2.1 A shift in Innovation Paradigms

According to Henry Chesbrough (2003d), we are witnessing a radical shift in innovation paradigms moving from closed business models to more open and globally-linked models. In his research, the author uses explicitly the expression “paradigm shift” by the historian of science Thomas Kuhn, to emphasize the radical fundamental change in how companies commercialize industrial knowledge. In simple words, closed innovation is nothing but the predominant business model used by most major U.S. corporations to run their labs for most of the twentieth century. It is the strategic model that Xerox used to manage its PARC research facility. Closed innovation is a view that says “successful innovation requires control” (Chesbrough, 2003d: xx). Yet, according to the paradigm firms must be strongly self-reliant and independent, because it is always hard to manage successful business partnerships with other companies without running into troubles. The idea is that: “If you want something done right, you have got to do it yourself” (Chesbrough, 2003d: xx). The past success of the closed innovation paradigm was mainly due to the centralized knowledge landscape of the twentieth century. Although we were witnessing to numerous scientific revolutions with discoveries made by famous scientists such as Einstein, Bohr, Maxwell, Curie, the norm of science at that time suggested that the scientific community would have not benefited from the practical use of its inventions. “Emulating the norms of ‘pure’ science held in German universities, U.S. scientists regarded the pursuit of practical knowledge as ‘prostituted science” (Chesbrough, 2003d: 22). Thus, although the knowledge generated within universities seemed to hold great promise, the growing enterprises of that time could not rely on this valuable know-how being transferred in the industry. As a consequence of this isolationism, universities lacked the financial resources to conduct significant experiments and come up with revolutionary advancements themselves. Neither government played a great role in the research system by offering assistance and support in the form of financial grants. As a result of the scarce participation of leading universities and government in the commercial application of science, the industry became the primary source of research funding for practical use of knowledge, and industry R&D laboratories were the primary locus of this industrial research. Historian Alfred Chandler (1990) documented the choices of many industrial enterprises during this period. Among his important findings was the role of companies’ internal R&D functions in creating economies of scale in their business. The institution of the central research lab and internal product development was thus a critical element of

the rise of the modern industrial corporation (Chesbrough, 2003d: 24). Outside the fortified central R&D castles, the knowledge landscape was assumed to be rather barren. This was also when the term 'not invented here' was first coined. Basically, if a technology was not developed inside a company (i.e. not invented here), the firm could not be sure of the quality, performance and availability of the particular technology. Moreover, because of the closed nature of the system, the intellectual property (IP) generated in the internal R&D departments was closely guarded from fraudulent conversion. The golden age of R&D was an age of severe vertical integration, born of necessity (since there were few capable external alternatives) and of virtue (since it was easy to capture value from one's R&D when one controlled the entire value chain of business activities) (Chesbrough, 2003d: 30). Figure 2.1 illustrates this closed model of innovation for managing R&D also called stage-gate model (Cooper, 1992; Tidd et al., 2005). The solid lines represent the boundaries of the firm. Ideas are internally generated in the corporate R&D department on the left and flow out to the market on the right. A large number of new concepts are screened and narrowed down to those that best fit the company business model and that can be transferred into further development and then taken to market. There is no other route for ideas to come into the company, nor is there any other path for products and services to be taken to the outside.

Figure Errore. Nel documento non esiste testo dello stile specificato..**1: The Closed innovation funnel.**
Source: Henry Chesbrough, 2003d: xxii.

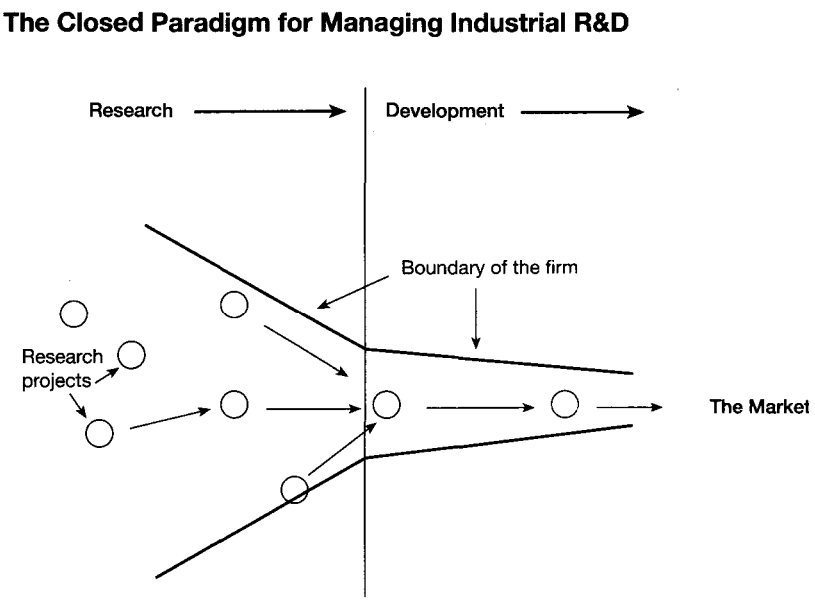
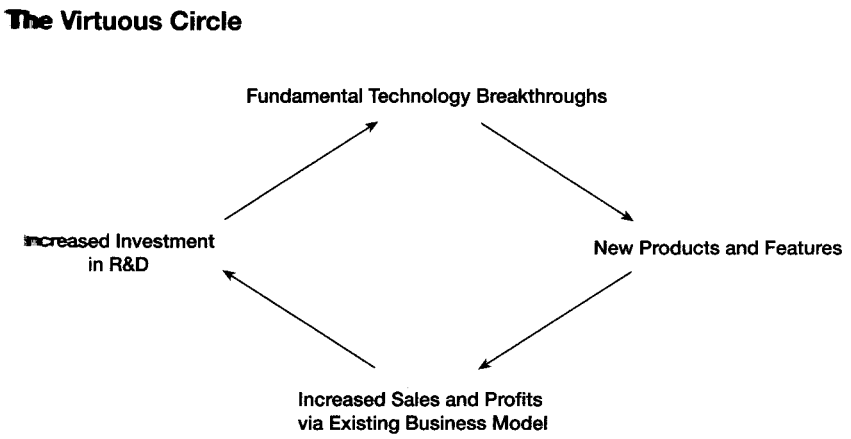


Figure 2.1 shows also the knowledge landscape that stems from the pattern of deep, vertically integrated R&D organizations, and the impoverished surrounding environment. Although there might be many ideas, few of them were available outside the borders of this firm. The company's R&D system is self-sufficient and sustainable over time. The logic of the closed model of innovation is a virtuous circle, companies invested in internal R&D, which led to many breakthrough discoveries. These discoveries encourage those companies to bring new products and services to market, to realize more sales and higher margin, and to reinvest in more internal R&D, which led again to further breakthroughs closing the virtuous circle (Figure 2.2).

Figure Errore. Nel documento non esiste testo dello stile specificato..**2: The virtuous circle of internal R&D.**
Source: Henry Chesbrough, 2003d: xxi.



In certain industries, the golden age continues, and this vertically-integrated system remains the best option for managing the innovation process. Oliver Gassmann (2006) describes the nuclear and military industries as typical examples of closed innovation industries in which non-proliferation of technology and protection remain important. In these sectors, the protection of intellectual property is extremely highs; start-ups seldom pop up and venture capitalists make little investments. In many other industries, though, the logic underlying the closed innovation paradigm has become fundamentally obsolete. Substantially, several factors have eroded the validity and effectiveness of this underpinning paradigm.

First of all, the progressive and rapid change in the knowledge landscape has been crucial for establishing new open ways of thinking. The unique relationship between the

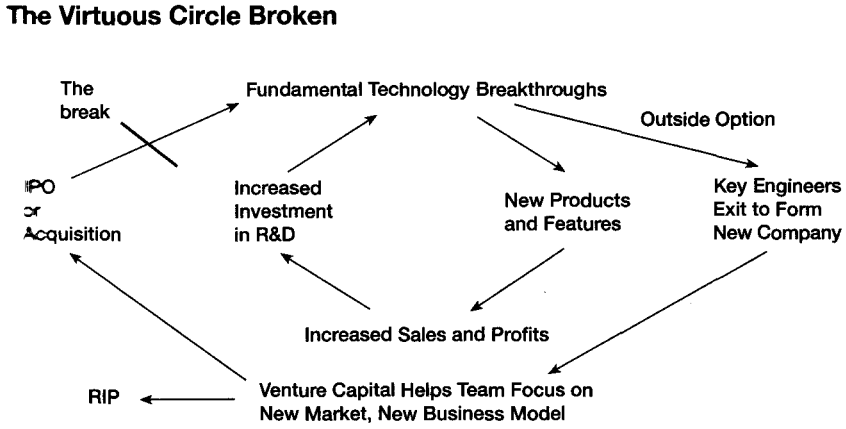
public university and corporations that developed in the first half of the twentieth century has been paramount in fostering scientific knowledge and identifying new commercial routes for discoveries. In the U.S. the higher education system is highly decentralized, state schools are funded by state government and thus responding to local commercial needs. After the Civil War the federal government established a land-grant program for state universities that focused on science and technology. As a consequence of decentralization, government funding and focus on higher education, U.S. universities expanded the pool of qualified engineers and scientists from which corporations could staff their personnel. On the other hand, because of the excellent reputation of the public universities and career incentives for further education, a large number of employees left their company in order to undertake various graduate or post-graduate courses (Chesbrough, 2003d). The growing number of these people allowed knowledge to spill out of the fortified corporate central R&D labs to companies of all sizes in the industries as well as customers, partners, consultants and universities. U.S. immigration policy also played a vital role in attracting skilled professionals or fine minds from other countries. The influx of highly talented foreigners and the high mobility of other skilled workers have been rejuvenating for the U.S. economy of the second half of the twentieth century. In Europe we have witnessed these phenomena in more recent years, but it is indisputable that they will be the trends of the future global economy. A further factor has been the growing presence of private venture capital (VC), crucial in the launch and development of new start-ups that commercialize external research from universities and other institutions. Prior to 1980, little VC was available in the United States and Europe. According to Chesbrough (2003d: 37), “the ability of companies to attract other talented staff to the new venture was impaired by the lack of adequate capital to justify the risk of leaving a well-capitalized company for an un-known start-up company”. About $700 million in VC was invested in the United States in 1980, and the figure rose to more than $80 billion in 2000 (Gompers & Lerner, 2001). Similarly, in Europe we have witnessed an extraordinary increase of about 636% from 1988 (€ 3,451 million) to 1999 (€ 25,401 million) (FT, 2000). It can be argued that this large and growing availability of VC can be really threatening for companies that make significant commitments to internal R&D. As a result of the combination of the two afore mentioned factors (mobility and availability of skilled workers, and VC), innovative outside paths to markets for many ideas are becoming decisive for many companies. As product life cycle shortens and as external options grow, it becomes crucial for companies to identify new routes to speed up the innovation process. In a highly

competitive and saturated market, if a company's internal R&D lab is not ready to use a new research result, it should find other ways to commercialize these new concepts outside the company's boundaries. There may be new potential markets to explore with these ideas, which the established company may be poorly suited to address. Similarly, discontented company's entrepreneurs may decide to form start-ups to bring their ideas to market, otherwise left on the shelf for years. Finally, as a further consequence of the shift in the knowledge landscape, customers and suppliers are becoming more knowledgeable and therefore they may further challenge the firm's ability to profit from their knowledge silos. Besides, the external suppliers' linkages with various comers and start-ups in the industry can enable the spillover of unutilized ideas from the R&D labs into the market.

These erosion factors have loosed the linkage between research and development in the closed innovation paradigm. Nowadays, the knowledge landscape offers a myriad of new research inputs outside the firm. These concepts could be brought into the firm and turned into successful new products or services. At the same time, as a direct consequence of the erosion factors, ideas can no longer be left on the shelf for future development, because they might leak out to the broader environment over time and be exploited by existing competitors or newcomers. According to Chesbrough (2003d: 40) "what previously was a fundamentally closed, internal environment (where the firm can create ideas in order to use them) has transformed into an open environment (where the firm can create ideas for external and internal use, and the firm can access ideas from the outside as well as from within)". More importantly, these erosion factors have also reconfigured the landscape of knowledge. The distribution of know-how has shifted away from the fortified towers of central R&D facilities, toward numerous pools of knowledge disseminated across the globe. In today's world competition has become increasingly knowledge-based (Lane & Lubatkin, 1998; Seely Brown & Duguid, 1998; Amesse & Cohendet, 2001) and many firms have started to manage their knowledge silos as a strategic asset (Nonaka & Takeuchi, 1995; Teece, 2000). Some researchers have moved towards a distinctly knowledge-based theory of the firm (Grant, 1996; Spender, 1996) adopting a view on corporations as distributed knowledge system (Tsoukas, 1996).

In situations in which the erosion factors have taken place, closed innovation is no longer sustainable. "The do-it-yourself mentality in technology and R&D management is outdated" (Gassmann, 2006: 223) and the virtuous circle of R&D is broken (Figure 2.3).

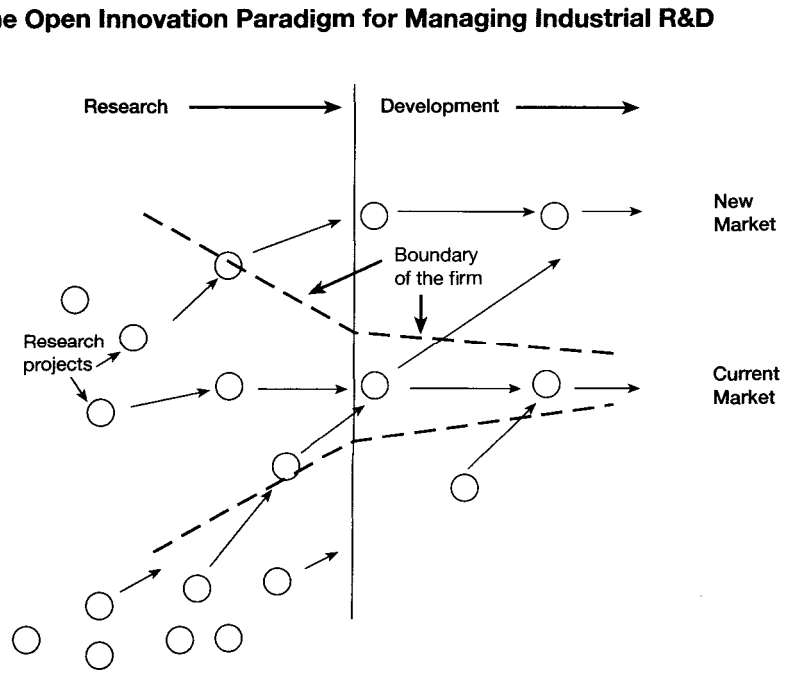
Figure Errore. Nel documento non esiste testo dello stile specificato..**3: The virtuous circle of internal R&D broken.** *Source:* Henry Chesbrough, 2003d: xxiii.



There are fewer economies of scale in R&D than there were a generation ago (Friedman, 2005) as a result of rising development costs and shorter product life cycles (Chesbrough, 2006; 2007). A new collaborative and global approach, which Chesbrough called 'Open Innovation', is emerging as an effective alternative to the closed model. While openness has existed in the past, its emergence as a global phenomenon is relatively new, tied to technological developments such as digitalization and the growth of the Internet (Maxwell, 2006). In a 1999 study, the Organization for Economic Cooperation and Development (OECD) demonstrated how the principles of openness had spurred the growth of electronic commerce. "The Internet has been adopted as a platform for business because of its non-proprietary standards and open nature as well as the huge industry that has evolved to support it. More importantly, openness has emerged as a strategy (…) (Wyckoff & Colecchia, 1999). Other than the Internet, the example of openness most familiar to the general public is the open-source software movement. In the early days of computing, programmers adhered to a "hacker ethic" based on principles of community, openness, peering, sharing and acting globally (Levy, 1984). While in fact the open-source movement is important in its right for its impact on the software market, its demonstration of an alternative model for creating value under an intellectual property regime, and as a laboratory for production through mass collaboration, it can be fundamentally considered an instance of open innovation. Despite its recent formidable popularity, open innovation is hardly a new phenomenon. Adam Smith (1776) wrote about innovations by working men in the Wealth of Nations. Lawrence Lessing (2005) has pointed out that the Oxford English Dictionary began with a call for volunteers to send in examples of vernacular word usage.

It can be argued that the recent fame of the term “open innovation” is partly due to the explicit reference to the open-source software movement and its ‘hacker ethic’. In short, Henry Chesbrough (2003d: xxiv) defines open innovation as a “paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology”. In figure 2.4, new concepts can still originate from inside the firm’s R&D department, but some of these ideas may stem from the outside and be equally included in the development process. While in figure 2.1, the solid lines of the funnel represented the boundary of the firm; in figure 2.4 these lines are dotted, reflecting more porous boundary, the interface between firm’s internal operations and the two-way linkages with the outside world.

Figure Errore. Nel documento non esiste testo dello stile specificato..**4: Open innovation funnel.**
Source: Henry Chesbrough, 2003d: xxv.



The model shows that many ideas may seep out the R&D funnel to search new business opportunities outside the firm’s borders in the form of start-ups, external licensing or departing employees. As a matter of fact, some projects may find more value in a new market, rather than in the current market.