# 3. The what, who and how of innovation generation

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## 3.1 INTRODUCTION

The majority of companies agree that innovation is one of their top priorities. However, there is much disagreement about what innovation exactly entails, who carries the responsibility for innovation, and how the process of creating innovation is structured. The "what" of innovation has shifted from a focus on process and product innovation to a focus on service and business model innovation. Companies such as Tesla, Nespresso and Netflix have revolutionized industries with their disruptive business models. The "who" issue for many companies has shifted from a pure top-down model to a more open and bottom-up approach. Incumbents such as P&G and IBM have embraced new sources of innovation and have welcomed customers to their ideation process. Others, such as Michelin and Merck, have leveraged the immense potential of their employee base through grassroots innovation. Finally, the "how" of innovation concerns the various processes of creating innovation, which range from structured stage-gates to leaner ones. Startups such as LinkedIn and Dropbox have fully embraced the lean mentality, decreasing the time to develop the product by involving customers in the early development stages.

In this chapter, we provide researchers and managers with a comprehensive review of the innovation generation process. We shed light on the different facets of the process by discussing case examples from a wide variety of industries and by drawing insights from both startups and multinationals. This chapter helps managers better understand what it takes to innovate and provides an overview of the tools at their disposal.

This chapter is organized as follows. In Section 3.2, we discuss four types of innovation (what) and how companies can combine them to achieve success. We complement this discussion with a classification of innovation based on the differences in risk and time horizon. We thus set the stage by reviewing avenues companies can pursue in their innovation agenda. This is followed by a discussion of who then takes responsibility for innovation. Hence, in Section 3.3, we review five methodologies for innovation (who) and the transition from a closed to a more open model of innovation generation. In Section 3.4, we explore five innovation processes (how) and disentangle their advantages and disadvantages. Figure 3.1 provides an overview of the components of the innovation generation process that this chapter explores.

## 3.2 WHAT OF INNOVATION: THE OBJECT OF INNOVATION

Innovation research has traditionally focused on new products. However, influenced by the rise of the sharing economy and the distinct impact of startups on mature industries, both managers and scholars are increasingly interested in service and business model innovation. Although less visible than the other three innovation types, process

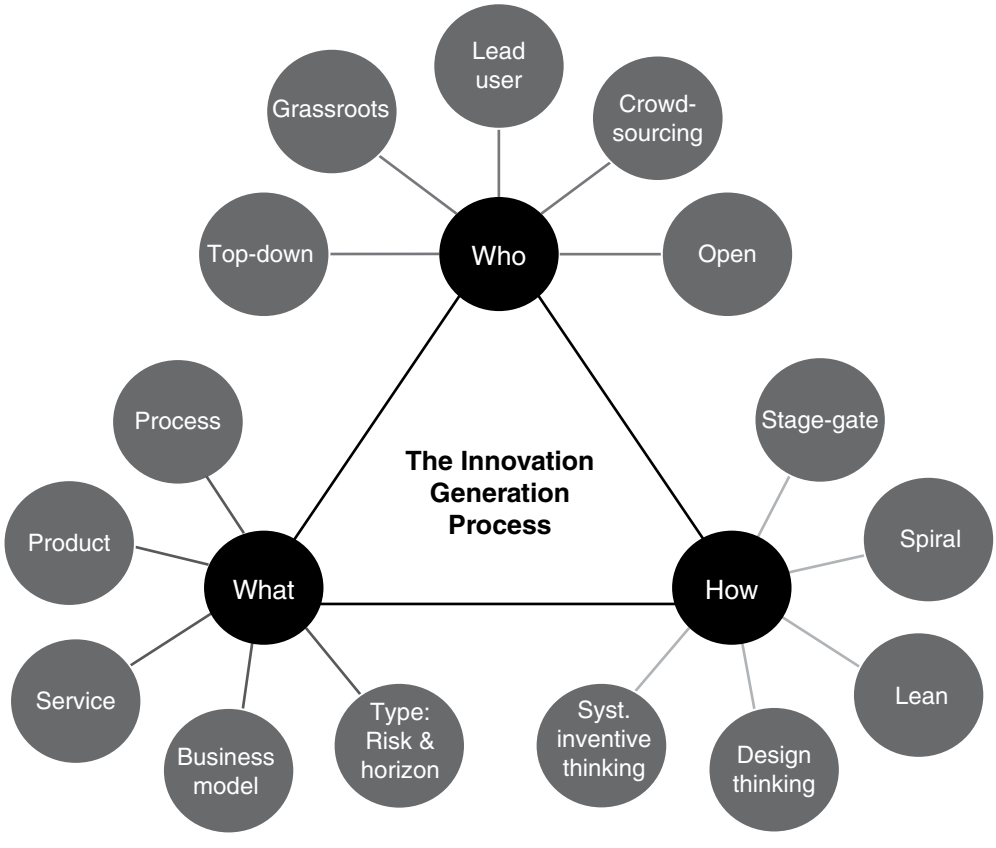


*Figure 3.1 Components of the innovation generation process*

innovation is essential for the long-term profitability of companies. We shall discuss these four types of innovation and classify innovation according to the amount of risk and time involved in its development.

### 3.2.1 Product Innovation

Schumpeter (1934, p. 66) defines product innovation as "the introduction of a new good . . . or of a new quality of a good." This definition, which is part of Schumpeter's theory of economic development, forms the basis of the rather sizeable literature on new product development. For most firms, successful new products are engines of growth (Cohen et al. 1997). However, in the past few decades, the failure rate of new products has been high, ranging from 35 percent to 45 percent (Boulding et al. 1997).

An example of such a failure is Segway, a two-wheel personal transportation vehicle created by the renowned inventor Dean Kamen. Upon Segway's launch in 2002, visionaries such as Steve Jobs and Jeff Bezos were convinced that this product would change the world. However, instead of selling 10,000 machines a week as predicted by Kamen,

Segway only sold 30,000 units between 2002 and 2007. The main reason behind this failure is the lack of a clear need for the product among the target market. Other contributing factors were the $5000 price tag, the associated regulatory problems (Segway was classified as a road vehicle in some countries), and the numerous Segway-related accidents (Tweney 2009). In fact, the owner of Segway, Jim Heselden, died in such an accident. Heselden reportedly lost control of his Segway and fell down an 80 foot limestone cliff near his home.

Given these high failure rates, one may wonder if investments in new product development pay off. This question has received considerable attention among marketing scholars. Numerous academic studies show that product innovation is positively related with firm performance (e.g., Geroski et al. 1993; Wuyts et al. 2004). Sood and Tellis (2009) estimate that the total market returns on an average innovation project in their sample is $643 million. Srinivasan et al. (2009) find that new product introductions have positive post-launch effects on stock market performance. The impact of product innovation has also been studied in specific industries. For example, Bayus et al. (2003) demonstrate that new product introductions in the personal computer industry positively influence firm profitability and Pauwels et al. (2004) show that new product introductions increase long-term financial performance and firm value in the automobile industry.

uBeam, a startup founded in 2011 by Meredith Perry while she was an undergrad at the University of Pennsylvania, is a good example of the impact that a single product innovation can have on a firm. uBeam, currently valued at approximately $500 million, is working on a wireless charging technology that can send energy up to 15 feet away through ultrasound. This technology could eventually replace charging cords. Perry has convinced investors to fund uBeam with over $23 million. While the technology still requires validation, the company has attracted the interest of major airlines, hotels, retail chains, as well as major hardware manufacturers such as Apple and Samsung (Constine 2015). While uBeam is a startup, product innovation can also have a distinct impact on existing firms. Apple, for instance, spent approximately $150 million developing the iPhone. In the final quarter of 2014 alone Apple sold over 74 million iPhones, worth $51.1 billion (Williams-Grut 2015).

Numerous scholars have tried identifying the antecedents of new product success (e.g., Ayers et al. 1997; Carbonell and Rodriguez 2006; Cooper 1979; Cooper and Kleinschmidt 1995). In their meta-analysis, Henard and Szymanski (2001) find that product advantage, market potential, meeting customer needs, predevelopment task proficiencies and dedicated resources have on average the most significant impact on new product performance. Evanschitzky et al. (2012) update Henard and Szymanki's meta-analysis and provide evolutionary evidence of decreased effects of the success factors over time. They speculate that the potential of success factors decreases as they become widespread among managers. In other words, as many managers learn how to do things right, doing such things right sets them less apart from their competitors and thus drives success to an ever-lesser extent.

### 3.2.2 Service Innovation

The growing economic importance of services has resulted in increased attention for service innovation in the last two decades. The Marketing Science Institute recognized the importance of service innovation by including it among the top research priorities for the

2008–10 period. There are several closely related definitions of service innovation. Berry et al. (2006, p. 56) define service innovation as "an idea for a performance enhancement that customers perceive as offering a new benefit of sufficient appeal that it dramatically influences their behavior as well as the behavior of competing companies." Dotzel et al. (2013, p. 259) adapt this definition and describe service innovation as "a new or enhanced intangible offering that involves the firm's performance of a task/activity intended to benefit customers."

Service innovations can have a distinct impact on industries. For example, new service offerings are rapidly changing the banking sector and startups are increasingly challenging established banks. In Europe, Powa, a mobile payment system, and Funding Circle, a peer-to-peer platform that provides loans to small and medium-sized businesses, are changing the industry. With valuations of over a billion dollars, these two companies are highly successful. In Kenya, Safaricom, the country's largest mobile-network operator, launched M-PESA ("M" stands for "mobile" and "pesa" is Swahili for "money"). As in many developing countries, in Kenya it is common for a person to have a mobile phone but not a bank account. Vodafone, which owns 40 percent of Safaricom, realized that Kenyans were not interested in having a bank account, but that they did want an effective way to send money. M-PESA empowered the Kenyans by enabling them to transfer money without a bank account as quickly and as easily as sending a text message (Graham 2010). M-PESA's user base has grown to over 18 million people (Thomas and Manson 2014) spread over countries such as Tanzania, Egypt, Lesotho and Mozambique, and more recently India and Romania (The Economist 2013).

There is a growing stream of research on service innovation. Such research has mainly focused on how service innovation is different from product innovation in a manufacturing environment (see, e.g., Ettlie and Rosenthal 2011) and what are the critical success factors of service innovation, assuming they may be different from the success factors for product innovation (see, e.g., Van Riel et al. 2004).

### 3.2.3 Process Innovation

Damanpour (1991, p. 561) defines process innovation as "new elements introduced into an organization's production or service operations – input materials, task specifications, work and information flow mechanisms, and equipment used to produce a product or render a service." Ettlie and Reza (1992, p. 796) alternatively define process innovation as the "changes in throughput technology for an organization or operating unit, such as a plant, that are new to an industry."

Process innovations are typically directed within the firm and therefore often are not as well documented for the outside world compared to product or service innovations. There are exceptions, such as the introduction of the assembly line by Henry Ford in December 1913. The first moving assembly line was the beginning of the mass production of automobiles. The introduction of the assembly line reduced the time to build a car from more than 12 hours to 2 hours and 30 minutes. Countless other industries adopted Ford's manufacturing principles. Approximately 60 years later, Toyota introduced Just-In-Time (JIT) manufacturing. JIT manufacturing is a production system based on the idea of "producing salable items, at a salable point in time, in a salable quantity" (Monden 2011, p. xxix). A wide variety of industries adopted this process innovation.

The majority of studies on process innovation focus on the dynamics between product and process innovation. For instance, Utterback and Abernathy (1975) empirically test the frequency of innovation types (product versus process) during the technology life cycle. They find that firms will initially focus on product innovation and this will ultimately yield a dominant design (the optimal product configuration). Once a dominant design has surfaced, the firm's focus shifts to process innovation in an effort to lower the production costs. By exploring the interaction between innovation choices and consumer demand during the development of a technology, Adner and Levinthal (2001) offer an alternative explanation for the technology life cycle. The authors claim that during the early stages, innovation is driven by the need to meet market requirements. Once these requirements (e.g., price and performance) are met, competition among suppliers in a mature market focuses on innovation to reduce costs.

Zara, a clothing and accessories retailer owned by the Spanish company Inditex, is a clear example of how process innovation can help a company rise to the top (for an excellent overview, see Ghemawat and Nueno 2003). Zara's philosophy is based on "fast fashion," which entails bringing the latest fashion trends to stores as quickly as possible. To do so, Zara adapts trends directly from high-street fashion shows, brings new items to their stores quickly, and sells them at affordable prices (Hansen 2012). Zara's ability to keep up with ever-changing market trends rests on its maintaining control of every part of the supply chain: from design to production to distribution (CNN 2001). Zara does not hire top fashion designers, but instead copies their designs (Thompson 2012). The company then relies on customers' purchase patterns and feedback to change designs and clothing lines that are responsive to customer needs. In order to bring new clothes rapidly to its stores, Zara manufactures a large share of its clothes through its own facilities in Spain and Morocco (Thompson 2012). This allows for fast and controlled production. While competitors may take up to nine months to bring new lines to stores, Zara is able to do so in just a couple of weeks (CNN 2001). By innovating its process, Zara is consistently able to offer new and fashionable clothing to its customers at the right time.

### 3.2.4 Business Model Innovation

Every company has a business model, which may not always be formally articulated, that explains how the organization creates and captures value. Chesbrough and Rosenbloom (2002) define a business model as a set of functions that a business performs. These functions include the company's value proposition, the market segments in which the company operates, the structure of its value chain, its revenue generation mechanism(s), its position within its value network, and the competitive strategy by which the company gains or holds an advantage over rivals. Amit and Zott (2012, p. 42) define a business model as "a system of interconnected and interdependent activities that determines the way the company 'does business' with its customers, partners and vendors." For Osterwalder and Pigneur (2010, p. 14), "a business model describes the rationale of how an organization creates, delivers and captures value." In their work, a business model is based on nine building blocks, including: (1) the *customer segments* a company serves; (2) a company's *value proposition(s)*; (3) the *channels* a company uses to deliver its value proposition(s); (4) the *customer relationships* a company establishes; (5) a company's *revenue streams*; (6) the *key resources* a company uses; (7) the *key activities* a company performs; (8) the *key*

*partnerships* the company establishes; and (9) the *cost structure* adopted. The authors bring these building blocks together in a business model canvas that companies can use to develop and improve their business model.

Innovating a company's business model means more than just introducing a new product, service or process. Business model innovation affects multiple activities of a firm at once (in the Amit and Zott definition of business models) or changes multiple building blocks at once in the business model canvas (in the Osterwalder definition of business models). Thus, business model innovation causes far-reaching and system-wide change in how a firm conducts its business or, in the case of startups with unconventional business models, displays a fundamentally different way of doing business, as compared to incumbents. Therefore, innovative business models may offer formidable protection against competitors (Amit and Zott 2012). In line with this, Chesbrough (2010, p. 354) states that "a mediocre technology pursued within a great business model may be more valuable than a great technology exploited via a mediocre business model."

In recent years, we have seen many incumbent industries disrupted by innovative business models, such as Airbnb, Uber and Tesla. Tesla innovated on the value proposition it offers to customers, the way it delivers such value, and the channel it uses to reach customers. The value proposition of Tesla's Roadster was that it was the first not to compromise between performance and fuel efficiency. Tesla chose to integrate the charging infrastructure with its superchargers, which no car manufacturer had done. Tesla also did not adopt an independent dealership network as was common in the automotive industry (and in the USA, even required by law), but operated its own stores, Apple-like, and allowed customers to order and pay online for their new Tesla. In this way, Tesla avoided a potential conflict of interest at dealerships that would have an interest in promoting the combustion engine (higher maintenance revenues) at the expense of the electric car.

Similarly, established companies are also looking for new ways to innovate their business models and gain a competitive advantage. Nespresso, a subsidiary of Nestlé, revolutionized the way the coffee business worked. In 1976, Eric Favre, a Nestlé employee, invented and patented the original machine (Mulier 2011). In 1986, Nestlé established Nespresso SA, a fully owned subsidiary that introduced the first version of the system to the Swiss market. By 1988, Nespresso sold coffee capsules directly to high-income households by mail, shifting its original focus from offices (Osterwalder and Pigneur 2010). However, sales struggled, until Nestlé innovated its Nespresso business model.

First, Nespresso hired a top designer to upgrade its machines to look more trendy. Second, it started to use uncommon channels to promote its brand and to sell its machines and capsules. As such, Nespresso demonstrated its products in premium events, such as golf tournaments and fashion shows, and partnered with airlines to offer its coffee to business class passengers (by 2000, 20 airlines served Nespresso in business class in more than 1000 planes (Slywotzky 2011)). Nespresso also vertically integrated into a retailer and started its own chain of Nespresso stores in well-targeted, highly visible locations. By operating its own stores, Nespresso moved from a transactional business model selling coffee through other retailers to one with recurring revenues by selling coffee capsules using direct channels (Osterwalder 2013). This choice also enabled Nespresso to adopt more of a service model. Third, Nespresso's pricing model is tailored towards seducing customers into buying a Nespresso machine at a relatively low cost, after which the consumer is locked into Nespresso capsules at very high prices. Nespresso has aggres-

sively protected its captive markets through a wide patent portfolio and innovation in its brewing technology, continuously providing it protection from "capsule entry" in its captive market.

### 3.2.5 Innovation Types According to Risk and Time Horizon

Product, service, business model and process innovations may vary in the risk they entail as well as in the time horizon within which the firm can expect to reap its benefits. Scholars have used different categorizations that practically trace back to such varying risk rates and time horizons. Most well known are: (1) incremental versus radical innovations; (2) sustaining versus disruptive innovations; and (3) core versus adjacent versus transformational innovations. We discuss each in turn.

Chandy and Tellis (1998, p. 476) possibly provide the best definitions to distinguish incremental innovations from radical innovations. They define incremental innovations as innovations that "involve relatively minor changes in technology and provide relatively low incremental customer benefits per dollar" and radical innovations as innovations that "involve substantially new technology and provide substantially greater customer benefits per dollar, relative to existing products." An innovation may be incremental on the product level, but radical on the business model level, or vice versa. For instance, the iPhone is considered to be an incremental product innovation because it did not include substantially new technology (with the possible exception of the multi-touch function), but at the same time it represented a radically new business model. Similar variations in the extent to which an innovation is radical or incremental may exist across product, service, business model and process innovation.

Radical innovation is an engine of economic growth capable of changing market structures and even creating entirely new markets (Chandy and Tellis 2000). Wuyts et al. (2004) find that radical innovations are more profitable than incremental ones. The authors also identify alliance portfolios as a driver of radical and incremental innovation success. Furthermore, a meta-analysis by Rubera and Kirca (2012) shows that radical innovations consistently generate more positive outcomes than do incremental innovations.

It is therefore not surprising that many scholars (e.g., Golder et al. 2009; Montaguti et al. 2002; Sood and Tellis 2005; Sorescu et al. 2003) study and advocate radical innovation. One of the interesting topics is why some firms are more likely than others to introduce (radical) innovations. The literature has firmly established the following determinants of radical innovation: firm size (e.g., Cohen 2010); national differences such as culture (e.g., Song and Parry 1997; Tellis et al. 2009); and organizational differences such as structure and culture (e.g., Chandy and Tellis 1998; Damanpour 1991; Olson et al. 1995).

Christensen and Overdorf (2000, p. 72) introduced the distinction between sustaining and disruptive innovations. Sustaining innovations "make a product or service perform better in ways that customers in the mainstream market already value." Disruptive innovations "create an entirely new market through the introduction of a new kind of product or service, one that's actually worse, initially, as judged by the performance metrics that mainstream customers value." Christensen (1997) theorized that companies that focus on sustaining innovations targeting the top market segments will achieve the greatest profitability in the short term. However, by doing so these companies enable disruptive innovators to target the bottom of the market. Such a disruptive innovation provides consumers

at the lower end of the market access to products that were previously only accessible to a select group of consumers. From this lower end of the market, disruptive innovations may destroy the fortune of former market leaders in the long term.

Nagji and Tuff (2012) adapt the risk matrix of Day (2007) to manage risk and reward in innovation portfolios. This adaptation results in the innovation ambition matrix, which maps innovations on the extent to which they develop new products and assets and the extent to which innovations create new markets and target new customer needs. Nagji and Tuff (2012, pp. 68–9) distinguish between three innovation initiatives: core, adjacent and transformational innovations. Core innovations "are efforts to make incremental changes to existing products and incremental inroads into new markets." Adjacent innovations "leverage something the company does well into a new space." Transformational innovations "are new offers – if not whole new businesses – to serve new markets and customer needs." The authors find that firms that outperform their competitors dedicate 70 percent of their investments to core innovations, 20 percent to riskier adjacent innovations, and only 10 percent to transformational innovation "gambles." Interestingly, the authors find that these transformational innovations are most profitable.

## 3.3 WHO OF INNOVATION: INNOVATION SOURCES

While the traditional top-down innovation approach is still present in many companies, different innovation methods that involve other innovative demographics often complement it. A first demographic is firms' own employee base in its broadest sense, leading to grassroots innovation efforts. A second demographic are select customers, so-called lead users, of a firm that experience a need for an innovation before the mainstream market. By extension, a company can crowdsource its innovations from a very large demographic of customers or the general public at large, which may include technical experts from other fields. Last, we review open innovation logic, which advocates direct cooperation of firms with external experts or other firms rather than sending out a call for ideas to a large audience, like grassroots or crowdsourcing approaches advocate (see Figure 3.2 for an overview of sources of innovation).

### 3.3.1 Top-down Innovation

The more traditional of the innovation methodologies is top-down innovation, where innovation is conceived at the top or by a "lab elite" and pushed down the organization. Although lower-level employees in top-down organizations carry through most innovation initiatives, higher management is responsible for setting goals, deploying resources, and overseeing innovation development. Several companies are well known for using this management style. Think of Apple in the days of Steve Jobs as chief executive officer (CEO) and the "lab elite" model used by Alcatel-Lucent's Bell Labs. This model can be especially successful when those at the top in charge of innovation have a sharp vision of where they want the company to go, think long term, and develop innovations that customers may not know they want or need.

Concentration of power at the top can also be important in times of crisis or great opportunities, when power can be used to instill radical change (Huy and Mintzberg

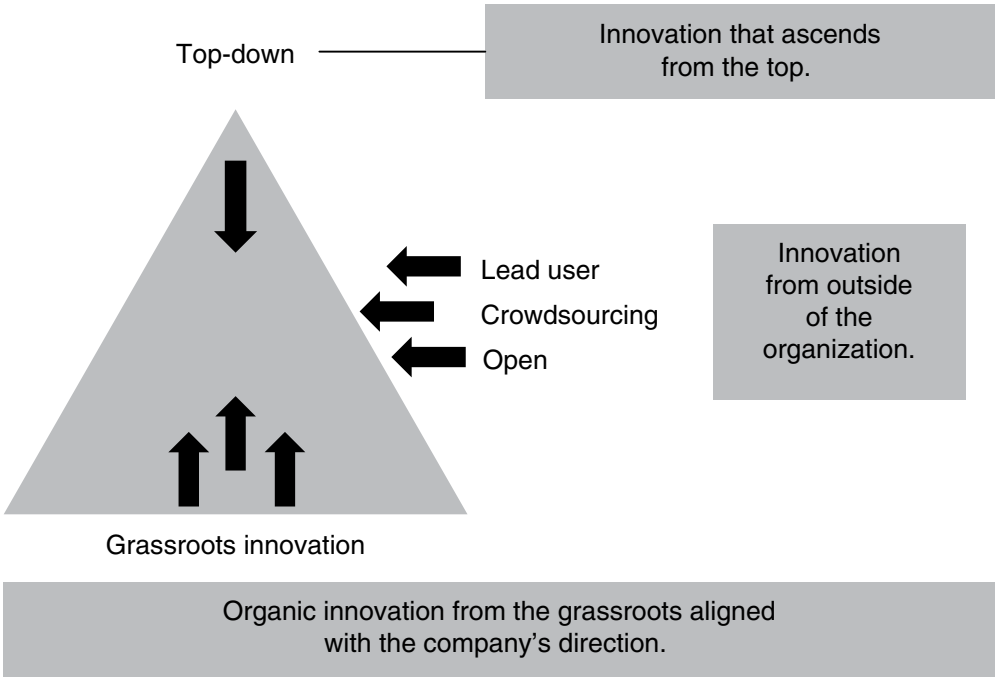


*Figure 3.2 Sources of innovation*

2003). In the early 1990s, with increasing oil prices, a growing middle class, and the US government's focus on fuel efficiency, Toyota's top management charged a team with developing a more fuel-efficient vehicle (Tellis 2013). The top-down directive, aimed at capturing the market for efficient vehicles and changing Toyota's image as an unimaginative copycat, led to the introduction of the Toyota Prius in 1997.

A strong top-down vision from entrepreneurs has also yielded many powerful new firms. Richard Branson's dream to explore space began when he was just a teenager and saw the first moon landing in 1969. While he was building an empire through Virgin Records and Virgin Atlantic, his ambition to democratize space travel never vanished. In the early 1980s, without any concrete plans, Branson trademarked the name Virgin Galactic. He was even given the chance to become the first tourist in space in 1988 when Russia's President Mikhail Gorbachev offered Branson the chance to become a cosmonaut. There was only one problem: it would cost Branson $50 million (Higginbotham 2013). Branson declined and continued to look for alternatives. In 2004, Virgin Galactic was born with the goal of becoming the world's first "spaceline." By 2015, with investments in the company reaching $500 million and with more than 700 people who paid up to $250,000 to travel with Virgin Galactic, Branson's dream is yet to become reality (Langewiesche 2015). While development has been left to experts, it took Branson's vision from the top to start the revolutionary project.

While top-down innovation has led to celebrated products such as Apple's iPod or the Toyota Prius and to the search for new frontiers, such as Virgin Galactic, it has also

led companies to failure. Founded in 1925, Bell Labs was an innovation powerhouse for much of the twentieth century, so much so that seven researchers at Bell Labs received Noble Prizes for their work at the company. With mounting competition for its parent company (AT&T, later Lucent Technologies) and decreasing funding, Bell Labs was no longer able to sustain itself. The "lab elite" model of Bell Labs created major problems for the company (Coupland 2014). The lab elite focused too much on long-term fundamental research, which made it difficult to create short-term projects that would bring in the revenue to keep the company going. Moreover, the lab elite was not close enough to the customers to develop products that would serve their needs.

The lack of connection with customers also accounts for a major failure within the Tata Group. The development of the Tata Nano followed Ratan Tata's vision to build a safe and affordable car to compete with scooters that often transported multiple passengers at great risk. While many innovations at Tata were employee led and evidence based, the Nano came as a directive from its chairman. Ratan Tata set a price tag of 1 lakh (approximately $2000) for the car. Introduced in 2009 as "the people's car," the Tata Nano failed to appeal to customers. By this time, Tata had already spent $400 million developing the car and hundreds of millions had been invested in a factory that could produce 15,000 to 20,000 Nanos monthly. Sales reached their peak in April 2012 with 10,000 cars sold, but soon declined to less than 2000 cars per month in early 2013. Tata had failed to understand that while India's growing middle class citizens wanted cheap cars, they did not want the image of driving a cheap-looking car (McLain 2013).

### 3.3.2 Grassroots Innovation

Grassroots innovation refers to the process where all employees within a company, regardless of their rank, can ideate and develop innovations (Betz et al. 2014). Companies that embrace this innovation methodology make innovation the job of everyone and foster an entrepreneurial environment (Hamel 1998; Hamel and Breen 2007). Birkinshaw et al. (2011, p. 49) explain that the reason behind pushing responsibility down to the entire organization is simple and stems from the idea that "top executives are not close enough to the action to be able to come up with or implement new ideas." Fostering ideas from employees can be a major source of value creation for companies and allows them to be more adaptive. This type of innovation, which stands at the core of companies such as Google, 3M and W.L. Gore, is commonly referred to as bottom-up innovation. While top-down innovation may lead to dramatic changes in companies, grassroots innovation allows for organic and sustainable change (Huy and Minzberg 2003). While many companies adopt grassroots principles, some companies have established a structured process to harness their employees' creativity and innovativeness.

In 2009, Merck KGaA introduced a grassroots initiative named Innospire (Betz et al. 2014) to complement its traditional top-down process. The name "Innospire" came to be through the combination of innovation and inspiration. Innospire had several goals. One was to promote cross-divisional cooperation, especially between the chemical and pharmaceutical divisions. Moreover, it aimed to foster an entrepreneurial spirit within the company and to motivate employees to develop new business ideas. Importantly, Merck was looking to innovate by using the knowledge and expertise of its large employee base.

The initiative received an unprecedented response from employees, with 462 ideas submitted from 32 countries in its first edition.

By 2015, two new products have been launched, seven projects are being developed and over 30 patents have been submitted as a result of these grassroots initiatives. Merck estimates that €200–500 million in revenues from new business resulted from Innospire. Innovations coming from Innospire and the initiative itself have also received much external acclaim. In 2012, one of the Innospire projects, Lisprova, won the CphI Pharma Silver Award for Best Innovation. The award recognizes innovations in the pharmaceutical industry that help drive the industry forward. In the same year, Merck received a best-practice award for the capacity of Innospire to mobilize the innovation potential of its employees. In 2015, Merck won the *Innovationspreis der Deutschen Wirtschaft* (the Innovation Award of the German Economy), the oldest innovation award in the world that recognizes the most significant scientific, technical, managerial and intellectual innovations in Germany.

Similar to Merck, Michelin leverages its full employee base to drive new business growth. In 2012, Michelin developed a grassroots initiative called InnovationWorks to encourage grassroots innovation within and outside Michelin's core business. To reach a global scale and involve employees from all ranks, Michelin scaled InnovationWorks in three phases. The first phase included a deployment in the USA, after which Michelin deployed InnovationWorks in China and Europe. By 2015, Michelin employees had submitted over 5000 ideas in the InnovationWorks process. By 2016, the initiative has produced more than ten new activities on three continents, several of which are showing strong and profitable growth only two years after the start of InnovationWorks.

Another well-known initiative is Dell's EmployeeStorm (started in 2007), an internal social media platform where employees could suggest, discuss and vote on ideas. This initiative started four months after introducing IdeaStorm, a crowdsourcing platform to listen to the ideas of Dell's customers. Ideas submitted in the EmployeeStorm platform could be about almost anything, including ideas for customers, new products, and for employees and company facilities. Through this initiative, Dell wanted to harness the power of its more than 80,000 employees. Through EmployeeStorm, Dell showed employees that their voices are important and fostered a culture where information flows more easily throughout the company (Bennett 2009).

### 3.3.3 Lead-user Innovation

Traditional marketing research tends to gather input from representative consumers, those at the center of the market whose thinking is confined by their current experience and environment (Eliashberg et al. 1997; Lilien et al. 2002). In order to forecast future customer needs, companies have turned to "lead users." Introduced in 1986 by Eric von Hippel, the concept of lead users refers to "users whose present strong needs will become general in a marketplace months or years in the future" (von Hippel 1986, p. 791). Lead users do not only serve as a need-identification tool. As they attempt to fill their needs, lead users can help companies with designing and developing products (Lilien et al. 2002; Urban and von Hippel 1988; von Hippel 1986). Early prototypes or improvised versions of products made by lead users to serve their own needs have become highly successful innovations (Morrison et al. 2000; von Hippel 2005).

In a natural experiment conducted at 3M, Lilien and colleagues (2002) found that lead-user idea generation projects perform substantially better than contemporaneous traditional projects. They find that, on average, annual sales from a lead-user-led project was more than eight times larger than the five-year cumulative revenues from other products within the company that did not use the lead-user methodology during development. The authors describe 3M's methodology as "identifying and learning from lead users both within the target market and in 'advanced analog' markets that have needs in a more extreme form" (Lilien et al. 2002, p. 1043). An example of such an advanced analog market facing an extreme situation is a car manufacturer needing efficiency gains through the reduced weight of lighter, stronger materials and looking to the aerospace industry for inspiration (Lilien et al. 2002).

Lead users have shaped innovation in a variety of contexts. They have been beneficial for developing new industrial products (Herstatt and von Hippel 1992; Urban and von Hippel 1988), medical equipment (Lilien et al. 2002), software innovation (von Hippel 2001), and innovation in sports equipment (Franke and Shah 2003; von Hippel 2005). Furthermore, empowering users and involving them in the design and development of products can have positive effects on demand (Fuchs and Schreier 2011; Fuchs et al. 2010; Schreier et al. 2012).

An important user-led innovation comes from John Heysham Gibbon, the doctor who invented the first heart-lung machine. In the early twentieth century, medical equipment companies could not assess its market potential and therefore did not invest in its development (Mangelsdorf 2011). However, Gibbon, faced with the death of many young patients, saw the need for a heart-lung bypass machine. Following successful use of a prototype on animals in 1935, he then used a heart-lung machine (i.e., pump oxygenator) on a human patient in 1953 and performed the first open-heart bypass surgery. Following his original idea and prototype, IBM engineers joined Gibbon's project and helped develop fully functional models.

### 3.3.4 Crowdsourcing Innovation

The term "crowdsourcing" was first coined by Jeff Howe in 2006 and he defined it as "the act of taking a job traditionally performed by a designated agent (usually an employee) and outsourcing it to an undefined, generally large group of people in the form of an open call" (Howe 2010). While new internet-based technologies have spurred the growth of crowdsourcing by facilitating its application, the idea is not a new one. As early as 1714, the British government offered a cash prize, named the Longitude prize, to anyone who could propose a simple and reliable way to determine a ship's position at sea (The Economist 2008). Isaac Newton, who advised the Longitude board, strongly believed that there could only be an astronomical solution. However, the winner was the carpenter and clockmaker John Harrison, who based his solution on the inner workings of clocks (Jeppesen and Lakhani 2010). In their work, Jeppesen and Lakhani (2010) find that being further away from the problem – that is, having expertise in a different field than the one for which you are trying to find a solution – can be advantageous because it can bring forth a different perspective.

To explain the rise of crowdsourcing, Howe provides several examples of how crowdsourcing communities are changing industries and how large, more traditional organiza-

tions are adopting its principles. iStockphoto, a photo-sharing website where anyone from a large community of photographers can share their images, was founded in 2000. These images were sold at a fraction of the price of professional photographs, disrupting the traditional agency-based model. Following rapid growth, Getty Images purchased iStockphoto in 2006 for $50 million (Howe 2006).

Through similar principles, Wikipedia managed to create an impressive and free online encyclopedia by depending on a large community of contributors. In an attempt to solve an 800-year-old mystery about the location of Genghis Khan's tomb, National Geographic has been asking the wider community to go through and tag satellite images of Mongolia (Boudreau and Lakhani 2013). Their efforts started in 2010 and by 2015 more than 200,000 "explorers" have processed more than 1 million images.

Other groups and companies have quickly followed suit in adopting crowdsourcing. Dell introduced IdeaStorm (Bayus 2013), Cisco introduced the I-Prize competition (Jouret 2009), Netflix launched the Netflix prize in a search for a better recommendation algorithm (Afuah and Tucci 2012), and Eli Lilly funded InnoCentive, a platform that connects companies with the crowd and which has been used by companies such as Boeing, DuPont and Procter & Gamble (Howe 2006).

Companies are also relying on their customers to generate and develop new ideas because customers best understand their own needs (Bayus 2013). In 2008, Starbucks introduced My Starbucks Idea, a community website that collects suggestions and ideas from its customers. Users can share their ideas, vote on each other's ideas, discuss ideas, and offer further suggestions to give guidance to the company on what to implement. Customers are also able to view "ideas in action" where Starbucks reports on changes made in response to community feedback. The initiative was a great success and in the first year alone, users generated more than 70,000 ideas. On the fifth birthday of My Starbucks Idea in 2013, Starbucks had implemented more than 250 ideas from customers. These included free Wi-Fi in all of its stores, free drinks to customers after purchasing a certain number of drinks, and several new coffee flavors.

### 3.3.5 Open Innovation

Open innovation entails the use of internal and external ideas as well as internal and external paths to market because firms aim to advance their technologies (Chesbrough 2003). Open innovation is "the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively" (Gassmann et al. 2010, p. 213). While crowdsourcing can fall within the general open innovation paradigm, open innovation, as explained by researchers such as Chesbrough (2003), Huston and Sakkab (2006) and Guinan et al. (2013), is about companies working with external experts or partnering with other companies as opposed to sending out a call for ideas to the general public. The open innovation concept explains how companies can go beyond their internal boundaries by using external knowledge rather than relying merely on their internal research and development (R&D) operations.

Going back to the failure of Bell Labs, Henry Chesbrough (2003) explains how Bell Labs' lack of openness led it to losing the battle against Cisco Systems. Through Bell Labs, Lucent Technologies devoted substantial resources to internally develop new products and services. Cisco Systems, lacking the internal R&D capabilities of Bell Labs, acquired

the technology it needed externally by partnering or investing in promising startups. Through this strategy and without conducting much research of its own, Cisco was able to become a formidable competitor to Lucent's R&D powerhouse.

Procter & Gamble (P&G) has a long history of collaboration and open innovation. It was founded in 1837 through the collaboration between William Procter and James Gamble. Procter was a candle maker while Gamble was a soap maker. The two founders realized that because they were using the same materials, they could negotiate better prices by joining forces, and so they created P&G. Some of P&G's biggest products, such as Tide detergent, Crest toothpaste and Bounce fabric softener, came from the acquisition of external technologies. In 2000, P&G initiated an open innovation program called Connect & Develop. At that time, P&G's CEO A.G. Lafley had set the goal to acquire 50 percent of innovations from outside the company (Huston and Sakkab 2006). By 2006, more than 35 percent of the company's innovations came from open innovation, bringing in billions of dollars in revenues for the company. The idea behind Connect & Develop was not to replace staff with external resources, but to have a constant flow of ideas and to harness the firm's own internal R&D capabilities. P&G realized that, while they had 7500 people in the company, there were 1.5 million people outside that could potentially contribute to innovation (Huston and Sakkab 2006).

Under Lou Gerstner, the first outsider appointed as CEO (in 1993), IBM, known for its strong internal R&D, began a radical transformation. It began to open its doors to collaborations and to form strategic alliances with other companies (Chesbrough 2003, 2007). IBM has introduced several programs to gain value from open innovation. For example, for its First-of-a-Kind (FOAK) program, IBM cooperates with customers to solve the problems they face. They staff each initiative with an average of four to five IBM researchers for one year. The customer benefits from the solutions that arise, while IBM owns the intellectual property (IP) created by its staff. By 2008, on average 70 percent of completed FOAK projects were transferred to an IBM Business Unit for commercialization. From 2002 to 2007, FOAK projects brought more than $400 million in direct revenues from sales related to the reuse of FOAK assets and more than $4 billion from revenue generated by adapting FOAK concepts to new businesses (Frost & Sullivan 2009).

### 3.3.6 Combining Innovation Methodologies

The methodologies proposed above are by no means mutually exclusive. Dell, for example, uses a combination of crowdsourcing, lead user, open innovation, grassroots innovation, and top-down directives to develop and accelerate innovation. The InnovationWorks initiative at Michelin infuses top-down directives with employee-led innovation. Top management is in charge of setting goals for the initiatives and for helping teams develop their ideas to ensure full alignment between the employees and the company. Furthermore, in bringing their ideas to the market, employee teams need to continuously gather customer input and work with external partners where needed. Combining multiple innovation methodologies allows companies to make use of both their internal capabilities and external knowledge and resources.

## 3.4 HOW OF INNOVATION: INNOVATION PROCESSES

In this section, we discuss how firms generate and develop innovations. We review more traditional approaches such as the stage-gate and spiral innovation processes, as well as more recent approaches such as lean innovation, design thinking and systematic inventive thinking.

### 3.4.1 Stage-gate Innovation Process

Cooper (1994, p. 4) defines the stage-gate innovation process as "a roadmap from idea to launch consisting of discrete stages, each stage preceded by a Go/Kill decision point or gate." The stage-gate methodology stems from NASA's "phased project planning" and gained popularity in the 1980s and early 1990s (Cooper 1994, 2008). In 1997, Griffin found that approximately 60 percent of US firms were using the stage-gate methodology. More recently, Ettlie and Elsenbach (2007) find that 48.6 percent of the companies in the automotive industry are using a traditional stage-gate process.

The stage-gate process varies with each company, but it typically consists of between four to eight stages and gates (O'Connor 1994). To illustrate, let us consider the stage-gate process of P&G, also known internally as the Successful Initiative Management and Product Launch model (SIMPL). SIMPL consists of five stages (including ideation) and four gates that guide projects from the ideation to the post-launch stage. Consistent with the stage-gate philosophy, P&G's SIMPL methodology consists of clearly defined activities and expectations, evaluated against specific criteria. Cooper and Mills (2005) identify the following drivers behind the success of P&G's stage-gate process: (1) instead of focusing on progressing (all) projects through the various stages of the process, P&G focuses its efforts on projects that can win in the marketplace; (2) P&G has clearly defined success criteria that it uses to evaluate the projects; (3) a strong customer focus combined with rigorous planning and decision making mitigates the risks of projects.

The stage-gate process uses multifunctional teams that work on several activities at the same time (Cooper 2008). This approach makes it considerably more efficient than phased project planning, which reportedly doubles the development time of projects (Cooper 1994). A firm increases resource investment as the project passes through successive stages and uncertainty decreases. The stage-gate methodology incorporates a go-or-kill decision after each stage. This decision is based on the progress of the project as evaluated against a predetermined set of criteria (Cooper 2008).

Several scholars have inventoried the main disadvantages of the stage-gate method. O'Connor (1994) concludes that implementing the stage-gate process is neither easy nor quick. Cooper (1994) concludes that the stage-gate process: (1) may delay the progress of a project because each stage has to be completed before the next can start; (2) may be too heavy for small, low-risk projects; and (3) does not prioritize projects and, thus, does not focus resources on projects with the highest priority. Sethi and Iqbal (2008) find that rigorously applying strict review criteria to all projects decreases the flexibility of projects. Such lower flexibility may lead to lesser exploitation of learning over the course of a project, increasing the risk of market failure of new products. Van Oorschot et al. (2010) find that strictly applying the stage-gate methodology may lead to abandoning viable projects. Overestimating team size (i.e., a team may need more time to finish) or underestimating

workload (i.e., a team may need more resources to finish a stage in time) may result in projects being abandoned.

Companies have typically customized stage-gate processes to fit their own context. Ettlie and Elsenbach (2007) find that approximately one-third of the companies in the automotive industry are using a modified stage-gate process. Modified stage-gate processes typically focus on increasing the speed without compromising the thoroughness of the process. Cooper (1994, 2008) differentiates between the traditional and the modified stage-gate processes: the latter is typically more adaptable (e.g., it is tailored to accommodate different risk levels), less strict (e.g., conditional instead of final go-kill decisions), and more focused (e.g., direct resources only to the most promising projects) than the former.

### 3.4.2 Spiral Innovation Process

Boehm (1988) first introduced the spiral process of innovation as a model for software development and enhancement. We can see the foundations of the spiral model in various models for software development such as the waterfall model (Boehm 1988), which is essentially a step-by-step approach to software development related to the stage-gate methodology. Boehm (2000, p. vii) defines the spiral development process as "a family of software development processes characterized by repeatedly iterating a set of elemental development processes and managing risk so it is actively being reduced." Essentially, the spiral model consists of numerous rapid iterations of the stages from ideation to testing a prototype among customers. Each successive spiral proceeds at greater speed and lower costs (Hauser et al. 2006). The number of iterations depends on the risks and the project's state of development (Mizell and Malone 2007).

The spiral development process starts at the center of the spiral, which represents the inception of the project idea. The spiral process is divided into four main parts (Boehm 1988). (1) Finding out the goal of the project and identifying technical, legal and feasibility constraints. (2) Risk identification, which is crucial to the process. Ideally, the biggest risk is resolved first, followed by the next biggest risk and so forth. If a risk cannot be resolved, the project may be cancelled. (3) Verifying the concept by requesting customers' feedback on a prototype. (4) The customer feedback determines whether a project is cancelled, put through to another iteration of the spiral process or is ready for market launch.

Numerous case studies (e.g., Boehm et al. 1998) illustrate the popularity and effectiveness of the spiral process for software development. The spiral process emphasizes risk management and is very flexible. These characteristics make the methodology particularly suitable for large-scale high-risk projects. According to Mizell and Malone (2007), the spiral process results in high-quality customer-centric products.

### 3.4.3 Lean Innovation Process

The lean innovation process is based on speed of execution and on deploying minimum viable products that can receive continuous customer feedback (Blank 2013). The process places emphasis on experimentation, learning and customer development (Ries 2011); it follows from the idea of lean thinking that characterized Toyota's lean manufacturing

philosophy. The ideas of waste reduction, immediate feedback and customer satisfaction form the foundation of this process (Womack and Jones 1996).

Dropbox, a file sharing tool, attributes its growth to the lean methodology. The founders of Dropbox, Drew Houston and Arash Ferdowsi, created it as a solution to their own frustrations. They created a minimum viable product and called upon end users to quickly learn and improve it (Ries 2011). In September 2008, the team publicly launched beta versions of the program to test whether others would also see the value in this solution and would be willing to pay for it. These beta testers were enthusiastic users who signaled their interest in using Dropbox as well as in helping to improve the program and to spread the word about it. The team continued launching fast, early and often. Word of mouth became their main customer acquisition vehicle and they adapted their business model accordingly. In order to stimulate referrals, users would gain more free space in their Dropbox for every referral. This was the best way to create demand for a product that not all customers realized they needed. Three years after its launch, Dropbox went from 100,000 to over 50 million registered users worldwide. By 2015, Dropbox's valuation has reached $10 billion, with more than 400 million registered users.

Similar to Dropbox, LinkedIn has grown to more than 380 million users in 2015 by starting out lean. The LinkedIn site was officially launched in 2003 and through multiple iterations based on customer feedback, it launched public profiles in 2006. In line with the lean philosophy, LinkedIn's co-founder Reid Hoffman famously stated, "If you are not embarrassed by the first version of your product, you've launched too late."

While it was initially only startups that created and deployed lean innovation, its principles are increasingly making their way to large companies (Blank 2013; Ries 2011). With growing competition and rapidly changing customer needs, large companies can no longer risk spending years and millions of dollars on products that the customer may not want. One company that embraced the lean startup approach is General Electric (GE). Through a new initiative called FastWorks, GE attempts to increase the speed by which its products are tested and works closely with customers to incorporate their feedback into the products. By late 2014, the company had already trained 40,000 employees on the new initiative and started more than 300 FastWorks-based projects (Clough 2014). By encouraging employees to fail fast and small, GE aims to bring products to market faster and at lower costs than ever before. Qualcomm and Intuit have joined GE by adopting similar principles (Blank 2013).

### 3.4.4 Design Thinking Innovation Process

Herbert Simon first introduced the idea of incorporating design in decision making in his 1969 book, *The Sciences of the Artificial*. Peter Rowe introduced the term "design thinking" in 1987 in a book with the same name and which describes the architectural and urban planning design process. IDEO, a global design and innovation-consulting firm, later applied the design thinking principles to the process of innovation generation and development. Design thinking as an innovation process was then popularized by IDEO's CEO and president Tim Brown, together with one of IDEO's co-founders David Kelley, who in 2003 first labeled IDEO's approach as "design thinking" (Brown 2008).

Design thinking takes a human-centered approach to innovation. It is driven by understanding people's wants and needs through direct observation and learning what they like

and dislike about products (Brown 2008). Using a designer's method, this methodology aims to create innovation at the intersection of customer needs, technological feasibility and a viable business strategy (Kelley and Kelley 2012). To do so, a design process goes through the three stages of inspiration, ideation and implementation (Brown 2008). Innovators are encouraged to "leave the building" to observe people, to rapidly create a prototype and to gather continuous customer feedback.

An example of design thinking is the innovation led by Doug Dietz, a GE employee (Kelley and Kelley 2012). At the unveiling of a new MRI-scan, Dietz observed the anxiety of a young girl and her parents as she was waiting to get an MRI-scan. Dietz later discovered that up to 80 percent of pediatric patients had to be sedated because they could not lie still long enough for the scan to take place. Without any funding to redesign the machine, Dietz and his team focused on making the experience more enjoyable. They came up with the new "Adventure Series" scanners, which were colorful, fun, and resembled a pirate ship or a space ship. MRI technicians even had scripts that guide the patients through the adventure. These new machines significantly reduced the number of pediatric patients needing sedation, diminished the need for anesthesiologists, and increased the number of patients scanned on a given day.

### 3.4.5 Systematic Inventive Thinking

While customers can be a great resource for innovation, they may not always know what they need or lack the imagination to help develop innovations (Goldenberg et al. 2003). As opposed to many other processes, systematic inventive thinking is characterized by "inside the box" thinking and listening to the voice of the product rather than solely to that of the consumer. This process is inspired by the research of the Russian engineer, Genrich Altshuller, whose work aimed to place some structure on the creative process.

By studying patents and other inventions, Altshuller realized that there are certain patterns to how people solve problems and develop innovations (Goldenberg et al. 2003). In a series of papers, Goldenberg et al. (1999a, 1999b, 1999c) explain that structure is needed for creativity to flourish. They describe how lack of structure leads to the failure of commonly used idea-generating methods such as brainstorming and lateral thinking (Goldenberg et al. 1999a). Furthermore, they find that even in one of the most creative industries, advertising, award-winning ads show a clear pattern and up to 89 percent can be captured by only six creativity templates (Goldenberg et al.1999b). In innovation in general, a set of different patterns emerge, which not only help in categorizing ideas but also in generating them (Goldenberg et al. 2003).

In practice, the process of systematic inventive thinking starts by listing the physical components and attributes of existing products, understanding the products' direct environment, and then seeking paths for improvement (Goldenberg et al. 2003). Innovation can then follow one or more of five identified patterns.

The first pattern, subtraction, entails removing undesirable components from the product in question. An example is the Sony Walkman, a portable cassette player that did not have the ability to record (Boyd and Goldenberg 2013).

The second pattern, multiplication, involves creating copies of certain product components and then changing those copied parts to develop an innovation. This is what Gillette did to its razor when it added a second blade at a different angle to the first, allowing the

first blade to raise the whiskers and the second to achieve a clean shave (Goldenberg et al. 2003).

The third pattern, division, entails separating the components physically or functionally and then rearranging them differently. For instance, the first air conditioners came as a single unit. With the division technique, later models separated the motor and fan from the cooling unit, which minimized noise, heat and space requirements (Boyd and Goldenberg 2013).

The fourth pattern, task unification, emerges when innovators add a new unrelated function to an existing component. A clear example is printing assembly instructions on the packaging of a product, such as a cabinet or cupboard (Boyd and Goldenberg 2013). This eliminates the need for a separate sheet that customers often lose, saves costs on printing the paper, and simplifies the packaging process of the manufacturer.

The fifth pattern, attribute dependency, entails innovation arising from beneficial connections between a product and its environment. For example, eyeglasses with lenses that change color when it is sunny or dark eliminate the need to buy multiple pairs of eyeglasses (Boyd and Goldenberg 2013). Innovators can make use of one or a combination of several of these five patterns simultaneously to develop new products or services.

## 3.5 CONCLUSIONS

Building an innovation agenda is becoming increasingly important but at the same time challenging for managers. To help managers along the way, we aimed to provide a review of the options available to them, including leading literature and leading cases. This review could therefore serve as a basic compass to guide managers through innovation terminology and different innovation processes. Undoubtedly, many more innovation processes and hybrid models for innovation generation have emerged and will emerge. In this respect, academic researchers will continue to play an important role in understanding better the innovation generation process. Ultimately, companies must choose which process fits them best given their industry, their employee base and management style. What is clear is that ignoring new ways to innovate can lead to the failure of even the most established companies. Thus, companies need to continue to innovate how they innovate.

## NOTE

* Stefan Stremersch acknowledges to have served as a consultant to several of the firms mentioned in this chapter, but has acted independently and impartially in the writing of this chapter.

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