possibly around the needs of different groups of users (as in the disruptive innovation case). Here the challenge is in reconfiguring the knowledge sources and configurations. We may use existing knowledge and recombine it in different ways or we may use a combination of new and old. Examples might be low-cost airlines and direct-line insurance.