2.3 Evolving models of the process

The importance of viewing innovation as a process is that this understanding shapes the way in which we try and manage it. Put simply, our mental models shape our actions – we pay attention to, allocate resources to, take decisions about things, according to how we think about them. So if innovation is a process we need to have a clear and shared understanding of what that process involves and how it operates.

This understanding of the core process model has changed a great deal over time. Early models (both explicit and, more importantly, the implicit mental models whereby people managed the process) saw it as a linear sequence of functional activities. Either new opportunities arising out of research gave rise to applications and refinements which eventually found their way to the marketplace ('technology push') or else the market signalled needs for something new, which then drew through new solutions to the problem ('need pull', where necessity becomes the mother of invention).

The limitations of such an approach are clear: in practice innovation is a coupling and matching process where interaction is the critical element.[52,53] Sometimes the 'push' will dominate, sometimes the 'pull', but successful innovation requires interaction between the two. The analogy to a pair of scissors is useful here: without both blades it is difficult to cut. (Chapter 5 explores the issue of sources of innovation and how there is considerable interplay between these two types.)

One of the key problems in managing innovation is that we need to make sense of a complex, uncertain and highly risky set of phenomena. Inevitably we try and simplify these through the use of mental models – often reverting to the simplest linear models to help us explore the management issues which emerge over time. Prescriptions for structuring the process along these lines abound, for example, one of the most-cited models for product innovation is due to Booz, Allen and Hamilton.[54] Many variations exist on this theme – for example, Robert Cooper's work suggests a slightly extended view with 'gates' between stages which permit management of the risks in the process.[55] There is also a British Standard (BS 7000), which sets out a design-centred model of the process.[56]

Much recent work recognizes the limits of linear models and tries to build more complexity and interaction into the frameworks. For example, the Product Development Management Association (PDMA) offers a detailed guide to the process and an accompanying toolkit.[57] Increasingly there is recognition of some of the difficulties around what is often termed the 'fuzzy front end' where uncertainty is highest, but there is still convergence around a basic process structure as a way of focusing our attention.[58] The balance needs to be struck between simplifications and representations which help thinking – but just as the map is not the same as the territory it represents so they need to be seen as frameworks for thinking, not as descriptions of the way the process actually operates.

Most innovation is messy, involving false starts, recycling between stages, dead ends, jumps out of sequence, etc. Various authors have tried different metaphors – for example, seeing the process as a railway journey with the option of stopping at different stations, going into sidings or even, at times, going backwards – but most agree that there is still some sequence to the basic process.[59,60] In an important programme of case-study-based research looking at widely different innovation types, Van de Ven and colleagues explored the limitations of simple models of the process.[61] They drew attention to the complex ways in which innovations actually evolve over time, and derived some important modifiers to the basic model:

- Shocks trigger innovations – change happens when people or organizations reach a threshold of opportunity or dissatisfaction.

- Ideas proliferate – after starting out in a single direction, the process proliferates into multiple, divergent progressions.
- Setbacks frequently arise, plans are overoptimistic, commitments escalate, mistakes accumulate and vicious cycles can develop.
- Restructuring of the innovating unit often occurs through external intervention, personnel changes or other unexpected events.
- Top management plays a key role in sponsoring – but also in criticizing and shaping – innovation.
- Success criteria shift over time, differ between groups and make innovation a political process.
- Innovation involves learning, but many of its outcomes are due to other events that occur as the innovation develops – making learning often 'superstitious' in nature.

They suggest that the underlying structure can be represented by the metaphor of an 'innovation journey', which has key phases of initiation, development and implementation/termination. But the progress of any particular innovation along this journey will depend on a variety of contingent circumstances; depending on which of these apply, different specific models of the process will emerge.

Roy Rothwell was for many years a key researcher in the field of innovation management, working at the Science Policy Research Unit (SPRU) at the University of Sussex. In one of his later papers he provided a useful historical perspective, suggesting that our appreciation of the nature of the innovation process has been evolving from such simple linear models (characteristic of the 1960s) through to increasingly complex interactive models (Table 2.4). His 'fifth-generation innovation' concept sees innovation as a multi-actor process, which requires high levels of integration at both intra- and inter-firm levels and which is increasingly facilitated by IT-based networking.[62] Whilst his work did not explicitly mention the Internet, it is clear that the kinds of innovation management challenge posed by the emergence of this new form fit well with the model. Although such fifth-generation models and the technologies which enable them appear complex, they still involve the same basic process framework.[63]

TABLE 2.4 Rothwell's five generations of innovation models

Generation	Key features
First/second	Simple linear models – need pull, technology push
Third	Coupling model, recognizing interaction between different elements and feedback loops between them
Fourth	Parallel model, integration within the company, upstream with key suppliers and downstream with demanding and active customers, emphasis on linkages and alliances
Fifth	Systems integration and extensive networking, flexible and customized response, continuous innovation