CHAPTER ONE

NEW PRODUCTS: WHAT SEPARATES THE WINNERS FROM THE LOSERS AND WHAT DRIVES SUCCESS

Robert G. Cooper

1.1 Introduction

The central role of product innovation in business strategy coupled with poor innovation performance by many firms has resulted in an urgent quest for solutions – how to improve new product (NP) practices and performance. That begs the questions: What are the factors that underlie NP success? Why are some new products so successful? And why do some companies achieve outstanding performance in product innovation? In short, *what makes a winner* – that's the topic of this chapter.

1.1.1 Critical to Firms, but High Failure Rates

Product innovation – the development of new and improved products and services – is crucial to the survival and prosperity of the modern corporation. New products launched in the last three years account for 27 percent of company sales and 25 percent of profits (Buffoni et al. 2017).

The secrets to success in new product development (NPD) are complex, however, and elusive for many firms. Witness the *high failure rate of new products* and the *poor innovation performance in industry – 40 percent* of *launched products fail* (but not the common assertion that 80 to 90 percent of new products fail; Castellion and Markham 2013). If one starts measuring earlier in the NP

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process, out of every 7 to 10 NP concepts, on average only one becomes a commercial success (Barczak et al. 2009). Further, only 53 percent of businesses' NP projects achieve their financial objectives; 44 percent are launched on time (Cooper and Edgett 2012; Edgett 2011); and only 13 percent of firms' new product efforts achieve their annual profit objectives (Cooper 2019). Wide variances exist around performance metrics, however, with the *best performing firms doing dramatically better than the rest* (the top 20 percent of businesses in terms of NPD performance results, as measured by a number of metrics).

This Chapter's Scope: This chapter is based on studies from the world of physical or manufactured new products. While service and software are important sectors, the fact that in the US manufacturers account for 58 percent of R&D spending means that physical products are very much a vital area in NPD (National Science Foundation 2021), hence the current focus. Some success factors also have applicability to the other two sectors; but not all do, nor are the relative impacts the same.

1.1.2 Some Definitions

New product development covers the complete process of bringing a new product to market, renewing an existing product, or introducing a product in a new market. Thus, there are different "degrees of newness" of a new product, as shown in Figure 1.1. Here, both the average breakdown by numbers of projects (Barczak et al. 2009) and by resources spent by project type (Cooper and Kleinschmidt 2021) are shown.

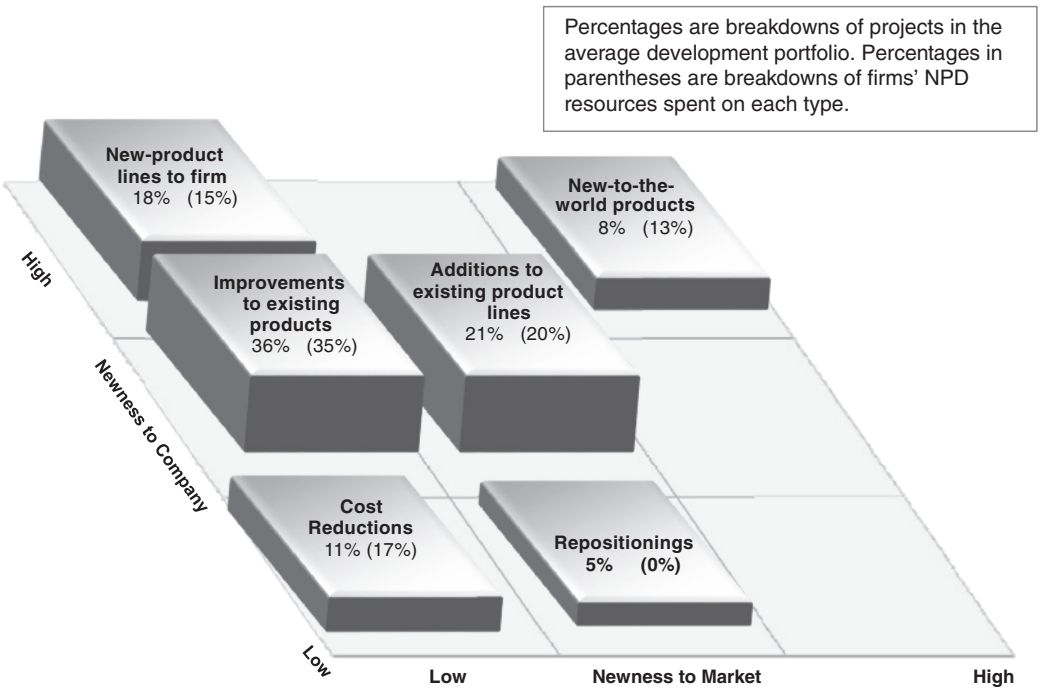
The concept of *innovation* is more complex and includes three major facets (Joubert and Van Belle 2012). First, an innovation is *not the same as an invention*; it must be successfully introduced and adopted in the marketplace (Garcia and Calantone 2002). Second, innovation is *an iterative process*: Cycles of innovation repeat, and so improved versions of innovations are continuously introduced to the market. Third, the definition includes *many different types of innovation* in an organization, such as product and service innovation, and also process and technological innovation. This chapter only focuses on one aspect of innovation, *product innovation.*

1.2 The Critical Success Factors in Product Innovation

Twenty-five success drivers have been singled out in this chapter. Each has been cited in several notable studies. For reading convenience, these 25 drivers are arbitrarily divided into three categories (although some drivers cut across categories):

1. Success drivers of individual new product projects: These are tactical and capture the characteristics of the NP project or the product itself (see Table 1.1).

FIGURE 1.1 TYPES OF NEW PRODUCTS ON TWO DIMENSIONS – "NEW TO THE COMPANY" AND "NEW TO THE MARKET."



Source of percentages: Barczak et al. (2009); Cooper and Kleinschmidt (2021).

2. Drivers of success for the business, including the business's innovation strategy, climate, and culture, and how the firm organizes for NPD (see Table 1.2).
3. The systems and methods that the firm has in place for managing NPD (see Table 1.3).

The Quest for the Critical Success Drivers

The keys to new product success outlined in this chapter are based on numerous research studies and reviews of why new products succeed, why they fail, comparisons of winners and losers, and benchmarking studies of best-performing businesses. Many of these investigations have been reported in the PDMA journal, the *Journal of Product Innovation Management* (*JPIM*).

Some of the most revealing studies have been the large-sample quantitative investigations of successful versus unsuccessful new product projects. They began with Project SAPPHO in the early 1970s, followed by the NewProd series of studies, the Stanford Innovation Project, and, subsequently, studies in countries outside of North America and Europe (Mishra et al. 1996; Song and Parry 1996). Then,

(Continued)

several large benchmarking studies of best practices in firms have provided other insights into how to succeed at product innovation (American Productivity & Quality Center, APQC 2003; Barczak et al. 2009; Cooper et al. 2004; Edgett 2011; Griffin 1997).

In more recent years, a number of relevant meta-analyses and literature reviews have been undertaken, and have provided additional useful insights to success drivers: Cankurtaran et al. (2013); Dwivedi et al. (2021); Evanschitzky et al. (2012); Joubert and Van Belle (2012); Salmen (2021); and Storey et al. (2016).

1.3 Success Drivers of Individual New Product Projects

Why do so many new products fail and why do some succeed? And is there a pattern? Ten drivers of success at the *NP project level* have been identified (Table 1.1).

TABLE 1.1 SUCCESS DRIVERS OF INDIVIDUAL NEW PRODUCT PROJECTS.

Driver Name	Success Driver Description
1. Product Advantage	A unique superior product – a differentiated product that delivers unique benefits & a compelling value proposition to the customer or user; also the role of "smart products"
2. VoC	Building in the voice-of-the-customer – market-driven & customer-focused NPD
3. Up-front Homework	Predevelopment work – doing the homework & front-end loading the project; doing the due diligence before Development gets underway
4. Product Definition	Sharp, early & fact-based product definition to avoid scope creep & unstable specs; leads to higher success rates & faster to market
5. Iterative Development	Building into the project a series of "build & test" iterations; putting something in front of the customer, early & often, to get the product right; early & frequent technical validations of versions of the product
6. Speed & Order of Entry	The impact of speed and time to market; timing & the order of market entry (first to market)
7. Agility	Responsive to making rapid changes in the portfolio of projects; able to react to changing customer needs; ability to pivot from the original plan of action
8. Proficient Launch	A well-conceived, properly executed market launch, driven by a solid, properly resourced marketing plan
9. Global Orientation	A global or "glocal" product (global platform, tailored for local markets) and targeted at international markets (as opposed to the product designed to meet home-country needs)
10. Expectations of Success	Expect success, get success – success is a self-fulfilling prophecy: when project team members expect success, they are empowered & thus realize success

1.3.1 Product Advantage – A Unique Superior Product

Gaining competitive advantage by delivering *differentiated products with unique benefits* and a *compelling value proposition* for the customer and or user distinguishes new product winners from losers more often than any other single factor (Cooper 2017b, 2019; Dwivedi et al. 2021; Evanschitzky et al. 2012; Salmen 2021; Storey et al. 2016). Such superior products have five times the success rate, over four times the market share, and four times the profitability of "me too," copycat, reactive and ho-hum products with few differentiated characteristics (Cooper 2019; McNally et al. 2010.)

What do superior products have in common? Winning products…

- Are superior to competing products in terms of meeting users' needs, offer unique features not available in competitive products, or solve a problem the customer has with competitive products;
- Feature good value for money for the customer, reduce the customer's total costs (high value-in-use), and boast high price/performance;
- Provide excellent product quality relative to competitors' products (in terms of how the user measures quality); and
- Offer product benefits or attributes that are highly visible, easily perceived as useful, and are meaningful to the customer.

Other product characteristics have been investigated, with little or insignificant connection to new product success, either positive or negative (Evanschitzky et al. 2012). These less relevant product characteristics include:

- Product price;
- Product technological sophistication; and
- Product innovativeness (new to the market).

The term "superior product" used above is defined from an *external* or *market perspective*, that is, differentiated from (or better than) *competitive products*, consistent with the definitions of "innovativeness" by Garcia and Calantone (2002). This external perspective is different than an *internal perspective of innovativeness*, namely "new to the firm" products, which may have lower success rates due to loss of synergy or lack of experience in the new market or technology.

Innovativeness or differentiation alone is not necessarily the key: A product might be "novel and different" in the eyes of the customer – the first of its kind, never been seen before – yet deliver little of benefit to that customer. Product *meaningfulness* is what is vital: the *benefits that users receive* from buying and using a new product (Rijsdijk et al. 2011).

Note also that "product" is broadly defined here. It includes not only the evident or physical product, but also the "extended product" – the *entire bundle of benefits associated with the product*, including the system supporting the product, product service, and technical support, as well as the product's image or branding.

Smart products: The Digital Transformation underway in industry has introduced a relatively new category of physical products, namely "smart products" – physical products with embedded software. Smart products cover a broad range from home appliances (a smart kitchen stove) to a smart car (a Tesla) to IoT production equipment (connected to the Internet to enable monitoring of performance; Raff et al. 2020).

The hardware component still dominates physical product development, however, with more than 50 percent of product composition being hardware for almost two-thirds of manufacturing firms (Schmidt et al. 2019). On average, *embedded software is now about 30 percent* of the composition of manufacturers' new products, a significant percentage (Cooper and Fürst 2020a).

The questions become: Are smart new products really more successful? And what are their success drivers? Research into smart new product success is in its infancy, however. To the extent that connected or smart products offer new and desired functionality versus traditional physical products, these would be seen as benefits by customers, and thus one might expect a higher success rate. But no concrete evidence exists on relative success rates of smart new products versus traditional ones.

Some of *success drivers of smart new products* are consistent with those for physical new products, such as:

- A strong market orientation and understanding users' unmet needs;
- Proficiency of the new product process (how well executed both marketing and technical tasks are during the project); and
- The existence of internal competences (Shashishekar et al. 2022).

But only a few potential drivers have been investigated. Smart or connected new products are an area that merits research.

1.3.2 Market-driven Products and Voice-of-the-Customer (VoC) Built In

A thorough understanding of customers' needs and wants, the competitive situation, and the nature of the market is an essential component of new product success (Calantone and Di Benedetto 2007; Cooper 2019; Fang 2008; Florén et al. 2018; Joubert and Van Belle 2012; Kim et al. 2016; Verhaegde and Kfir 2002). This tenet is supported by *virtually every study of product success factors.* Conversely, failure to adopt a strong market orientation in product innovation, unwillingness to undertake the needed market assessments, and leaving the customer out of the development project spell disaster. These culprits are found in almost every study of why new products fail, starting back with the first study on NP failures! (National Industrial Conference Board 1964).

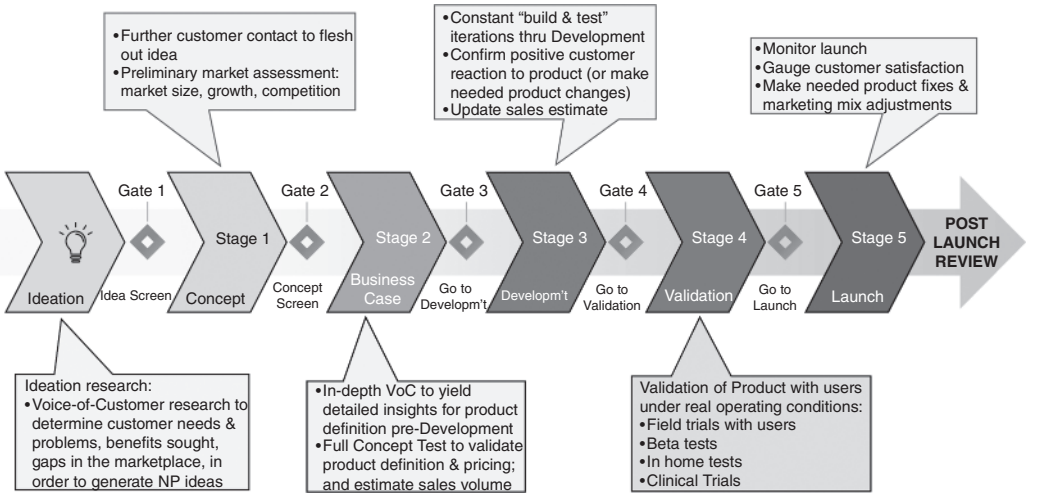
A strong *market orientation is missing* in the majority of firms' new product projects, and detailed market studies are frequently omitted from NP projects (Edgett 2011). In general, marketing activities are the most poorly executed activities of the entire new product process, rated far below corresponding

technical (engineering, design, R&D) activities. Moreover, relatively few resources are spent on marketing actions (except for the launch), accounting for less than 20 percent of total project costs.

A market focus is relevant throughout the entire new product project – see Figure 1.2:

- Idea generation: The *best ideas come from customers*. Market-oriented idea generation activities, such as focus groups and VoC research (ethnography and site visits) to determine unmet needs or problems lead to superior ideas (Cooper and Dreher 2010). Robust ideas also come from innovative users and web-based customer inputs (open innovation). Customer participation in the ideation stage also improves new product financial performance (Woojung and Taylor 2016).
- Product design: Customer inputs often have a vital role in the design of the product, helping to define the product's requirements and specifications. But the value of customer involvement in the early stages of an NP project is somewhat controversial: Customers may not provide useful product suggestions or solutions nor rich information. The conclusion is that firms learn more from *listening to the voice of the customer* – getting customers to talk about the problems they face, their requirements and expectations, and the benefits they seek – rather than asking for specific product solutions (Florén et al. 2018).
- Before pushing ahead with development: Best performers *test the product concept with the customer* by presenting representations of the product – via models, mock-ups, "protocepts,"[1] and even virtual prototypes – and gauging the customer's

FIGURE 1.2 A STRONG CUSTOMER FOCUS INCLUDES KEY ACTIONS FROM BEGINNING TO END IN THE INNOVATION PROCESS.



liking and purchase intent. It's much cheaper to test and learn before development begins than to develop the product and then begin customer testing (Cooper and Fürst 2020a).

- Throughout the Development stage of the project: Customer inputs shouldn't cease at the completion of the predevelopment market studies. Testing product designs with the user is very much an *iterative process*: By bringing the customer into the process to view facets of the product via a series of rapid prototypes-and-tests, or customer tests of pretotypes,[2] the developer verifies assumptions about the winning product design. Feedback shared by the customer can also help identify and resolve potential problems, which minimizes development delays and improves speed to market (Fang 2008). (See 1.3.5 below.)
- Product testing and validation stage: Customer participation in the testing or validation stage also improves NP financial performance directly, and indirectly through acceleration of time to market (Florén et al. 2018). Validation includes activities such as prototype testing (beta tests, field trials, consumer tests) and market testing (test market or trial selling; selling an MVP[3]) that provide first-hand feedback from customers on product usability, product performance, potential product problems, and the positioning and marketing mix for the new product.

Some literature emphasizes involving customers in *high-tech industries*, thereby gaining the benefits of new knowledge from customers. Evidence exists, however, that customer participation could be an even more effective strategy in *low-tech industries* because of the ease of knowledge integration and utilization in such industries (Woojung and Taylor 2016).

Open innovation: This goal of involving the customer in product development has moved beyond the relatively low-key need to "listen to the voice of the customer" to *more intense customer-involvement methods* such as crowdsourcing and open innovation (Chesbrough and Crowther 2006; Cui and Wu 2016; Docherty 2006; Enkel et al. 2009; Product Development and Management Association 2014; Poetz and Schreier 2012). Through *open innovation*, the developer obtains resources and knowledge from sources external to the company: ideas for new products; intellectual property and outsourced development work; marketing and launch resources; and even licensed products ready to launch.

Open innovation is one way that the customer is built into the process and has proven effective. But a firm must be able to acquire, transform, assimilate, and exploit the knowledge to maximize any impact that open innovation may have on competitive advantage (Morgan et al. 2018). Firms with *higher absorptive capacity* are better equipped to apply customer knowledge to newer, differentiated products; and they are more able to internalize external knowledge from customers and exploit it commercially, which enhances the relationship between customer participation and new product performance.

Codevelopment: Here, customers or users are invited *to help the product developer design the next new product*, and in so doing, provide many suggestions for

significant product improvements (von Hippel et al. 2011). Indeed, consumers were found to be 2.4 times *more efficient* at developing significant innovations than producers, and much more prolific and efficient product developers when the project is in its early stages (Hienerth et al. 2012). Co-development is more feasible today, in part because of IT and Internet tools.

1.3.3 Predevelopment Work – The Up-front Homework

Homework is critical to winning. Studies reveal that the *steps preceding the development* of the product make the difference – the "game is won or lost in the first five plays" – in Stages 1 and 2 in Figure 1.2 above (Cooper 2011, 2019; Evanchitsky et al. 2012; Storey et al. 2016). Quality of execution is key to success, but the front-end of the innovation process tends to be where most of the weaknesses occur (Edgett 2011).

Successful firms spend about twice as much time and money as unsuccessful firms on these vital front-end activities (Cooper 2019):

- Preliminary market assessment – a quick market study to assess market potential and desired product attributes;
- Preliminary technical assessment – the first technical appraisal of the project, assessing technical feasibility and identifying technical risks;
- Detailed market study, market research, and VoC research;
- Detailed technical assessment – in-depth technical appraisal, establishing proof of concept, intellectual property (IP) issues resolution, and an operations and source-of-supply assessment; and
- Business and financial analysis before the investment decision to go to full-scale development.

"More homework means longer development times" is a frequently voiced complaint. However, research shows that homework pays for itself in improved success rates and actually reduces development times:

1. A much higher likelihood of product failure results if the homework is omitted.
2. Better project definition, the result of sound homework, speeds up the development process. Poorly defined projects with vague targets incur time slippage as they enter the Development stage.
3. Given the inevitable product design evolution that occurs during the life of a project, ideally, most of these design changes should be made early when they are less costly to correct. Predevelopment homework anticipates these changes and fosters their occurrence earlier in the process (Cooper 2019).

As Toyota's new products handbook (Morgan and Liker 2006) recommends, "Front-end load the project." That is, undertake a higher proportion of the project's work in the early stages.

1.3.4 Sharp, Early, and Fact-based Product Definition

Two of the worst time wasters in NPD are *project scope creep* and *unstable product specifications*. Scope creep means that the definition of the project constantly changes. The project might begin as a single-customer initiative, then be targeted at multiple users, and finally ends up being a new family of products. *Unstable product specs* means that the product definition – product requirements and specifications – keeps changing throughout the Development stage. Thus, the technical people chase elusive development targets – moving goalposts – and take forever to get to the goal (Cooper 2019).

Sharp, early, and fact-based product definition during the homework phase is one solution. How well the product is defined before the Development stage begins is a major success factor, impacting positively on both profitability and reduced time to market. This definition includes:

- The project's scope;
- The target market;
- The product concept and the benefits to be delivered to the user (including the value proposition);
- The positioning strategy (including the target price); and
- The product's features, attributes, requirements, and high-level specifications (Cooper 2019).

Unless this product definition is in place and fact-based, the odds of failure increase:

1. Building in a definition step *forces more attention to the* front-end homework, a key success driver.
2. The definition serves as a *communication tool*: All functional areas have a clear definition of the product.
3. This definition provides *clear objectives* for the technical team members, so they can move more quickly to their objective.

In today's dynamic world however, things change! In order to accommodate new information and inputs, smart firms allow *fact-based modification* of the original product definition by building in a series of "build and test" iterations…. next.

1.3.5 Iterative Development – Build, Test, Feedback, and Revise

The world moves too fast to make a stable and rigid product definition always possible. Often customers are not clear on what they want (or need) in the first place, so it's difficult to get an accurate product definition prior to development; and sometimes, customer requirements change in the time that passes between the beginning and end of development. As Steve Jobs, never a proponent of

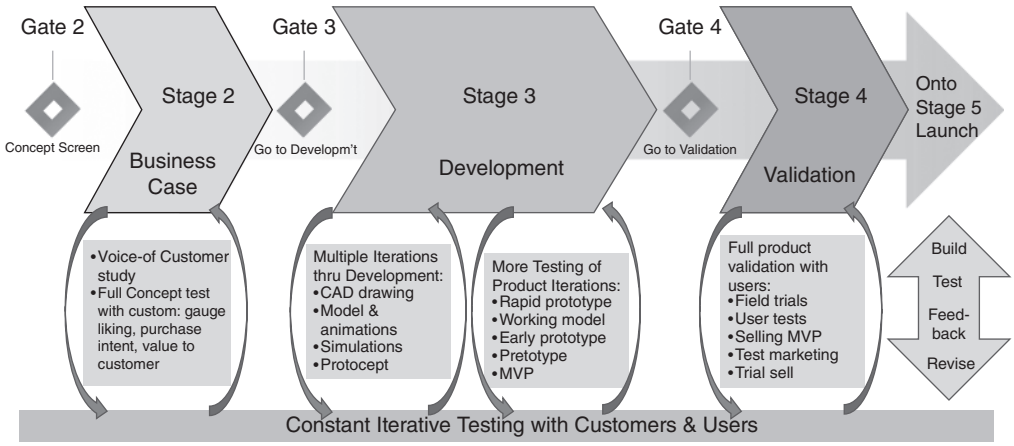
traditional market research, famously said, "People don't know what they want until you show it to them" (Isaacson 2011, p. 567).

Smart businesses have made the idea-to-launch system *much more adaptive*, allowing adjustments on the fly via *iterative development* (Cooper 2014, 2019). When there exists a high degree of customer participation at the prototype development stage (feedback, testing, opinions, and comments), the new product is much more likely to be successful in the market (Tih et al. 2016). That is, during development, efforts should be made to obtain customer feedback on early prototypes in order to increase the chances of the market success of the new product.

Smart project teams build in a series of *deliberate iterative steps* whereby successive versions of the product are shown to the customer to seek feedback and verification, as shown as the curved arrows in Figure 1.3. Each iteration consists of:

- *Build*: Build something to show the customer – a representation of the product, such as computer-generated graphics, a simulation, a virtual-reality prototype, a protocept, a rapid prototype, a crude working model, an early prototype or beta version, or a pretotype … each version closer to the final product.
- *Test*: Test that product version with the customer; and also test it internally (technically).
- *Feedback*: Gather feedback from the customer or user – what they like or don't like, what value they see, and purchase intent. And check the results of internal technical tests.

FIGURE 1.3 ITERATIVE OR SPIRAL DEVELOPMENT – A SERIES OF "BUILD-TEST-FEEDBACK-REVISE" ITERATIONS WITH CUSTOMERS – GETS THE PRODUCT RIGHT.



Source: Cooper (2017b).

- *Revise*: Reset your thinking about the value proposition, benefits sought, the product's design, and the technical solution; pivot if necessary; and then move to the next iteration (Cooper 2014).

This *iterative approach promotes experimentation*, encouraging project teams to fail often, fail fast, and fail cheaply.

Not only do iterations reduce market uncertainties, they also can be used to reduce technical uncertainties by seeking technical solutions in an experimental, iterative fashion. Moreover, there is strong evidence that this iterative development is *both feasible and works*: 44.8 percent of best-performing businesses practice these build-and-test iterations with customers (but only 26.3 percent of average firms do; APQC 2003). And a study of leading B2B European manufacturers revealed that, on average, between 3 and 4.5 versions of the product are presented to validate the design with customers through the Development and Testing stages, while product ideation-and-design contractors, such as IDEO, iterate on average *15 times with the customer* per project (Sandmeier et al. 2010).

Words of warning, however: Involving customers in via a series of iterative customer tests during the Development stage does take time, may increase time to market, and could diminish new product financial performance, particularly where the market is rapidly changing and interdependency among a product's parts is critical (Woojung and Taylor 2016). Thus, there is a trade-off between getting the product right versus the extra time needed to undertake iterative testing of the product with customers during development. A meta-analysis of speed of development, however, reveals that building in frequent build and test iterations has *no negative effect on speed* (Cankurtaran et al. 2012), while an earlier such meta-study revealed that frequent iterations actually improved time-to-market (Chen et al. 2010). Later in this chapter comes the topic of Agile Development, a set of principles and methods from the software world; Agile Development builds in frequent and very short build-and-test iterations.

1.3.6 The Impact of Speed and Order of Market Entry

Two concepts – *speed* and *order of entry* – are time related, and this section deals with both.

Speed or Time to Market: The theory is clear: Faster to market means higher profits (sales and profits are realized sooner; and money has a time value). Being in the market first results in higher market share, hence more sales and profits: "first mover advantage"; and being late to market means missing the window of opportunity, or incurring other penalties (such as annoying valued customers). Moreover, with rapid technology change occurring, speed has become an economic requirement of the NDP process: Delaying a product introduction can affect the sales of the product by up to 35 percent (Dwivedi et al. 2021).

The logic appears sound, *but strong research evidence on the positive impact of speed is lacking* (Cooper 2021a). Indeed, a review of empirical studies reveals inconsistent, even conflicting results on the relationship between accelerated

development and project success (Chen et al. 2005; Griffin 2002; Langerak 2010). Some research on accelerated development looks at easily-measured dependent variables, such as the impact of speed on development costs; these studies often yield negative results (Cooper 2021a). While "development cost" is easily measured, it may not be a valid metric: One usually moves quickly not to save money, but in order to gain competitive advantage. Other metrics also produce mixed results (Langerak 2010). For example, the relationship between cycle time and product quality is also unclear. However, shorter cycle time is correlated with an increase in the new product's sales when speed is managed across all of the stages of the process (Eling et al. 2013).

Conflicting outcomes regarding the importance of accelerated development for new product success may also occur because the impact of cycle time reduction may pale when compared to other key success drivers (Langerak 2010). Cycle time reduction may also yield major negatives (Crawford 1992): In order to cut cycle time, *a firm may avoid bolder innovations* – too many product modifications and line extensions that can be done quickly, but result in few innovative products (Cooper 2011). Additionally, project teams, faced with an aggressive time-line, *may cut some vital tasks short* (such as VoC work or product testing). Finally, project teams, driven by time, may also become *too committed to their project and its plan*, and fail to pivot when needed.

One of the few large-sample meta-analyses on this speed topic concludes that *generally development speed is associated with increased new product success* (Cankurtaran et al. 2013). Even here, one cannot be sure about whether faster development speed leads to improved NPD success, or whether companies that are more successful at developing new products are also speedier due to their development capabilities. More on the topic of how to achieve accelerated development is in 1.5.3.

Order of market entry: Three NPD project types exist in terms of order of market entry (Marinov 2020):

1. *First mover* products are the first on the market; they have no direct competition, but compete with other forms of the product available, as well as with substitute products that satisfy the same need.
2. *Fast follower* products rival one or several products that are already on the market. This product type enters the market in the first stage of the product life cycle, before sales have grown rapidly.
3. *Late mover* products follow the first mover and the early entrants, and enter a growth or mature market, that is, after the market has grown.

The firm with the early-entry new product has the advantage *of establishing a market position, reputation, and direct relations* with customers, and also gaining better knowledge of the technology and application. But the late entrant *learns from the pioneer's mistakes*, and has more time to gather information about competitors, suppliers, and market trends, hence can choose who to compete with or how to differentiate from early entrant rivals (Marinov 2020). Note that 50 percent of best performing firms pursue a first-to-market strategy (Barczak et al. 2009).

Introducing a new product first, and getting the largest market share and hence the highest profitability, is one reason why firms seek to reduce time-to-market. But here the evidence is inconsistent: Some studies show that market pioneers perform better than late entrants, whereas others find the reverse to be true (Marinov 2020); for example, a major meta-analysis on NP success factors looked at 233 independent company samples (204 studies) and found only five that probed the impact of order of entry on NP success; the effect was insignificant (Evanschitzky et al. 2012). One explanation is that research often *focuses on the wrong variable*: on "order of market entry" rather than on the "getting the timing right." The timing, and not so much order of entry, is key: Early entrants may not generate sales because they enter the market *too early* when the window is not yet open, while followers may fail because they enter the market after the window is closed.

1.3.7 Agility in NPD

Agility refers to an organization's ability to sense and respond to changes quickly: *a responsive organization*. Agility has been widely embraced as a management approach for the modern corporation. According to a *Harvard Business Review* article, "agile methodologies – which involve new values, principles, practices, and benefits, a radical alternative to command-and-control-style management – are spreading across a broad range of industries and functions, and even into the C-suite" (Rigby et al. 2016). Some examples in NPD include:

- Responding to *changing or new customer needs quickly*, for example redefining a product already under development or defining a new product opportunity quickly.
- *Reprioritizing the portfolio of projects* if conditions change, including quickly adding new projects to the active list (Kock and Gemünden 2016).
- Being *able to pivot from the original project plan* when circumstances change.

Considerable evidence exists that shows the positive impact of agility on NP success (Evanschitzky et al. 2012; Rigby et al. 2016; Storey et al. 2016); while other studies reveal that being responsive to customer needs also enhances the odds of success (Zhan et al. 2018). But what factors improve agility in NPD?

Agility in portfolio management is enhanced by having a clear innovation strategy, formal portfolio processes, frequent portfolio monitoring, and a climate that fosters innovation and open communication of risks (Kock and Gemünden 2016). Iterative development, outlined above in 1.3.5, provides for a fast and *agile response to changing customer* needs throughout the entire NP process, leading to success (Tih et al. 2016). And big data – the effective use of data aggregation and data analysis tools – plays a role in developing agility (Hajli et al. 2020): Big data enables the firm to identify previously unrecognized customer needs and respond speedily to opportunities for innovation.

1.3.8 Planning and Resourcing the Launch

A quality launch is strongly linked to new product profitability, and effective after-sales service is central to the successful launch of the new product (Calantone et al. 2011; Evanschitzky et al. 2012; Joubert and Van Belle 2012; Kuester et al. 2012; Salmen 2021; Storey et al. 2016).

Good products don't sell themselves, and the launch should not be treated as an afterthought to be handled late in the project. A well-integrated and properly targeted launch is the result of a *finely tuned marketing plan, proficiently executed*. The launch must be *properly resourced* in terms of both people and funds (Kim et al. 2016; Kyriakopoulos et al. 2016); too often, an otherwise great new product fails to achieve its sales goals simply because of an under-resourced launch.

Those who execute the launch – the sales force, technical support people, and other front-line personnel – should be engaged in the development of the market launch plan and *therefore should be members of the project team*. This ensures valuable input and insight into the design of the launch effort, availability of resources when needed, and buy-in by those who must execute the launch – elements critical to a successful launch (Hultink and Atuahene-Gima 2000).

1.3.9 The World Product – A Global Orientation

Corporate growth and profitability depend on a *global business strategy married to product innovation*. In global markets, product development plays a primary role in achieving a sustainable competitive advantage (Kleinschmidt et al. 2007): Multinational firms that take a global approach to NPD outperform those that concentrate their R&D spending on their home market (de Brentani et al. 2010; de Brentani and Kleinschmidt 2015; Kleinschmidt et al. 2007; Le Meunier-FitzHugh et al. 2021). International products designed for and targeted at world and nearest neighbor export markets are the best-performing new products. By contrast, products designed for only the domestic or home market, and later adjusted and sold to nearest neighbor export markets, fare much worse. The magnitude of the differences between international new products and domestic products is striking: 2 or 3:1 on various performance gauges.

The management implications of these and other studies is that globalization of markets demands *a global innovation culture* and *a global innovation strategy* (de Brentani and Kleinschmidt 2015).

Sadly, this international dimension is often overlooked or, if included, is handled late in the development process or as a side issue. This global orientation translates into defining the market as international and *designing products to meet international requirements*, not just domestic ones. The result is either a global product (one version for the entire world) or a "glocal product" (one development effort, one basic product or platform, but several product variants to satisfy different international regions).

A global orientation also means undertaking VoC research, concept testing, and product testing in multiple countries rather than just in the home

market, and tailored launch plans for different countries. It means employing a *global project team* with team members in multiple countries (but only one new product project team in five is reported to be a global development team, de Brentani et al. 2010; Kleinschmidt et al. 2007). Finally, the coordination and collaboration between marketing in the home country and the sales force in international markets is critical; devolving power while using cross-functional teams and formal processes to encourage communication results in successfully adapted new product launches for each country-market (Le Meunier-FitzHugh et al. 2021).

1.3.10 Expectations – "Expect Success, Get Success"

One of the strongest predictive drivers of new product success, only recently uncovered, is the existence of *expectations of success* by employees (usually members of the project team; Watson et al. 2021). A model of NP success consisting of well-known predictors, such as market orientation and product advantage, has a dramatic increase in predictive ability when "expected success" is included.

Organizational psychology and behavioral science researchers have long recognized that *expectations impact actual performance*: a self-fulfilling prophecy or the "Galatea effect." Findings from social psychology are noticeably absent from the NPD literature, however. A self-fulfilling prophecy occurs when individuals' expectations about themselves result in actions that confirm those expectations – they rise to the occasion. This Galatea effect stems from self-expectancy rather than supervisory expectations.

Recent research shows that product developers who understand customer and competitive actions and then develop products that are superior (have competitive advantage) *will expect, and thus realize, greater levels of product success* than those who simply carry out management orders. However, development teams cannot simply *think a successful product into existence* because that is what is expected of them. Self-fulfilling prophecy is powerful, but only when *leaders empower employees to act* and give them the latitude to engage in innovative and market-oriented behaviors, such as customer research (VoC), competitor analysis, and product testing (Watson et al. 2021).

This Galatea effect is positive self-expectancy, likely triggered by a supervisory source who communicates high expectations that motivate subordinates (Watson et al. 2021). But Galatea effects do not require sustained supervisor support beyond the communication of high expectations, because employees have internalized the motivation to perform. Senior management support alone will not guarantee product success, especially if the product developers themselves lack confidence in their new product. Employees need self-confidence to successfully promote a solution or idea; thus companies should foster confidence among product developers, not simply among senior management. While project teams require senior management support in order to obtain needed resources, such support may become counterproductive in instances where a heavy-handed approach stifles product developers' confidence, their creative output, and their success expectations.

The surprising and pronounced impact of this Galatea or "self fulfilling prophecy" effect comes as *new news* to many investigators of new product success drivers. But it is a well-known phenomenon in other fields. This is an area requiring more investigation in the field of NPD.

1.4 Drivers of Success for Businesses: Organizational and Strategic Factors.

Why are some businesses so much more successful at product innovation than others? Huge differences in product development productivity exist between the best and worst firms (Arthur D. Little 2005). The top 25 percent of *firms have 12 times the productivity* in NPD, realizing a huge $39 in new product sales per R&D dollar spent, while the bottom 25 percent of firms achieve only $3.3. The quest for the drivers of NPD success continues, but now with a *focus on the business* as the unit of analysis – see Table 1.2.

TABLE 1.2 DRIVERS OF SUCCESS FOR BUSINESSES – ORGANIZATIONAL & STRATEGIC FACTORS.

Driver Name	Success Driver Description
1. A Product Innovation Strategy	Having a product innovation strategy for the business: clear NPD objectives; defined strategic arenas (markets, product types) for the business to focus its NPD efforts on; and the product roadmap to define placemarks for future products
2. Sustainability Focus	Social responsibility, sustainability & a green orientation; launching green new products
3. Leveraging Core Competencies	Leverage, synergy & familiarity: getting a good fit between the firm's core competencies & the resource needs of the project to gain competitive advantage
4. Targeting Attractive Markets	Targeting large, growing, high-need markets with good long-term potential; avoiding intensively competitive markets with low margins & heavy price competition
5. Resources	Adequately resourcing projects; having dedicated project teams
6. Effective Teams	Cross-functional teams, with the right skills; a strong capable team leader; having clear goals & accountability for the project
7. Integrating the Supply Chain	Building the supply chain into NP projects; good communication with suppliers; seeking ideas & solutions from suppliers
8. Climate & Culture for Innovation	The right environment – a climate that supports innovation activities, risk taking & freedom to experiment; also: rewards teams & idea-generators; allows time for creative work; & no micromanaging of teams
9. Organizational Design	An organic structure – fluid & flexible in task execution, open channels of communication, decentralized decision making & few formal procedures
10. Top Management	Transformational leadership that is committed to NPD; develops the organization's vision, mission, NPD objectives & innovation strategy; commits the necessary resources to NPD; is engaged in the NP process, makes Go/Kill decisions & supports committed product champions

1.4.1 A Product Innovation Strategy for the Business

A product innovation strategy for the business charts the way forward for NPD; and having a new product strategy is strongly linked to positive NPD performance (APQC 2003; Cooper 2011; Dwivedi et al. 2021; Joubert and Van Belle 2012; Kock and Gemünden 2016; Song et al. 2011a). The *ingredients of such a strategy* with the strongest positive impact on performance include (Cooper 2011; Cooper and Edgett 2010):

- Clearly defined *product innovation goals and objectives*; for example, what percentage of the business's sales will come from new products?
- The *role of product innovation in achieving the overall businesses goals*, to link the product innovation goals to the business's overall goals.
- Strategic arenas defined – *areas of strategic focus on which to concentrate* new product efforts. The goal is to select strategic arenas rich with opportunities for innovation – those that will generate the business's future engines of growth (Cooper 2011, 2019; Florén et al. 2018). The great majority of businesses do designate strategic arenas – markets, product areas, industry sectors, or technologies – but evidence suggests that many are focused on *traditional and sterile areas* that fail to yield the needed opportunities (Cooper 2005).
- A *product roadmap* in place, which maps out a series of planned development, initiatives over time, often five years into the future. A roadmap is simply management's view of how to get to where they want to be, or to achieve their desired objective (Albright and Kappel 2003; McMillan 2003; Vishnevskiy et al. 2016), and provides *placemarks* for future development projects.

1.4.2 Social Responsibility, Sustainability, and a Green Orientation

Sustainability is now a key factor in firms' pursuit of long-term competitive advantage. The empirical evidence suggests a moderate and positive relationship between sustainability orientation and corporate financial performance (Chan et al. 2012; Dixon-Fowler et al. 2013).

In a similar vein, the growing environmental concern among customers has triggered many firms to adopt innovative strategies to meet the green requirement, offering "green products," thereby gaining competitive advantage. Thus, sustainability has been identified as a driver of technological innovation (Nidumolu et al. 2009).

Although a sustainability orientation impacts the corporation's financial performance, the *evidence is less clear* about the direct role of sustainability and launching green products on new product success. The development of sustainable products and services is still one of the *least understood areas* in sustainability management (de Medeiros et al. 2014).

A firm's sustainability orientation generally has a *positive influence* on new product success for the firm, and this relationship holds regardless of firm size,

market, and product type (Claudy et al. 2016). A sustainability orientation includes both culture (how important environmental or social sustainability is to the company) and practices (how important sustainability practices, such as carbon footprint analysis, are during the NP process; Papadas et al. 2017). But some research shows that *sustainable new products achieve lower sales* than their conventional counterparts (van Dorn et al. 2021): Adding a sustainability claim to a new product leads to a higher likelihood of product failure. Why? If a firm's social responsibility reputation is negative, the success of its new sustainable or green products will also be low. But investing in corporate social responsibility activities compensates for this negative effect and is therefore a viable strategy to boost sales of new sustainable products.

While having a positive social responsibility reputation appears to have a positive impact on new product success, it is an *indirect impact* (Borah et al. 2021; Song et al. 2019). Corporate social responsibility impacts the firm's sustainability or green orientation (Song et al. 2019), helping firms to be environmentally conscious (Li et al. 2018). A green orientation in turn promotes investments in green innovation (technological capabilities in pollution prevention, green product design, energy-saving, waste recycling, and corporate environmental management). These green technological capabilities then influence the success of new products introduced: The technological capabilities result in new products that are accepted by green-conscious customers. That is, it is not just enough to have a sustainability or green orientation as a strategic direction, but *also to develop the technological capability to transform* those ideals into successful innovative products (Borah et al. 2021).

In summary, corporate social responsibility, a sustainable orientation, and introducing green new products have complex interlinkages with limited direct impacts on ultimate new product success, either at the firm or at the product level. More research is required here to better understand whether green products are indeed more successful, and under what conditions; and also, what drives the success – both directly and indirectly – of green new products.

1.4.3 Leveraging Core Competencies – Synergy and Familiarity

"Attack from a position of strength" may be an old adage, but it applies to new product management. A core competency is a major strength of an organization based on the organization's unique skills and experiences. The term was coined by Hamel and Prahalad (1994), who argued that a business should utilize or leverage its core competencies in order to gain competitive advantage. A variety of resources, such as skills, physical assets, intellectual property, and brand equity contribute to a company's core competencies.

In the context of new products, the ability to leverage means having a strong fit between (or have synergy with) the resource needs of the new product project and the core competencies and strengths of the firm in order to gain competitive advantage or be faster to market (Cankurtaran et al. 2013; Cooper 2019;

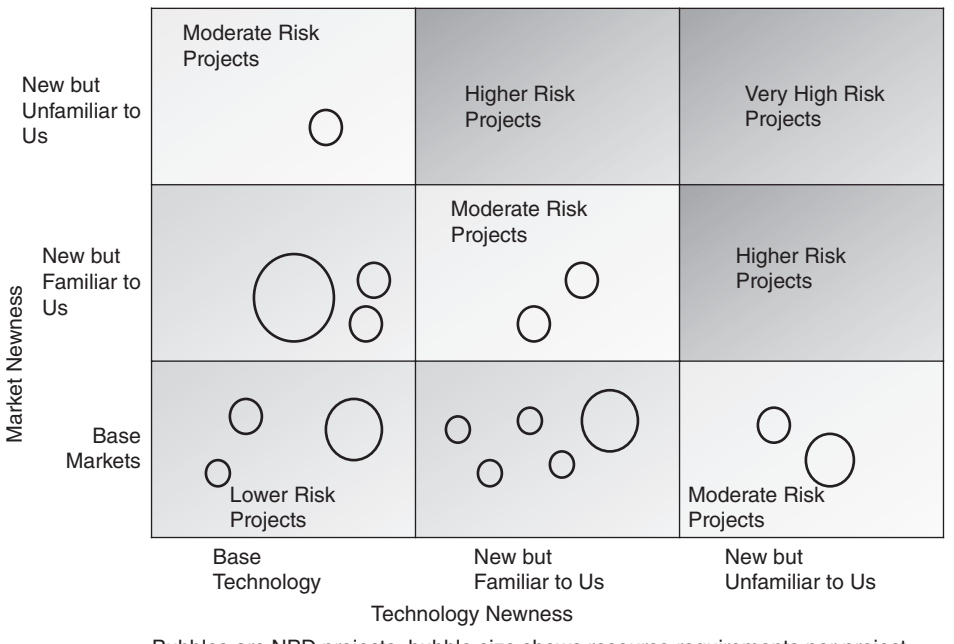
Evanschitzky et al. 2012). When *synergy with the base business* is lacking, new products fare more poorly on average. Areas of leverage include:

- R&D or technology resources – ideally the new product should leverage the business's existing technology competencies, IP, or patents;
- Marketing, sales force, and distribution (channel) resources;
- Branding, image, and marketing communications and promotional assets;
- Manufacturing, operations, or source-of-supply capabilities and resources;
- Technical support and customer service resources; and
- Management capabilities.

These six synergy or leverage ingredients become *important criteria* to evaluate and prioritize new product projects. If the "leverage score" is low, then there must be other compelling reasons to proceed with the project. Leverage is not essential, but it does improve the odds of winning.

"Familiarity" is a parallel concept and has its roots in the popular familiarity matrix (Roberts and Berry 1985). Some new product projects *take the company into unfamiliar territory* – a product category new to the firm; new customers with unfamiliar needs; unfamiliar technology; new sales force, channels and servicing requirements; or an unfamiliar manufacturing process – see Figure 1.4. And the business often pays the price: Step-out projects are riskier

FIGURE 1.4 NEWNESS OR FAMILIARITY CHART SHOWING PROJECT RISK LEVEL.



Bubbles are NPD projects; bubble size shows resource requirements per project

and have higher failure rates due to lack of strengths, experience, knowledge, and skills.

The negative impact here is not as strong as for most success drivers, however. New and unfamiliar territory certainly results in lower success rates and profitability on average, but the success rates are not dramatically lower.

Further, for such step-out projects, strategies such as *collaborative development* and *open innovation* may help the developer acquire the missing resources, skills, and knowledge (Chesbrough 2006; Docherty 2006; PDMA 2014). Indeed, resources from partner firms – from customers, other developer-firms, and even suppliers – may also have a positive impact on other success factors, such as effective cross-functional teams (team members available from the partner), voice-of-customer work, and effective launches.

Partnering does pose risks, however: Open innovation arrangements and collaborative developments are not always a "win win" situation for both firms. Conflicts and misalignments can occur due to misunderstandings, cultural differences, and even a lack of trust. Additionally, there is no strong evidence to suggest that partnering or collaborative NPD projects are more successful than those done alone (although some evidence exists that the project may not have been done at all were it not for the partnership; Campbell and Cooper et al. 1999; and Håkansson and Waluszewski 2002).

1.4.4 Targeting Attractive Markets

Market attractiveness is an important strategic variable and plays a role in notable strategy models such as Porter's "five forces" model and the BCG[4] matrix (market growth and market share) business portfolio grid. Market attractiveness is also important for new products: New products targeted at more attractive markets are more successful (Cooper 2019; Evanschitzky et al. 2012; Salmen 2021).

Market attractiveness has two facets:

- *Market potential*: Positive market environments, namely large and growing markets with large long-term potential and where the purchase is important to the customer.
- *Competitive situation*: Negative markets characterized by tough competitors with strong products, and capable sales forces and channel systems; and by intense price competition and low margins.

Both facets of market attractiveness – market potential and competitive situation – impact new product fortunes and both should be *considered as criteria* for project selection and prioritization.

1.4.5 The Resources in Place

Too many projects suffer from *a lack of time and financial commitment*. The predictable result is much higher failure rates (APQC 2003; Dalton 2016; Thomke and Reinsertsen 2012). As the quest for profits has intensified, companies often

have responded by restructuring and cost-cutting – doing more with less – and so resources are limited. Also, many firms try to do too many projects for the resources available: an inability to say "no" to mediocre development projects, resulting in *pipeline gridlock* (Cooper 2021b). The resulting *resource crunch* takes its toll and is the root cause for much of what ails product development: too long to market; a lack of VoC; inadequate front-end homework; and an overemphasis on smaller, simpler projects.

Best-practice companies *commit the necessary resources* to new products, much more so than most firms. While new product resources are limited across the board – with less than 30 percent of businesses indicating that they have sufficient NPD resources in the key functional areas – the best performers are much better resourced (APQC 2003; Cankurtaran et al. 2013; Cooper and Edgett 2003; Dwivedi et al. 2021; Joubert and Van Belle 2012; Salmen 2021).

Equally important, these resources are *focused and dedicated*, with project team members heavily dedicated to one or a few development projects. Totally dedicated project teams are rare among manufacturers, however: Typically, project teams are thinly spread and multi-tasking across multiple projects and other duties (Cankurtaran et al. 2013; Joubert and Van Belle 2012). Dedicated human resources (largely R&D people) *is one of the strongest drivers of new product success* (Evanschitzky et al. 2012; Storey et al. 2016). Similarly, a dedicated project organization structure is more likely to facilitate successful products (Joubert and Van Belle 2012). Indeed, about half of the best performers have a dedicated product innovation group whose full-time job is to work on new product projects (Cooper 2019).

1.4.6 Effective Cross-functional Teams

Product innovation is very much a team effort. Do a post-mortem on any bungled new product project and invariably you'll find each functional area doing its own piece of the project with very little communication between functional areas (a fiefdom mentality), and no real commitment of team members to the project. Many studies concur that *the way the project team is organized and functions* strongly influences project outcomes (APQC 2003; Cooper 2019; Nakata and Im 2010; Sivasubramaniam et al. 2012). A great many facets of a high-performing NPD team have been uncovered, and include:

- *A cross-functional project team*: New product projects that have *clearly assigned project team members* do better. Further, NP results are better when the team is *multidisciplinary and cross-functional*, with team members from R&D, Sales, Marketing, and Operations, a practice now embraced by the majority of businesses (Cankurtaran et al. 2013; Cooper 2019; Dwivedi et al. 2021; Sivasubramaniam et al. 2012). Cross-functional project teams seem to operate as an organization on their own, simply because they possess a combination of entrepreneurial traits that complement one another to boost the NP process's performance and results (Dwivedi et al. 2021).
- *Team skills*: Innovation effectiveness is enhanced when team members have diverse skills and experience from several areas; high levels of education and

self-esteem (Joubert and Van Belle 2012); and the skills to deal with complex NPD projects, including general intelligence and previous team experience (Sivasubramaniam et al. 2012). Finally, project team members should have tenure; that is, remain on the project *from beginning to end*, not just for a short period or a single phase; and have worked together for a long time with little team turnover (Sivasubramaniam et al. 2012).

- *A capable, strong project leader*: A clearly identified *project leader* or *project manager* – a team member who is in charge and responsible for driving the project – enhances NP success (Joubert and Van Belle 2012). The project leader helps to define goals, prioritizes work, and provides leadership; and influences the product definition, promotes teamwork, facilitates strategic alignment, and creates a sense of joint team mission.
- *Characteristics of a good team leader*: A project team leader who is receptive to the ideas, needs, and wants of his/her team members is more likely to have highly motivated, conscientious people working to achieve the team's objectives (Sivasubramaniam et al. 2012). The team leader must be task-aware and emotionally intelligent in understanding the team members' work mannerisms, strengths, and weaknesses (Dwivedi et al. 2021). Most importantly, the leader must not be burdened with more than one project at a time in order to strengthen focus and enable efficiency in one direction. A good team leader requests support, lobbies for resources, and manages technical problems and design issues (Florén et al. 2018).
- *Clear goals*: Goal clarity and internal communication have a very strong relationship with NPD outcomes (including speed to market), suggesting that improved internal communication and a shared understanding of project objectives are key to success (Cankurtaran et al. 2013; Sivasubramaniam et al. 2012). Goal clarity is measured by the level of goal consensus within the project team. Clarity of goals contributes to employee motivation, and when teams engage in mission analysis, they develop a shared vision of the team's purpose and objectives, thus achieving greater clarity of team goals.
- *Accountability*: Project teams should be *accountable* for their project's end result – for example, for ensuring that their project meets profit, revenue targets, and time targets. A post-implementation review (or post-launch review) is recommended (Joubert and Van Belle 2012). This review, which involves the entire project team, and is presented to senior management, is where the accountability issues are finally addressed: Did the team deliver what they promised when the project was approved?

Project Leader versus Project Manager

Differences do exist between a *project leader* and *project manager* in different firms, and indeed a single project may have *both roles*. A consistent definition between what a project manager and a project leader do is elusive because often their jobs overlap; and sometimes the terms are used interchangeably. In many situa-

(Continued)

tions, a project leader *is* a project manager (just with extra responsibilities). But generally, a project manager is responsible for the completion of a project, while the team leader is responsible for the productivity and morale of their team (TechDee 2022).

1.4.7 Integrating the Supply Chain into NPD

Given an increasingly turbulent global environment, *supply chain management* has become a major issue for many corporations. Further, there exists mounting evidence that supplier relationships are important to NPD success (Florén et al. 2018; Johnsen 2009). Firms coordinate with their supply chain participants in NPD both to improve input quality and to reduce production costs. Numerous empirical studies have documented that supplier involvement in a firm's NPD positively influences the firm's innovation performance (Kou and Lee 2015; Moon et al. 2018; Song et al. 2011b).

In the front end of NPD, suppliers can offer assistance and useful input for concept development (Harvey et al. 2015). Suppliers may even share new product ideas with their customers (Wagner 2012). Further, suppliers can offer suggestions regarding product's design and component simplification to improve new product performance (He et al. 2014); partnering with competent suppliers in the front end may also reduce technological uncertainty.

Beyond the front end, collaboration with suppliers has been shown to improve innovation and indeed can be crucial (He et al. 2014; Joubert and Van Belle 2012). Effective supplier cooperation decreases time-to-market, reduces development costs, and improves product quality (Kim and Wilemon 2002).

A number of studies show no significant results or even negative effects of supplier involvement, however (Moon et al. 2018). One explanation is that the roles of suppliers, and hence their impact, *varys across the stages of NPD*: Supplier's activities are more or less relevant in certain stages than in others. For example, too much supplier involvement during the Concept Development stage slows the development of the product concept and design, since the product offering is still experimental and standards are not yet established. Similarly, too much involvement of suppliers in the Development stage may cause managerial problems and delay decisions about moving to the next stage, ultimately hurting the number of new products introduced in the market (Moon et al. 2018).

1.4.8 The Right Environment – Climate and Culture

A positive climate for innovation is one of the *top three success factors that distinguishes top-performing businesses in new product development*, with a huge impact on performance results (APQC 2003; Cooper 2011; Edgett 2011). Such a climate has been found to have many attributes, including (Round et al. 2020):

- Transformational leadership: senior management strongly and passionately supporting innovation in the business (Round et al. 2020) – see 1.4.10 below.

- "Intrepreneurs" (internal entrepreneurs) and risk-taking behavior encouraged;
- A propensity to take risks – not reckless risk taking, but informed decision making (defined as the willingness to confront opportunities, tolerate failure, and learn from mistakes; Joubert and Van Belle 2012);
- Allowing people the freedom to experiment, important for both group and individual autonomy (Joubert and Van Belle 2012);
- Team characteristics, including a highly motivated and ambitious team (Round et al. 2020);
- New product success rewarded or recognized (and failures not punished); team efforts recognized rather than individuals; and high morale and motivation fostered through rewards and the use of criteria to measure job satisfaction (Joubert and Van Belle 2012);
- Idea generators recognized or rewarded;
- Senior managers refraining from micromanaging projects and second-guessing project teams;
- Open project review meetings with senior people (the entire project team participating);
- Time allowed for creative people to work on projects of their own choice (projects on-the-side); and
- Employing skunk works and allowing unofficial projects (projects done "outside the system").

Most businesses are quite weak on almost all of these elements of a positive climate, with typically less than one-third of businesses employing each of these practices (APQC 2003; Cooper 2011, 2019). Best performers embrace these practices much more so.

1.4.9 The Right Organizational Design

The successful commercialization of new products is fostered when the firm's organizational structures are designed to unleash personnel to overcome both internal and external resistance to innovation (Walheiser et al. 2021). Organizational structure is the "enduring allocation of work roles and administrative mechanisms that allow firms to conduct, coordinate, and control their work activities and resource flows" (Droge et al. 2008).

Organic organizational structures (that is, with less centralization and formalization) have a performance-enhancing effect on new product outcomes (Walheiser et al. 2021). An *organic structure* is characterized by fluidity and flexibility in task execution, open channels of communication, decentralized decision making, and few formal procedures. Similarly, *organizational flexibility* (agile and responsive to change) and flexibility of personnel (the willingness to experiment and try new procedures to improve the product) enhance innovation outcomes (Joubert and Van Belle 2012).

One caution: Organizational structure affects performance in a unique way *during the commercialization phase* where a more mechanistic and formal structure

may work better for some departments, such as Operations. Thus, firms are urged to consider a *selective* approach in choosing an organizational structure. Given the unique requirements of certain departments or tasks, firms might choose a structure that fits those requirements instead of following a "one-size-fits-all" approach (Walheiser et al. 2021).

1.4.10 Top Management

One of the highest-ranked critical success factors in NPD is transformational leadership with a strong commitment to product innovation (APQC 2003; Cooper 2011, 2019; Dwivedi et al. 2021; Edgett 2011; Reid et al. 2015). Senior management's main role is to define the organization's vision, mission, NPD objectives, and innovation strategy, which communicate a futuristic perception of the organization in the minds of its people, who in return drive initiatives to pursue these goals.

In best-performing businesses, senior management makes a long-term commitment to product innovation as a source of growth (Cooper 2011, 2019). It makes *available the necessary resources* for product development and ensures that they aren't diverted to more immediate needs in times of shortage. Most important, senior management is engaged in the new product process, reviewing projects, making timely and firm Go/Kill decisions, and if Go, making resource commitments to project teams. Senior management support thus improves time to market (Cankurtaran et al. 2013), and also enhances NP success rates: If senior management accepts personal accountability for an NP project, the chances of a successful product increase, and the likelihood of the project being terminated decreases (Joubert and Van Belle 2012).

Senior management *empowers project teams* and supports committed champions by acting as mentors, facilitators, or sponsors of project leaders and teams. Indeed, one role of senior management is "power promoters" or product champions (Joubert and Van Belle 2012). Finally, senior management's technology vision has a significant positive impact on NPs' competitive advantage and early success with customers (Reid et al. 2015).

1.5 The Right Systems, Processes, and Methodologies in Place

The *systems, methods, and procedures* that businesses put in place often hold the key to NP success. Newer methods, such as Agile Development from the software world but employed by developers of physical products, and Design Thinking to generate new product ideas, are positive methods that firms are adopting. Table 1.3 lists some of these methodological success drivers.

1.5.1 A Multistage, Disciplined Idea-to-Launch Gated Process

A *systematic idea-to-launch methodology*, such as a stage-and-gate system, is the solution many companies have adopted in order to overcome the deficiencies

TABLE 1.3 THE RIGHT SYSTEMS, PROCESSES, AND METHODOLOGIES.

Driver Name	Success Driver Description
1. An NP Idea-to-Launch Gated Process	An effective gating process: a multistage, disciplined idea-to-launch system, such as Stage-Gate, with defined Go/Kill decision points or gates & stages with success drivers and best-practices built in
2. Portfolio Management	Focus (doing fewer development projects) & making sharp project selection decisions (picking better projects & getting the right mix & balance of projects in the portfolio); using effective portfolio & project selection methods
3. Accelerated Development	Including: Lean Development; "build-and-test" iterations; & Agile Development. Also success drivers from this chapter, such as an innovative climate; effective cross-functional teams; & resourcing projects adequately (prioritizing projects, focusing resources)
4. Integrating Agile into the NP Process	Borrowing Agile Development from the software world & applying Agile to physical products (includes sprints, scrums, demo's, retrospects, new roles & the Agile values & mindset)
5. Effective Ideation	VoC methods; Open Innovation & co-development; lead user analysis; strategic approaches; & Design Thinking

that plague new product efforts (Barczak et al. 2009; Cankurtaran et al. 2013; Cooper 2011, 2017b, 2019; Dwivedi et al. 2021; Edgett 2011; Griffin 1997; Joubert and Van Belle 2012). A gating system, such as Stage-Gate,[5] is simply a roadmap or "playbook" for a project team to successfully and efficiently drive their NP project from idea through to launch and beyond. Other terms for such a gating process are phase-gate, phase review, and gating systems – see Figure 1.2.

Such gating systems are quite popular in business. Introduced in the 1980s, Stage-Gate remains the most widely adopted NP process (Cocchi et al. 2021). An APQC benchmarking study revealed that 88 percent of US businesses employ such a process, and identified the stage-and-gate process as *one of the strongest best practices*, employed by almost every best-performing business (Cooper and Edgett 2012).

The goal of a robust idea-to-launch system is to integrate the best practices outlined above into a single model (Cooper 2017b). A typical gating system for major projects (Figure 1.2) breaks the innovation process into five or six stages (Cooper 2014). The stages have *success drivers and best practices built in*: VoC, front-end homework, and build-and-test iterations. Stages also have *defined deliverables*, so that project teams have clear objectives.

Preceding each stage is a gate. These gates are the *quality control* and *Go/Kill decision points* in the system:

- Has the project been executed well; are the data generated reliable?
- Is the project still a good investment – technically feasible, customer demand, good financial prospects?

The gates thus open the door for the project to proceed and also commit the necessary resources – people and funds – to the project team. Weaker projects get killed at gates, and their resources are re-allocated to better projects.

Gating systems have evolved over the years and now include newer practices such as (Cooper 2014):

- A *scalable process* – for example, Lite and XPress versions of Stage-Gate for lower-risk and smaller projects; and unique versions of Stage-Gate for different types of projects, such as technology platform developments (Ajamian and Koen 2002; Cooper 2003).
- Adapting the system to accommodate open innovation (Grölund et al. 2010).
- Integration with the *total Product Life Cycle management* – from idea all the way through to product exit and disposal.
- An *adaptive and iterative process* – by using iterative development (see 1.3.5 above).
- An *automated* idea-to-launch system, via software solutions that handle idea management, the development process, portfolio management, and resource management.

1.5.2 Portfolio Management to Make the Right R&D Investment Decisions

Many businesses have moved to more *formal portfolio management systems* to help allocate resources effectively and to prioritize new product projects (Barczak et al. 2009; Cooper et al. 2004). Most companies suffer from *too many projects*, often the *wrong projects*, and *not enough resources* to mount an effective or timely effort on each (Cooper 2011, 2021b; Dalton 2016; Joubert and Van Belle 2012). This deficiency stems from a lack of adequate prioritization, with very negative results:

- First, scarce and valuable resources are wasted on poor projects. Thus, the *productivity of the business's R&D resources suffers.*
- Second, the truly deserving projects don't receive the resources they need, and so the good projects, starved for resources, move at a crawl, or just don't get done. *Time to market suffers.*

Portfolio management: The accepted definition is that "new-product portfolio management is a dynamic decision process, whereby a business's list of active new-product (R&D) projects is constantly updated and revised. In this process, new projects are evaluated, selected, and prioritized; existing projects may be accelerated, killed or deprioritized; and resources are allocated and reallocated to the active projects" (Cooper et al. 1999; Meifort 2016).

One goal in portfolio management is *to achieve focus* – focusing development efforts on those projects that deliver on the firm's long-term goals, such as growth or profitability. Indeed, focus is strongly connected to achieving a high value portfolio (Cooper 2011, 2013; Evanschitzky et al. 2012). This need to focus limited resources on the best projects coupled with the desire to cull out bad projects means that *tough Go or Kill and prioritization decisions* must be made; this results in fewer but better projects, and shorter times to market.

Project evaluations, however, are consistently cited as being poorly handled: Decisions involve the wrong people from the wrong functional areas; no consistent criteria exist to screen projects; and no will to kill projects exists. Smart firms have built in *tough gates* (Cooper 2009), and they have redesigned their idea-to-launch systems and created a funneling process that successively weeds out poor projects. Visible Go/Kill decision criteria employed at these gates, such as the use of a *scoring model*, improves decision effectiveness (Cooper 2011, 2021b; Cooper and Edgett 2006; Edgett 2013). And at periodic portfolio reviews, where *all the projects* are considered, projects should be rank-ordered – from best to worst – by using financial metrics such as the *Productivity Index* (Cooper 2021b).

Selecting high-value new product projects is only part of the task. Other portfolio goals are selecting the right *mix and balance of projects* in the development portfolio – across project types (improvements versus new products, for example) and the right risk/reward profile (Evanschitzky et al. 2012). In order to ensure the right mix and balance, some firms have adopted Strategic Buckets, earmarking *buckets of resources* targeted at different project types or strategic arenas (Cooper 2011, 2019; Edgett 2013). Ensuring *strategic alignment* in the portfolio is another goal: that the business's spending on product innovation *mirrors its strategic priorities* (Evanschitzky et al. 2012).

1.5.3 Accelerated Development

Speed offers the competitive advantage of being first on the market, namely "first mover advantage." But speed and success are not necessarily closely linked, as noted in 1.3.6. Nonetheless, speed or time to market remains an important performance metric for many firms.

Sound principles exist that firms embrace in order to reduce time-to-market, most already highlighted in this chapter, and include:

- Fostering an innovative climate in the firm (Cankurtaran et al. 2013); see 1.4.8.
- Employing *effective cross-functional teams*: a strong, influential leader; dedicated team members; clear project goals; team stability; proficiency of problem-solving skills on the team; team learning; and teams accountable for the end result (Cankurtaran et al. 2013); see 1.4.6.
- Using *parallel processing*: undertaking tasks concurrently, such as in *concurrent engineering*; overlapping stages in Figure 1.2 by moving long lead-time activities forward (such as purchasing production equipment); and moving ahead with only partial information. The relay race, sequential, or series approach to product development is inappropriate for today's fast-paced projects (Cooper 2021a).
- Using iterative development: These *build-and-test iterations* get the product right earlier and make needed adjustments long before formal product trials begin; see 1.3.5.
- Resourcing projects adequately by prioritizing and focusing – undertaking *fewer projects with higher value* (Cankurtaran et al. 2013); see 1.5.2.

- Employing Lean approaches to remove unnecessary work in the NP process (Fiore 2005; Salgado and Dekkers 2018). By mapping the NP process from end-to-end, and using *value stream analysis* to remove all waste, the result is a *leaner process*.
- Utilizing Agile Development from the software world, but with modifications to suit manufactured products (Cooper and Sommer 2016a, 2018)…. next.

1.5.4 Integrating Agile Development into the NP Process

Agile development is a group of *software development methodologies* based on *iterative and incremental development*, where requirements and software solutions evolve through collaboration between self-organizing, cross-functional teams. Agile Development promotes adaptive planning and evolutionary development and delivery; it utilizes a time-boxed iterative approach; and it encourages rapid and flexible response to change. The Agile values are outlined in the *Agile Manifesto* (Beck et al. 2001).

Some features of the *Scrum version*[6] of Agile:

- A software development project is broken down into a number of iterations called *sprints*, which are *time-boxed* and very short, typically lasting *two weeks*.
- Sprints begin with a *sprint planning meeting*. Daily *scrums* or stand-up meetings (development team meetings) are held during the sprint, facilitated by a *Scrum Master*.
- Each sprint produces a *working product* (executable software code) and ends with a *product demo* to management and customers, followed by a *sprint retrospect*.
- Agile is a very visual process with many charts, such as the burndown, backlog, and Kanban charts.
- Agile has *new roles*: the Scrum Master and the Product Owner (but eliminates the traditional project manager role).
- The development team is *100 percent dedicated* to the one project, and is *physically co-located* in the same room.

Agile Development is more than just new methods and roles, however. It is *a new way of working* and features *new values* and an *Agile mindset*.

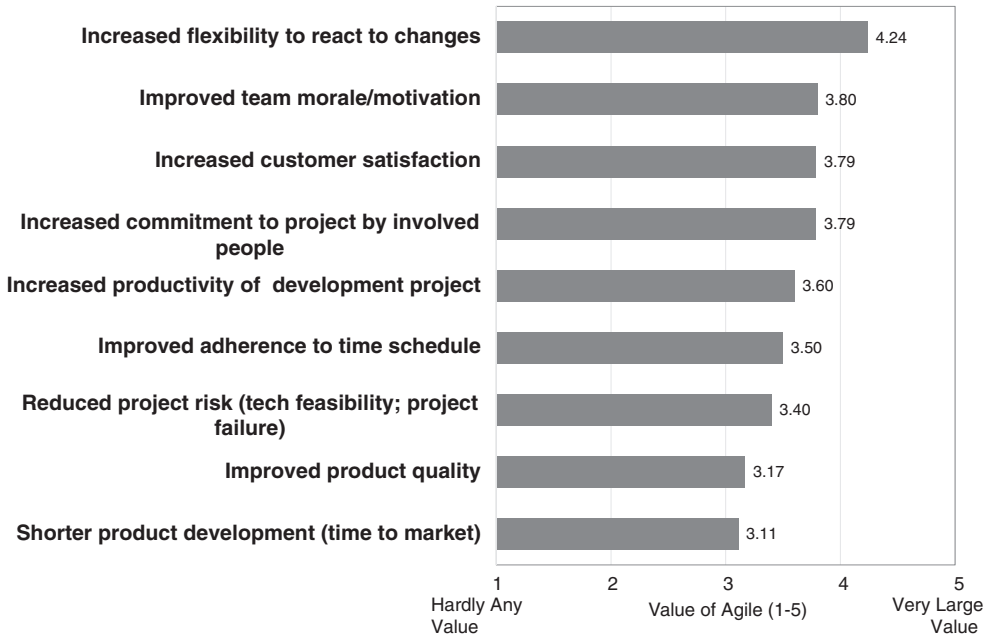
Larger *software developers* with existing development systems began integrating Agile into their traditional gated development processes with considerable success (Karlström and Runeson, 2005, 2006). More recently, *manufacturers of physical products* have successfully built elements of Agile Development into their gating models (Ovesen and Sommer 2015; Sommer et al. 2015). These firms simply *integrated Agile methods into the stages* of their gating process, replacing traditional project management methods, such as Gantt charts, timelines, and milestones, with Agile project management. Agile is typically initially employed in the two technical stages, namely, Development and Testing; with experience, manufacturing firms also apply Agile to the *entire idea-to-launch*

process to create a true *Agile-Stage-Gate hybrid model* (Cooper 2016; Cooper and Sommer 2016a, 2016b, 2018). Agile-Stage-Gate encourages experimentation, so is best suited to NPD projects where there are many ambiguities and unknowns, as shown in the hybrid model matrix (Cocchi et al. 2021).

Adjustments must be made when applying Agile to physical products (Cooper and Fürst 2020b). When contrasted to software development, hardware development is usually *not as divisible;* thus it's not possible to have anything that actually functions within a few weeks, as in software development. So a sprint *does not* build a working product, but a *product version* somewhere between concept through to a ready-to-trial prototype – something to show the customer, as described in *iterative development* above (1.3.5). And most manufacturing firms lengthen the two-week sprint to *four weeks*, some as long as *eight weeks* (Cooper and Sommer 2016b, 2018).

The advantages of Agile-Stage-Gate are speed (sprints are time-boxed with no relaxation of the time); dedicated or focused teams (core team members are close to 100 percent dedicated to the one project); much better communication within the team (via frequent scrums); and constant customer feedback with strategic pivots (product revisions) if needed (Sommer et al. 2015). Early adopters of this new hybrid system report positive results (Figure 1.5; Invention Center 2018; Schmidt et al. 2019). But implementation challenges do exist (Cooper and Sommer 2016b, 2018).

FIGURE 1.5 PERFORMANCE IMPROVEMENTS REALIZED USING AGILE FOR NPD FOR PHYSICAL PRODUCTS.



Source: Cooper 2019.

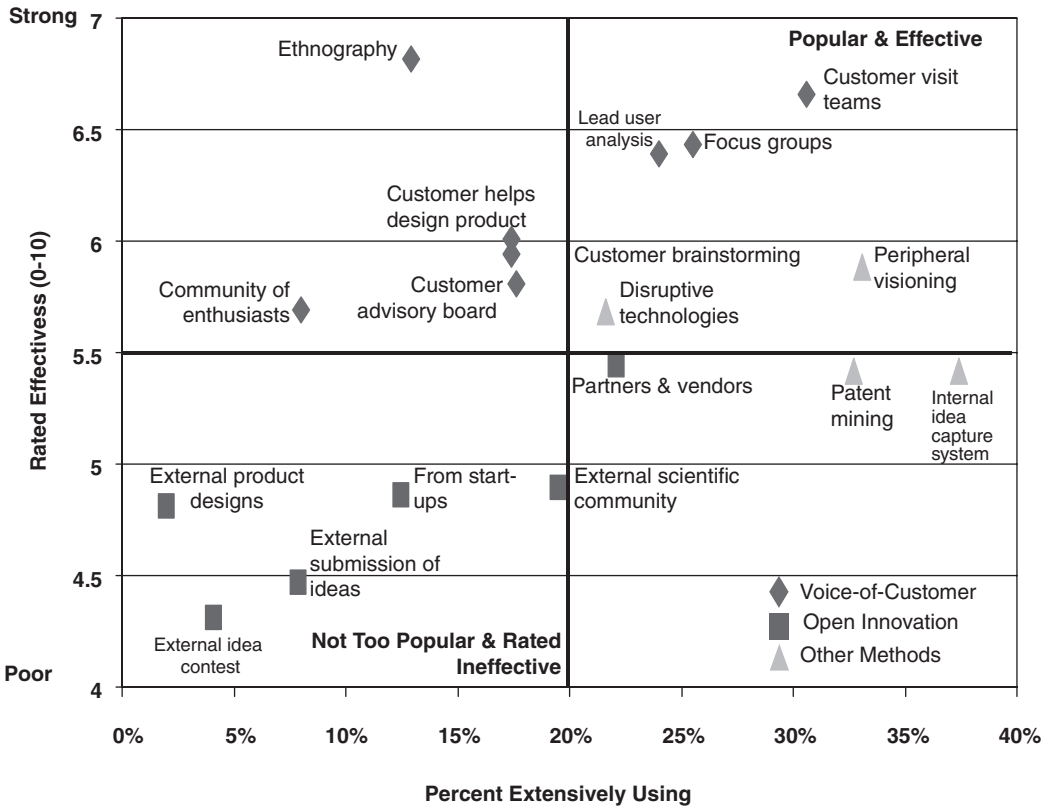
1.5.5 Effective Ideation

Great ideas are the foundation for great new products. Thus, increasingly more attention is being devoted to the "fuzzy front-end" of the innovation process. Idea generation and idea evaluation are key components. Successful ideation requires the simultaneous application of both:

- Open action strategies that increase the number and variability of ideas – for example, granting employees autonomy to develop new ideas and supporting them in their creative efforts.
- Closed action strategies that focus, integrate, and select ideas – formal processes to evaluate and select innovation ideas to increase the likelihood of success (Kock et al., *JPIM* 2014).

The rated effectiveness by users of a number of ideation methods and sources is shown in Figure 1.6, along with their popularity (Cooper and Dreher 2010). Note how effective VoC methods are rated – most are near the top of Figure 1.6.

FIGURE 1.6 POPULARITY VERSUS EFFECTIVENESS OF IDEATION METHODS.



Source: Adapted from Cooper & Dreher, 2010.

And although internal idea capture methods (soliciting ideas from one's own employees) are the most popular, they are not the most effective (Cooper 2011; Cooper and Edgett 2008).

Voice-of-customer: VoC methods generally *are rated the most effective for generating breakthrough ideas*:

- Customer visit teams – typically a cross-functional team of 2–3 people undertaking a systematic visitation program with key purchase influencers in a limited number of representative customers.
- Lead user analysis – identifying leading or innovative users (ahead of the wave) and working with them (typically in workshop format) to develop new product concepts (von Hippel et al. 2011).
- Ethnography – camping out with customers to observe behaviors (cultural anthropology), and in so doing, understanding their unspoken, unmet, and often unknown needs.
- Focus groups with groups of customers (often consumers) to identify problems, desires, needs, and wants.
- Design thinking, whereby users' needs are understood through VoC (for example, ethnography) and a series of product versions are immediately tested with users (Brown 2008; Mahmoud-Jouini et al. 2019).

Lead user analysis: Much literature recognizes the importance of customer involvement in NPD (Fang 2008; Woojung and Taylor 2016; Cui and Wu 2016), indicating that customers not only are passive buyers but also *act as co-creators of new products and NP ideas*. Many commercially important products are initially thought of and even prototyped by users rather than by suppliers (Lilien et al. 2002; von Hippel et al. 1999). Such products tend to be developed by "lead users" – innovative companies, organizations, or individuals that are well ahead of market trends and even have needs that go far beyond the average user. The challenge is to track down lead users, who are by definition rare. Social networks are a source of lead users, and identifying them is facilitated by using web-mining tools and netnography methods (Kratzer et al. 2016).

Open innovation: Looking outside one's company has a positive impact on the firm's product innovativeness, customer satisfaction, and NP profitability (Cheng and Huizing 2014). Open innovation is *valuable source of NP ideas* (Chesbrough 2006; Docherty 2006; PDMA 2014). But most firms are not well positioned to solicit or handle outside ideas and IP. Thus, it is important to adapt the firm's processes and systems for open innovation in order to encourage the inclusion of ideas, IP, R&D work, and even fully developed products from outside the firm (Docherty 2006; Grölund et al. 2010).

Strategic methods: These also are positively rated and include exploiting disruptive technologies (Christensen 2000) and peripheral visioning (Day and Schoemaker 2005).

1.6 Looking Ahead

Philosopher and statesman Edmund Burke once said, "Those who don't know history are destined to repeat it." Thirty years of research has led to many more insights about NP success drivers than we had when such research began in earnest circa 1970 (Cooper 2017a).

Today however, product developers face many new challenges: The world is faster, more global, less predictable, and more ambiguous than it was when those early research studies began. And there have been many new practices introduced to NPD since then in order to deal with these challenges: practices such as Agile Development, Open Innovation, Lean Product Development, and developing smart products and green products, whose impacts have not yet been thoroughly investigated. And so, research into NP success drivers and new and promising NPD practices must continue, simply because product innovation is *so important to business prosperity*, and yet many of the keys to success still remain a mystery.

Notes

1 Protocept: Something between a concept (words and drawings) and a working product prototype.
2 Pretotype: A mock up or stripped-down version of a product, used to validate the product with customers or users.
3 MVP or minimum viable product: a feature-limited product that can actually be sold and thus generate revenue (Ries 2011). An MVP contains more detail than a pretotype and is also usable; it provides enough value that customers will actually pay to buy it. The term MVP is often misused in industry – calling a not-for-sale early prototype an MVP.
4 BCG: Boston Consulting Group.
5 Stage-Gate® is a registered trademark of R. Cooper, R.G. Cooper & Associates Inc., and Stage-Gate International Inc., in the USA, Canada, and Europe.
6 A "scrum" is a meeting on the field of the players in the game of British rugby. Scrum is the most popular version of Agile Development, and is also the version used by most manufacturing firms.

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Dr. Robert Cooper is ISBM Distinguished Research Fellow at Penn State University's Smeal College of Business Administration; and Professor Emeritus, DeGroote School of Business, McMaster University, Canada. He was named "The World's Top Innovation Management Scholar" in the *Journal of Product Innovation Management*; and #21 Scientist in the World in the entire field of Business and Management in 2022 by https//Research.com. He is a Crawford Fellow of the Product Development & Management Association. Cooper is the creator of the *Stage-Gate® system*, and has published over 150 articles and 11 books on new product management, including *Winning at New Products*.