

# Leveraging Artificial Intelligence and Collaborative Strategies for Innovative Product Development

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## Abstract

*The integration of artificial intelligence (AI) in new product development (NPD) is transforming technologically advanced industries. This paper examines the impact of AI in design and development, highlighting its advantages and potential drawbacks. We identify key challenges and propose strategic solutions to overcome them, aiming to develop a vision for effective AI incorporation in NPD. Our findings emphasize the need for a balanced approach to harness AI's capabilities while addressing its challenges to foster innovation and efficiency in NPD processes.*

**Keywords:** artificial intelligence, new product development, collaboration.

## 1. Use of AI in design and development

The integration of artificial intelligence (AI) tools in new product development (NPD) has enabled companies to streamline operations, enhance innovation, and reduce time-to-market. AI tools' capabilities to analyze large data sets quickly and accurately allow for more informed decision-making during the early stages of NPD (Cooper, 2024). For instance, machine learning algorithms can identify patterns and predict market trends, providing insights into consumer preferences and potential demand (Sullivan & Wamba 2024). AI tools can foster explorative and exploitative innovations and enhance organizational performance (Kumar et al. 2024).

AI tools enhance the efficiency of the development process through automation and optimization. Tasks such as conceptual design, prototyping, and testing can be significantly expedited with AI-driven tools. They optimize resource allocation by streamlining routine tasks such as workload balancing and scheduling and offering data-driven insights, leading to more efficient and cost-effective design processes. Generative design algorithms can create numerous design iterations

based on specific criteria, leading to innovative solutions that may not be conceived through traditional methods (Marion et al., 2023). AI-powered simulation and testing tools enable virtual prototyping, reduce the need for physical models, and allow for rapid iterations (Bendoly et al., 2023). Continuous learning from data ensures ongoing improvements in design, resulting in higher-quality products that meet industry standards and customer expectations.

Despite its numerous benefits, several significant challenges associated with AI in NPD exist. The high initial investment required for AI implementation, including costs for software, hardware, and specialized talent, can be prohibitive (Mithas et al., 2022). AI's reliance on existing patterns may limit creativity and innovation, potentially leading to more homogenized products. Quality of the data they are trained on limits AI's efficiency; biased or poor-quality data can lead to flawed outputs and suboptimal product designs (Akhtar & Ramkumar, 2023). Ethical and regulatory challenges due to data privacy and security exist since AI systems require access to vast amounts of sensitive information.

We aim to extend our understanding of the current usage of AI tools in NPD, provide further insights on the advantages and challenges of collaborating with AI, and discuss considerations to amplify benefits and mitigate complications.

## 3. Case studies

We conducted case studies and collected data in 2024 from nine individuals with at least five years of experience in innovative endeavors, holding roles such as senior director, senior manager and manager overseeing NPD projects and portfolios in manufacturing, food and beverage, information technology (IT), finance, education, and sourcing industries. We gathered the information via a standardized, open-ended case study interview tool composed of 17 questions. 78% of the participants

responded that they have incorporated AI into their NPD process at some level, and all had initiatives in pipeline for (further) application of AI in product development.

### 3.1. Case study observations

**3.1.1. Collaboration with AI tools.** A common theme among the managers is the use of AI as a collaborative tool for NPD. Rather than simply delegating tasks to AI or replacing personal skills, AI aids development projects in multiple ways. For example, managers agree that AI's efficacy in pattern recognition bridges the gap between market trends and demands, facilitating diverse and innovative concepts during the planning phases. However, human intervention is crucial to ensure the practicality and feasibility of the alternatives generated, even in the early conceptualization stages.

Through our case study, we gathered several use cases on how AI is employed as a collaborative tool. One manager from the IT industry indicated that AI is useful in determining the timing of predictive maintenance on IT systems. AI and machine learning techniques are utilized to analyze sensor data from the equipment and forecast when maintenance would be necessary to avoid system breakdowns. Human and AI collaboration is evident: the manager ensures the accuracy of the data provided to the AI systems by leveraging the data infrastructure he specifically built for AI use.

A senior director of a project focused on testing and quality assurance for resume evaluation and screening tools indicated that generative AI has been useful in automating mundane tasks so far. However, a deeper utilization of AI is planned, where the initial screening of resumes will be delegated to AI tools.

In the sourcing industry, where new processes are being developed for forecasting in-house production and materials planning, AI tools are currently employed in a limited format. They are being established for the initial drafting and finalization of project plans and flowcharts, ensuring that safety standards are satisfied.

The manager of an innovation project focused on developing an automated account management tool emphasized the immense usefulness of consolidating decades of volatile financial data, such as currency trends across numerous countries. AI tools have eliminated the need to manually search multiple databases, record, and sort the data, allowing for speedy and effective processing and utilization of this information. Similarly, a software development manager whose clients are mostly in the manufacturing industry for outdoor and recreational goods leverages the efficiency and speed of AI tools

to sort through bulk data.

The manager of product development for K-8 social studies curriculum indicated that AI tools are most useful in the critical step of retrieving content from online sources. AI tools search for and find information, images, and articles for instructional designers. The project manager and instructional designers then curate and verify this content, working together to develop the curriculum.

**3.1.2. Key advantages and challenges.** Several key benefits of collaborating with AI tools emerged from our interviews. Time savings were unanimously mentioned, ranging from moderate savings through rapid access to information and solutions to weeks deducted from project timelines. Other commonly expressed benefits included more efficient workflows, increased accuracy, and ensuring adherence to rules and regulations. AI tools' ability to perform sentiment analysis efficiently and rapidly to achieve customer satisfaction while delivering authentic yet generalizable outputs was emphasized. Managers noted that they could tackle larger-scale projects without increasing the workforce size. AI is also utilized for authenticating manually collected data or conducting rough analyses.

The managers identify multiple challenges associated with AI-human collaboration. One manager described the collective frustration as "knowing how to get exactly what you are looking for." Ensuring sufficient, high-quality data for training AI models is also frequently emphasized as a critical issue.

Overreliance on AI tools by team members and attempting to apply AI output without diligent confirmation of its accuracy, relevancy, and practicality also emerged as common issues. The output of AI requires vetting and verification, as the information presented may be a "first best" local optimum with incomplete or imprecise details based on the tool employed and the prompts used. One manager emphasized the urgent need to teach others that AI is a tool and does not replace the need to review and verify. This was echoed by others: "Often, AI will get code wrong or source unreliable information, and you end up having to babysit it. There is a necessity to scrutinize AI output "with a fine-tooth comb before employing it."

## 4. Discussion and Conclusions

Our study reveals significant variability in how AI is perceived. Many view AI as automation or data simulation, rather than a system capable of creating unique solutions and determining its own pathways based on constraints. For instance, a software

manager described AI as automating code testing rather than designing its own mechanisms to achieve specific objectives. We highlight key points for NPD managers to consider for successful AI integration.

NPD managers should first understand the intricacies of the NPD process and identify the areas that would benefit most from AI applications. Only then, they should find the best-matching technology. Rather than diving headfirst into AI initiatives to become leaders in AI integration, managers should step back, clearly define the problem, and ensure clarity on the availability of data and resources. We developed a framework to map AI applications to different phases of the NPD process (Figure 1).

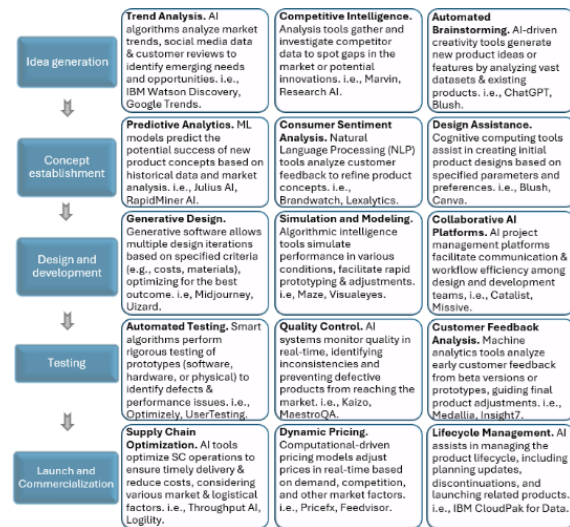


Figure 1: AI applications through NPD phases

AI is not (yet) a tool for managing NPD processes end-to-end. In different projects, some parts of the NPD process may be more "AI-ready" than others. For example, tasks such as documentation or simulation can be delegated to AI tools, while other steps, like identifying the prototype to advance, still require the intuition of a product manager. NPD managers should combine experiential learning with insights from successful AI-driven projects. These experiences serve as valuable resources for determining AI readiness for product development activities. Chevron's use of AI-driven projects as case studies for internal development is one example illustrating AI's transformative potential (Ransbotham & Khodabandeh, 2023).

Our study also highlights the challenge of ensuring the accuracy of AI-provided information. Factors such as algorithmic biases, the complexity of real-world scenarios, and changes in the operating environment affect AI outcomes. However, one of the most impactful factors is the accuracy and

completeness of the data available to the AI, whether for training or as inputs. NPD managers should ensure data accuracy by employing data governance frameworks, robust data collection procedures, automated cleaning tools, and clear data protocols. Key actions for managers include building stringent data management systems, like those of the Mayo Clinic, which ensure reliability in its AI diagnostic tools (Halamka, 2023). Other ways managers should employ are forming strategic partnerships for access to diverse and high-quality data sets, exercising caution when combining data from multiple sources, conducting routine data quality audits, and integrating real-time data from IoT systems are also essential. Finally, closing the loop with AI tools safeguard against data corruption and disruption is crucial to maintaining accuracy.

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