Revolution or Evolution:
A Study of the Adoption of AI in New-Product Development[1]

Robert G. Cooper (2023)

Executive Summary:

Artificial Intelligence (AI) is poised to transform all aspects of business, and with it, new-product development (NPD). Pioneering companies that are early adopters of AI for NPD have demonstrated its major benefits, such as remarkable reductions in development times and a heightened pace of innovation. But what about the more typical firms. We set out to address that question by undertaken a survey of ISBM member firms at the conference on AI's role in Marketing, held in Chicago in September 2023.

The ensuing report unveils the study's findings, shedding light on the current implementation status of AI across 13 crucial areas in NPD. It also delves into the businesses' intentions to adopt AI in their NP processes in the foreseeable future, along with noting the improvements that AI has already brought. The results are surprising: Businesses in the study have not implemented AI across any of the 13 possible application areas in NPD; and the "intention to adopt" is fairly weak. The one exception is a somewhat positive intent to adopt Natural Language Processing, useful for converting unstructured text, for example from online sources, customer complaints, or market research reports, into useful structured facts. Additionally, the report scrutinizes the businesses' readiness to embark on AI adoption for NPD, and finds that while the leadership seems somewhat prepared, the rest of the organization is not.

The results are surprising and somewhat alarming, given that the benefits of AI in business in general, and in NPD in particular, have been outlined many times in reputable publications such as the *Harvard Business Review* and *Forbes*. The report concludes with critical messages for management, offering five recommendations to guide the next steps forward. The urgency to act and embrace AI in NPD becomes evident as we uncover the immense potential it holds for propelling businesses into a future of enhanced productivity, efficiency, and innovation.[2]

The Coming Revolution… Or Is It?

Artificial Intelligence (AI) is poised to transform all aspects of business, and with it, new-product development, according to several *Harvard Business Review* articles. Business historians, a century from now, will pinpoint this era as a pivotal moment for AI, drawing parallels to the early stages of the Industrial Revolution.

In contemporary times, our current approach to new product development closely mirrors decades-old methods. Unfortunately, the outcomes have persistently fallen short, with only a 25-30% success rate in

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[1] Citation: Cooper, R.G. 2023. "Revolution or Evolution: A Study of the Adoption of AI in New-Product Development," Penn State Institute for the Study of Business Markets: Oct 2023.

[2] In keeping with the Artificial Intelligence theme of this study, parts of this report have been edited by ChatGPT for errors and grammar.

commercializing new-product development projects.[1] This is about to change, however, as the Artificial Intelligence Revolution takes hold in new-product development (NPD).[2]

Early adopter firms that embraced AI technologies have showcased that AI not only holds immense potential in NPD but also brings about significant advantages, often leading to a 50% reduction in development times or a major acceleration in the pace of development. Remarkable applications of AI in NPD abound:

- **GE's Enhanced Design Speed:** GE has *halved design times* by leveraging AI for fast design and testing in turbine development.[3] Traditionally, engineers required two days to computationally analyze the fluid dynamics of a single turbine blade design. Now, machine learning trains a surrogate model, enabling evaluation of a million blade design variations within a mere 15 minutes.

- **Unilever's Robotic Laboratory:** Unilever's $120-million laboratory, staffed by by robots, engages in the *end-to-end creation and testing of new products*.[4] Termed the "Material Innovation Factory" (MIF), this facility hosts the world's highest concentration of robots specialized in material chemistry. Each machine meticulously processes extensive data volumes and ensures consistency across samples and tests. Unilever's robotic chemistry lab sets a benchmark for companies in the chemical, materials, and pharmaceutical sectors.

- **Nestle's Innovative Concept Generator:** Nestle employs a "concept generator" powered by AI that scours diverse data sources for insights, identifies gaps and opportunities, and subsequently *generates new product concepts* based on the analysis results.[5] This innovative method is applicable to both B2C and B2B businesses.

- **General Motors' AI-Driven Car Design:** General Motors employs a generative AI model that *creates fresh car designs* based on prompts from designers regarding viewpoints, colors, body type, and image. Additionally, an AI predictive model *forecasts consumer preferences* for the car design, effectively eliminating initial customer concept-testing – an expensive and time-consuming task within the automotive industry. [6]

- **Digital Twins:** Major players like GE and Siemens have embraced digital twins; these are digital models that digitally mimic products or components, and can be pivotal during development (field testing of a prototype product in the field,

The Role of AI in NPD Study

Purpose:

- Determine the extent to which firms have adopted AI for NPD and also their intent and readiness to adopt (note that a business can have good intentions, but be "not quite ready" to adopt a new method or technology).
- Determine in which areas of NPD and types of applications.
- Determine the results of employing AI in NPD – for example reductions in time-to- market, or better decision-making.

The Sample of Businesses

Businesses surveyed, using the online tool *Survey Monkey*, are a purposeful sample of ISBM members (Institute for the Study of Business Markets). Twenty-three businesses completed the short questionnaire. Most of the questions are scaled, that is a 1-5 scale where 1="No, not at all" and 5 ="Yes, very much so". Other questions asked for a number or a percent. Businesses ranges across a number of B2B industries, including chemical, ingredient, materials, and mechanical products (too few businesses to provide a meaningful percentage breakdown). All firms are larger and well-established (no start-ups or SME firms in the sample).

and tracking tis performance using a digital twin); and also, during the post-launch period (by monitoring the new product in use, and enhancing customer satisfaction). GE's successful implementation of digital twins for its GE90 engines to monitor engine performance on Boeing 777 is a testament to their effectiveness. Siemens, a pioneer in this digital twin domain, has introduced ATOM, a virtual model for its gas turbines and compressors and also offers similar software to customers for their own NPD.

While industry giants like GM, GE, Siemens, Unilever, and Nestle, armed with significant resources, spearhead the early adoption of this transformative technology, the question arises: what about the more typical firm? Is AI similarly revolutionizing their NPD systems? Are they leveraging AI in NPD, and if so, how, and with what outcomes? And what strategies are in place for AI adoption, if any?

To shed light on these critical questions, we conducted a survey at a recent B2B conference on the role of AI in marketing.[7] The results prove to be highly provocative, offering important insights and lessons for management in businesses across the spectrum.

Navigating the Abundance of AI Applications in New Product Development – A Strategic Perspective

In today's digital landscape, a quick internet search reveals a multitude of AI applications in NPD, and vendors offering AI software. Each touts substantial benefits and improvements, leaving businesses facing a potential paradox of choice (Figure 1).

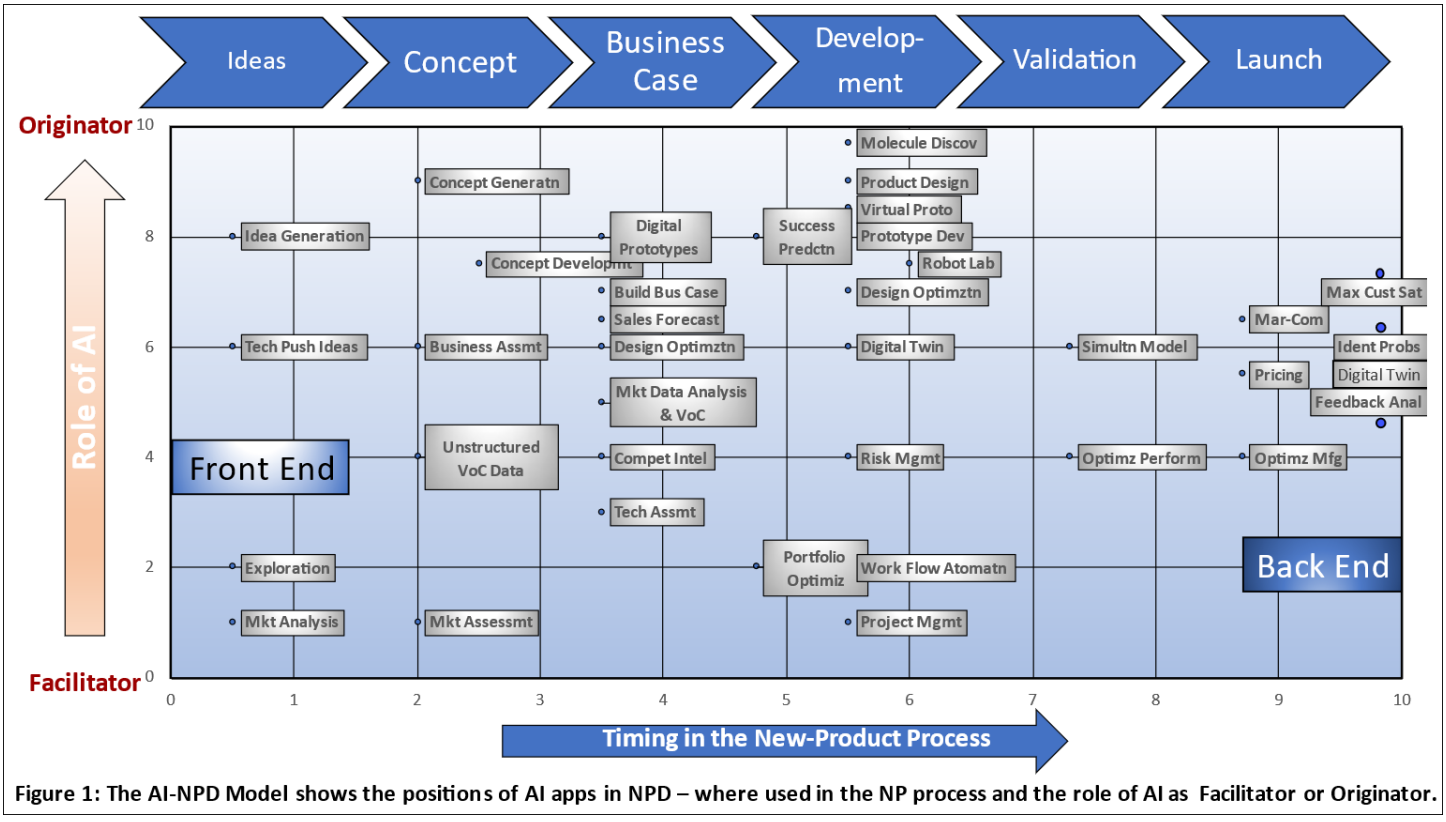


Figure 1: The AI-NPD Model shows the positions of AI apps in NPD – where used in the NP process and the role of AI as Facilitator or Originator.

One way to think about AI's many NPD apps is to visualize the role of AI is by *where it occurs in the NPD process.*[8] Is AI predominantly deployed in the early stages, such as idea generation, or does it primarily enhance the later stages, like planning the product launch?

Another valuable perspective is to ascertain whether AI serves as an *originator* or a *facilitator*. This distinction is drawn from a recent conceptual model of AI in NPD (Brem et al, 2023).[9] The *originator role* depicts AI as the creative force, leveraging its capabilities as a creative model capable of invention. Conversely, the *facilitator role* focuses on enhancing existing processes and methods, making them more efficient and effective.

Figure 1 presents the resulting AI-NPD model, incorporating these two dimensions: Originator-Facilitator and the location in the NPD process. This positioning accommodates over 35 AI-NPD applications, aiding in a structured assessment of their potential impact.

In this report, we delve into whether the businesses under study are presently leveraging these applications and if they intend to integrate them into their NPD practices. We have singled out a subset of 13 applications from the comprehensive list of 37 displayed in Figure 1, emphasizing the most prominent and viable options for implementation.[10] Stay tuned as we navigate this thriving landscape of AI applications, providing strategic insights for businesses seeking to optimize their NPD endeavors.

Results

AI Applications in the Front-End of NPD The front-end of the new project process offers many opportunities for employing AI to advantage, especially originator or more creative types of AI applications (apps), where the business or project team is trying to generate ideas and or create concepts.

Reality for the typical business is much different, however, as shown in Figure 2. What is striking here is the *minimal use of AI in the front end* – the red bars in the figure – very close to the "no, not at all" end of the scale. Indeed, the average "adoption score" across these five apps – all were thought to be logical candidates for deploying in NPD – is a meagre 1.37 out of 5 (here, 1 means "no, not at all" and 5 means "yes, very much so"). The two highest-scoring apps are online market and competitive analyses, but they too see little application.

The *plans or intentions* of these businesses to use each of these apps in Figure 2 in the foreseeable future are also investigated (the blue bars). While "intention to use" scores are higher than current usage, all intentions for five apps hover around the mid-point of the scale, with the app "Making Go/Kill decisions" faring the worst. Additionally, the *distribution of answers* around this midpoint of 3 is fairly tight (a standard deviation of about 1), meaning that the great majority of businesses score 2, 3 or 4; in other words, this is not a bipolar sample of businesses, with half the group definitely moving ahead with AI (scoring 5) and the other half at standstill (a score of 1): instead, most of the businesses are right around the "neither yes or no" midpoint – that is, a lack of a strong commitment to move forward here.

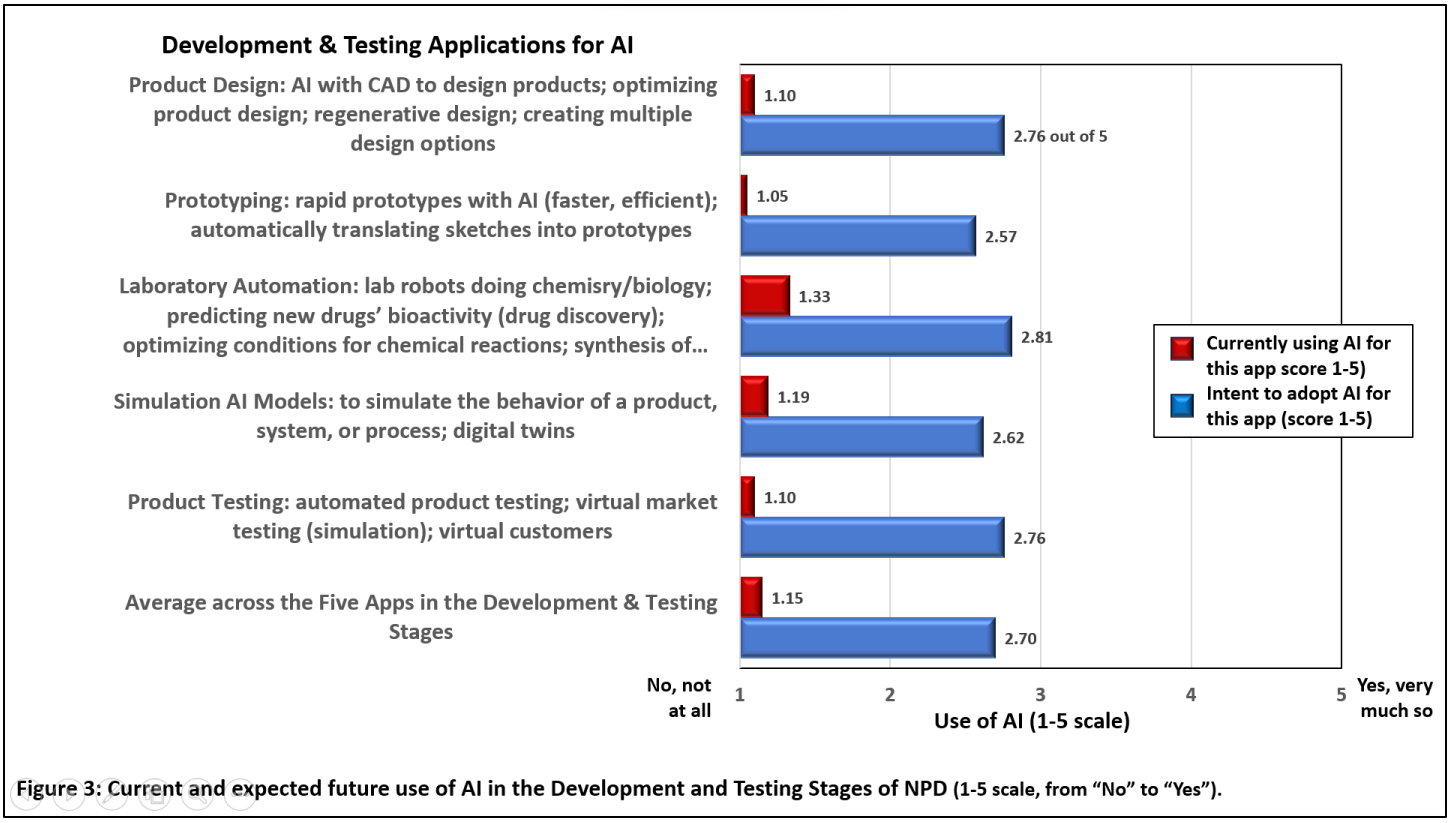


Figure 3: Current and expected future use of AI in the Development and Testing Stages of NPD (1-5 scale, from "No" to "Yes").

AI Applications in the Development and Testing Stages The picture is much the same as one moves along in the NPD process Into the Development and then the Testing stages in Figure 1. Here the "adoption scores" across five key applications – product design, prototyping, laboratory automation, simulation models (including digital twins), and product testing – are consistently low, averaging about 1.1 on a five-point scale (shown in Figure 3). Laboratory automation is slightly higher.

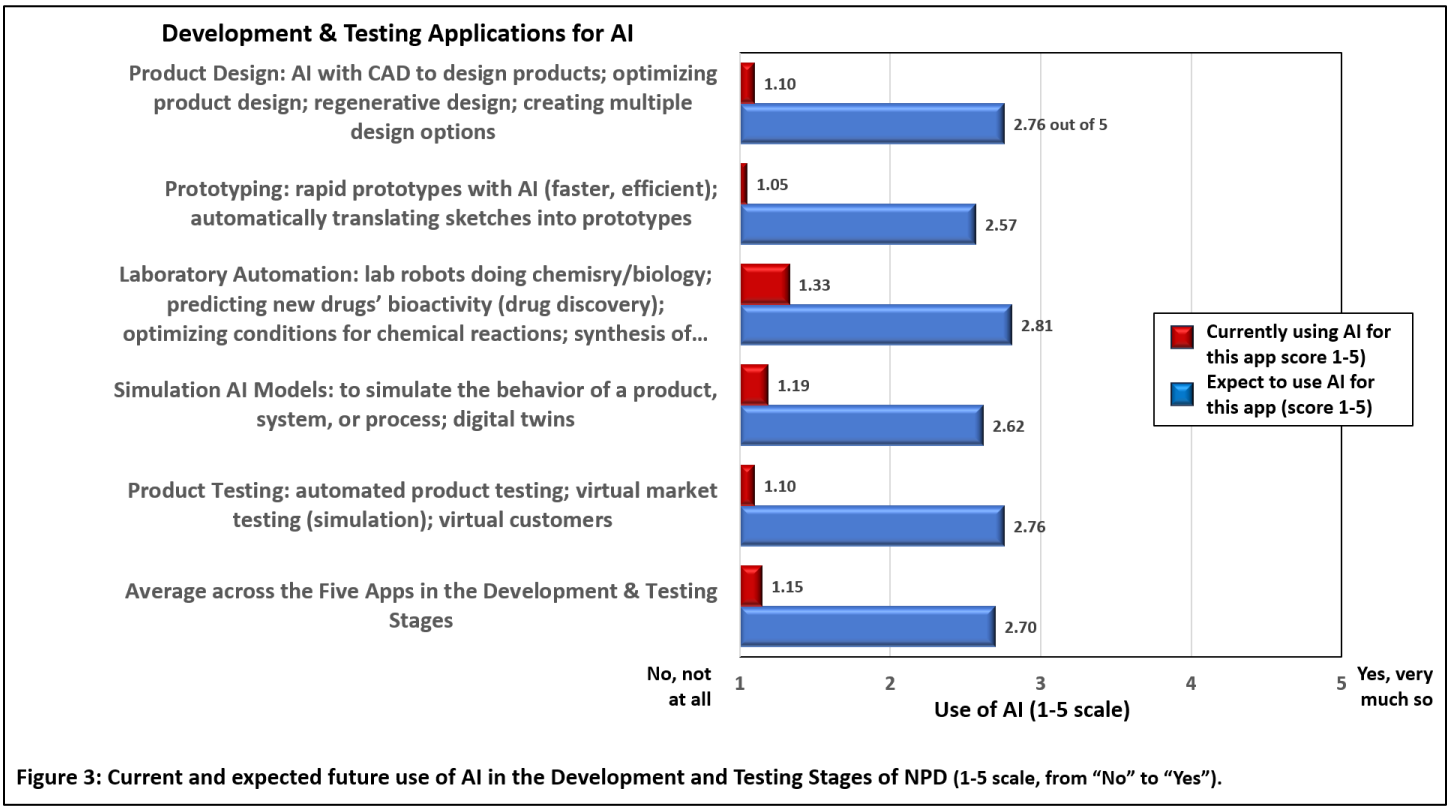


Figure 3: Current and expected future use of AI in the Development and Testing Stages of NPD (1-5 scale, from "No" to "Yes").

The "intention to use" scores are even lower than for the front-end activities in Figure 2 above. Here we see consistent scores of less than 3 out of 5; the average is 2.8 out of 5. Once again, deviations around this score is not high, suggesting that most businesses are clustered around this mean. The results point to a very low level of commitment to move forward with AI in Development and Testing applications.

Adoption of AI for Other Vital NPD Tasks Not every possible task or potential application of AI in NPD was investigated in the study, but three additional apps of particular interest were included, namely:

- AI for Project Management: creating project plans; optimizing Gantt charts; monitoring the progress of projects; identifying problems or late projects.
- AI for Portfolio Management (support for the PMO): tracking projects in the portfolio; identifying potential problems; automated preparation and distribution of project reports.
- Natural Language Processing (NLP): extracting information from unstructured data sources, such as customer reviews, social media posts, and market research reports.

The use of AI for Project and Portfolio Management in Figure 4 shows similar patterns to the previous applications displayed in Figures 2 and 3, namely *very low current usage* (average of 1.12 out of 5). Additionally, intentions to adopt are also fairly low, both below 3 out of 5.

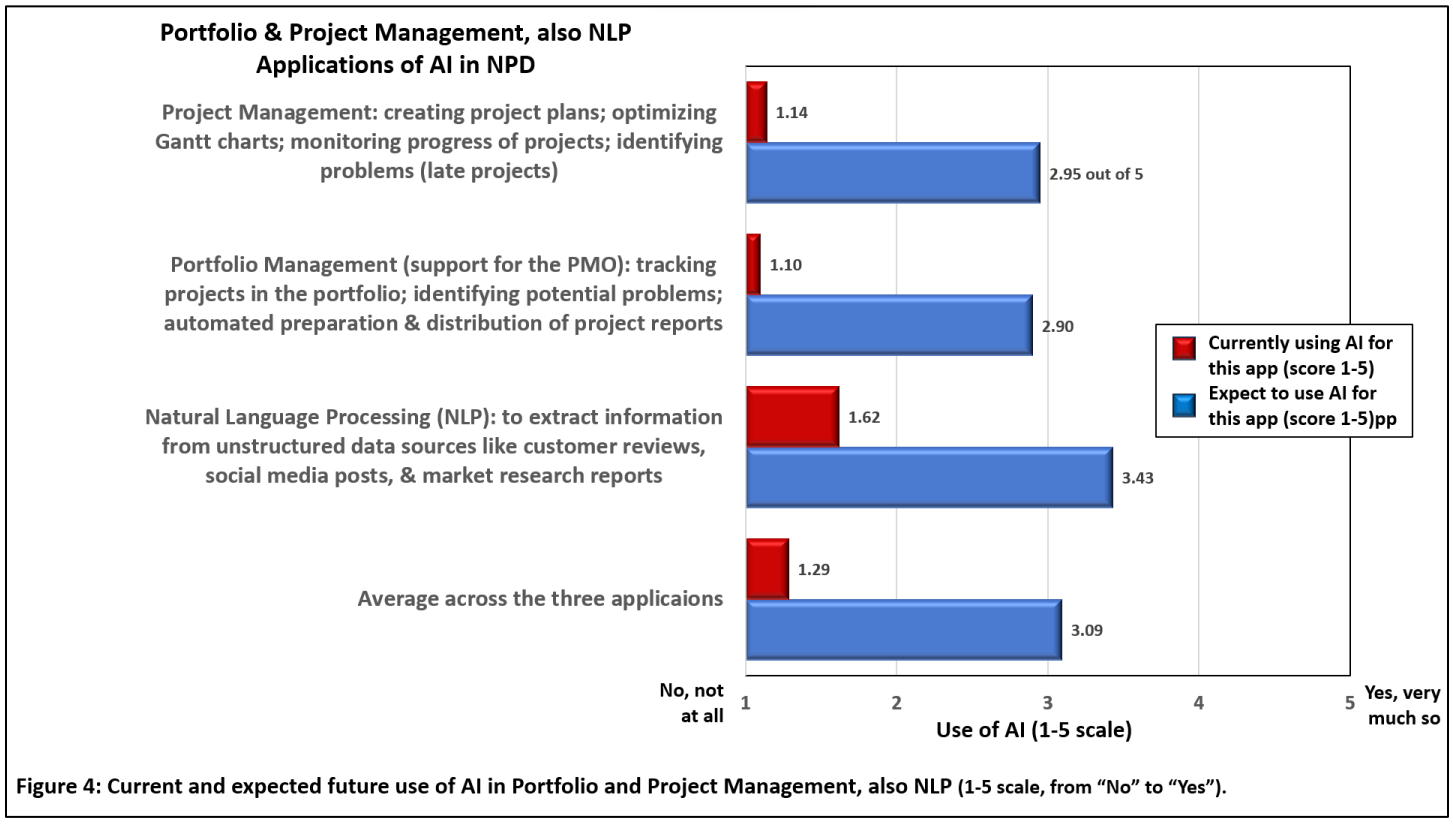


Figure 4: Current and expected future use of AI in Portfolio and Project Management, also NLP (1-5 scale, from "No" to "Yes").

The one application with some traction is the use of Natural Language Processing (NLP), which scores the highest "adoption intention" of all the 13 applications considered above – better, but still not a strong positive result. NLP has considerable potential in NPD for analyzing *unstructured text* or writing, in this case customer feedback

such as customer complaints, survey results, or from scanning blogs on the Internet. NLP can take unstructured data and draw conclusions from it, and even create charts and graphs. One application of NLP which sees considerable attention is analysing multiple data sources to gain insights into customer-points-of-pain and thus *identify gaps in the marketplace and potential opportunities*.[11] NLP and AI apps can even *generate new product concepts* from this types of unstructured data analysis. The "adoption intent" for NLP is also higher than for the other apps studied.

Performance Results Achieved *Types of AI applications* across the stages of the NP process in Figure 1 that are reported by the businesses are varied and include:

- Monitoring online for information (about 20% of businesses), including:
  - gaining insights and seeing innovations online;
  - monitoring media, social media;
  - digital marketing analytics; and
  - technical information extraction.
- Creating advertising or promotion copy text.
- Stock images, including generative imaging (AI creating images).
- Predictive formulations (e.g., for chemical or materials formulation).
- Operations and supply chain process optimization (several businesses).

Performance improvements achieved by using AI in NPD gauged across five metrics are shown in Figure 5. The performance metrics range from "reduced time-to-market" to "better decision-making". Performance results are very modest, averaging just 20% improvement across the five metrics, with none standing out. This result is not surprising, given that the level of adoption of AI apps is so low in the businesses. (One wonders whether or

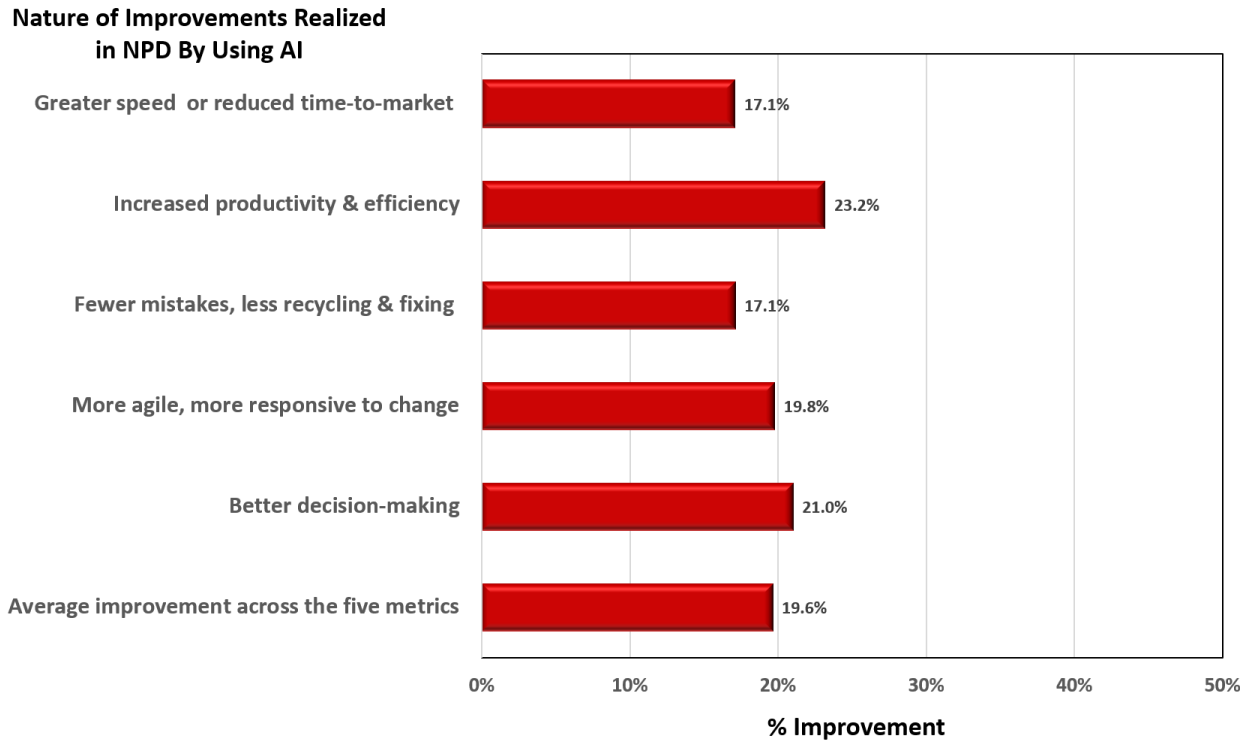


Figure 5: Improvements realized by using AI for NPD (% improvement).

not respondents were simply indicating "low to none" improvement, and so inserted a nominal answer of 20%; that the 20% thus may be even an overstatement).

A word of caution, however: One should not interpret the results in Figure 5 figure as evidence that AI provides minimal performance improvements in NPD! *Quite the opposite is true* for heavier adopters of AI. For example, GE, which employs AI for engineering design of new products, as noted above used AI to optimize product design and has seen *a 50% reduction in development time* in turbine development.[12] And Nestle has *increased its pace of product development by 60%* in 6 years by using AI.[13] So, the low performance results witnessed in Figure 5 *are not because AI, ML and NLP do not yield positive results in NPD*; the low results are because the sample of firms studied *have not really begun to implement AI in NPD* to any great extent.

Readiness to Adopt Given that the businesses studied have not really begun to implement AI, the main concern now is whether or not they are *ready to do so*. Fairly standard "adoption readiness" questions are posed, and the results are shown in Figure 6. The first two items are simply a confirmation of previous results – that the businesses have not adopted AI in NPD, nor have they achieved major performance improvements.

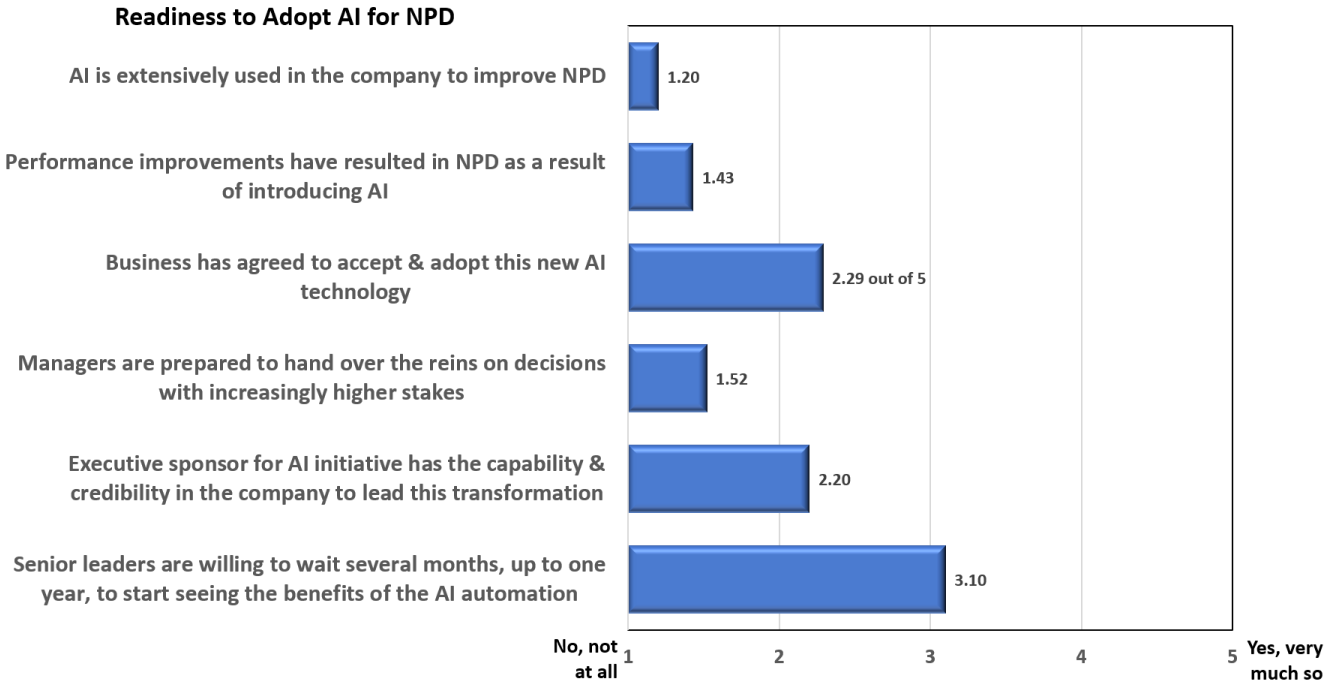


Figure 6: Readiness to adopt AI for NPD (1-5 scale, from "No" to "Yes").

How businesses fare on the next four readiness items in Figure 6 are troubling, as they indicate a modest to weak commitment and low willingness to adopt AI, at best. The typical business has not agreed to accept the concept of the AI technology for NPD; and the executive sponsor, if there is one, lacks the capability and credibility to lead this transformation. Both of these key readiness factors score a low 2.2 out of 5. Only the fact that that senior leaders are prepared to wait for up to a year to start seeing the benefits of AI is a positive sign, and even here the result is not particularly strong (a 3.1 out of 5).

Unlike the other "intent to adopt" measures in Figure 6, senior management's "willingness to wait" has a higher dispersion around it (a standard deviation of 1.41), because almost half the businesses indicate a willingness to wait for the benefits (a score of 4 or 5 out of 5), while 30% are "definitely not" or "likely not" willing to wait (a score of 1 or 2 out of 5). So almost half the businesses have hope here.

The very strong negative in Figure 6 is how low managerial *willingness to hand over the reigns on decision making* is – a very low 1.5 out of 5. This one indicator alone could mean a tough adoption journey for many of the AI apps in NPD.

Conclusions

The deployment of AI across a number of possible applications in NPD is very low for the business investigated. These results are a surprise, given the attention that AI has received in recent years, and the fact that a handful of early adopters have been using AI for several years now, and have made their journeys quite public and visible.

Equally, the "intention to adopt" is also quite low, and certainly cannot be described as a strong commitment to move forward with AI.

Messages for Management

1. **The AI Future is Here – It's Time to Take Action:**

"The ramifications for non-action will be swift: You either jump on board, or prepare to eat the dust of the other AI first-movers," says a recent *Forbes* article.[14] This is not the time to be sitting on the sidelines and waiting, watching, and dithering. Leading early adopter firms bought into AI some years ago, and have seen quite stunning results in NPD applications, far better, for example, than seen in the early days of adopting Lean or Agile NPD methods.

As noted above, too many businesses in this current study are not taking action, which could prove disastrous. Many are taking a "wait and see" attitude – except there is *ample evidence that shows that the results are strongly positive in early adopter firms.* Other firms appear unable or unwilling to act now.

2. **Undertake and AI Assessment and Needs Identification:**

Find out about AI and its potential for your business, not only for NPD but across the entire corporation (many good articles exist in *Forbes, Harvard Business Review*, and *Gartner* on where and how to apply AI in the business; undertake a search). Then, conduct a thorough assessment of your company's current operations, processes, and products to identify areas where AI can add value. This may involve understanding pain points, bottlenecks, or opportunities where AI can improve efficiency, reduce costs, enhance decision-making, or provide innovative solutions. (You might wish to benchmark your business on Deloitte's quick assessment quiz[15]).

3. **Educate and Build AI Awareness**:

Invest in educating your people about AI and its potential applications in your business's operations. Develop a foundational understanding of AI concepts, terminologies, and technologies to enable informed decision-making and strategy development (for illustrations of AI applications in NPD and many references and links, see the pre-pint of the article "The Artificial Intelligence Revolution in NPD," Oct 2023; Robert G. Cooper - Artificial Intelligence for NPD (bobcooper.ca)).

4. **Engage with AI Experts or Consultants**:

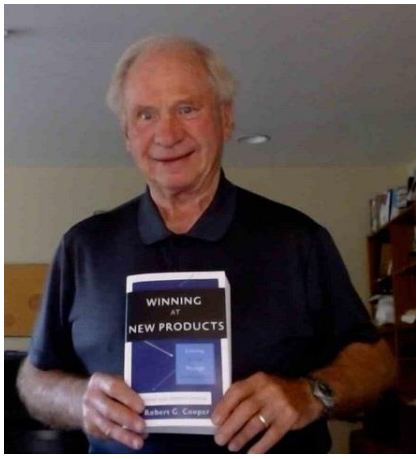
Consider engaging with AI experts, consultants, or specialized AI companies to assess your specific needs and develop a tailored AI strategy. These experts can help you understand the potential ROI, recommend suitable AI technologies, and formulate a roadmap for integrating AI into your product development processes.

5. **Develop an Enterprise-Wide Strategy for AI**

Experts agree that the AI journey is *not* about adopting AI on a piecemeal basis – one can become mesmerized by the many clever individual applications of AI in NPD or in marketing or production. Rather, this must be a *holistic transformation*: According to the strategy consulting firm, Deloitte: "One of the most frequently cited leading practices for AI transformation is the need for a bold, enterprise-wide strategy that is set and championed by an organization's highest leadership."

That time is now!

Bio-sketch of author:



Robert G. Cooper is Professor Emeritus at McMaster University's DeGroote School of Business (Canada), ISBM Distinguished Research Fellow at Penn State University's Smeal College of Business Administration, and a Crawford Fellow of the Product Development and Management Association (PDMA). He has published 11 books and more than 150 articles on the management of new products. He is the creator of the Stage-Gate® process. He has won the IRI's (Innovation Research Interchange) prestigious Maurice Holland Award three times. Cooper holds Bachelors and Master's degrees in chemical engineering from McGill University in Canada; and a PhD in Business and an MBA from Western University, Canada. Website: www.bobcooper.ca Contact: robertcooper@cogeco.ca

References, Good Reading & Links

[1] Knudsen, M. P., von Pedowitz, M., Griffin, A., and Barczak, G. 2023. "Best practices in new product development and Innovation: Results from PDMA's 2021 global survey." *Journal of Product Innovation Management* 40: 257–275. doi: 10.1111/ jpim.12663; and: Barczak, G., Griffin, A. and Kahn, K.B.2009. "Trends and drivers of success in NPD practices: Results of the 2003 PDMA best practices study." *Journal of Product Innovation Managem*ent 26: 3–23.

[2] Nieto-Rodriguez, A. and Vargas, R.V. Feb. 2, 2023. "How AI will transform project management." *Harvard Business Review* https://hbr.org/2023/02/how-ai-will-transform-project-management

[3] Bogaisky, J. March 6, 2019. "GE says it's leveraging Artificial Intelligence to cut product design times In half." *Forbes* GE Says It's Leveraging Artificial Intelligence To Cut Product Design Times In Half (forbes.com)

[4] Dominguez, L. April 21, 2023. "How Unilever expedites product innovation with AI, automation, and robots." *Consumer Goods Technology,* How Unilever Expedites Product Innovation With AI, Automation, and Robots | Consumer Goods Technology

[5] Watson, E. Aug. 18, 2023."'Concept Genie, build me a beverage concept with milk and lemon…' Ai Palette unveils generative AI tool to speed up new product development," *AFG Global Edition*, Ai Palette unveils 'Concept Genie' generative AI tool for rapid NPD (agfundernews.com)

[6] Eastwood, B. March 6, 2023. "Artificial intelligence can help design more appealing cars." *MIT Management* Artificial intelligence can help design more appealing cars | MIT Sloan

[7] ISBM. Sept 2023. ISBM-Penn State University Conference on "AI and the Transformational Effects on B2B Marketing": Chicago, IL.

[8] Nel, N. Feb. 6, 2023. "40 AI apps to streamline each stage of the product lifecycle," *Product Hunt* 40 AI apps to streamline each stage of the product lifecycle | Product Hunt

[10] Cooper, R.G. Oct 2023. "The Artificial Intelligence Revolution in New-Product Development," Penn State Institute for the Study of Business Markets Members Conference, Chicago IL: Sept 2023.

[11]Applied Marketing Science, 2023. "Powerful results: Skincare company Identifies compelling claim language, further differentiating their brand," *AMS Insights*, Powerful Results | Applied Marketing Science (ams-insights.com)

[12] Bogaisky, J. March 6, 2019. "GE says it's leveraging Artificial Intelligence to cut product design times In half." *Forbes,* GE Says It's Leveraging Artificial Intelligence To Cut Product Design Times In Half (forbes.com)

[13] Palzer, S. Nov 29, 2022. "Meaningful innovation to unlock growth." *Nestlé Investors Seminar,* Barcelona, Spain investor-seminar-2022-innovation-transcript.pdf (nestle.com)

[14] Deeb, G. Sept 6, 2023. "Artificial intelligence is taking over marketing," *Forbes*, Artificial Intelligence Is Taking Over Marketing (forbes.com)

[15] No author. "Becoming an AI-fueled organization: State of AI in the enterprise, 4th edition," *Deloitte Insights,* Becoming an AI-fueled organization | Deloitte Insights