Open innovation and the need to share and exchange knowledge (network models)

Innovation has been described as an information–creation process that arises out of social interaction. Chesbrough (2003), adopting a business strategy perspective, presents a persuasive argument that the process of innovation has shifted from one of closed systems, internal to the firm, to a new mode of open systems involving a range of players distributed up and down the supply chain. Significantly, it is Chesbrough's emphasis on the new knowledge-based economy that informs the concept **open innovation**. In particular, it is the use of cheap and instant information flows that places even more emphasis on the linkages and relationships of firms. It is from these linkages and the supply chain in particular that firms have to ensure that they have the capability to fully capture and utilise ideas.

Furthermore, the product innovation literature, in applying the open innovation paradigm, has been debating the strengths and limitations of so-called user toolkits, which seem to ratchet up further this drive to externalise the firm's capabilities to capture innovation opportunities (von Hippel, 2005).

Authors such as Thomke (2003), Schrange (2000) and Dodgson et al. (2005) have emphasised the importance of learning through experimentation. This is similar to Nonaka's work in the early 1990s, which emphasised the importance of learning by doing in the 'knowledge creating company' (Nonaka, 1991). However, Dodgson et al. argue that there are significant changes occurring at all levels of the innovation process, forcing us to reconceptualise the process with emphasis placed on the three areas that have experienced most significant change through the introduction and use of new technologies. These are: technologies that facilitate creativity, technologies that facilitate communication and technologies that facilitate

Table 1.6 The chronological development of models of innovation

Date	Model	Characteristics
1950/60s	Technology-push	Simple linear sequential process; emphasis on R&D; the market is a recipient of the fruits of R&D
1970s	Market-pull	Simple linear sequential process; emphasis on marketing; the market is the source for directing R&D; R&D has a reactive role
1970s	Dominant design	Abernathy and Utterback (1978) illustrate that an innovation system goes through three stages before a dominant design emerges
1980s	Coupling model	Emphasis on integrating R&D and marketing
1980/90s	Interactive model	Combinations of push and pull
1990	Architectural innovation	Recognition of the role of firm-embedded knowledge in influencing innovation
1990s	Network model	Emphasis on knowledge accumulation and external linkages
2000s	Open innovation	Chesbrough's (2003) emphasis on further externalisation of the innovation process in terms of linkages with knowledge inputs and collaboration to exploit knowledge outputs

manufacturing. For example, they argue that information and communication technologies have changed the way individuals, groups and communities interact. Mobile phones, email and websites are obvious examples of how people interact and information flows in a huge osmosis process through the boundaries of the firm. When this is coupled with changes in manufacturing and operations technologies, enabling rapid prototyping and flexible manufacturing at low costs, the process of innovation seems to be undergoing considerable change (Chesbrough, 2003; Dodgson et al., 2005; Schrange, 2000). Models of innovation need to take account of these new technologies, which allow immediate and extensive interaction with many collaborators throughout the process from conception to commercialisation.

Table 1.6 summarises the historical development of the dominant models of the industrial innovation process.