1 Overview of Free Innovation

In this book I integrate new theory and new research findings into the framework of a "free innovation paradigm." Free innovation involves innovations developed and given away by consumers as a "free good," with resulting improvements in social welfare. It is an inherently simple, transaction-free, grassroots innovation process engaged in by tens of millions of people. As we will see, free innovation has very important economic impacts but, from the perspective of participants, it is fundamentally *not* about money.

I define a free innovation as a functionally novel product, service, or process that (1) was developed by consumers at private cost during their unpaid discretionary time (that is, no one paid them to do it) and (2) is not protected by its developers, and so is potentially acquirable by anyone without payment—for free. No compensated transactions take place in the development or in the diffusion of free innovations.

Consider the following example:

Jason Adams, a business-development executive by day and a molecular biologist by training, had never considered himself a hacker. That changed when he discovered an off-label way to monitor his 8-year-old daughter's blood-sugar levels from afar.

His daughter Ella has Type 1 diabetes and wears a glucose monitor made by Dexcom Inc. The device measures her blood sugar every five minutes and displays it on a nearby receiver the size of a pager, a huge advantage in helping monitor her blood sugar for spikes and potentially fatal drops. But it can't transmit the data to the Internet, which meant Mr. Adams never sent Ella to sleepovers for fear she could slip into a coma during the night.

Then Mr. Adams found NightScout, a system cobbled together by a constellation of software engineers, many with diabetic children, who were frustrated by the limitations of current technology. The open-source system they

developed essentially hacks the Dexcom device and uploads its data to the Internet, which lets Mr. Adams see Ella's blood-sugar levels on his Pebble smartwatch wherever she is.

NightScout got its start in the Livonia, N.Y., home of John Costik, a software engineer at the Wegmans supermarket chain. In 2012, his son Evan was diagnosed with Type 1 diabetes at the age of four. The father of two bought a Dexcom continuous glucose monitoring system, which uses a hair's width sensor under the skin to measure blood-sugar levels. He was frustrated that he couldn't see Evan's numbers when he was at work. So he started fiddling around.

On May 14 last year, he tweeted a picture of his solution: a way to upload the Dexcom receiver's data to the Internet using his software, a $4 cable and an Android phone.

That tweet caught the eye of other engineers across the country. One was Lane Desborough, an engineer with a background in control systems for oil refineries and chemical plants whose son, 15, has diabetes. Mr. Desborough had designed a home-display system for glucose-monitor data and called it NightScout. But his system couldn't connect to the Internet, so it was merged with Mr. Costik's software to create the system used today.

Users stay in touch with each other and the developers via a Facebook group set up by Mr. Adams. It now has more than 6,800 members. The developers are making fixes as bugs arise and adding functions such as text-message alarms and access controls via updates. … (Linebaugh 2014)

Free innovation is carried out in the "household sector" of national economies. In contrast to the business or government sectors, the household sector is the consuming population of the economy, in a word all of us, all consumers, "all resident households, with each household comprising one individual or a group of individuals" (OECD Guidelines 2013, 44). Household production entails the "production of goods and services by members of a household, for their own consumption, using their own capital and their own unpaid labor" (Ironmonger 2000, 3). Free innovation, therefore, is a form of household production.

How can individual consumers justify investing in the development of free innovations when no one pays them for either their labor or for their freely revealed innovation designs? As we will see, the answer is that free innovators in the household sector are *self-rewarded.* When they personally use their own innovations, they are self-rewarded by benefits they derive from that use (von Hippel 1988, 2005). When they benefit from such things as the fun and learning of developing their innovations, or the good feelings that come from altruism, they are also

self-rewarded (Raasch and von Hippel 2013). (In chapter 11, I will compare the concepts of free innovation, user innovation, commons-based peer production, and open innovation. Each offers a lens able to bring different aspects of household sector innovation into sharp focus.)

The Nightscout project described above illustrates several types of self-reward. From the account given, we can see that many participants gain direct self-rewards from personal or family use of the innovation they helped develop. Probably many also gain other forms of highly motivating self-rewards, such as enjoyment and learning, and perhaps also strong altruistic satisfactions from freely giving away their project designs to help many diabetic children.

Due to its self-rewarding nature, free innovation does not require compensated transactions to reward consumers for the time and money they invest to develop their innovations. (Compensated transactions involve explicit, compensated exchanges of property—that is, giving someone specifically this in exchange for specifically that. See Tadelis and Williamson 2013; Baldwin 2008.) Free innovation therefore differs fundamentally from producer innovation, which has compensated transactions at its very core. Producers cannot profit from their private investments in innovation development unless they can protect their innovations from rivals and can sell copies at a profit via compensated transactions (Schumpeter 1934; Machlup and Penrose 1950; Teece 1986; Gallini and Scotchmer 2002).

Enabled by individuals' access to increasingly powerful design and communication tools, free innovation is steadily becoming both a stronger rival to and a stronger complement to producer innovation (Baldwin and von Hippel 2011). Even today, it is very significant in both scale and scope. In just six countries surveyed to date, tens of millions of individuals in the household sector have been found to collectively spend tens of billions of dollars in time and materials per year developing products for their own use (von Hippel, de Jong, and Flowers 2012; von Hippel, Ogawa, and de Jong 2011; de Jong, von Hippel, Gault, Kuusisto, and Raasch 2015; de Jong 2013; Kim 2015). Over 90 percent of these individuals met both of the criteria defining free innovation: (1) they developed their innovations during unpaid, discretionary time, and (2) they did not protect the designs they developed from adoption by others for free. The remainder were aspiring entrepreneurs

within the household sector, motivated at least in part by the goal of selling their innovations.

Free innovation provides great value to household sector innovators in the form of the specific forms of self-rewards described earlier and also in the form of a general "human flourishing" associated with personal participation in innovation activities (Fisher 2010; Samuelson 2015). It also, as we will see, very generally increases both social welfare and producers' profits relative to a world in which only producers innovate (Gambardella, Raasch, and von Hippel 2016). For all these reasons, free innovation is well worth understanding better.

The Free Innovation and Producer Innovation Paradigms

Free innovation differs so fundamentally from producer innovation that the two cannot be incorporated in a single paradigm. In this section I therefore propose and describe a new free innovation paradigm and contrast it with the traditional Schumpeterian producer innovation paradigm. Figure 1.1 schematically depicts these two paradigms and the interactions between them. Each describes a portion of the innovation activity in national economies.

Generally, development activity in the free innovation paradigm is devoted to types of innovative products and services consumed by

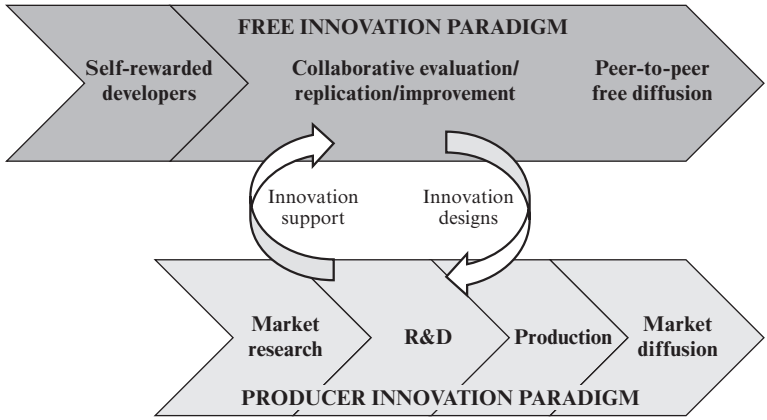


Figure 1.1
The free innovation paradigm and the producer innovation paradigm.

householders, not businesses. These represent a large fraction of Gross Domestic Product (GDP): In the United States and many other OECD countries, 60–70 percent of GDP is devoted to products and services intended for final consumption in the household sector (BEA 2016; OECD 2015). In contrast, innovation development activity in the producer innovation paradigm is devoted to addressing both consumer and industrial product and service needs.

As we will see, outputs from the two paradigms are complementary in some ways and competitive in others (Baldwin, Hienerth, and von Hippel 2006; Baldwin and von Hippel 2011; Gambardella, Raasch, and von Hippel 2016).

The free innovation paradigm

The free innovation paradigm is represented by the broad arrow shown in the top half of figure 1.1. At the left side of the arrow, we see consumers in the household sector spending their unpaid discretionary time developing new products and services. Discretionary time can be seen as "time spent free of obligation and necessity" (OECD 2009, 20), time devoted to activities that "we do not really have to do at all if we do not wish to" (Burda, Hamermesh, and Weil 2007, 1). Scholars have noted the potential value obtainable by producers and society when consumers increase the portion of discretionary time devoted to a range of productive uses (Von Ahn and Dabbish 2008; Shirky 2010). Innovation is clearly among such productive uses, as we will see in detail later.

As is implied by the position of the free innovation arrow in figure 1.1, which starts further to the left than the producer arrow, individuals or groups of innovators who have a personal use for an innovation with a novel function generally begin development work earlier than producers do—they are pioneers. This is because the extent of general demand for really novel products and services is initially often quite unclear. General demand is irrelevant to individual free innovators, who care only about their own needs and other forms of private self-reward that they understand firsthand. Producers, in contrast, care greatly about the extent and nature of potential markets and, as the rightward positioning of the producer arrow indicates, often wait for market information to emerge before beginning their own development efforts (Baldwin, Hienerth, and von Hippel 2006).

If there is interest in an innovation beyond the initial developer, some or many other individuals may contribute improvements to the initial design, as is shown at the center of the free innovation paradigm arrow. This pattern is visible in the Nightscout example presented earlier and is familiar in open source software development projects as well (Raymond 1999). Thus, in the Nightscout case, many individuals with an interest in helping children with Type 1 diabetes came forward to join the efforts of the project's initiators (Nightscout project 2016).

Finally, free diffusion of unprotected design information via peer-to-peer transfer to free riders may occur, as is shown at the right end of the free innovation paradigm arrow. (Free riders are those who benefit from an innovation but do not contribute to developing it. In that sense they get a "free ride.") Again, a pattern of diffusion to free riders is clearly visible in the Nightscout project.

Note that what is generally being revealed free for the taking by free innovators is design information, not free copies of physical products. In the case of products or services that themselves consist of information, such as software, a design for an innovation can be identical to the usable product itself. In the case of a physical product, such as a wrench or a car, what is being revealed is a design "recipe" that must be converted into a physical form before it can be used. In free peer-to-peer diffusion, this conversion is generally done by individual adopters—each adopter creates a physical implementation of a free design at private expense in order to use it. However, this is not a firm rule. Sometimes free innovators, motivated by altruism or other forms of self-reward, do create free physical copies of free designs to give to free riders. As an example, consider the worldwide e-Nable network. Founders of this network developed open source designs for inexpensive, 3D-printed artificial hands for children and adults who lack hands. Network members who own 3D printers donate their time to tailor the freely available hand designs to individual needs, and also donate the use of their personal printers to produce copies for free (Owen 2015).

The producer innovation paradigm

The long-established producer innovation paradigm centers on development and diffusion activities carried out by producers. The basic

sequence of activities in that paradigm is shown on the lower arrow of figure 1.1. Moving from left to right on that arrow, we see profit-seeking firms first identifying a potentially profitable market opportunity by acquiring information on unfilled needs. They then invest in research and development to design a novel product or service responsive to that opportunity. Next, they produce the innovation and sell it on the market. In sharp contrast to household sector innovators, producers' innovation activities are *not* self-rewarding: the producer is rewarded by profit obtained via compensated transactions with others. (Of course, employees within firms may find their work personally self-rewarding. This can sometimes be reflected in their wages. In labor economics it has long been argued that firms can pay a lower wage as compensation for work that employees find more desirable in other ways. See Smith 1776, 111; Stern 2004.)

The producer innovation paradigm can be traced back to Joseph Schumpeter, who between 1912 and 1945 put forth a theory of innovation in which profit-seeking entrepreneurs and corporations played the central role. Schumpeter argued that "it is … the producer who as a rule initiates economic change, and consumers are educated by him if necessary" (1934, 65). The economic logic underlying this argument is that producers generally expect to distribute their costs of developing innovations over many consumers, each of whom purchases one or a few copies. Individual or collaborating free innovators, in contrast, depend only on their own in-house use of their innovation and other types of self-reward to justify their investments in innovation development. On the face of it, therefore, a producer serving many consumers can afford to invest more in developing an innovation than can any single free innovator, and so presumably can do a better job. By this logic, individuals in the household sector must simply be "consumers" who simply select among and purchase innovations that producers elect to create. After all, why would consumers innovate for themselves if producers can do it for them?

Schumpeter's views and the producer innovation paradigm came to be widely accepted by economists, business people, and policymakers, and that is still the case today. Sixty years later, Teece (1996, 193) echoed Schumpeter: "In market economies, the business firm is clearly the leading player in the development and commercialization of new

products and processes." Similarly, Romer (1990, S74) viewed producer innovation as the norm in his model of endogenous growth: "The vast majority of designs result from the research and development activities of private, profit-maximizing firms." And Baumol (2002, 35) placed producer innovation at the center of his theory of oligopolistic competition: "In major sectors of US industry, innovation has increasingly grown in relative importance as an instrument used by firms to battle their competitors."

Details of the producer paradigm have changed over time. Significant producer innovations once were viewed as starting from advances in basic research (Bush 1945; Godin 2006). Later, studies of innovation histories showed that there often was not a clearly demarked research event initiating important innovations—although "technology first" innovations do exist and can be important (Sherwin and Isenson 1967). Still later, it was argued that research findings fed into all phases of innovation in what was called a "chain link" model of innovation (Kline and Rosenberg 1986). Today, many would argue that, while research inputs are indeed important, producers' innovation projects are more frequently triggered by discovery of unfilled needs. Hence the marketing mantra: "Find a need and fill it." In line with this view, current prescriptions for the management of innovation by producers generally follow the market-demand-initiated version of the producer paradigm shown in figure 1.1 (Urban and Hauser 1993; Ulrich and Eppinger 2016).

Finally, when contrasting the two paradigms, I note that the definition of free innovation differs from the "official" definition of producer innovation with respect to mode of diffusion. A free innovation is defined as one that diffuses for free, as I said at the start of this chapter. Within the OECD, in contrast, the definition for an innovation includable in government statistics requires that it be introduced onto the market: "A common feature of an innovation is that it must have been *implemented*. A new or improved product is implemented when it is introduced on the market" (*Oslo Manual* 2005, paragraph 150). (Note that the focus of both definitions is on *availability* for diffusion. There is no requirement that anyone actually adopt a free innovation that is available outside of the market or actually buy a producer innovation that has been introduced onto the market.)

In the Internet era, the OECD's producer-centric, definitional restriction that innovations must be "introduced on the market"—that is, made available for sale—is obsolete, I believe. Today it is also possible to make free innovations available for widespread diffusion independent of markets, often via the Internet. For example, the Nightscout innovations are widely diffused outside of markets via Internet-based free transfer. Open source software and open source hardware very generally are diffused in that same way. Excluding free innovations from government statistics via the present market-focused definition distorts our understanding of the innovation process. It will be important to update the OECD's definition, and there are calls to do this (Gault 2012).

Interactions between the paradigms

There are four important interactions between the free innovation paradigm and the producer innovation paradigm (Gambardella, Raasch, and von Hippel 2016).

First, identical or closely substituting innovation designs can be made available to potential adopters via both paradigms at the same time. For example, Apache open source Web server software is offered free peer to peer by the Apache development community *and* at the same time a close substitute is offered commercially by Microsoft. In such cases, peer-to-peer diffusion via the free innovation paradigm can *compete with* products and services that producers are selling on the market. The level of competition can be substantial. In the specific case just mentioned, 38 percent of Internet websites used Apache free Web server software in 2015. Microsoft was second, serving 28 percent of sites with its commercial server software (Netcraft.com 2015). Competition from substitutes diffused for free via peer-to-peer transfers can increase social welfare by forcing producers to lower prices. It can also drive producers to other forms of competitive responses with social value, such as improving quality or increasing investments in innovation development.

Second, innovations available for free via the free innovation paradigm can *complement* innovations diffused via the producer innovation paradigm. Free complements are very valuable to consumers as well as to producers. They enable producers to focus on selling commercially viable products, while free innovators fill in with designs for

valuable or even essential complements. For example, a specialized mountain bike is of little value to a biker who has not learned specialized mountain biking techniques. Producers find it viable to produce and sell the specialized mountain bikes as commercial products, but largely rely on expert bikers innovating within the free paradigm to create and diffuse riding techniques as a free complement. That is, adopters generally learn new mountain biking techniques by a combination of self-practice and informal instruction freely given by more expert peers.

Third, we see from the vertical, downward-pointing arrow toward the right in figure 1.1 that a design developed by a free innovator may *spill over* to a producer and become the basis for a valuable commercial product. For example, the design of the mountain bike itself and many further improvements to it were developed by free innovator bikers. These designs were not protected by the free innovator developers, and were adopted for free by bike producing firms (Penning 1998; Buenstorf 2003). As we will see, adoption of free innovators' designs can greatly lower producers' in-house development costs (Baldwin, Hienerth, and von Hippel 2006; Franke and Shah 2003; Jeppesen and Frederiksen 2006; Lettl, Herstatt, and Gemuenden 2006).

Fourth and finally, we see from the vertical, upward-pointing arrow at the left of figure 1.1 that producers also supply valuable information and *support* to free innovators. For example, Valve Corporation, a video game development firm, offers Steam Workshop, a company-sponsored website designed to support innovation by gamers (Steam Workshop 2016). The site contains tools that make it easier for these individuals to develop their own game modifications and improvements and to share them with other players. Investments to support free design, such as the investment in Steam Workshop by Valve, can benefit producers by increasing the supply of commercially valuable designs that free innovators create (Gambardella, Raasch, and von Hippel 2016; Jeppesen and Frederiksen 2006; von Hippel and Finkelstein 1979).

The Need for a Free Innovation Paradigm

Thomas Kuhn defined scientific paradigms as "universally recognized scientific achievements that, for a time, provide model problems and

solutions for a community of researchers" (1962, viii). Having a paradigm in place that is widely accepted, as in the case of the producer innovation paradigm, can be very helpful to scientific advancement. Once a paradigm is in place, as Kuhn writes, researchers can engage in very productive "normal science," testing and more precisely filling in pieces of a paradigm now assumed to be correct in broad outline. However, as Kuhn also explains, a paradigm never adequately explains "everything" within a field. In fact, observations that do not fit the reigning paradigm commonly emerge during the work of normal science, but are often ignored in favor of pursuing productive advance within the paradigm.

In the case of innovation research, empirical evidence related to free innovation in the household sector has been increasing during recent years. However, innovations developed and diffused without compensated transactions are entirely outside the Schumpeterian producer innovation paradigm—and, indeed, entirely outside the transaction-based framework of economics in general. Ignoring this evidence has allowed researchers to do productive work within the Schumpeterian paradigm, while deferring the work of incorporating free innovation into our paradigmatic understanding of innovation processes.

Eventually, Kuhn writes, conflicts between the predictions of a reigning paradigm and real-world observations may become so pervasive or so important that they can no longer be ignored, and at that point, the reigning paradigm may be challenged by a new one (Kuhn 1962). I propose that this situation has been reached in the case of transaction-free innovation processes developed and utilized by free innovators in the household sector. I therefore frame the free innovation paradigm both as a challenge to the Schumpeterian innovation paradigm, and also as a useful complement. Both paradigms describe important innovation processes, with the free paradigm codifying important phenomena in the household sector that the producer innovation paradigm does not incorporate.

With respect to my proposal of complementary innovation paradigms functioning in parallel, it is important to note that Kuhn developed his concept of paradigms to explain how revolutions in understanding occur in the natural sciences. Central to his argument was that a new paradigm replaces an existing one in a "scientific

revolution." However, today the idea of paradigms has expanded beyond the study of natural sciences to the study of social sciences as well. In the social sciences, Kuhn's observation that new paradigms replace earlier ones is not always followed. Multiple paradigms may coexist as complementary or competing perspectives. (See, e.g., Guba and Lincoln 1994.) It is with that view in mind that I propose the free innovation paradigm as a *complement* to the producer innovation paradigm rather than as a replacement. I am proposing that each usefully frames *a portion* of extant innovation activity.

Note that by proposing and describing the free innovation paradigm, I by no means claim that research needed to support it is complete. Indeed, I wish to claim precisely the opposite. A new paradigm is most useful when understandings of newly observed phenomena are emergent and when ideas regarding a possible underlying unifying structure are needed to help guide the new research (Kuhn 1962). This is the role I hope the free innovation paradigm described in this book will play. If it is successful, it will usefully frame and support important research questions and findings not encompassed by the existing Schumpeterian producer-centered paradigm, and so provide an improved platform for further advances in innovation research, policymaking, and practice.

In the remainder of this chapter, I give very brief overviews of the contents of the succeeding chapters. In chapters 2–7, I present and discuss the core of the free innovation paradigm theory and related empirical findings. In chapters 8–10, I explore important contextual matters, including the broad scope of free innovation, the personal characteristics associated with free innovators' success, and the legal rights available to free innovators. Finally, in chapter 11, I suggest and discuss some next steps for theory building, policymaking, and practice related to the free innovation paradigm.

Evidence for Free Innovation (Chapter 2)

The importance of free innovation depends in large part on its scale and scope. In chapter 2, we will see from national surveys that free innovation is important on both of these dimensions. In just six countries surveyed to date, tens of millions of individuals have been found to collectively spend tens of billions of dollars on a wide range

of products for personal use. A cluster analysis shows that about 90 percent of household sector innovators meet the two criteria specified in the definition of free innovation. Less than 10 percent of household sector innovators are interested in becoming entrepreneurs or in selling their innovations to producers.

A central feature of the free innovation paradigm is that it is free from compensated transactions. I explain what compensated transactions are, and how free innovators can viably innovate and freely reveal their innovations without resorting to them.

Viability Zones for Free Innovation (Chapter 3)

Innovation opportunities are "viable" for free innovators or producers only when their innovation-related benefits equal or exceed their innovation-related costs. In chapter 3, I adapt modeling discussed by Baldwin and von Hippel (2011) to describe the conditions required for innovation viability within three innovation "modes": free innovation by single individuals in the household sector of the economy, collaborative free innovation by multiple household sector participants, and innovation by producers.

Baldwin and I argue that the number of innovation opportunities that are viable for individual and collaborative free innovation is increasing rapidly as powerful, easy-to-use design and communication technologies become steadily cheaper. Across many fields, radical reductions in design costs are being driven by advances in computerized design tools suitable for personal use. At the same time, radical reductions in personal communication costs are being driven by advances in the technical capabilities of the Internet. Field-specific tools are following the same trend. For example, inexpensive and easy-to-use tools for genome modification have greatly increased the number of opportunities for biological innovation that are viable for free innovators in the household sector.

Pioneering by Free Innovators (Chapter 4)

As has already been discussed, the incentives and behaviors of innovators acting within the free innovation paradigm differ fundamentally

from those of innovators acting within the producer innovation paradigm. As a consequence, innovation outcomes created within the two paradigms should also systematically differ. Indeed, identifying and clarifying such differences is a major value the free innovation paradigm can provide. In chapter 4, I illustrate this important point by showing that there are basic differences in the types of innovations developed, and in the timing of innovations developed, within the two paradigms. Free innovators, being self-rewarding, are free to follow their own interests. Unlike producers, they need not work only on projects they expect the market to reward. They therefore generally pioneer functionally new applications and markets prior to producers understanding the opportunity. Producer innovators generally enter later, after the nature and the commercial potential of markets have become clear (Riggs and von Hippel 1994; Baldwin, Hienerth, and von Hippel 2006).

Diffusion Shortfall in Free Innovation (Chapter 5)

In this chapter, I document and discuss an important difference between the free innovation paradigm and the producer innovation paradigm with respect to innovation diffusion. The difference springs from the fact that, unlike producers, free innovators do not protect their innovations from free adoption, and they do not sell them. As a result, benefits that free-riding adopters may gain are not systematically shared with free innovators—there is no market link between these parties. For this reason, free innovators may often have too little incentive, from the perspective of social welfare, to invest in *actively* diffusing their free innovations. In contrast, of course, producers do have a direct market link to consumers, so there should be no similar diffusion incentive shortfall within the producer innovation paradigm.

I review an initial empirical study that finds evidence compatible with diffusion incentive and diffusion investment shortfalls by free innovators (de Jong, von Hippel, Gault, Kuusisto, and Raasch 2015). I then suggest how to address a free innovation diffusion shortfall without resorting to the introduction of markets.

Division of Labor between Free Innovators and Producers (Chapter 6)

To this point in the book, we have seen that the free and producer paradigms systematically differ with respect to the innovators' incentives, activities, and outputs. Recall that the paradigms also interact. In chapter 6, I describe their major interactions and the effects of these in detail. Drawing upon modeling by Gambardella, Raasch, and von Hippel (2016), I explain that there is an opportunity for a division of innovation labor between free innovators and producer innovators that simultaneously enhances social welfare and producers' profits. Producers, my colleagues and I argue, will benefit by *not* investing in R&D that substitutes for innovations that free innovators develop. Instead, producers will—often but not always—benefit from investing in *supporting* free innovator design activities. Producers should then focus their own resources on development activities that free innovators do not engage in, such as refinements needed for commercialization. Social welfare, we find, will benefit from public policies that encourage producers to transition from a focus on in-house development to a division of innovation labor with free innovators.

Tightening the Loop between Free Innovators and Producers (Chapter 7)

As the value of free household sector design effort becomes clear, both free project sponsors and producers are increasing their efforts to "tighten the loop" between themselves and free innovators in order gain a more profitable fraction of that effort. Crowdsourcing calls by both free innovators and producers asking for assistance on innovation projects from the household sector are on the rise. Producers are also learning to support free innovators, seeking to channel their work into privately profitable directions.

The increased intensity of "mining" of household sector innovation resources by producers is likely to have both positive and negative effects on social welfare. On the positive side, projects that producers sponsor are likely to have commercial value, and so are likely to be commercially diffused when completed. On the negative side, producer creation and crowdsourcing of very attractive, "gamified" innovation

project opportunities may draw free innovators away from innovation opportunities of perhaps higher social value, such as the pioneering innovations they might otherwise develop.

The Broad Scope of Free Innovation (Chapter 8)

In chapter 8, I document that free innovation extends well beyond product innovation—the type of innovation focused upon by almost all studies of household sector innovation to date. I do this by reviewing field-specific empirical studies by a number of colleagues that find significant levels of free innovation are present in services, processes, marketing methods, and new organizational methods.

The broad scope of free innovation development should not be a surprise. After all, the test for whether innovation opportunities are viable for free innovators has nothing to do with the specific nature of those opportunities. All that is required for opportunity viability is that free innovators' expected benefits exceed their costs.

Personality Traits of Successful Free Innovators (Chapter 9)

Nationally representative surveys find that from 1.5 percent to 6.1 percent of members of the household sector in six countries engage in product innovation. That is a lot of people: tens of millions. At the same time, it also means that at least 94 percent of householders are *not* engaging in product development. Since household sector innovation increases social welfare, and also generally increases producers' profits, it becomes useful to inquire about differences between householders who successfully innovate and those who do not. To that end, Stock, von Hippel, and Gillert (2016) explore personality traits significantly associated with successful household sector innovation at each of three major innovation process stages: having an idea for a new product or product improvement, developing a prototype implementing the idea, and diffusing the innovation to others. My colleagues and I find that successful completion of each successive innovation process stage is importantly affected by *different* factors. Building upon that information, we propose ways to increase innovation success rates in the household sector.

Preserving Free Innovators' Legal Rights (Chapter 10)

In this chapter, I review household sector innovators' legal rights to engage in innovation and innovation diffusion. Drawing upon work reported in Torrance and von Hippel (2015), I explain that free innovators have very strong legal rights, at least in the United States, with respect to both innovation development and innovation diffusion. Individuals are generally free to act however they choose as long as they do not materially harm others (Jefferson 1819; Chafee 1919). Individuals also have the fundamental right of free speech, which enables them to exchange information in order to work collaboratively and to diffuse their findings to others. Further, free innovators sometimes have important practical, legal, and regulatory advantages over producers.

Despite this generally favorable situation, free innovators' freedom to operate is frequently reduced, and free innovation costs raised, by regulations or legislation promulgated for other purposes—often without awareness that free innovation even exists. Torrance and I make specific suggestions for improvement, and also propose that it will be valuable to increase general social awareness of free innovation, and the benefits it brings to society.

Next Steps for Free Innovation Research and Practice (Chapter 11)

In chapter 11, I suggest several next steps in free innovation research, policymaking, and practice that I think will be valuable. I begin by setting expectations for the role the free innovation paradigm might usefully play in these new efforts. Next, I compare and contrast the research lenses offered by free innovation, user innovation, peer production, and open innovation, outlining question types for which I expect each lens to be especially useful. I then propose steps to improve the measurement of free innovation, a matter that is very important to further progress on research questions related to the free innovation paradigm. Next I suggest research steps useful to incorporate free innovation into innovation theory and policymaking. Finally, I suggest how the free innovation paradigm can help us to understand the economics of household sector creative activities even beyond innovation, such as

"user-generated content" ranging from fan fiction to contributions to Wikipedia.

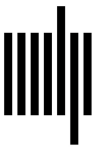
I conclude the book by again noting that free innovation, free from the need for compensated transactions and intellectual property rights, represents a robust, "grassroots" mode of innovation that differs fundamentally from the prevailing Schumpeterian model of producer-centered innovation. I suggest that the free innovation paradigm, presented and discussed in this book, will enable us to understand free innovation more clearly and apply it more effectively, with a resulting increase in social welfare and human flourishing.

Free Innovation

By: Eric von Hippel

Citation:

Free Innovation
By: Eric von Hippel
DOI: 10.7551/mitpress/9382.001.0001
ISBN (electronic): 9780262335461
Publisher: The MIT Press
Published: 2016



The MIT Press

A hardcover edition of this text is available from The MIT Press. Copies may be ordered online at http://mitpress.mit.edu.

Set in Stone Sans and Stone Serif by Toppan Best-set Premedia Limited. Printed and bound in the United States of America.

Library of Congress Cataloging-in-Publication Data

Names: von Hippel, Eric.
Title: Free innovation / Eric von Hippel.
Description: Cambridge, MA : MIT Press, 2016. | Includes bibliographical references and index.
Identifiers: LCCN 2016009390 | ISBN 9780262035217 (hardcover : alk. paper)
Subjects: LCSH: Technological innovations--Economic aspects. | Inventors. | Innovations.
Classification: LCC HC79.T4 H557 1988 | DDC 338/.064--dc23 LC record available at https://lccn.loc.gov/2016009390

10 9 8 7 6 5 4 3 2 1