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Best practices in new product development and innovation: Results from PDMA's 2021 global survey

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Abstract

Extending 30 years of NPD best practice studies, this paper presents the results of the most recent 2021 global best practice survey on product development management practices conducted by the Product Development & Management Association (PDMA). With responses from 651 companies in 37 countries, the results reveal once again that no single capability is necessary or sufficient to explain the best performance. The Best firms rely on the skillful combination of multiple new product development (NPD) practices to achieve greater overall innovation success. However, for the first time in this series of research, having an innovation strategy that encourages radical innovation, is oriented toward risk-taking and long-term, and strives for growth through new markets and new technologies is now a more important component of these practices than was previously found. Further results regarding the practices of the Best are discussed in the paper, and implications are provided.

KEYWORDS

best practice, COVID-19, innovation, innovation strategy, new product development (NPD), survey

1 | INTRODUCTION

The importance of NPD and innovation for long-term firm performance is well documented (Evanschitzky et al., 2012; Rosenbusch et al., 2011), but firms continue to struggle with finding the right strategy, portfolio mix of projects, and the process model to deliver innovation performance. Empirical insights gleaned from corporate best practices research are crucial for informing firm and business-level decision-makers. New and evolving technologies and organizational abilities require that best practice insights be up-to-date. This paper presents the results of the Product Development & Management Association (PDMA)'s 2021 Global Best Practices Research. This research surveyed NPD and innovation managers from 651 firms in 37 countries, expanding the global scope of the survey as compared with previous PDMA Best Practice studies.

We first recap the major findings from the four previous PDMA Best Practice studies (BP1: 1990; BP2: 1995;

BP3: 2004; and BP4: 2012[1]). The main anchor for our analyses delineates the Best from the Rest of the firms and we next show how this empirical differentiation is obtained. The main part of the paper presents the results comparing the Best versus the Rest on core dimensions: innovation strategy, NPD goals, NPD processes, and portfolio management. Where appropriate, we compare the 2021 outcomes to previous Best Practice studies. From these results, the paper identifies the core insights for NPD and innovation managers.

Overall, we find that having a more innovative strategy is strongly associated with a higher probability of being one of the best firms: They focus more on radical innovation projects than significant or incremental projects, are more risk-taking, long-term oriented, and strive for growth through new markets and new technologies. While BP3 found that the Best were likely to have a more innovative portfolio (Barczak et al., 2009), none of the other factors associated with having a more innovative overall strategy were associated with the Best firms.

This research also finds that the Best spend more than the Rest on *all types* of projects. They continue to invest in innovation even during a crisis (i.e., the COVID-19 pandemic) rather than decreasing their efforts. They stay committed to their strategies in uncertain times. Consequently, innovation strategy matters in being the Best more than it ever did before.

Other than strategy's importance, no one other factor seems to be required for higher innovation performance. Consistent with advice from all previous BP studies, firms need to constantly improve their NPD capabilities and practices just to remain on par with competitors. Rather than excelling in a single NPD star practice, the Best become masters at orchestrating multiple capabilities, where none in and of themselves is uniquely decisive for top performance, but together they add up to a fortune of innovation power.

These results raise questions that require further investigation by academics and/or practitioners. First, we suggest that new techniques such as Qualitative Comparative Analysis (QCA) could be used to determine if any combination of factors are necessary and sufficient for higher innovation performance. In this context, why are the performance differences between different strategy types so pronounced, especially with respect to so-called Reactor strategies? And what are possible interactions between strategy and different types of innovation (such as radical, significant, and incremental) and different operational trade-offs and goal conflicts in NPD? Second, what is the influence of digital and other emerging technologies on the craft of product development and innovation—not just on the engineering and technical skillset but also on managerial and organizational capabilities? Third, why did relatively few North American firms, primarily from the United States, respond to the survey, especially given their dominance in BP1 through 4? Why were so few of them among the best performers? Given that the study was fielded during the pandemic, were these firms primarily concerned just with survival or are they more fundamentally in decline due to a long-term shift in NPD efforts toward, for example, open innovation, quarterly results, or software? A fourth related question worth examining is to what extent other crises (e.g., the decoupling of global value chains from China, or resource and market limitations imposed by sustainability concerns) impact the ability of firms to innovate, that is, what constitutes the appropriate combination of innovation skills to weather those crises successfully? Fifth, Web Appendix Figures W4–W6 indicate that significant additional analyses comparing B2B/mix/B2C, goods/mix/services, and software/mix/hardware factors for success could be performed to tease out more nuanced contextual differences. As firm size and other factors differ by geography (Web Appendix Table W3), additional geographically related factors for success (such as culture or national digitalization maturity) could be performed. Finally, we recommend that future PDMA Best Practice studies retain and enhance the international outlook of the present 2021 BP5 survey, as only with a truly global distribution of responses is it possible to uncover differences across regions and between

Practitioner points

- Firms must continually evolve their NPD capabilities just to "stay in the game" as the business and technology environments change.
- No one single practice is required for greater innovation performance. Rather, the Best firms are better at employing and skillfully combining a variety of NPD capabilities and practices.
- The Best firms are much more likely to have a new product strategy that encourages radical innovation, is oriented toward risk-taking and long-term, and strives for growth through entering new markets and new technologies. They also spend more than the Rest on developing all types of innovations.
- The Best are more proactive in dealing with crises such as the global COVID-19 pandemic.

[1]BP3 and BP4 were fielded and published as "CPAS" or "Comparative Performance Assessment Surveys."

individual countries. Such unique insights will inform both academics and practitioners on the sources of innovation-based global competitiveness.

2 | PDMA'S FOUR PREVIOUS BEST PRACTICE SURVEYS

The PDMA's interest in empirically determining best practices in product development dates back more than 30 years. In 1990, the Association fielded its first Best Practice (BP1) research project to identify product development norms (Page, 1993). Table 1 and Figure 1 show trends for several performance variables across the surveys. While overall success rates (Table 1, performance dimension 6; Figure 1, top numbers) have been stable, performance has improved in other measures across the Best Practice studies.

BP1 was based on 189 responses from just PDMA members. Protocols (Crawford, 1984) and formal NPD processes (Cooper, 1990; Cooper & Kleinschmidt, 1986) had been introduced in the previous 5–10 years and the study's purpose was to update information from the landmark Booz, Allen, and Hamilton (1982) study.

The 1995 BP2 expanded both the research content and distribution, gathering data from 383 respondents, about two-thirds PDMA members (Griffin, 1997). This is the first research that differentiated between the practices of the Best versus the Rest, developing the approach that has been used since then (see Section 3). Overall, rather than doing just one or two things differently or better, the Best employed many practices significantly more and more effectively than the Rest: using formal, structured NPD processes, having a specific NPD strategy, measuring NPD outcomes and expecting more out of NPD efforts, and using cross-functional teams, qualitative market research, and engineering design tools.

In 2004, PDMA obtained 416 responses for BP3, again about two-thirds PDMA members (Barczak et al., 2009). The breadth and depth of questions were expanded due to intensifying global competition and increased computing power allowing for digital development and testing. For the first time, this research obtained differentiated responses for radical versus more innovative versus incremental innovations. Compared with BP2, the sales and profit outcomes from new products commercialized declined, suggesting a decrease in the innovativeness of project portfolios.

Again, while no one practice differentiated the Best firms from the Rest, the Best emphasized, and integrated their innovation strategy across all levels of the firm, better supported their people and teams, conducted extensive experimentation, and used numerous new marketing and engineering methods and techniques.

The fourth PDMA Best Practices research (BP4 in 2012) obtained 453 respondents and, for the first time, from respondents on multiple continents, allowing some comparisons between North America, Europe, and Asia (Markham & Lee, 2013). This was the longest survey ever fielded, with new topics including culture, social media, sustainability, open innovation, and global product development. Overall, North American firms had higher success than European and Asian firms. Still, as before, no one single practice or technique differentiated the Best

TABLE 1 NPD performance across five waves of Best Practices research

	Performance dimension	BP1 1990	BP2 1995	BP3 2004	BP4 2012	BP5 2021	Best	Rest
1–2	"The Best"—% of Sample	—	22.2%	24.1%	24.6%	32.3%		
	Program Success (1–9 scale, 2-item average)	—	5.5	5.4	5.8	6.8	8.0	6.2
3	Competitive Success—% in Top Third of Industry	—	39.1%	44.0%	59.6%	48.4%	21.3%	27.3%
4	% of Sales from New Products to Total Sales (5 years)	32.6%	32.4%	28.0%	31.1%	45.2%	64.2%	35.5%
5	% of Profits from New Products to Total Profits (5 years)	33.2%	30.6%	28.3%	30.8%	44.0%	64.8%	33.3%
6	% New Product Success (5 years)	58.0%	59.0%	59.0%	61.0%	59.6%	75.3%	51.4%
7	% Success in Terms of Profitability (5 years)	55.0%	54.6%	54.2%	56.1%	55.6%	73.4%	46.5%
4–7	Market/Financial Success (4-item average)	44.7%	44.2%	42.4%	44.8%	51.1%	69.4%	41.7%
A	No. of ideas for 1 Success	11.0	6.6	7.0	—	—		
B	% with Formal Process	54.5%	61.5%	69.0%	68.2%	—		
C	% with Strategy for Innovation	56.4%	55.6%	73.3%	59.4%	—		

Note: Dimensions 1–7 were used since BP2, dimensions A–C only in BP1 through BP4.

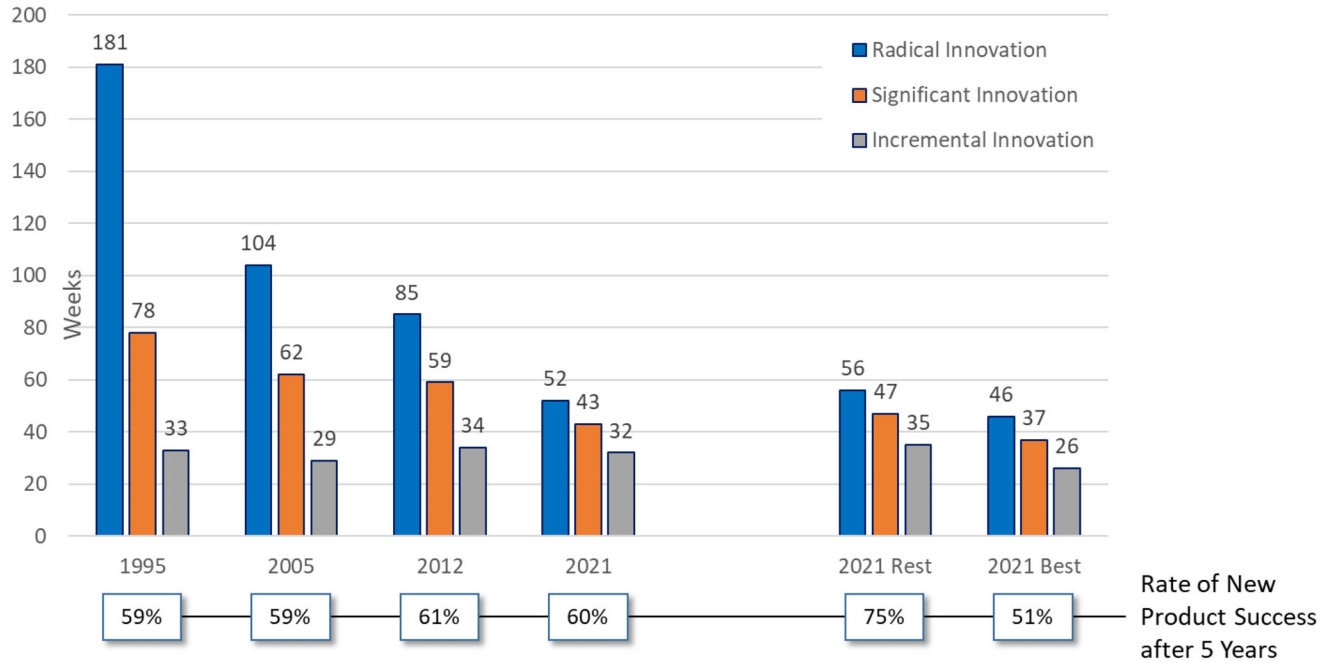

FIGURE 1 In all five benchmarking surveys since 1995, NPD cycle times for radical and significant innovation have decreased, while cycle times for incremental innovation and the rate of new product success after 5 years have stayed constant. The 2021 Best firms have faster cycle times for all types of innovation.

from the Rest. Indeed, the number of practices and techniques supporting successful NPD had grown materially since 2004, and the Best were better and/or more efficient at all of them than the Rest.

The research method for the 2021 BP5 and the resulting sample demographics are in the Web Appendix S1. The sample is the most global ever, with 62% of the 651 respondents from Europe and the UK and only 6% (39) from North America. Section W.5 in the Web Appendix S1 details further differences between this sample and previous PDMA BP samples. These significant differences mean that drawing longitudinal comparisons to previous BP findings should be made with caution.

3 | DIFFERENTIATING THE BEST FROM THE REST

The Best firms are derived empirically using seven variables representing three performance dimensions (Griffin, 1997):

1. **Program Success**, measured as the average agreement with two items

a. our new product program meets the performance objectives set out for it; and
b. overall, our new product program is a success.

2. **Competitive Success**, measured through one item

a. your subjective assessment of your business unit's (BU) overall new product success compared with your primary competitors over the past 5 years.

3. **Market/Financial Success**, measured as the average of four items

a. new product sales as a percent of total sales;
b. new product profits as a percent of total profits;
c. percent of all new products that are successful based upon your business unit's definition of success; and
d. percent of all new products that are successful in terms of profitability.

To be categorized as the Best, a firm's Program, and Market/Financial Success scores must both be above the sample mean (e.g., Program Success >6.8 *and* Market/Financial Success >51.1%), *and* Competitive Success must be in the top third of their industry. In BP5, 213 firms are characterized as the Best (32.3%) and 416 as the Rest (67.7%). Table 1 shows success outcomes across the five BP studies. While over the years the results are quite similar for the first two Market/Financial Success items (Table 1, dimensions 6 and 7), much higher numbers—nearly 50% higher—are observed for the second two Market/Financial Success items (Table 1, dimensions 4 and 5) in BP5 compared with previous BP studies. Furthermore, the percentage of firms in the Best category jumped by nearly a third—from 24% to 32%. This increase can only result from having a higher percentage of firms indicating that they

are in the top one-third in their industry. Whether this is because the sample is more global or has other differentiating factors is unknown.

Table 2 shows how overall success differs by BU headquarters geographic region. Evidently, the European and UK samples are driving both the higher Market/Financial Success outcomes, as well as the increase in overall percentage of firms categorized as the Best. This result is the opposite of the findings from BP4, where North American firms were more successful than European firms.

Table 3 shows the distribution of the percentage of firms categorized as the Best by various core firm characteristics. Categories statistically higher than the 32.3% sample average are **bolded**, while statistically lower categories are in *italics*. The Best are more likely to be making a mix of goods and services (51.5%), targeting a mix of B2C and B2B markets (46.3%), and offering a mix of hardware and software (41.97%). The firms least likely to constitute the Best produce physical goods or software for B2C markets, and have fewer than 10 NPD employees. Overall firm size is not related to the percentage of firms that are the Best; however, the number of NPD employees was positively related with firms belonging to the Best.

To understand further how the Best may differ from the Rest, respondents were asked about their NPD program drivers. Specifically, we investigated drivers associated with internal firm (e.g., revenue, cost objectives), customer (e.g., performance needs, business goals), and competitor considerations (e.g., technology capabilities, business goals). Figure 2 shows that, while the Best take all three types of NPD drivers more highly into account than the Rest, surprisingly, they are not driven more by customers than by internal or competitor considerations. The differences across the three categories are marginal.

Another way in which the Best operate significantly differently from the Rest is in their focus on radical versus incremental innovation. First, Table 4 indicates that the Best spend much more of their revenue on all types of innovation than do the Rest. Then, Table 5 shows that firms for which radical innovations make up 21%–50% of their total innovation projects are most likely to be the Best—over 50% of these firms fall into the Best category. However, 16% of the firms who claim to have no (zero!) radical innovation projects still attain status among the Best. On the other hand, a whopping 84% of firms claiming no radical innovation are members of the Rest. So, while clearly helpful in attaining Best-in-Class status, developing radical innovations does not ensure it. When we further investigate the profits earned from NPD projects of different innovativeness (Table 6), the Best earn higher proportions of their overall NPD profits from radical and more innovative projects than do the Rest; however, the difference is statistically insignificant. Conversely, the Rest earn over 50% of their total NPD profits from incremental innovation, almost 50% more than do the Best.

Overall, these points show clear relationships between the Best focusing on more innovative/radical projects and the Rest having a higher propensity for less innovative/more incremental innovation, suggesting that innovation strategy may be a major differentiating factor between the Best and the Rest.

4 | INNOVATION STRATEGY

Innovation strategy was operationalized using the Miles et al. (1978) categorization of four strategy types: Prospectors, Analyzers, Defenders, and Reactors. Prospector companies are driven by innovation and leadership to be first movers in markets with growth. Analyzers (also known as Imitators) are seldom first to market, however, by carefully monitoring competitors they become fast

TABLE 2 Best Practice performance results by geographic region

BU headquarters	Program Success	% Market/Financial Success	The Best % of country responses	The Best no. in total sample
Europe	6.97	55.7%	41.0%	112
Australasia	6.61	41.1%	20.3%	27
UK	7.31	58.6%	45.1%	51
Mideast/Africa	6.11	47.0%	25.5%	12
North America	5.91	41.0%	10.3%	4
Global	5.65	42.4%	23.1%	3
Central/South America	6.81	56.6%	50.0%	4
Sample average	6.80	51.3%	32.3%	213

Note: Program Success measured on a Likert Scale (1: not meet, to 9: meets fully).

TABLE 3 Percent of firms that are the Best by different characteristics

	The Best		Total	
	No.	% of sample	No.	% of total sample
Product Type				
Goods	50	*24.0%*	208	35.3%
Mix	85	**51.5%**	165	28.0%
Services	73	33.6%	217	36.8%
Market				
B2C (consumer)	22	*23.6%*	93	15.4%
Mix	88	**46.3%**	190	31.5%
B2B (business)	102	31.8%	321	53.1%
Product				
Hardware	85	33.6%	253	42.5%
Mix	98	**41.9%**	234	39.3%
Software	27	*25.0%*	108	18.2%
Size: Employees in Firm (global)				
Small (<50 employees)	43	32.1%	134	21.4%
Medium (50–249 employees)	42	36.5%	115	18.4%
Large (250–999 employees)	30	33.0%	91	14.6%
Very large (>1000 employees)	99	34.7%	285	45.6%
NPD Employees				
Fewer than 10	42	*23.0%*	183	29.3%
10–49	60	31.9%	188	30.1%
50–249	64	41.8%	153	24.5%
250 and more	48	**47.5%**	101	16.2%
Full Sample	**214**	**32.3%**	**629**	**100%**

Note: Response numbers vary due to nonresponses.
Categories statistically higher than the 32.3% sample average are **bolded**, while statistically lower categories are in *italics*.

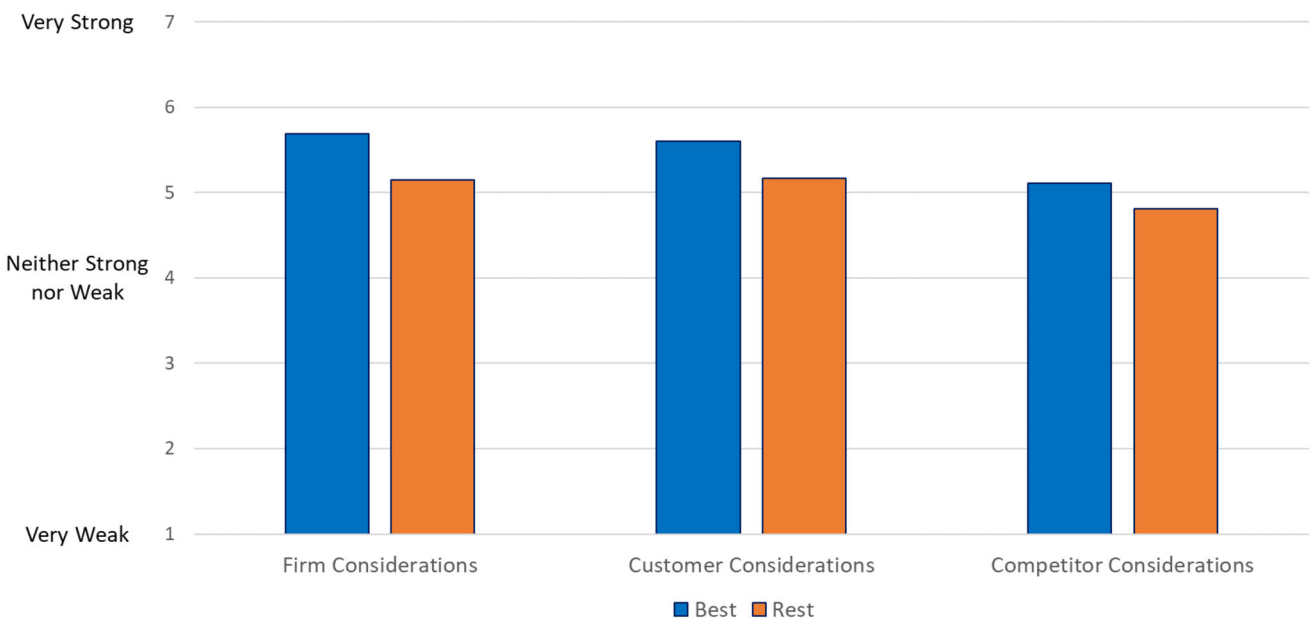

FIGURE 2 Regarding firm, customer and competitor considerations as NPD drivers, the Best take all three types of NPD drivers more highly into account than the Rest. Scale from 1 (very weak) to 7 (very strong). All differences $p < 0.01$.

followers, bringing a more cost-efficient or innovative product into the market very rapidly. Defenders attempt to locate and maintain a secure niche in a relatively stable market, protecting their niche by offering higher quality, superior service, or lower prices. Reactors are not as aggressive in updating their established products as competitors, responding when forced to by environmental threats or unusual opportunities.

Figure 3 shows that the sample consists of significantly fewer Reactors than firms following any of the other three strategies. Table 7 highlights that Prospectors are the most likely firms to be among the Best (48.0% are among the Best), whereas Reactors are far more likely to fall into the Rest category (88.5% are among the Rest). Overall, Prospectors have higher Program Success than Reactors (7.3 vs. 5.3 on a 1–9 scale), as well as higher 5-year new product success rates (64.4% success vs. 45.4%, sample average = 59.8%) (numbers not shown in table).

Overall, over 80% of Prospectors, Analyzers, and even Defenders indicate that their innovation strategy drives their development efforts; for Reactors, less than half of the firms claim this. Supporting these findings, and as presaged earlier, Table 8 shows that the more proactive the firm strategy, the higher the proportion of radical innovation projects the firm is pursuing. Reactors are the least likely to commercialize radical innovations. The overwhelming conclusion from these results is that pursuing more proactive strategies is associated with a higher propensity to be counted among the Best in NPD, and that part of that success is likely driven by an increased focus on developing and commercializing radical innovations.

TABLE 4 The Best and the Rest: Investment of revenue in development efforts (5 years)

	The Best	The Rest	Average
% Revenue spent on radical innovation	26.3%	14.1%	18.3%
% Revenue spent on significant innovation**	**30.1%**	18.6%	22.5%
% Revenue spent on incremental innovation*	**28.9%**	22.4%	24.6%

Note: Statistical significance: *$p < 0.05$; **$p < 0.01$. Categories statistically higher than the 32.3% sample average are **bolded**, while statistically lower categories are in *italics*.

TABLE 6 The Best and the Rest: Percentage of profits derived from projects of different innovation levels

% of total profits	The Best	The Rest	Sample average
From radical innovation	30.4%	19.1%	22.9%
From significant innovation	34.7%	29.3%	31.1%
From incremental innovation*	35.0%	**51.6%**	45.9%

Note: ANOVA: *$p < 0.01$. Categories statistically higher than the 32.3% sample average are **bolded**, while statistically lower categories are in *italics*.

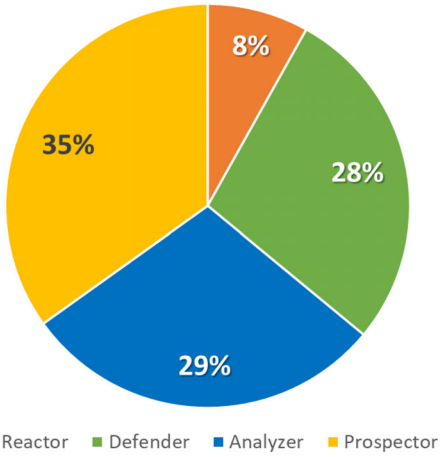

FIGURE 3 Breakdown of the sample into one of the four Miles & Snow innovation strategy types.

TABLE 5 Percentage of firms that are the Best by amount of radical innovation

% of development projects that are radical innovations	No. of Best firms	% of firms that are the Best	Total no. in sample	% of total sample
0%	20	15.9%	126	19.9%
1%–20%	69	27.3%	253	40.0%
21%–50%	110	51.4%	214	33.8%
>50%	16	40.0%	40	6.3%
Total sample	215	32.3%	633	100%

Note: X^2; $p < 0.001$.

5 | NPD GOALS

Project managers face a triple constraint problem of needing to simultaneously complete projects on time, in budget, and to specification (Baratta, 2006). NPD managers must make similar trade-offs between achieving three analogous goals: development speed, development cost, and product quality. The survey asked the respondents to choose what trade-off they would make between each of the three goal pairs: speed versus cost; cost versus quality; and quality versus speed (on a scale from 0 to 100 where the extremes indicate no trade-off and 50 indicates goal equality). Figure 4, where the dashed line indicates no preference for one goal over the other (labeled 50–50), shows that the Best (blue line) favor reducing costs over both quality and speed, and markedly favor achieving product quality over development speed. The Rest (red line) show no real preference across the goal trade-offs, suggesting ambivalence, indecision, or a lack of focus on any goal at all.

Analyzing the NPD goal trade-off preferences by innovation strategy types (Figure 5) reveals that Prospectors, Analyzers, and Defenders make similar trade-offs across the goal pairs, and that their trade-offs differ significantly from those made by Reactors. Prospectors, Analyzers, and Defenders, in alignment with what characterizes the Best, all markedly favor achieving product quality over speed. Further, they are relatively ambivalent in how the other two trade-offs are made. Among all strategy types, Analyzers emphasize development costs over speed, favoring cost-efficiency of their innovations over speed in following innovation leaders (often the Prospectors). However, Reactors focus primarily on development speed over both development cost and product quality. Of course, one way to increase development speed is by commercializing more incremental innovations, which take less time to develop than do more

TABLE 7 Percentage of Best by Miles & Snow strategy type

	The Best: % of total strategy type	Total no. in strategy type
Prospector	48.0%	221
Analyzer	26.4%	182
Defender	31.6%	177
Reactor	11.5%	52
Total no.	**216**	**632**
Average across the full sample	**32.3%**	

Note: Following the Miles & Snow types.

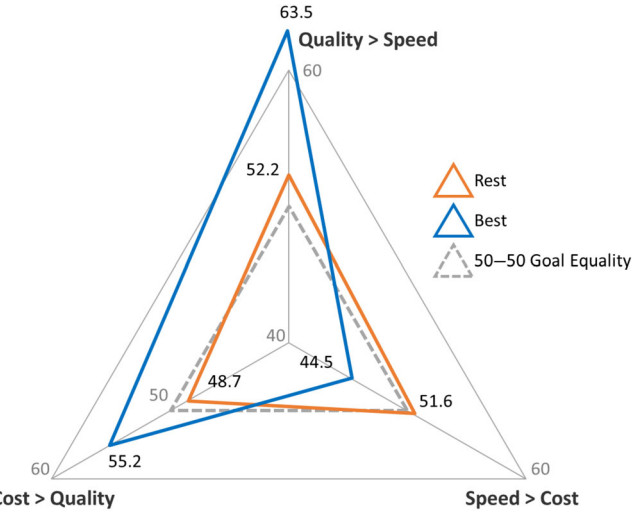

FIGURE 4 When asked about trade-offs between goals for new product quality, reduction of development cost, and development speed, the Best firms favor quality over speed, costs over quality, and costs over speed. Scale from 0 to 100 where, for example, speed is compared with cost, a value above 50 indicates that speed is more important than cost; analogous for other trade-offs. 50/50 means no priority of one goal over the other. The goal mentioned first is prioritized higher (on average).

TABLE 8 Amount of radical innovation by Miles & Snow strategy type

	Percentage of products that are radical				
Strategy type	No radical innovation	1%–20% of projects	21%–50% of projects	More than half of the projects	No. responses by strategy
Prospector	9.5%	**41.4%**	**40.9%**	8.2%	220
Analyzer	19.2%	**45.1%**	**31.3%**	4.4%	182
Defender	**24.1%**	**36.8%**	**33.9%**	5.2%	174
Reactor	**52.9%**	29.4%	11.8%	5.9%	51
Total no.	125	252	212	38	627
% of total sample	19.9%	40.2%	33.8%	6.1%	100.0%

Note: X^2 (9, 627) = 58.9, $p < 0.001$. Categories statistically higher than the 32.3% sample average are **bolded**, while statistically lower categories are in *italics*.

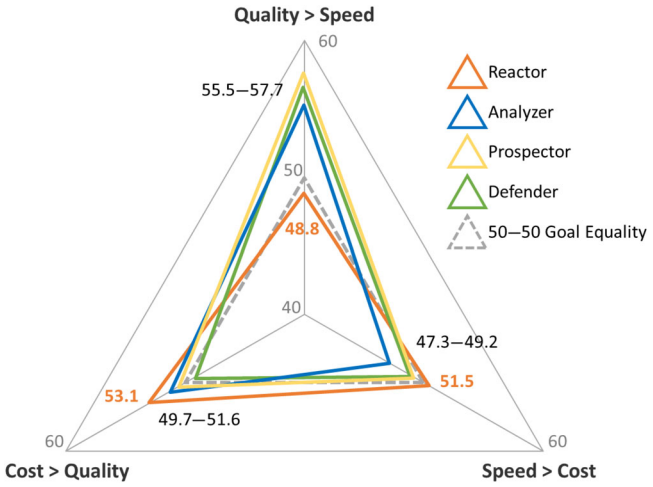

FIGURE 5 When asked about trade-offs between goals for new product quality, reduction of development cost, and development speed, firms differ by Miles & Snow innovation strategies. Scale from 0 to 100 where, for example, speed is compared with cost, a value above 50 indicates that speed is more important than cost; analogous for other trade-offs. 50/50 means no priority of one goal over the other. The goal mentioned first is prioritized higher (on average).

innovative products (see the next section for details), but also lead to a lower probability of becoming one of the Best in innovation. In this way, the Reactors follow quite distinct and less successful strategies with focus on speed and more incremental innovation.

6 | NPD PROCESS

A formal process continues to matter for overall innovation performance. Although all process types are used by the total sample, the Best are more likely to use a formal, structured process such as functional phase review, cross-functional stage gate, or the more recently introduced agile, iterative NPD process (Table 9). However, adopting a formal process is still not a necessary condition for becoming one of the Best in NPD.

Firms using more structured processes, especially stage gate and functional phase reviews, are mostly developing physical products and are focused on hardware (rather than software). By contrast, the firms that do not have any standard process are more likely to be within services (52.5%) and pursue products that are a mix of hardware and software (50.8%). These types of firms also are more likely to employ an agile and iterative process (services, 52.5%; mix of hardware and software, 41.3%; Tables 10 and 11). Overall, these findings suggest that the more structured processes developed in the late-20th century may be less useful for firms producing these types of service and

TABLE 9 NPD process formalization

	The Rest	The Best	Total
No standard process			
No.	56	13	69
% within Best vs. Rest	13.3%	6.0%	10.8%
Informally understood process			
No.	83	15	98
% within Best vs. Rest	19.7%	7.0%	15.4%
Functional phase review process			
No.	80	54	134
% within Best vs. Rest	19.0%	25.1%	21.1%
Cross-functional stage-gate process			
No.	148	86	234
% within Best vs. Rest	35.2%	40.0%	36.8%
Agile, iterative process			
No.	54	47	101
% within Best vs. Rest	12.8%	21.9%	15.9%
Total			
No.	421	215	636
% within Best vs. Rest	100.0%	100.0%	100.0%

mixed hardware/software offerings than the more recent and more agile NPD processes. Indeed, both phase review and stage gate processes were developed specifically for physical goods that did not contain software components. It is only with the advent of the "Internet of Things" in the last decade that being able to repeatedly develop successful products combining hardware and software capabilities has increasingly become more important.

Development cycle times continue to decline. As shown in Figure 1, the most notable decreases in cycle time between the 2012 BP4 and the 2021 BP5 occurred for radical (from 85 to 52 weeks; −38%) and significant innovations (59 to 43 weeks; −27%). Cycle times for incremental innovations have remained roughly the same. It is worth noting that cycle times for the three types of innovations are getting closer to each other. This narrowing of the cycle time differences may mean that firms genuinely have become better at managing more challenging innovation.

In 2021, the Best firms are consistently faster than the Rest of the firms in each of the innovation categories—radical, significant, and incremental. In fact, for the first time, the Best are 20%–25% faster for each type of innovation and are in fact just as fast at radical innovation as the Rest are at significant innovation (Figure 1).

TABLE 10 Process use differs depending on the type of products being developed: Goods versus services

	Mostly physical goods	Mix of goods/ services	Mostly services
No standard process*	21%	26%	**52%**
Informally understood process*	27%	30%	**43%**
Functional phase review process	34%	32%	34%
Cross-functional stage-gate process*	**48%**	23%	28%
Agile, iterative process*	24%	32%	**44%**

*$p < 0.01$, ANOVA test. Categories statistically higher than the 32.3% sample average are **bolded**, while statistically lower categories are in *italics*.

TABLE 11 Process use differs depending on the type of products being developed: Hardware versus software

	Mostly software	Mix of software/ hardware	Mostly hardware
No standard process*	27%	**51%**	22%
Informally understood process*	25%	35%	40%
Functional phase review process	*18%*	40%	42%
Cross-functional stage-gate process*	*10%*	37%	**54%**
Agile, iterative process*	27%	**41%**	32%

*$p < 0.01$, ANOVA test. Categories statistically higher than the 32.3% sample average are **bolded**, while statistically lower categories are in *italics*.

7 | NPD PORTFOLIO MANAGEMENT

Only 77.7% ($n = 506$, 144 excluded) of the respondents indicated that they have personal knowledge about their business unit's portfolio management practices. Thus, only this subset of the sample was used in the portfolio management analyses. In this section, we present results focusing on two aspects of NPD portfolios: their management and their execution.

A total of 67.3% of business units (BU) have an executive with responsibility for their NPD portfolio management (Figure 6). For the Best, 81.5% have a BU portfolio management executive and the responsibility resides most frequently with the BU president resp. managing director (30.2%). Others who have BU responsibility in the Best include the R&D Director (17.8%), Product Management (16.9%), and Marketing (16.7%) directors.

At the firm level, 59.4% have an executive with responsibility for their NPD portfolio management (Figure 7). For the Best, 75.9% have a portfolio management firm-level executive and the responsibility again resides most frequently with the CEO/President (39.6%). Other C-suite executives in the Best that have responsibility are the CFO (23.2%) and CTO (22.6%). These results highlight the importance that the Best firms place on managing their strategic NPD portfolio by placing responsibility for portfolio management at the highest BU and firm executive levels. Table 12 shows that the Best are more likely to use a formalized portfolio management process, integrate their NPD and Portfolio management processes to a higher degree, and have their portfolio management process drive their NPD process to a higher degree. The Rest also do these things, but to a much lesser degree.

Drawing from Cooper's research (Cooper, 2001), respondents assessed their firm's resource allocation across three core portfolio outcomes—maximizing portfolio return, balancing the portfolio, and aligning projects with innovation strategy. The results indicate that the Best prioritizes each of the three dimensions more than the Rest (Figure 8). In addition, the Best review a higher share of NPD projects in their portfolio (about 20% more) for all innovation types—radical, significant, and incremental. Clearly, the Best have moved from managing NPD projects as stand-alone individual endeavors to formally and more consistently using the needs of the NPD portfolio to drive individual project efforts to achieve overall success.

In terms of portfolio execution, Figure 9 shows that the Best focus more on entering new markets, applying new technologies, taking more risk, and being more long-term oriented than the Rest. These results align with the prior finding on innovation strategies that the Best firms are more likely to be Prospectors, as Prospectors share these traits.

Figures 10 and 11 detail these tendencies further. Both figures suggest a linear association between technology and market newness and time horizon versus risk orientation, respectively. In other words, more technology newness is associated with higher market newness, and more long-term orientation is associated with a higher risk orientation.

Figure 10 shows that business units with a mixture of B2B/B2C, hardware/software, and goods/services are closer to the profile of the Best, whereas the firms pursuing mostly goods and mostly software are closer to the profile of the Rest with regard to market and technology newness. Similarly, Figure 11 illustrates that, for time orientation and risk level, business units pursuing a mixture of B2B/B2C, hardware/software, and goods/services also are closer to the profile of the Best, whereas the firms

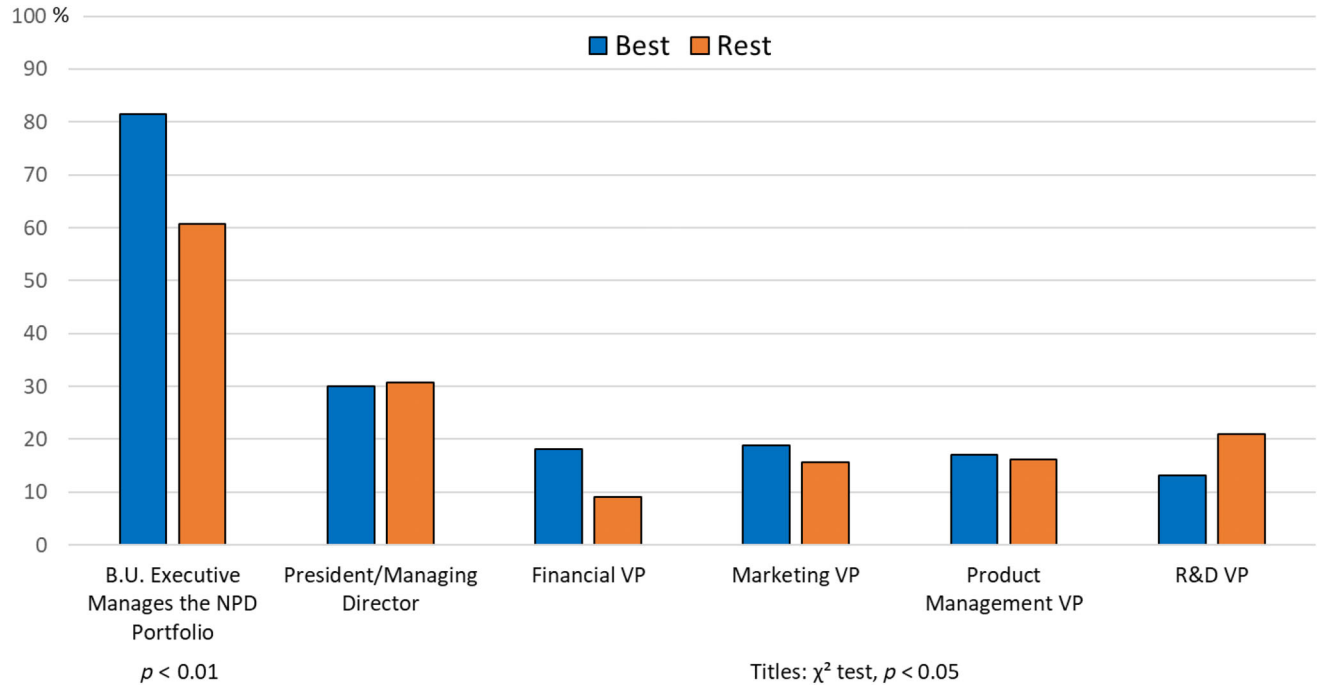

FIGURE 6 Average of business units with executive management for the NPD portfolio (yes/no) for Best and Rest. First column shows the share of respondents answering 'yes' to having an executive managing the portfolio (in Best/Rest). The next five categories are the subdivision by management titles.

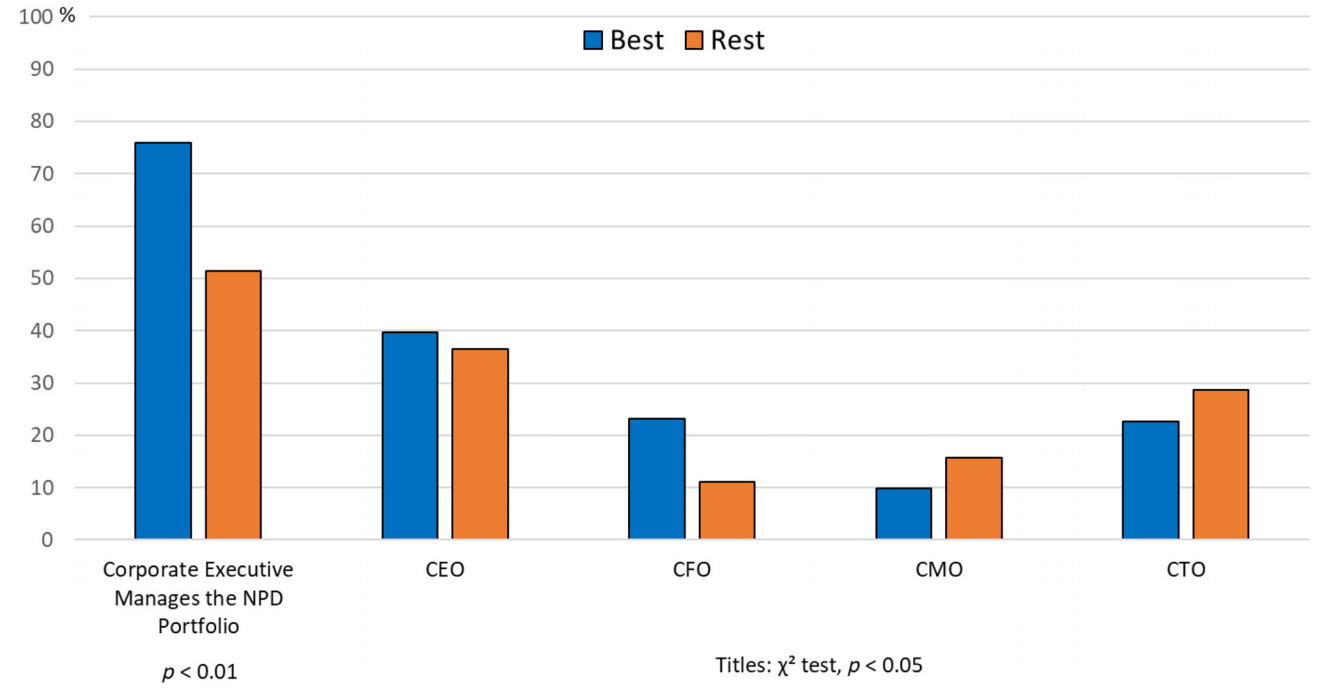

FIGURE 7 Average of firms with executive management for the NPD portfolio (yes/no) for Best and Rest. First column shows the share of respondents answering 'yes' to having an executive managing the portfolio (in Best/Rest). The next four categories are the subdivision by management titles.

that are more focused on goods or software again are closer to the profile of the Rest. Overall, these results suggest that a singular focus on products versus services or hardware versus software is not a winning strategy in this changing environment, where digitalization has helped to blur distinctions between different offerings.

As we see in Figure 12, the Best are more likely to have a portfolio that reflects their strategy and prioritizes

the best projects. Additionally, the Best are willing to make kill decisions, undertake repeatable decision analyses, consider their capacity when selecting projects, consider the entire portfolio, and justify portfolio investments against other investments. Although the Rest also do these things, the Best do them all to a greater extent.

In sum, the results of BP5 regarding portfolio management show that the Best firms manage their portfolios by having senior executives at both the business unit and firm levels responsible for the portfolio and its outcomes, integrate their portfolio management and NPD processes, and more consistently use more formalized and sophisticated methods. Further, they execute their portfolios by being more long-term and risk-focused, and they have a portfolio that reflects their innovation strategy.

TABLE 12 Portfolio management dimensions

	The Best		Total in the sample
	No.	%	
*Use formalized portfolio management processes**			
Low Formalization	32	17.3%	185
High Formalization	126	**49.4%**	255
*Integration vs. Separation**			
Separated Processes	18	14.8%	121
Integrated Processes	145	**47.1%**	308
*Which Process Drives**			
NPD Drives Portfolio	36	27.7%	130
Portfolio Drives NPD	116	**43.8%**	265
Average in Database		32.3%	

Note: Statistical significance: $*p < 0.01$ (X^2). Categories statistically higher than the 32.3% sample average are **bolded**, while statistically lower categories are in *italics*.

8 | BEST PRACTICES IN TIMES OF A PANDEMIC

The fifth Best Practice study was carried out during the COVID-19 pandemic. As data collection started at the end of 2020, the team added questions to evaluate firm responses to the global crisis for their new product development efforts. Specifically, we asked how the pandemic influenced NPD in the business unit with respect to changes in the number of people working in NPD (2020 compared with 2019), and investments in NPD (2020 compared with 2019), and how the planned budget for 2021 changed compared with the original 2020 budget.

As can be seen in Table 13, the Best were significantly more active in confronting the crisis caused by the COVID-19 pandemic. While, on average, the sampled firms grew their NPD staff by almost 10%, the Best increased NPD employees by 25% whereas the numbers for the Rest are almost unchanged. For investments in NPD, the difference between the Best and the Rest is

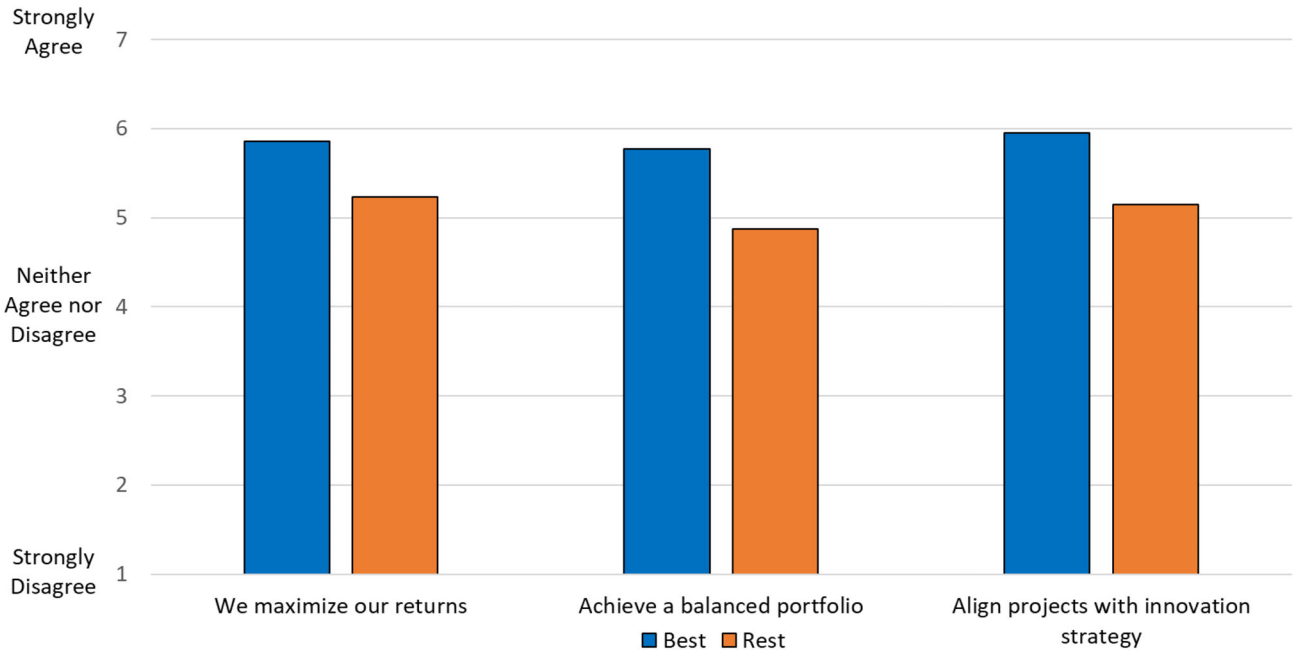

FIGURE 8 Allocation of resources among alternatives is aimed at the outcomes: Maximize returns, achieve a balanced outcome, or alignment of projects with innovation strategy for Best and Rest (average). Scale from 1 (very weak) to 7 (very strong). All differences $p < 0.01$.

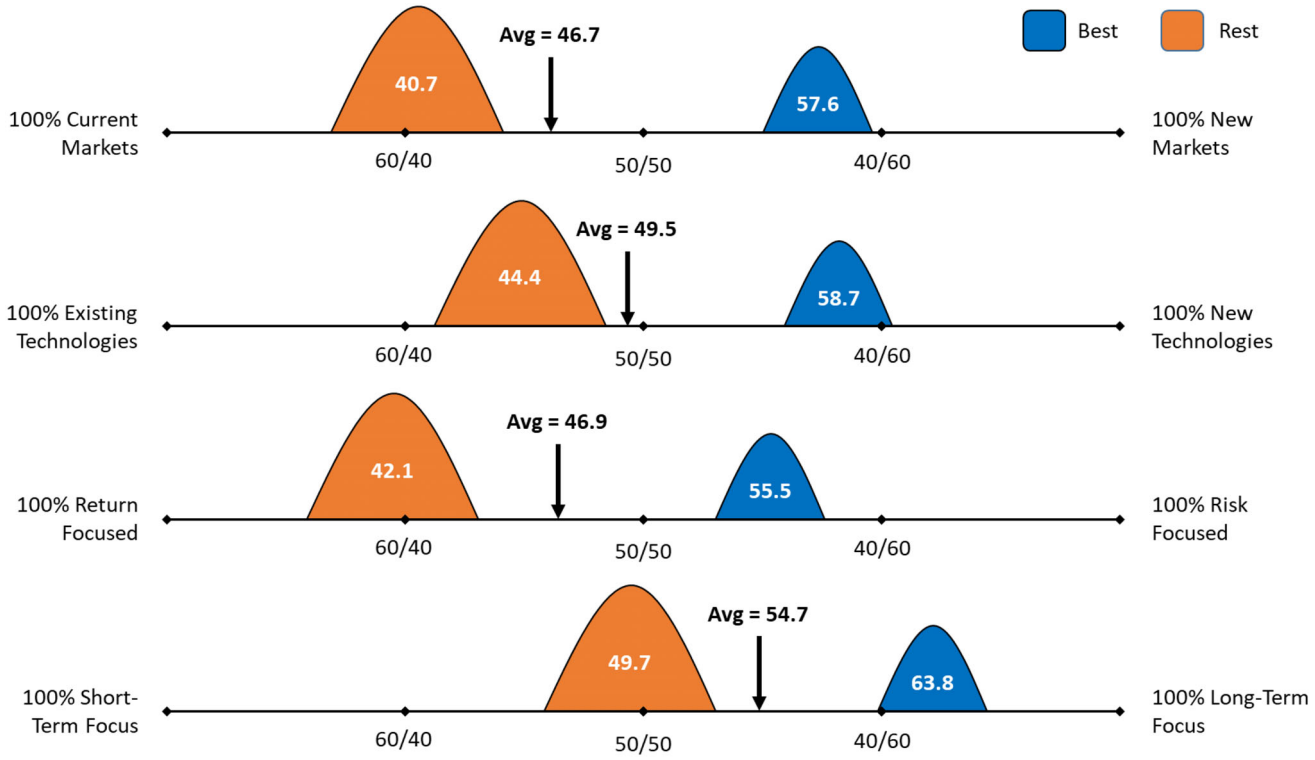

FIGURE 9 NPD portfolio characterizations of the Best versus the Rest. The four dimensions in the figure illustrate the process for managing the portfolio of NPD projects in terms of Market Newness (1), Use of New Technologies (2), Balance of Risk and Return (3), and Time Horizon of the Portfolio (4). Scale from 0 to 100, where a value of 50 indicates equal weight of the dimensions, a value of 0 indicates unique focus on current markets (or existing technologies, returns, and the short-term, respectively), and a value of 100 indicates unique focus on new markets (or new technologies, risk, and the long-term, respectively).

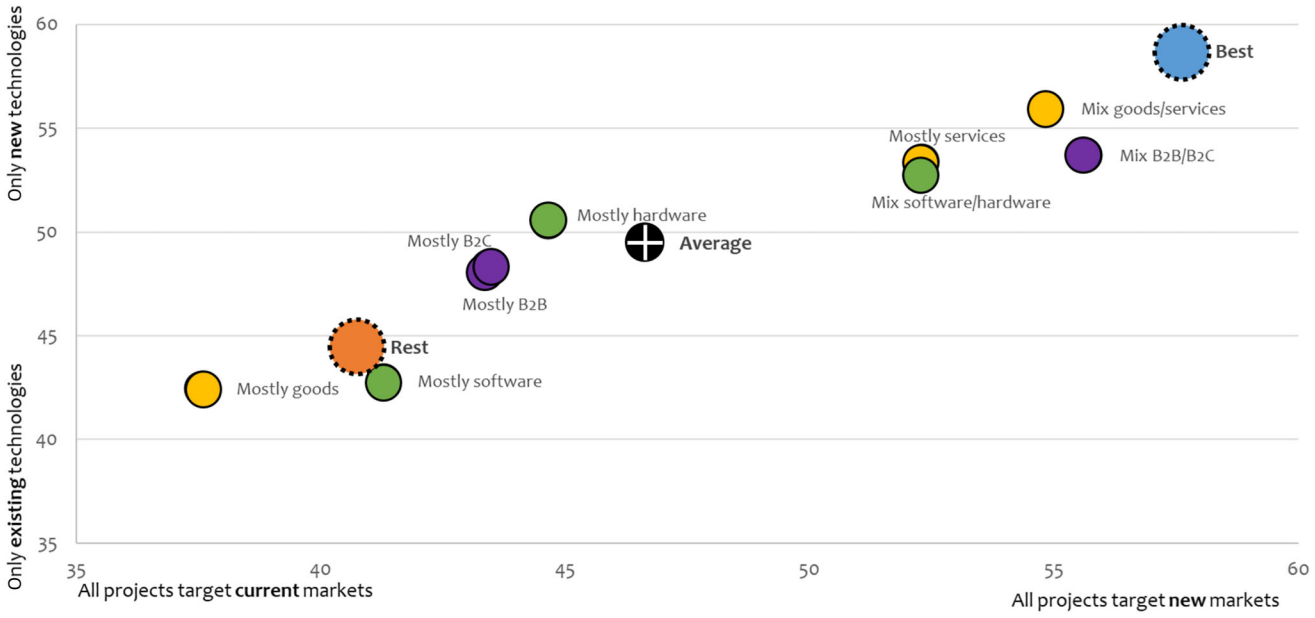

FIGURE 10 New product portfolio orientation toward Technology Newness and Market Newness across Goods/Services, Hardware/Software, and B2C/B2B structural characteristics. Scale from 0 to 100. A value of 50 indicates equal weight of the dimensions, a value of 0 indicates unique focus on current markets (existing technologies on the *Y* axis), and a value of 100 indicates a unique focus on new markets (new technologies on the *Y* axis). The mix of goods/services are measured at the level of the business unit on a scale from 0 (only physical goods) to 100 (only services), the mix of hardware/software on a scale from 0 (only software) to 100 (only hardware), and the mix of B2C/B2B on a scale from 0 (selling to consumer markets only) to 100 (industrial markets only) are assessed individually.

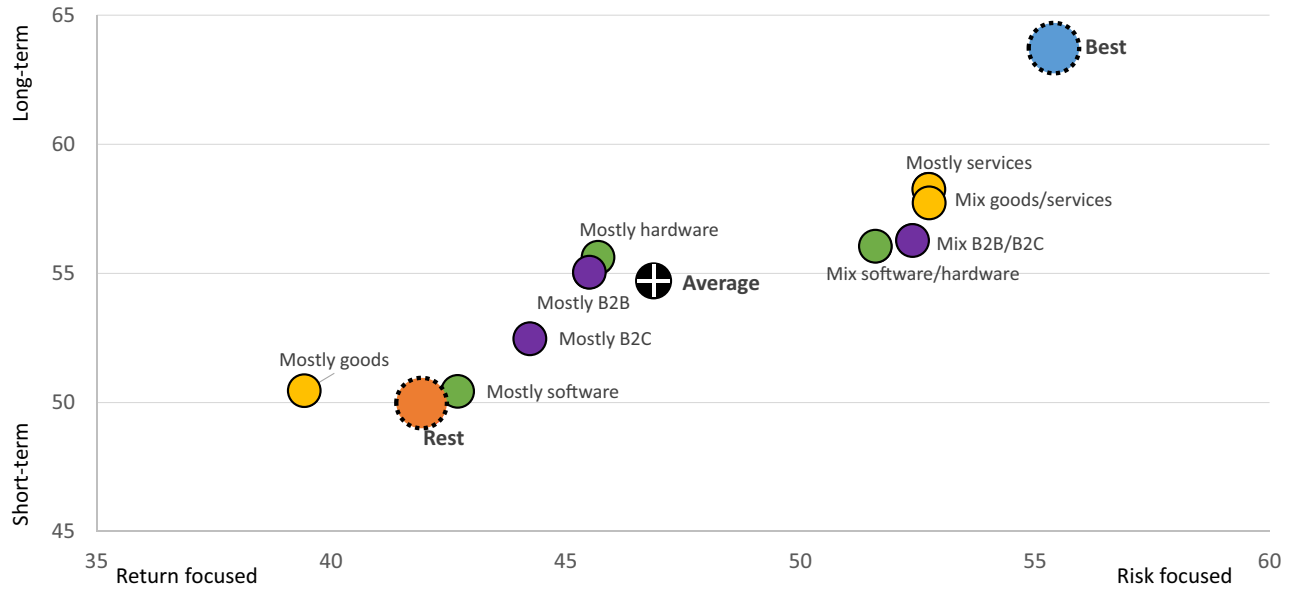

FIGURE 11 New product portfolio orientation toward Return versus Risk and Short versus Long Term across Goods/Services, Hardware/Software, and B2C/B2B structural characteristics. Scale from 0 to 100. A value of 50 indicates equal weight of the dimensions, a value of 0 indicates unique focus on returns (the short term, respectively), and a value of 100 indicates a unique focus on risk (the long term focus, respectively). The mix of goods/services are measured at the level of the business unit on a scale from 0 (only physical goods) to 100 (only services), the mix of hardware/software on a scale from 0 (only software) to 100 (only hardware), and the mix of B2C/B2B on a scale from 0 (selling to consumer markets only) to 100 (industrial markets only) are assessed individually.

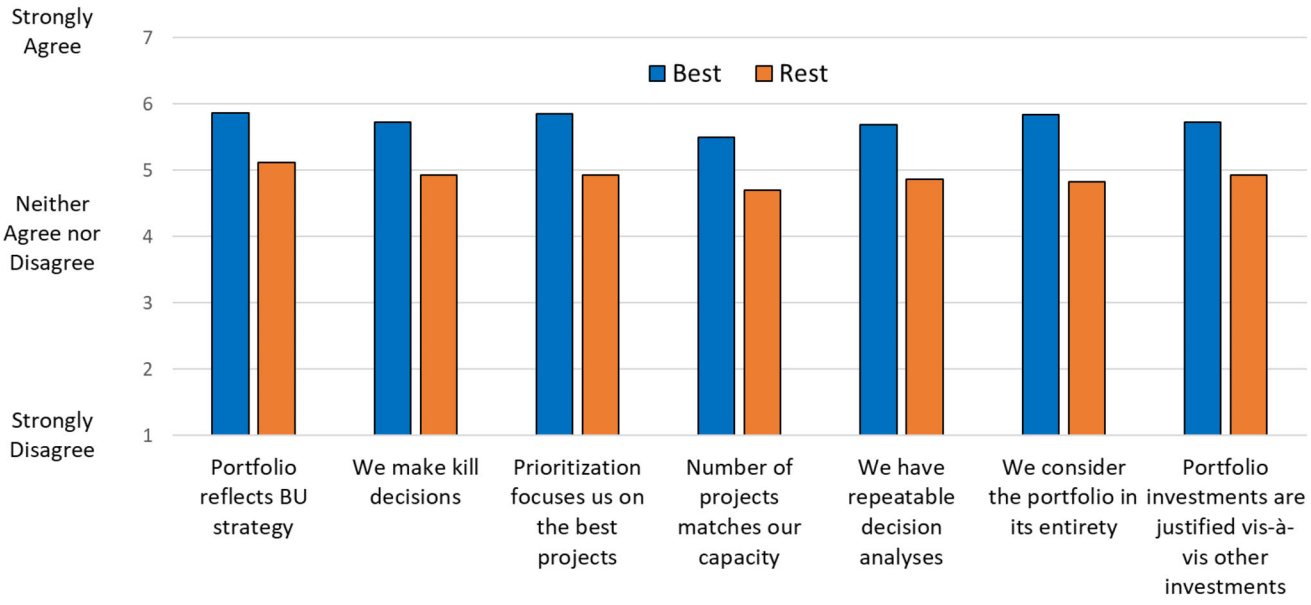

FIGURE 12 NPD portfolio management process and execution: Best versus Rest. Scale from 1 (very weak) to 7 (very strong). All differences $p < 0.01$.

even more pronounced: the Best increased NPD investments by 21%, while the Rest decreased by almost 4%. Finally, similar expectations are reported for future NPD budget changes. It is evident that the Best were more willing to invest during the pandemic and its associated crisis, whereas the Rest took a more defensive approach.

These results are backed up by a comparison of the study respondents' innovation strategies and reactions to the pandemic. Figure 13 shows that the Prospectors are more active than any of the other firms and the only strategy type to increase investments in 2020 compared with 2019.

Further, Figure 14 illustrates that business units with a mixture of B2B/B2C and goods/services had greater positive changes in their NPD investments and NPD budget and are closer to the positive investment changes made by the Best. Business units that focused on B2B and a mix of hardware/software are closer to the average regarding their NPD investments and NPD budget. Interestingly, business units with a singular focus on goods, software, or B2C decreased their NPD investments and overall NPD budget and are closer to being in the Rest. These results align with previous findings (Figures 10 and 11) and indicate that achieving better innovation performance depends on adapting to the changing macro-environment and evolving one's innovation practices to fit that environment, such as providing a mixture of offerings to customers, even in times of crisis.

TABLE 13 Comparison of Best versus Rest: Reaction to the COVID-19 pandemic

	Average	Best	Rest
NPD People: 2020 compared with 2019	9.9%	25.2%	0.7%
NPD Investments: 2020 compared with 2019	5.4%	21.1%	−3.9%
Future budget change: 2021 compared with 2020	8.8%	21.2%	1.4%

9 | DISCUSSION AND CONCLUSION

9.1 | The Best are different

The overarching conclusion of BP5, similar to BP2 through BP4 conducted in 1995, 2004, and 2012, respectively, is that no single capability or practice will ensure that a firm is among the best firms at NPD and innovation. In fact, the results show that the Best firms undertake and implement many practices that lead to higher product performance. Although the Rest also utilize many of these practices, they do so to a lesser extent than the Best firms.

The results also clearly indicate, however, that the firm's new product development strategy is now more

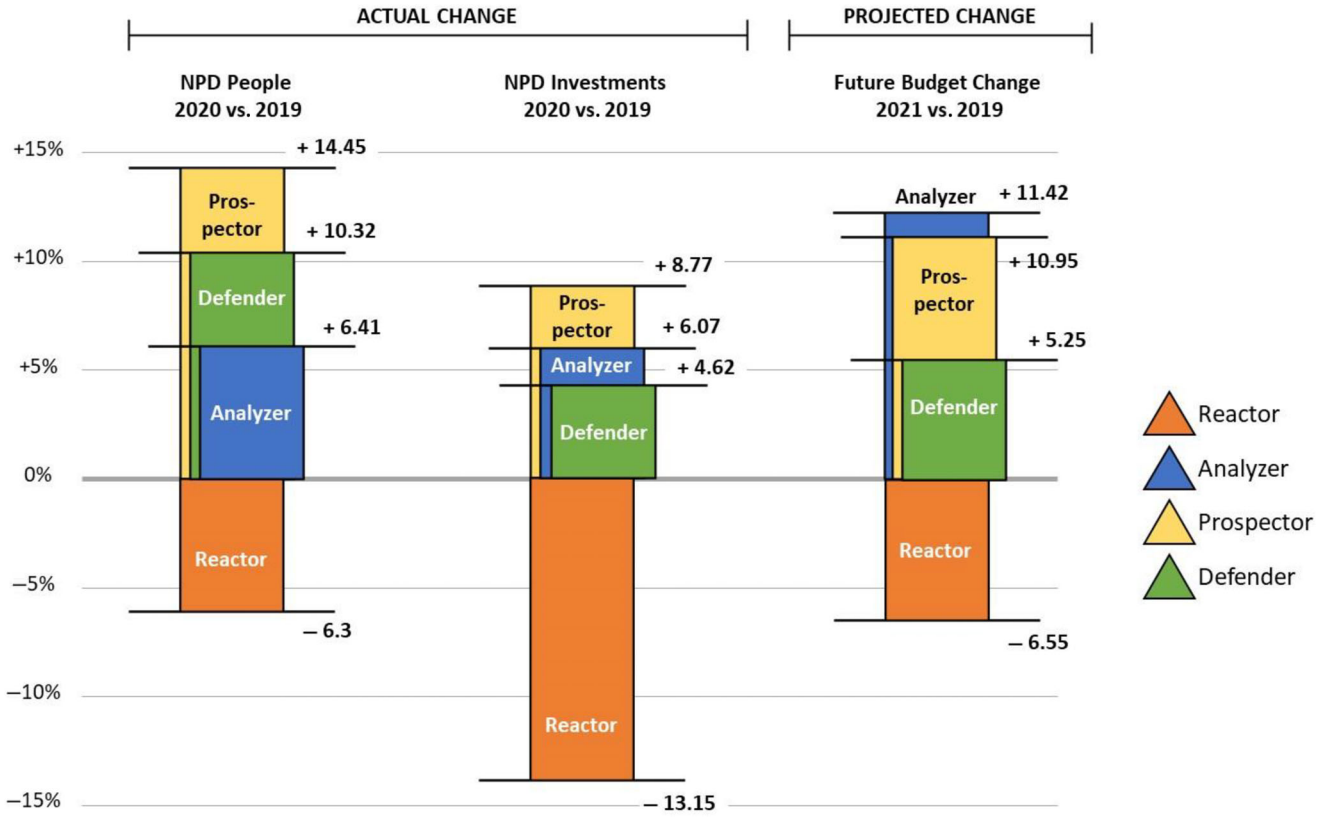

FIGURE 13 Actual and predicted changes in NPD by Miles & Snow innovation strategy type and the COVID-19 pandemic. NPD People: Change in number of people in NPD in 2020 compared with 2019. NPD investments: Change in investments in NPD in 2020 compared with 2019. Future budget change: The change in planned business unit NPD budget for 2021 compared with the originally 2020 budget.

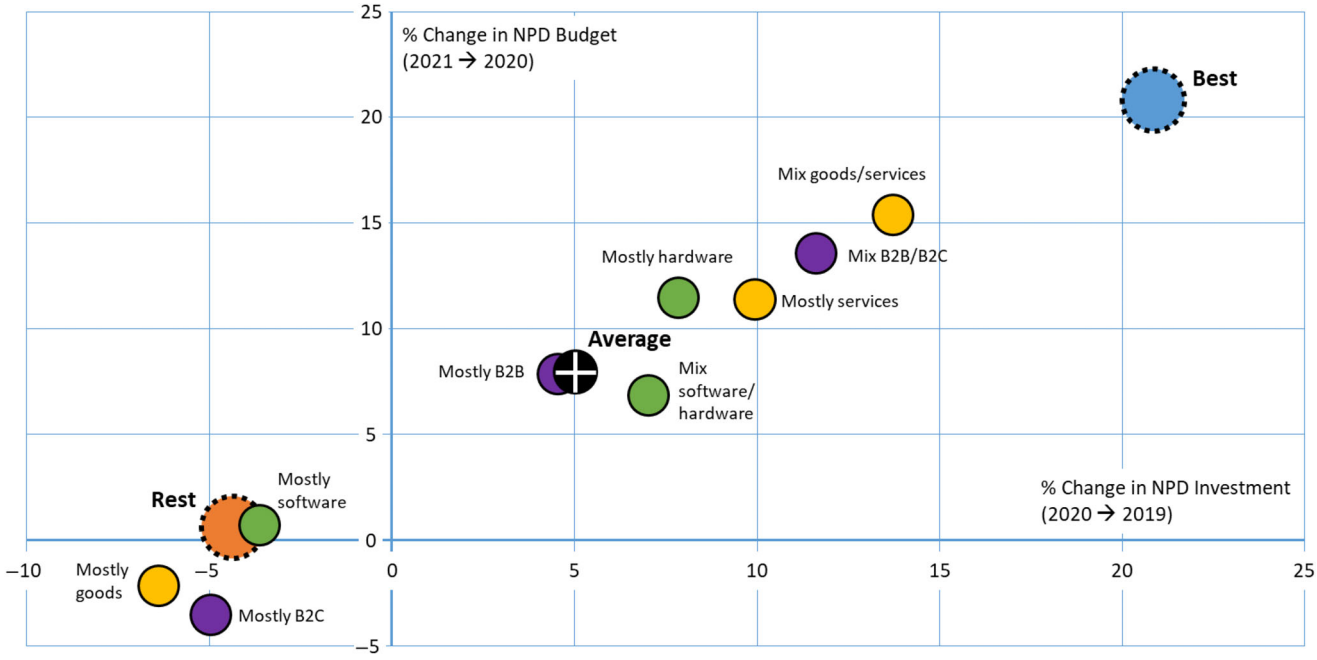

FIGURE 14 COVID-19 change in NPD investments and change in NPD budget across Goods/Services, Hardware/Software, and B2C/B2B structural characteristics. *X*-axis: Change in investments in NPD in 2020 compared with 2019. *Y*-axis: The change in planned business unit NPD budget for 2021 compared with the originally 2020 budget. The mix of goods/services are measured at the level of the business unit on a scale from 0 (only physical goods) to 100 (only services), the mix of hardware/software on a scale from 0 (only software) to 100 (only hardware), and the mix of B2C/B2B on a scale from 0 (selling to consumer markets only) to 100 (industrial markets only) are assessed individually.

important than previous BP's in differentiating between the Best versus the Rest. Specifically, Prospector firms, characterized by being innovative first movers, are much more likely to be among the Best (48% of them are in this category). By contrast, Reactors, who respond only when forced to by environmental threats or unusual opportunities, are the least likely to be among the Best (11.5%). A more innovative strategy, as exemplified by Prospectors, is also associated with the pursuit of a higher proportion of radical innovation projects. However, the Best not only focus more on radical innovation—they spend more on *all* types of innovation projects. Overall, these results suggest that better performance is linked to both a more innovative strategy and more radical innovation projects.

Another important difference between the Best and the Rest revolves around the trade-offs they make between quality, speed, and cost. The Best favor reducing costs over both quality and speed and highly favor product quality over development speed. The Rest have no preference among these three goals suggesting ambivalence, indecision, or a lack of focus on any of the goals. So, even though the Best pursue a more innovative strategy and more radical innovation, they are still concerned about development costs. And, while they clearly prioritize quality over speed, they still are concerned about speed, as the results also show that they have achieved faster cycle times for all types of innovation—radical, significant, and incremental—than the Rest. Thus, increasing development speed for the Best does not come at the expense of cost or quality. At first glance these results may seem contradictory. However, faster cycle times result from the use of a formal, structured NPD process such as functional phase review, cross-functional stage-gate, or agile, as well as numerous other practices that the Best have implemented over the last 10 years aimed at improving development efficiency. Perhaps, in already implementing these other techniques, the Best have reduced their cycle time to a point where they are less concerned about speed now.

The way the new product portfolio is managed is another key differentiator of the Best versus the Rest. The Best are more likely to use a formalized portfolio management process and integrate their portfolio and NPD processes to a higher degree. Further, they manage three critical portfolio outcomes to a greater degree: maximizing returns from the portfolio, balancing the portfolio, and aligning the portfolio with their innovation strategy. Importantly, the Best are better at executing their portfolio strategy, at least in part by having senior executives at

both the business unit and firm level responsible for the portfolio and its outcomes.

The Best focus more on entering new markets and new technologies which aligns with the traits of Prospector firms. They are long-term and risk-oriented, which supports their emphasis on radical and significant innovations. They also pursue a mixture of B2B/B2c, goods/services, and hardware/software suggesting that firms today need to have a wide variety of product combinations in their portfolio to be successful. Overall, the Best firms are more likely to undertake and execute portfolio management practices that have been found in academic research to lead to greater performance (Cooper et al., 2001).

Finally, the results show that during times of crises, such as the COVID-19 pandemic, the Best firms are willing to invest in NPD with more people, higher budgets, and more overall investments. These findings again align with the emphasis of the Best on facing risk head-on while being more long-term oriented. Obviously, at the time of the BP5 study, the ultimate duration and extent of the crisis remained uncertain.

9.2 | Major take-aways for practitioners

The overall NPD success rate (59.6%, Table 1) has not changed materially in 30 years. Although many differences between the Best and the Rest are statistically significant, the absolute differences are not that large. Numerous new tools and practices such as stage-gate, concurrent, waterfall, and agile product development processes, Voice-of-the-Customer research, virtual team management, and electronic communication techniques and advanced digital development tools, have been implemented by firms, and they have improved the efficiency and effectiveness of NPD programs. Together, these results imply that all firms must continually evolve their NPD capabilities just to "stay in the game" as circumstances and the environment change. The Best do have a higher success rate than the Rest by almost 50% and implement many NPD practices to a greater extent than the Rest; however, there is still room for improvement even for the Best firms. In sum, BP5 shows once again that all firms need to constantly change and improve their NPD capabilities and practices just to remain on par with competitors.

The BP5 results also provide several important new take-aways for NPD practitioners. First, for the first time in the PDMA Best Practice series of studies, having a more innovative strategy is associated with a much higher probability of being one of the best firms. Second, the Best firms also spend more than the Rest on *all types* of innovation projects, indicating they understand the importance of commercializing a mix of projects regardless of their innovation strategy. Third, the Best are more active when confronted with unexpected situations (e.g., a pandemic). They understand that uncertain times present an opportunity for investing in innovation rather than retreating. These results align with findings in a European Commission study by Santos et al. (2021), which found that the probability of an increase in turnover for innovative firms in the pandemic was greater than for noninnovative firms, even though a McKinsey survey (Am et al., 2020) showed that companies generally deprioritized innovation during the pandemic.

Fourth, as has been found in prior BP studies, other than strategy's importance, no one other factor seems to be required for higher innovation performance. For example, the Best firms emphasize costs over quality and quality over speed but are concerned about all three when developing new products. Overall, our results suggest that firms need to create and master multiple NPD capabilities, where none in and of themselves is particularly valuable, but combined they lead the Best firms to greater innovation performance.

9.3 | Call for action for academics and practitioners

The survey results provide several areas for further investigation. First, a notable characteristic of BP5 was the lack of responses from firms in North America, primarily the United States, which comprise only 6% (39 responses) of the sample. The sample is dominated by UK and European firms, which account for the increase in the number of the Best firms. By contrast, BP4 had 198 North American respondents.

In the present BP5, only 10.3% of the North American respondents were among the Best firms, that is, a share of less than a third of the global average (Table 2). At the same time, a recent Economist report suggests that American firms lead in OI adoption (Economist Impact, 2022). We believe it would be helpful to investigate whether US firms, in particular, are focusing so much on open innovation that they have decreased their internal innovation activities, thereby diminishing their NPD-based competitiveness. This research question presents opportunities for empirical survey research as well as case studies.

A second question worth examining is whether there is, in case of an unexpected crisis, an appropriate combination of practices and skills that allow firms to sustain their innovation performance.

Third, as noted in all the previous BP studies, Best Practices research needs to keep pace with emerging

concepts and practices promoted by consultants and used by leading product development companies. Thus, we recommend that Best Practice research by the PDMA Foundation continue to be conducted on a consistent basis.

Fourth, we focus our analyses on frequencies and statistical tests such as ANOVA and t-tests. Subsequently, we cannot draw definite conclusions about causal relationships. New techniques such as Qualitative Comparative Analysis (QCA) which identifies configurations of necessary and sufficient conditions for an outcome might be used to determine factors, besides strategy, that might be necessary and sufficient for higher innovation performance.

Finally, Web Appendix Table S3 and Figures W4–W6 indicate that significant additional analyses comparing geographic location, firm size, B2B/mix/B2C, goods/mix/services, and software/mix/hardware factors for success could be performed—both using these data as well as through gathering additional new data. Such analyses could provide more insight as to how specific contexts impact innovation performance.

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ETHICS STATEMENT

This research was approved for human subject safety by the Institutional Research Board of the University of Utah and San Francisco State University.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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