Introduction to the research policy 20th anniversary special issue of the publication of “Profiting from Innovation” by David J. Teece

Abstract

This introductory essay reviews the key contributions of David Teece’s landmark paper “Profiting from Innovation” published in research policy in 1986. It summarises the contributions of each of the papers in the special issue. It then offers some perspectives on the key themes emerging from these papers, and on the broader challenges facing researchers, strategists and policymakers in the field of technology innovation today.

Keywords: Teece; Technology; Innovation; Profitability

We have been admirers of David Teece’s work for many years. His research has made lasting contributions to the study of innovation by treating the management of innovation within far more realistic conceptions of the firm than those that have prevailed in more traditional economics theories. Instead of viewing the firm as a production function, or simply as a black box (to use Nathan Rosenberg’s term), Teece has studied the innovation process in firms where rationality is bounded, history matters, change is costly, and firm endowments are heterogeneous.

This is not the place for a detailed review of Teece’s extensive scholarship. His Clarendon lectures at Oxford (Teece, 2000) provide the best place to start in appreciating the full scope of his research output. Instead, we wish to focus this introduction, and indeed, this entire special issue of Research Policy, upon a particularly important article from within Teece’s research. While Teece had already established himself as a capable academic, it is no exaggeration to say that his seminal article, “Profiting from Innovation” (Research Policy, 15:6, 1986, pp. 285–305), forever altered the trajectory of his career.

This paper is the single most cited paper ever published by Research Policy, with 681 cites as of July 2006. And, befitting this impressive citation count, the importance of the paper extends beyond technology and innovation management to broader topics of business strategy, science and technology policy, and the theory of the firm, just to identify some of the most salient areas of its influence. With the publication of this article, Teece left forever the relatively narrow confines of economic analyses of innovation, and forged a much broader, multidisciplinary approach to the study of innovation. For in this single article, he combines economics with organizations, technologies, intellectual property, and markets (or the lack thereof) for complementary assets. If one reads his earlier work, prior to 1986, and compares it to the research that Teece has performed subsequent to this article, one cannot help but be struck by his shift in scope following this article.

Teece’s article was so influential in large part because it asked – and then answered – a very important question: under what conditions do firms profit from innovation? Why do Alfred Chandler’s “first movers” prevail in the market with certain innovations, while in other situations the “followers” gain the lion’s share of the profits? Teece’s answer transcended traditional economic approaches to the question (which would largely hinge on so-called “first mover” advantages in Porter (1980)
that in turn emanated from earlier industrial organization theories of entry barriers), or game theoretic treatments of sunk investments in two stage games, as in Shapiro (1989) by insisting that aspects of economic organization, business strategy, technology and innovation must all be understood in order to give a satisfactory answer to this question.

Teece’s answer, in his own words, combined these various perspectives. To quote from the abstract for his article (Teece, 1986, p. 285)

“... when imitation is easy, markets don’t work well, and the profits from innovation may accrue to the owners of certain complementary assets, rather than to the developers of the intellectual property. This speaks to the need, in certain cases, for the innovating firm to establish a prior position in these complementary assets [...] innovators with new products and processes which provide value to consumers may sometimes be so ill positioned in the market that they necessarily will fail”.

However, the question he posed is far from settled. And given the events of the past 20 years, we felt that refocusing on his question once again seems appropriate and desirable. While the approach of “Profiting from innovation” remains quite apt, the challenge of appropriating returns from innovation investments is made even more challenging in the more global context of innovation in the early 21st century.

Accordingly, this special issue focuses on profiting from innovation in a global, digitally interconnected economy. While many of the ideas raised in the 1986 Teece article remain highly relevant today, it is stunning to consider how much of the context for innovation has changed.1

Think back to 1986 and the years before the innovations mentioned by Teece were launched. The Internet did not exist in its current form (and its ARPANET predecessor was confined to use in a very few military and academic supercomputing centers). MS-DOS was the operating system for a new type of personal computer. Video games were played only in arcades and amusement parks. AT&T ruled the telecommunications universe (despite its recent breakup by Judge Green), and cellular telephony was only beginning to emerge among a very narrow niche of sales professionals. On the social technology front, Venture Capital as an industry and market was relatively new. The NASDAQ stock exchange, while enabling ‘high quality’ high tech start ups to undertake Initial Public Offerings (IPOs) in the US, was not yet open to emerging start-ups from other countries. Moreover, the human genome was unknown. Japan was regarded by many as the next hegemon in technology and innovation.2 India and China were economic backwaters. There were stirrings about an integrated market in Europe that would take place in 1992.

Subsequent to the 1980s, the global economy entered a new phase which opened up significant new opportunities for and incentives to young, high tech start up (or new technology-based) companies. Increasingly and in part due to the internationalization of venture capital, such companies were able to access global capital markets for technology companies. This process, less visible during the 1980s, increasingly provided such companies with the financial resources to access complementary assets while also providing an anticipated return to inventors and early investors (through venture capital, IPOs and the enhanced possibilities for M&A). Today, books like Saxenian’s The New Argonauts (2005) describe the role of young entrepreneurs from India and China who are stimulating even more globally oriented innovation.

Since the world has changed so significantly, we felt that it made makes sense to revisit the ways in which innovative firms can profit from their innovation activities. To what extent does Teece’s (1986) perspective still apply? And where do we need to revise or update our understanding?

1. Overview of papers in the special issue

We challenged prospective authors not only to revisit the seminal 1986 article and its arguments, but to challenge themselves to ask anew Teece’s question. Under what conditions in today’s global economy can firms profit from their innovative activities? What has changed since the appearance of the 1986 article? What remains the same? And what do the answers to these questions

1 The examples used by Teece in the 1986 article have been overtaken by subsequent events. The IBM PC is no longer the success story for IBM that it was in his article. Distribution companies like Businesland and Computerland, which were important complementary assets that could dictate success or failure, are themselves long out of business. Other examples are still relevant, but quite dated, such as Searle’s management of Nutrasweet, or GE’s success with the CAT scanner relative to EMI.

2 A careful reading of “Profiting from Innovation” shows that Teece went to great pains to articulate the rationale for continued manufacturing, as a core competence required for American competitiveness. So he was not immune to the compelling issues of that time either. However, in our judgment his article remains vibrant and important today because it did not pander to simple-minded prescriptions that others in that era propounded.
tell us about the firm, business strategy, technological advance and innovation in the early 21st century?

We were gratified to receive a large number of abstracts and papers in response to our earlier Call for Papers. We were further gratified when four noted scholars – Richard Nelson, Sidney Winter, Giovanni Dosi, and Gary Pisano – agreed to contribute invited papers or notes to the special issue. We worked closely with Stefan Thomke, the North American editor of Research Policy, to bring this issue together under tight deadlines. We wish to express our heartfelt thanks as well to the more than 40 reviewers who took the time to provide careful and thoughtful criticisms that improved these articles.

We think that the resulting contributions in this special issue collectively allow us to advance some answers to the questions we posed above. First, though, we will review briefly each of the papers in this special issue. We will then return to these questions at the end of this introduction.

Sid Winter’s paper helps us anchor our understanding of Teece’s article in the broader economic critique of neoclassical economics of which he and Dick Nelson have been so vitally important. His modesty, however, causes him to pay only glancing attention to his own work in the paper. Instead, he focuses on the intellectual legacy of Joseph Schumpeter and Kenneth Arrow, as each endeavored to explain the inadequacy of neoclassical theory in understanding innovation, and the role of the entrepreneur.

As Winter notes, Teece’s fundamental contribution in his 1986 paper was to contribute a contracting perspective to the firm’s problem of appropriating value from its innovative activities. While the Teece apparatus is still rather parsimonious, it incorporates vital dimensions that had been suppressed or neglected entirely in earlier work. Weinstagram this important innovation in that industry occurred during periods of weak appropriability. We were gratified to receive a large number of abstracts and papers in response to our earlier Call for Papers. We were further gratified when four noted scholars – Richard Nelson, Sidney Winter, Giovanni Dosi, and Gary Pisano – agreed to contribute invited papers or notes to the special issue. We worked closely with Stefan Thomke, the North American editor of Research Policy, to bring this issue together under tight deadlines. We wish to express our heartfelt thanks as well to the more than 40 reviewers who took the time to provide careful and thoughtful criticisms that improved these articles.

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Richard Nelson’s piece also offers a reflection on the link between his own intellectual agenda and that of Teece. He had recently completed the Yale survey of appropriability, and had shown in convincing fashion that patents were ineffective means of protecting inventions in most, but not all, industries. Once Nelson heard the Teece paper delivered in Venice, Italy, he realized that he had just heard “an important paper”. Important, because it provided a conceptually rigorous way for the firm to think through its strategy depending upon whether its appropriability regime (determined by the efficacy of patent protection, among other attributes) was “tight” or “loose”.

Nelson then introduces a very important and increasingly topical concern into the discussion: are increasingly strong patents good for innovation in the larger economy? Can too much appropriability actually work against the broader interests of society in fostering economic growth and technical advance in the market?

This is a concern that is also shared by the paper by Giovanni Dosi and his colleagues. Dosi, Marengo, and Pasquali remind us in their paper that the “market failure” argument that underlies most justifications for strong IP protection lacks an adequate understanding of both the character of technical knowledge (which is diffuse, cumulative, and increasingly widely distributed) and the importance of non-market institutions (public bodies, universities, communities, etc.) in the origination, development, and diffusion of new innovations.

Moreover, as an empirical matter, there is little convincing evidence that, past a certain threshold, stronger appropriability leads to more innovation. To be sure, there is a threshold that must be reached. But most Western economies are at or past this threshold (while many developing economics may not yet be there). Their review of the information and communications technology (ICT) sector leads them to conclude that much of the important innovation in that industry occurred during periods of weak appropriability.

Gary Pisano’s paper examines the role that Teece’s (1986) article played in linking the previously unconnected fields of innovation and strategy research. Among the interesting points in his paper, he turns the appropriability concerns of Nelson and Dosi around. He argues that often firms would consciously prefer – and even take concrete actions to foster – weaker appropriability regimes as part of their strategy to profit from innovation. He provides examples from Merck’s Gene Index and from open source software to illustrate this point.

As Pisano points out, a fruitful area for future research is how and when firms can influence their appropriability regime. This would turn an exogenous variable in Teece’s (1986) original setup into an endogenous variable.

David Teece’s own contribution situates his own paper in the larger context of the academic research process, starting from his search and framing of the research question, and the relevant prior research that he had in mind when he wrote the paper. With the passage of time, he has had the opportunity to revisit the paper. While he identifies many flaws in the paper, on the whole he finds it to be useful to this day (a conclusion that we will endorse at the end of this introduction).

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3 While not noted by Pisano, other examples of this phenomenon can be found in Chesbrough’s work on Open Innovation (2003, Chapter 6; 2006, Chapter 8).
Teece’s own intellectual process, however, makes him restless about this paper. While the paper is useful, he cannot resist envisioning areas where it is weak or could be otherwise improved. Instead, he identifies numerous areas for improvement or elaboration. Some of these he himself has already explored in other subsequent work, such as incorporating a more dynamic framework into the analysis. This led to his work with Gary Pisano and Amy Shuen on dynamic capabilities (Teece et al., 1997). Others, such as the business model (Chesbrough and Rosenbloom, 2002), he has yet to address, though he regards this to be of great importance in understanding how firms do and do not profit from innovation.

From the Call for Papers, we were fortunate to receive many interesting and well done papers. Because there was not enough space to publish them all, we faced the hard decisions of selecting the papers that could contribute the most to understanding the question posed by Teece in the global, digitally interconnected era.

The first paper, by He, Lim, and Wong, explores the dynamics of entry in the mobile telecommunications industry through the Teece, 1986 lens, as updated and formalized through a model by Joshua Gans and Scott Stern (Gans and Stern, 2003). While the Teece/Gans/Stern analysis examined a new innovating firm confronting an established incumbent firm, He et al. examine the possibility of entry from a third set of players (termed de alio entrants), which are established firms operating in adjacent industries who decide to enter into the focal industry.

This introduces a new analytic dimension to the profiting from innovation analysis: what happens when de alio entrants also have complementary assets? What makes the mobile telecommunications industry an interesting choice to study is the turbulent competition between large, established firms. AT&T was overtaken by Motorola, which in turn gave way to Nokia, which is now pressured by Samsung. Each firm had complementary assets to varying degrees. These assets did not prevent de alio entrants from leapfrogging them, and displacing them as industry leaders.

He et al. conclude that firm strategies explain this phenomenon, both in the (in)ability of firms to exploit their technologies, and the patents associated with those technologies. While undoubtedly helpful, complementary assets alone cannot carry the day in situations such as this.

Colombo, Grilli and Piva look at the profiting from innovation question from the perspective of a start-up (they prefer the term new technology-based firm). According to Teece (1986), these firms must search for and access appropriate complementary assets in cases of weak appropriability if they wish to profit from their innovative activities. Colombo et al. find evidence of such search activity in a large sample of Italian start-ups.

Colombo et al. exploit March’s (1991) distinction between exploitation-oriented and exploration-oriented activities in the context of the alliances formed by Italian start-ups to obtain access to complementary assets. They distinguish between technology alliances formed to explore new possibilities (exploration) and commercial alliances formed to get technologies to market (exploitation).

Consistent with Teece, Colombo et al. find that firm survival rates among Italian start-ups do increase significantly when those firms can form exploitative, commercial alliances. Start-ups with strong patents are particularly likely to succeed in this search, though the effect diminishes as the size of the firm grows. Exploitative alliances, by contrast, also increase survival, but this effect does not diminish with firm size. Colombo et al. report that the formation of both exploitative and explorative alliances may suffer, due to the unusual institutional conditions of Italy and Europe. Some of the particular vehicles for alliance formation, such as the European joint venture, are constrained by high transaction costs (Williamson, 1975, 1985).

Jacobides, Knudsen, and Augier push Teece’s (1986) work in a different direction. The innovation in the Teece, 1986 analysis was exogenous to the model. Jacobides et al. seek to examine the underlying conditions that generate the innovation as part of the analysis of when innovators profit or not. Put differently, they explore some of the technical underpinnings of appropriability—under what conditions is it strong or weak? By exploring “industry architectures”, they join Teece’s analysis to another literature on systems architecture and systems design (Baldwin and Clark, 2000; Prencipe et al., 2003).

This approach invites them to explore the construct of complementary assets more deeply. They argue that this construct joins two conceptually separate notions, one of co-specialization and one of factor mobility. This opens up new areas of firm strategy, such that the innovating...
firm might consciously choose to promote competition among suppliers of complementary assets, or, alternatively, selectively invest in complementary assets. This opens up the question of the business model of the firm (Chesbrough and Rosenbloom, 2002; Amit and Zott, 2001), and connects that literature to Teece, 1986.

Finally, Jacobides and his colleagues explore some of the dynamic implications of complementary asset investments. Such investments, once made, not only support a focal innovation; they may also support a stream of future innovations as well. These ideas echo Teece’s more recent work on Dynamic Capabilities (Teece et al., 1997).

McGahan and Silverman incorporate a different dimension in their analysis of the Teece, 1986 question of who profits from innovation, and when. They introduce the financial markets as an external indicator of the outcome of the struggle for innovation profits. Using a concordance developed by Silverman (1999), and combining that with the NBER patent citation data file (Hall et al., 2001), they show that whether the stock market rewards a firm (and its investors) for innovation depends in part upon the behavior of competing firms and their technologies.

Teece (1986) talked about appropriability in a rather abstract way; McGahan and Silverman operationalize it in a very specific way, through the development of “important” (i.e., highly cited) patents. When new entrants emerge with “important” patents regarding a new technology, the financial market punishes the incumbent firm. This makes sense in an environment with tight appropriability, because the new entrant can readily anticipate obtaining a healthy share of the incumbent’s profits. However, in weak appropriability environments, McGahan and Silverman find the reverse: the presence of a new “important” patent increases the incumbent’s financial market value. This suggests that the market anticipates that the innovator will gain little of the profit from the innovation, while the incumbent firm is likely to obtain a healthy portion of it.

They further examine the same general question that He et al did, namely the effect of de alio entrants who are established firms who had not previously entered the industry. The “important” patents of these firms show different effects upon the incumbent firms from the effects of important patents from existing competitor firms.

Dahlander and Wallin examine the question of profiting from innovation in a more open innovation context (Chesbrough, 2003). If external networks of innovation are developing around particular technologies, can those networks become complementary assets for the innovating firm? If so, can firms proactively influence the formation and behavior of these external networks, to steer them towards activities that enhance the value of their innovation, or move them away from activities that might damage the value of the innovation?

Through a network analysis of the GNOME project within the open source software community, Dahlander and Wallin find that firms can and do act strategically to influence the formation and behavior of this project. Firms act to sponsor individuals who contribute to the open source software development. And the network treats firm-sponsored individuals differently from individuals who are not sponsored. By putting “a man on the inside” of such open communities, the firm can convert a distributed resource like open source software into another type of Teecian complementary asset.

2. Insights from the special issue and future challenges

In the final part of this introductory essay, we wish to return to some of the questions we developed to challenge our contributors. Their papers allow us to propose some answers to those questions that are synthesized from the work of those in this special issue and other contemporary writings.

2.1. Under what conditions can today’s firms profit from innovation?

The papers in the special issue confirm the enduring power of Teece’s (1986) framework, but they also highlight that firms still face a complex set of choices in terms of how they develop their innovation strategy. For example, He et al show how de alio entrants in the mobile telephony industry benefited from the technological spillovers of incumbents while simultaneously attacking them in the areas where their complementary assets were weak, while Jacobides et al describe Intel’s clever approach of encouraging competition in complementary technological areas rather than seeking to control those areas. While not denying the importance of complementary assets for securing the profits from innovation, these and other studies show how nuanced and subtle the strategic choices firms make have to be.

More broadly, there is also some evidence that complementary assets are less important for profiting from innovation as long as the necessary intermediary markets exist. It has been noted, for example, that the prevalence of VCs and the emergence of markets for relatively early-stage technologies enables firms with important innovations to obtain profits by selling or licensing their
technology (e.g. Antonelli and Teubal, 2006; Arora and Gambardella, 2001), or by selling equity in the capital markets. There are even hints of an emerging secondary market for intellectual property (Chesbrough, 2006) which would enable innovation owners to access an increasingly thick market for their innovations, without having to invest directly in the complementary assets. Moreover, high-tech start-ups requiring access to complementary assets have new opportunities to access them through various forms of alliance with larger firms. And as Colombo et al suggest, these alliances can operate at both the development and marketing ends of the value chain, and are becoming more common.

These changes all suggest greater choices for firms – small and large – in terms of how they profit from innovation. Firms need to consider to what extent “profiting from innovation” requires access to the production and marketing-based complementary assets that allow them to commercialize their product, and to what extent they can profit instead by commercializing the technology or knowledge underlying the product. These are very different strategic choices. Moreover, they also allow us to reconsider the nature of complementary assets, as we do below.

2.2. How has the conceptualization of complementary assets changed since the 1986 article?

According to Teece (1986), complementary assets are those used in conjunction with a core technological asset in the process of commercialization, and they can be generic (not tailored in any way), specialized (involving unilateral dependence with the core asset) or co-specialized (involving bilateral dependence with the core asset) in nature. Generic complementary assets confer little or no competitive advantage to the firm, since they are widely available through the market to others as well. Specific complementary assets, by contrast, are problematic to access through markets due to transactions cost issues of asset specificity and small numbers bargaining (Williamson, 1985). It is these specific complementary assets that confer competitive advantage to an innovating firm. This basic definition has stood the test of time, but there are several directions in which the concept of complementary assets is being developed further.

One, as mentioned above, is the notion that venture capital firms, corporate venturing operations, and less-regulated markets are making it possible for firms to commercialize their technology assets without investing in the traditional forms of complementary assets such as manufacturing, distribution and marketing. If secondary markets for IP actually develop (Chesbrough, 2006), such markets will deepen the specialization of innovation tasks, and potentially expand the market to access complementary assets. It is interesting to consider whether such institutions are simply market-makers who help start-ups to link their core technology asset to the necessary complementary assets, or whether these institutions are actually complementary assets themselves. Or perhaps the greater degree of market development and specialization fostered by these new institutions enables markets to function well in areas where previously they were disadvantaged from a transactions cost view. In any case, it is certainly fruitful for research to take a broader perspective on the nature of the complementary assets and the governance mechanisms that collectively shape the process of commercialization.

A second extension is the distinction made by Jacobides et al. between the mobility of the complementary asset and its complementarity in use or production. The key idea here is that companies such as Intel and Microsoft have profited enormously from their core technology assets (the microprocessor and the PC operating system, respectively) by encouraging mobility in complementary technology areas rather than in controlling those areas. These companies exerted sufficient control over the PC architecture that they could stimulate investment and innovation in other technology areas. In turn, their control ensured that these external investments enhanced demand for their own technologies. Further, by enabling many firms to enter, the profits from those complementary areas were bid away and passed on to consumers, keeping the prices for these complementary technologies low (which further stimulates demand for the Intel and Microsoft technologies).

A third extension is related to the notion of complementary technology in the context of what Jacobides et al term an “industry architecture”. This is the emerging distinction between Teece’s complementary assets’ and the ability to tightly connect to other products/services within contiguous layers of an industry (Fransman, 2002).

Teeccian complementary assets take the innovation and the corresponding value chain as more or less given and consider what are the requirements for commercialization, how easy or difficult this is, and whether the inventor/innovation will profit from this and how much (absolutely and relatively). When tight connection to related technologies in an architecture is technically required, bundling the innovative product/service with others within contiguous industry layers is important for ‘profiting from innovation’. For example, this may hap-
pen in the broadband industry (Fransman, 2002), which is not one industry but a set of dynamic, interrelated and interconnected industries (in the same way as a technological revolution is a set of interrelated ‘radical’ innovations).

It may be stated from an economists’ viewpoint that the reason why ‘profiting from innovation’ may require a bundling of activities upstream or downstream is because well functioning markets do not (and cannot, due to the dynamics of the industry) link the various contiguous layers of the industry. In these circumstances, there may be a similarity between Teece’s co-specialized complementary assets and the suggested new category of “contiguous layer” complementary assets. Further, since the industry architecture that defines these contiguous layers is itself evolving over time, it becomes evident why a firm’s innovation strategy becomes so complex in these industries.

2.3. What has changed in the conditions facing technology innovators since the 1986 article?

There have been many notable changes in the business environment for technological innovation since 1986. The “System of Innovation” in which inventor firms – small and large – operate has changed dramatically, with the opening up of new financial markets, and the increasing availability of Venture Capital (Antonelli and Teubal, 2006). The increasingly interconnected nature of the global economy has made it easier for firms to identify partners with complementary assets wherever in the world they are located, and to commercialize their ideas in multiple markets simultaneously. And the open innovation movement (Chesbrough, 2003, 2006; Chesbrough et al., 2006) has increased large firms’ openness to partnering with small firms in both the sourcing and deployment of new technologies. All of these factors have served to increase the number of options firms face when considering how best to profit from a technological innovation.

There is also much greater sophistication among firms and industry observers today about the challenges of profiting from innovation. Thanks in part to the work of Teece and others, executives understand the risk of trying to commercialize a technology without the necessary complementary assets, and they are highly cognizant of the appropriability regime of their industry. And as the study by McGahan and Silverman shows, investors and industry observers are also well-versed in the competitive dynamics of innovation, and have a clear point of view on who is likely to benefit when an important innovation comes along.

The implications of these changes are important. First, firms need to find ways of building complementarities on a global basis—by building alliances (Colombo et al.), by gaining access to new development communities (Dahlander and Wallin), or by more effective sourcing of external sources of knowledge (Laursen and Salter, 2006). Second, firms need to develop a more balanced attitude to appropriability. Patents filed by competitors can under certain conditions become a source of advantage for the focal firm (McGahan and Silverman; He et al.). And patenting or secrecy by the focal firm is sometimes counterproductive as it can put up artificial walls between the firm and its potential allies (Dahlander and Wallin).

More broadly, a review of the articles within this special issue shows that the core of Teece’s conceptualization remains quite robust. As Coase and Williamson have taught us, markets often function brilliantly in coordinating even very complex transactions, while firms can organize transactions that markets cannot. While the character of complementary assets may be changing, and while the institutions that support market exchange are deepening even further, there are still limits to what markets can do. Teece’s insight was to apply these general concepts to the problem of managing innovation.

While Teece’s core concept remains robust, there are still gaps and limits in his treatment of profiting from innovation. Teece’s paper focuses strongly on those inventions, which have eventually become new product classes or even new industries and/or markets (e.g. the EMI scanner, the PC). He does not analyze ‘improvement innovations’, even though these are obviously important to the performance of the firm, and indeed, the health of the economy. And he certainly does not consider innovations in foundational technologies, such as semiconductors, whose potential impact on the creation of new industries and new jobs is largely separate from the question of whether the inventor or imitator profits most. This moves us to consider the public policy implications of Teece’s article.

2.4. What role should public policy play to promote and sustain innovation according to our updated understanding of the 1986 article?

The papers in this issue are primarily concerned with firm-level strategy issues, but they hint at some important implications for public policy. Three areas, in particular, are worth highlighting.

First, countries and regions need to look carefully at the range of complementary assets and institutions they have in place to ensure, depending on context and
other factors, that at least a share of domestic inventor firms are able to profit from their innovations in situ, and thus achieve increases in employment and national productivity. This does not mean adopting strategies of pushing “national champions” that invest across a full range of activities from R&D to marketing. Such vertical and horizontal integration strategies may be ill-suited to the distributed knowledge environment that exists in so many areas. More appropriate strategies might include sponsoring the emergence of start up support institutions or markets in the areas of venture capital and technology-transfer. Stimulating public capital markets for technology companies is also crucial. A third approach might be to utilize public resources to assist the division of innovation labor within a region, so that transaction costs might be reduced within the region, enabling greater specialization of technical focus while mitigating market hazards in exchange. Groups as diverse as Tekes in Finland, or the Semiconductor Industry Association in the US, coordinate extensive exchanges of information that provide these benefits.

A corollary of this point is that the availability of Venture Capital may – if managed in a laissez faire context – lead to too much invention and too little economy-wide impact in terms of the creation of industries and new jobs (Teubal and Avnimelech, 2003). While it is now recognized that an important way for a start-up company to profit from innovation is to sell its technology or its shares to external bidders, the spillover benefits to the local economy from such a move are minimal. And in such circumstances, it is open to debate whether local policymakers should have invested more in helping to create the complementary assets to allow in situ development. For example, the Roslin Institute in Edinburgh, aided by healthy amounts of public research funding, achieved the first successful cloning of a living animal (“Dolly the Sheep”). In a latter-day version of the EMI scanner story in Teece (1986), the company appropriated value from its platform technology by selling the technology to a Californian biotechnology company, Geron. While the Roslin Insitute continues to be a centre of excellence in basic research that may develop other useful technologies, the broader benefits from its scientific advances are likely to be realized in California, not Scotland.

Second, some radical inventions require complementary assets, which are public or semipublic goods. This has been emphasized by Tassey et al. (2006) in relation to the oncoming phase of the internet (the required complementary assets being new technology standards). More generally, radical innovations and new industries confront the inventor with the need to access or acquire new technological or technological-related infrastructures (it may be that such infrastructural needs underlie many of the radical innovations analyzed by Teece). An economy with a strong focus on knowledge-based growth must therefore consider these other requirements, some of which may involve accessing Teeccian complementary assets, while others may be infrastructure technologies that may pave the way for the development and subsequent access of such assets.

A third critical policy consideration is the strength of IP protection and its enforcement. In this special issue, no one takes the stance that all IP should be unprotected entirely. However, the challenge of how much protection is socially necessary and desirable to motivate entrepreneurial effort on the one hand, and to foster wide diffusion on the other hand, is a difficult balance to strike. Countries like the US have effectively experimented with policy in this area over the past 25 or so years by providing increasingly strong – and, from the perspective of the IP owners – effective protection. There are now emerging a new crop of industry entrants in the US, such as Utek or Intellectual Ventures, who are building new business models that are predicated on the continued strength of IP protection (Chesbrough, 2006, Chapter 7).

One clear implication of Teece’s analysis is that firms are not simply passive players in the appropriability game. Firms can and do construct varying levels of appropriability for their innovations, making appropriability only partly determined by public policy. Nonetheless, it seems clear that public policies towards IP protection play a critical role in stimulating innovative activities, and in determining the subsequent use and diffusion of those innovations in society.

3. Concluding comments

In sum, this special issue has allowed us to take stock of the state of research in an important area of research for both innovating firms, and for the economies that wish to foster the growth of such firms. A lot has changed since 1986. This is inevitable in innovation studies, since the domain of application of theory in this field is in a constant state of flux. Amidst that upheaval, it becomes critical to have some core perspectives to organize our understanding, lest that upheaval descend into chaos, where all is Brownian motion, where nothing can be learned.

Teece’s (1986) article provides such a core perspective. What Teece has taught us is that the limits of what markets can coordinate are at the heart of what a firm must organize in order to profit from innovation. The
boundary of what activities should be organized within the firm, and what activities may be coordinated through the market will shift over time. Innovations will continue to emerge, and the choices firms make in how to appropriate value from them will also vary over time. But there will always be a boundary between the firm and its markets. It is the firms who negotiate that boundary, take the risks, make the investments, access the requisite specific complementary assets, and manage them effectively, who will be positioned to profit from their innovative activities.

References


Henry Chesbrough*

Center for Open Innovation, Institute of Management, Innovation & Organization, Haas School of Business, University of California at Berkeley, Berkeley, CA 94720-1900, United States

* Corresponding author. Tel.: +1 510 643 2067.
E-mail address: chesbrou@haas.berkeley.edu

Julian Birkinshaw
Strategic and International Management, London Business School, Regents Park, London NW1 4SA, United Kingdom
Tel.: +44 207 000 7000.
E-mail address: jbirkinshaw@london.edu

Morris Teubal
Hebrew University (Economics), Jerusalem 91905, Israel
Tel.: +972 5883257.
E-mail address: msmith@pluto.mscc.huji.ac.il

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