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Case Study

Beyond Code Generation: AI Across the Product Development Lifecycle

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Abstract

Artificial intelligence (AI) is becoming an important part of modern product development. However, most existing studies focus on software development or individual AI applications rather than the entire product lifecycle. This study explores how AI can support different stages of product development in a lean technology startup. A comparative case study was conducted using two similar product development projects completed by the same company. The projects had similar functionality, target market, technology stack, and development process, but differed in the level of AI adoption. The study combined quantitative analysis of labor effort with qualitative observations of how AI tools were used throughout the product lifecycle. The results show that AI supported activities from market research and hypothesis validation to software development, testing, release preparation, and post-release product improvement. The greatest benefits were observed in research, requirements preparation, documentation, and design, while software development and testing also became more efficient. Overall labor effort was reduced by 35.8% in the AI-assisted project. The findings suggest that AI can support the entire product development lifecycle, helping lean startup teams work more efficiently while leaving key decisions and expert judgment to people.

Keywords: artificial intelligence, product development, product lifecycle, product management, lean startup, generative AI, software development, digital product development, productivity, technology startup

1. Introduction

Developing a digital product is a long, complex, and multi-stage process. It starts long before the first line of code is written.

Product development usually begins with defining the purpose of the product and identifying the problems it is expected to solve for users. It then includes market research, competitor analysis, generating and validating product hypotheses, preparing requirements, designing the user experience, software development, testing, product launch, and the ongoing improvement and promotion of the product. As a result, a significant part of product development is not software engineering itself, but research, information analysis, documentation, communication, and decision-making.

Building a successful digital product requires a multidisciplinary team. Each stage of the product lifecycle involves specialists with different skills, including product managers, project managers, business analysts, designers, software developers, QA engineers, DevOps engineers, marketing specialists, and others.

For technology startups, building and maintaining such a team is especially challenging. In the early stages,

startups usually operate with limited financial resources and a high level of uncertainty. The product often generates little or no revenue, while the company must still cover the costs of salaries, infrastructure, and product development. At the same time, startups need to validate ideas quickly, release minimum viable products (MVPs), deliver frequent updates, and respond rapidly to market changes. Under these conditions, using available resources efficiently becomes one of the key factors for success.

In recent years, artificial intelligence (AI) has become one of the most discussed topics in the technology industry. More and more companies are exploring how AI can improve different aspects of digital product development.

Early research mainly focused on using AI for software development and code generation. Today, however, it is clear that AI can support a much wider range of activities. Modern AI tools are used for market research, information analysis, requirements engineering, documentation, interface design, software development, testing, and decision support.

As a result, AI is becoming part of the daily work of product teams. Instead of being used only for individual tasks, AI is increasingly acting as a permanent assistant throughout the entire product development lifecycle.

This shift is changing the way product teams work. AI influences how responsibilities are distributed within teams and changes the skills that specialists need in their daily work.

Despite the growing interest in AI, most existing research continues to examine AI as a collection of tools that improve individual activities, such as software development, documentation, or information processing. Much less attention has been given to AI as an integrated capability that supports the entire product development lifecycle and reshapes the way product teams organize their work. As AI becomes embedded in everyday product development, the key research challenge is no longer whether AI improves individual tasks, but how it changes the overall product management process. This gap is especially important for lean technology startups, where small cross-functional teams must continuously balance limited resources, rapid experimentation, and fast product delivery.

Rather than evaluating AI as a standalone technology, this study adopts a product management perspective. It examines how different AI tools interact across successive stages of product development and proposes a lifecycle-oriented view of AI adoption, in which AI becomes an operational capability integrated into the everyday work of product teams rather than a set of isolated productivity applications.

To address this gap, this study investigates the following research question: **How can AI tools support different stages of the product development lifecycle in a lean technology startup, and at which stages can the greatest benefits be achieved?**

2. Literature Review

2.1. AI in Software Development

The use of artificial intelligence in software development has become one of the most actively studied topics in recent years.

One of the best-known studies was conducted by Peng et al. [1]. The authors found that developers using GitHub Copilot completed coding tasks about 55% faster than those who worked without AI assistance. The greatest improvements were observed in routine programming tasks and the implementation of standard code.

Similar findings were reported by Vaithilingam et al. [2], who examined how AI tools affect software development. Their study showed that AI can significantly reduce the time required for routine programming tasks. However, the benefits largely depend on the developer's experience and ability to evaluate AI-generated

suggestions.

More recent studies suggest that AI is no longer used only for writing code. It also supports code review, bug detection, architecture analysis, and other engineering tasks (Adamantiadou et al. [3]).

Overall, existing research shows that AI can improve developer productivity and help software teams complete many development tasks more efficiently. At the same time, most studies focus on software engineering activities, while much less attention has been given to the use of AI across the broader product development lifecycle.

2.2. AI and Knowledge Work

Although early research on AI in digital product development focused mainly on software engineering, recent studies have increasingly explored the use of AI in other types of knowledge-intensive work.

Drucker [4] was one of the first to describe the growing role of knowledge workers - professionals whose work is based on analyzing information, preparing documents, communicating with others, and making decisions. Today, this group includes business analysts, product managers, project managers, marketing specialists, and many other professionals.

As the importance of knowledge work has grown, so has the interest in applying AI to these activities. Davenport [5] argues that knowledge workers create value primarily through information processing, analysis, communication, and decision-making, making their work particularly well suited for AI support.

Noy et al. [6] found that AI significantly improved the productivity of professionals performing writing and information-processing tasks. Participants completed their work faster and, in many cases, produced higher-quality results than those who worked without AI.

Similar conclusions were reported by Brynjolfsson et al. [7], who showed that AI helps professionals work more efficiently by speeding up information search, analysis, and organization. Rather than replacing people, AI was found to complement human expertise and improve overall performance.

Recent studies also suggest that AI can improve productivity across many knowledge-intensive occupations, particularly those involving writing, analysis, and information synthesis (Bubeck et al. [8]; OpenAI [9]). Adamantiadou et al. [3] further note that AI is especially effective for tasks such as information gathering, data analysis, documentation, requirements preparation, and communication support.

Overall, the existing literature shows that AI has become an effective tool for many types of knowledge work. However, most studies examine individual professions or specific tasks, while little attention has been paid to how AI supports different knowledge-based activities throughout the entire product development lifecycle.

2.3. AI in Product Management

Compared with software development, the use of AI in product management has received much less attention in the research literature.

The role of a product manager covers a wide range of activities. These include identifying customer problems, conducting market and competitor research, generating and validating product ideas, preparing and prioritizing requirements, managing the product backlog, communicating with stakeholders, and making product decisions throughout the product lifecycle.

Many of these activities involve working with large amounts of information, preparing documents, and making decisions. As a result, they are well suited for AI support. Modern AI tools can help product managers collect

and analyze information, generate ideas, prepare product documentation, organize requirements, and improve communication within the team.

Although interest in AI beyond software development has grown rapidly in recent years, research on the use of AI in product management remains limited. Most existing studies focus on individual tasks or specific AI applications rather than examining how AI supports product managers throughout the entire product development process (Cooper [10]; Cagan [11]).

This creates an important research gap. There is still limited evidence on how AI can support product management activities across the entire product lifecycle and how its use affects the work of product teams in real projects.

2.4. AI Adoption in Startups

Recent studies suggest that AI is becoming an important part of digital transformation. Organizations increasingly use AI not only to automate individual tasks but also to improve business processes and support decision-making (Vial [12]).

However, most existing research focuses on large organizations or well-established companies with mature business processes (Taboada et al. [13]; Salimimoghadam et al. [14]). Much less attention has been given to startups.

Technology startups operate under very different conditions. They usually have limited financial resources, small teams, and a high level of uncertainty. At the same time, they need to validate product ideas quickly, release MVPs, respond to user feedback, and adapt to changing market conditions.

These characteristics closely match the Lean Startup approach proposed by Ries [15], which emphasizes rapid experimentation, continuous customer feedback, and data-driven decision-making. In this environment, even small improvements in team productivity can have a significant impact on development costs, time to market, and the efficient use of limited resources.

Many startups are already integrating AI into their daily work. AI is used for market research, documentation, content creation, interface design, software development, testing, and other product-related activities. However, despite the growing adoption of AI in practice, there is still limited empirical evidence showing how AI is used throughout the product development lifecycle in lean startup environments.

2.5. Research Gap

The studies reviewed above show that AI can improve the efficiency of software development teams as well as professionals performing knowledge-intensive work. However, most existing research focuses on individual activities, specific AI applications, or particular professional roles.

Much less attention has been given to how AI supports the entire product development lifecycle and how different AI tools are used together across multiple stages of product development.

This gap is especially noticeable in studies of lean technology startups. Although many startups already use AI for market research, requirements preparation, design, software development, testing, and product launch, there are still relatively few empirical studies based on real product development projects.

This study addresses this gap by examining the practical use of AI throughout the entire product development lifecycle in a lean technology startup. It analyzes how different AI tools support product teams at different stages of development and identifies the stages where AI provides the greatest benefits.

2.6. Contributions of the Study

This study makes four contributions to the literature.

First, it extends the current discussion of AI beyond software engineering by examining how AI supports the entire product development lifecycle rather than isolated development activities. The study adopts a lifecycle-oriented product management perspective that views AI as part of an integrated product development process.

Second, it provides empirical evidence from a comparative real-world case study of two highly comparable digital product development projects completed within the same lean technology startup. This research design makes it possible to observe how AI influences product development under realistic organizational conditions while minimizing differences unrelated to AI adoption.

Third, the study identifies the stages of the product development lifecycle where AI currently delivers the greatest practical benefits. Rather than evaluating AI as a single productivity tool, it demonstrates how different AI applications support different categories of product work, including research, requirements engineering, design, software development, testing, release preparation, and post-release improvement.

Finally, the study contributes to the emerging field of AI-enabled product management by showing how the integration of AI changes the distribution of responsibilities within lean product teams. The findings suggest that AI should be viewed not only as a technology for automating individual tasks, but also as an operational capability that enables product teams to perform a broader range of activities with existing resources.

3. Materials and Methods

3.1. Method

This study uses a case study approach to examine how artificial intelligence is applied at different stages of the digital product development lifecycle and what results can be achieved through its use.

A case study was chosen because the use of AI in product development is still a relatively new area, and there are only a limited number of studies based on real product development projects. This approach makes it possible to examine how AI is used in a real working environment and to better understand its role in a lean technology startup.

The study is based on a comparative analysis of two digital product development projects completed by the same company at different points in time. The first project was developed without AI tools, while the second project actively used AI throughout the entire product development lifecycle.

The main objective of the study is to understand how AI was used at different stages of product development and how it affected team organization, labor effort, and the overall project budget.

The case company is a technology startup operating in the cybersecurity industry.

One of the company's main activities is the development of digital products for both B2B and B2C markets. Its product portfolio includes mobile applications, desktop applications, browser extensions, and other digital services.

At the time of the study, the company had completed the development and market launch of one VPN product and had subsequently developed a second product with a similar feature set but a different market positioning. Both products were created for the same platforms (iOS, Android, Windows, and Web) and targeted the same customer segment.

The two projects provided a suitable basis for comparison because they were carried out within the same organization using a similar technology stack, development methodology, and product strategy. Both products included the same core functionality, such as user authentication, subscription management, VPN connectivity, server selection, and account management. The second project was not intentionally simplified or reduced in scope.

For this reason, the projects were considered sufficiently comparable for evaluating the impact of AI on the product development process. They represented the only product initiatives within the company that shared similar functionality, target users, development conditions, and organizational environment, allowing the analysis to focus primarily on differences related to AI adoption.

Both projects followed the same product development lifecycle, including market research, competitor analysis, hypothesis generation and validation, requirements engineering, UI/UX design, software development, testing, release preparation, and product launch.

The projects were also developed under typical lean startup conditions, including limited financial resources, small cross-functional teams, rapid MVP delivery, continuous validation of product hypotheses, and frequent adaptation to changing market conditions.

To improve the validity of the comparison, labor effort related to the existing backend infrastructure was excluded from the analysis. The same backend platform was used in both projects and therefore did not influence the comparison.

3.2. Data Collection

Data for this study were collected throughout both projects using information routinely recorded in the company's project management and software development systems. The main data sources included task-tracking systems, knowledge management platforms, sprint planning documents, burndown reports, product roadmaps, budget records, and project dashboards.

Labor effort was evaluated using completed task records and the corresponding person-hours reported by team members as part of the company's regular project management process. Work logs were reviewed during sprint planning, sprint reviews, and project reporting. The company used Jira as its primary project management system. Team members recorded the time spent on completed tasks as part of their regular workflow. These records were routinely reviewed during sprint planning, sprint reviews, and project reporting, providing the basis for the labor effort analysis conducted in this study. Each completed task was assigned to one of several activity categories, including research, requirements engineering, documentation, design, software development, testing, and release preparation.

Total labor effort was calculated by summing the person-hours spent by all team members on project activities. To ensure a fair comparison, work related to the existing backend infrastructure, which was reused in both projects, was excluded from the analysis.

The collected data were then grouped by activity category and compared across the two projects to identify the stages where AI had the greatest impact on team efficiency.

The analysis focused on several aspects of AI adoption, including:

- the ways AI tools were used;
- changes in development workflows;
- the impact of AI on different types of activities;

- changes in labor effort;
- changes in the distribution of responsibilities within the team.

In addition to quantitative data, the study included qualitative observations collected during project execution. These observations covered changes in team responsibilities, everyday AI usage, and the influence of AI on project organization and delivery.

Because the author managed both projects, the study also benefited from direct observations made throughout project planning, execution, and monitoring.

As this study compares two real-world product development projects rather than experimental groups, statistical significance testing was not performed. The objective was analytical rather than statistical generalization, with the aim of providing an in-depth understanding of AI adoption in a real organizational setting.

3.3. AI Tools Used

During Project B, the team used several AI tools throughout the product development lifecycle. The main tools included:

- ChatGPT;
- Claude;
- GitHub Copilot;
- Codex;
- Figma AI;
- Lovable;
- BrowserStack AI.

These tools supported a wide range of activities, including market research, competitor analysis, requirements engineering, documentation, interface design, software development, testing, and release preparation.

To provide a clearer overview, Table 1 summarizes the AI tools used at different stages of the product development lifecycle.

Table 1. AI tools used across the product development lifecycle.

Lifecycle Stage	AI Tools	Primary Use
Research	ChatGPT, Claude	Market research and competitor analysis
Hypothesis Validation	ChatGPT, Claude	Idea generation and scenario analysis
Requirements	ChatGPT, Claude	User stories and requirements preparation
Design	Figma AI, Lovable	UI concepts and prototypes
Development	GitHub Copilot, Claude, Codex	Code generation and programming support
Testing	BrowserStack AI, ChatGPT	Test case generation and quality assurance
Release	ChatGPT, Claude	Release notes and user communication

The use of AI was not treated as a separate experiment. Instead, these tools became part of the team's everyday workflow and were used as regular working tools throughout the project.

Generative AI was also used during the preparation of this manuscript. ChatGPT (OpenAI, GPT-5.5) assisted with language editing, translation, literature search, and the preparation of figures. All AI-generated outputs were reviewed, revised, and verified by the author. Generative AI was not used to generate or modify the quantitative labor-effort data reported in this study.

3.4. Study Limitations

The findings of this study should be interpreted with several limitations in mind.

First, the analysis is based on two product development projects completed within a single technology startup. Although this provided an opportunity to observe AI adoption in a real business environment, the results may not fully represent organizations with different products, industries, or development processes.

Second, the differences observed between the two projects cannot be attributed entirely to the use of AI. By the time the second project started, the team had gained additional experience, improved internal collaboration, and developed a better understanding of the product domain. While work related to the shared backend infrastructure was excluded from the analysis, the accumulated experience of the team may still have influenced overall project efficiency.

Another limitation is the fast pace of AI development. AI tools are evolving rapidly, and their capabilities continue to improve. As a result, the findings presented in this study reflect the state of AI technologies available during the period when the projects were carried out.

Finally, the way AI was adopted was shaped by the company's own development processes, organizational structure, and management practices. Other organizations may integrate AI differently and therefore achieve different outcomes.

Despite these limitations, the study provides real-world evidence of how AI can support product development in a lean technology startup. It also offers practical insights into the impact of AI on team performance, resource utilization, and the organization of product development activities.

4. Results

In Project B, AI was used throughout the entire product development lifecycle. Unlike the traditional approach, where AI is mainly seen as a tool for writing code, the team used AI for a much wider range of activities, from market research to release preparation and post-release product improvement.

4.1. Market Research and Competitive Analysis

Product development began with identifying the problems the product was intended to solve, understanding users' needs, conducting market research, and analyzing competitors.

At this stage, AI was used to collect information about potential users, identify existing solutions, analyze competitors and their products, explore market trends, understand industry limitations, and prepare research materials.

ChatGPT and Claude helped the team quickly search, collect, and organize information from a large number of sources. Instead of manually reviewing dozens of articles, market reports, websites, and product reviews, the team used AI to prepare an initial overview of the market and identify the most promising directions for

further research.

AI was also used to create competitor comparison tables, identify the strengths and weaknesses of competing products, and generate ideas for features that could differentiate the product from existing solutions.

Overall, AI significantly accelerated the initial research phase and reduced the time required to prepare analytical materials.

4.2. Hypothesis Validation

After completing the initial research, the team moved on to generating and validating product hypotheses.

At this stage, AI was used to explore different product scenarios, suggest alternative ways of implementing specific features, and identify potential risks.

AI did not replace the team's expertise or decision-making. Instead, it helped the team evaluate different options more quickly and identify additional factors that might have been missed during research and team discussions.

4.3. Requirements Engineering and Documentation

Preparing requirements and project documentation was one of the areas where AI delivered the greatest benefits.

ChatGPT and Claude were used to prepare business requirements, user stories, acceptance criteria, and technical documentation. AI also helped convert unstructured notes and meeting outcomes into clear and well-organized requirements that could be easily understood by the entire team.

Many tasks that had previously been completed manually required much less time. However, all AI-generated materials were reviewed, edited, and approved by team members before being used in the project.

4.4. Design and Prototyping

During the design stage, AI supported the creation of initial screen concepts, user experience ideas, and interactive prototypes. Figma AI and Lovable were the main tools used for these activities.

AI made it easy to generate multiple interface concepts, refine them quickly, and visualize product ideas at an early stage of development.

Although the final design decisions were made by designers and the product team, AI reduced the number of design iterations and helped the team prepare prototypes much faster.

4.5. Software Development

Software development remains the most widely studied area of AI application.

In Project B, the development team used GitHub Copilot, Claude, and Codex to support coding, refactoring, code review, and bug fixing. The greatest benefits were observed during routine programming tasks and code review activities.

AI did not replace software developers. All AI-generated code was reviewed and, when necessary, modified by the development team. For complex architectural decisions and critical implementation tasks, engineers remained responsible for the final solution.

4.6. Testing and Quality Assurance

AI also supported the testing process. ChatGPT and Claude were used to generate test scenarios, prepare test data, and simplify the creation of testing documentation. In some cases, AI also helped analyze software defects and identify possible causes of bugs.

These activities reduced the amount of routine work performed by QA engineers, allowing them to spend more time on testing tasks that required professional judgment and manual verification.

4.7. Release Preparation and Product Launch

During release preparation, AI was used to create release notes, user documentation, marketing materials, and promotional content.

ChatGPT, Figma AI, and Lovable also helped the team keep track of changes in the submission requirements for the Apple App Store, Google Play, and the Microsoft Store. In addition, these tools were used to generate banners, product descriptions, and other marketing assets.

After the product launch, AI continued to support the team by analyzing user feedback, processing reviews, and generating ideas for future product improvements.

Overall, the results show that AI can support much more than software development. In the studied startup, AI became part of the team's everyday workflow and was used throughout the entire product development lifecycle, from the initial research phase to post-release product improvement (Figure 1).

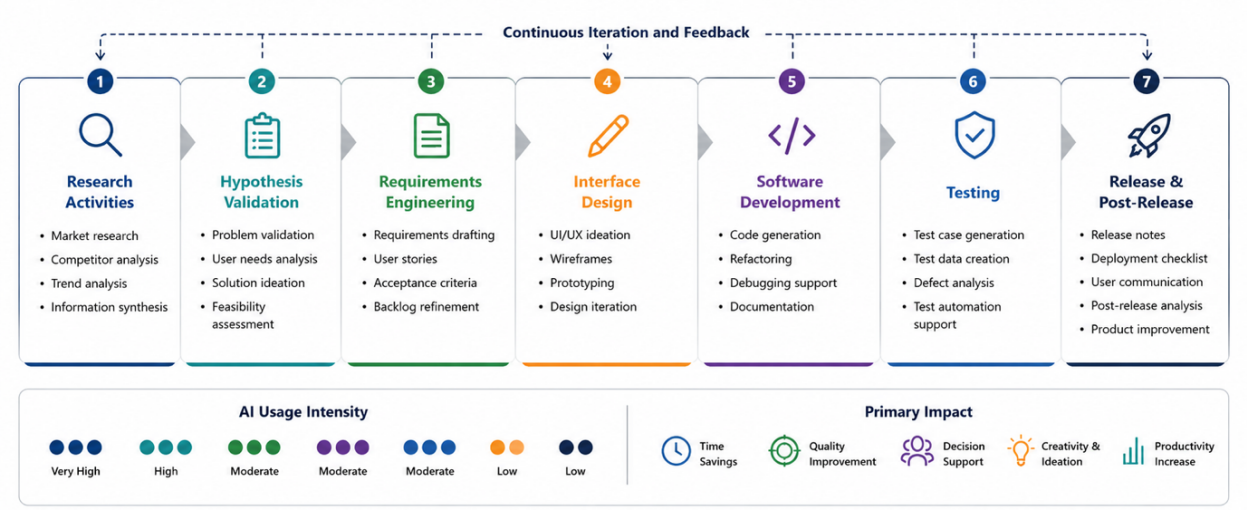

Figure 1. AI Usage Across the Product Development Lifecycle. AI tools were integrated throughout the entire product development lifecycle, supporting both knowledge work and technical execution.

Note: The intensity of AI usage reflects how extensively AI tools were applied in each stage of the studied projects.

Legend: The numbers (1–7) correspond to the stages of the product development lifecycle described in Section 2.2.

4.8. Quantitative Results

In addition to qualitative observations, the study made it possible to evaluate the impact of AI on labor effort across different stages of the product development lifecycle.

The comparison of the two projects showed that the benefits of AI were not the same across all activities. The largest reductions in labor effort were observed in research, requirements engineering, documentation,

and information analysis. These activities involve working with large amounts of information, preparing documents, and analyzing data, which closely matches the current strengths of modern AI tools.

A significant improvement was also observed during the design stage. AI proved especially useful for creating early prototypes and exploring different interface concepts. It enabled the product manager to quickly turn ideas into prototypes, make changes, share them with the team, and refine them based on feedback without involving a designer in every iteration.

The impact of AI was less pronounced in software development and testing. Although AI accelerated many routine tasks, these activities still required professional expertise, engineering judgment, and careful review of the generated results.

Table 2 presents the distribution of labor effort across the main product development activities. The results show that AI reduced labor effort in almost every stage of the product development lifecycle.

Table 2. Labor effort by product development activity.

Activity	Project A	Project B	Change
Requirements Preparation	40 h	24 h	-40%
Research Activities	40 h	16 h	-60%
Documentation Preparation	80 h	40 h	-50%
Design Prototyping	40 h	16 h	-60%
Software Development	400 h	280 h	-30%
Testing	120 h	80 h	-33%
Release Preparation	40 h	32 h	-20%

The largest reduction in labor effort was observed in research activities and design prototyping (60%), followed by documentation preparation (50%) and requirements engineering (40%).

Overall, total labor effort in Project B was 35.8% lower than in Project A (Figure 2). These findings suggest that the greatest benefits of AI can be achieved in activities related to information processing, documentation, and decision support, while software development and testing continue to rely heavily on human expertise.

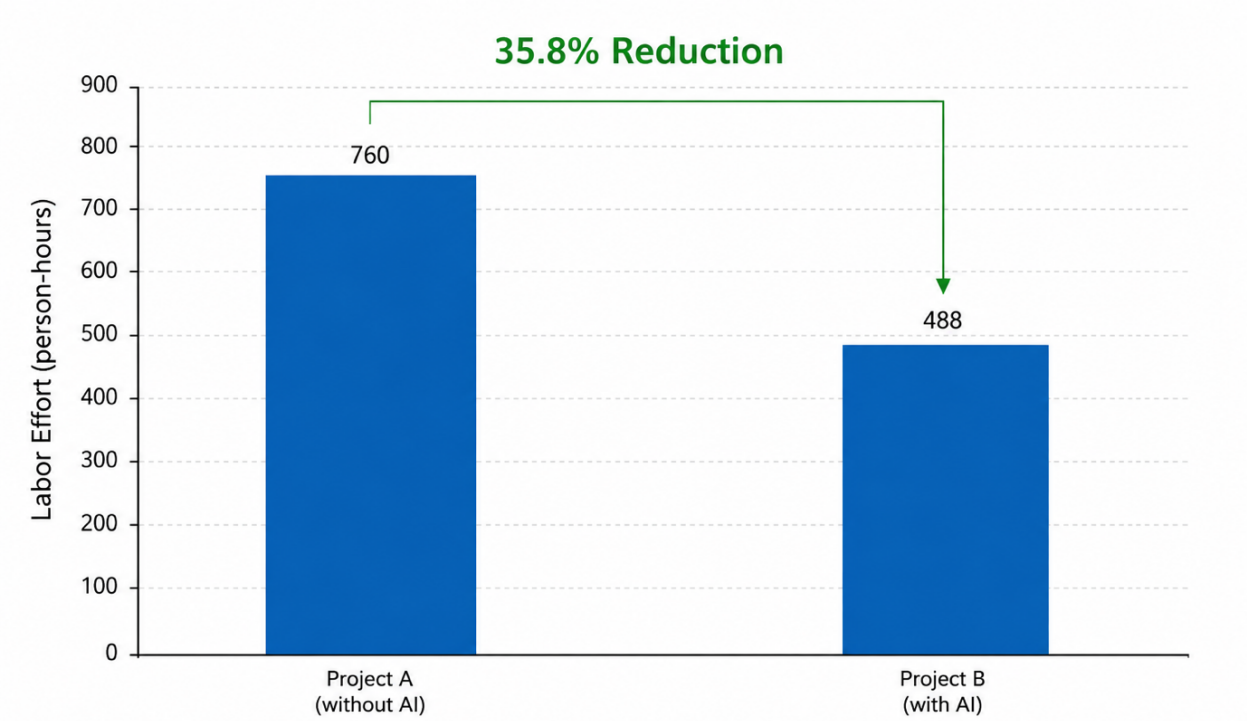

Figure 2. Comparison of total labor effort between Project A (without AI) and Project B (with AI). Project B required 35.8% fewer person-hours than Project A.

5. Discussion

The findings of this study suggest that the role of AI in product development extends beyond improving individual activities. Rather than functioning as a collection of independent productivity tools, AI increasingly acts as an operational capability embedded throughout the product development lifecycle. This perspective shifts the discussion from evaluating isolated AI applications toward understanding how AI reshapes the organization of product work. Instead of supporting only software engineering, AI becomes part of an integrated product management process spanning market research, product discovery, requirements engineering, design, development, testing, release preparation, and continuous product improvement.

The results are consistent with previous studies showing that AI can improve the productivity of knowledge workers. In particular, the findings support the conclusions of Noy et al. [6] and Brynjolfsson et al. [7], who reported that AI is especially effective in tasks involving information processing, content creation, and decision support. Similar patterns were observed in this study, where the greatest benefits were achieved in research, requirements engineering, documentation, and information analysis. However, unlike previous studies that typically evaluate AI within individual professional domains, the present study demonstrates that the value of AI emerges from its coordinated use across multiple stages of product development rather than from improvements in any single activity.

Most existing studies implicitly assume that AI adoption can be evaluated by measuring improvements within individual functions such as software development or documentation. The findings of this study suggest a broader interpretation. The practical value of AI lies not only in automating specific tasks but also in connecting previously separate stages of product development into a more integrated and continuously supported workflow. This lifecycle-oriented perspective provides a different way of understanding AI adoption,

particularly in lean technology startups where the same specialists often participate in multiple stages of product development.

Another important finding concerns the changing role of product teams. The results indicate that AI expands the capabilities of specialists rather than replacing them. Many activities that previously required significant time and effort were completed much faster with AI support, allowing team members to spend more time on product strategy, decision-making, and further product development.

The study also revealed changes in the distribution of responsibilities within the team. After AI became part of the team's daily workflow, specialists were able to perform a wider range of tasks. For example, team members prepared documentation, conducted research, and created prototypes without relying on additional specialists. As a result, traditional role boundaries became less rigid, and the team became more flexible. These findings indicate that AI influences organizational capabilities as much as individual productivity. Rather than replacing specialized roles, AI enables product teams to redistribute knowledge-intensive activities more efficiently while preserving human responsibility for strategic decisions and professional judgment.

This effect may be especially important for technology startups. Unlike large organizations, startups usually operate with limited financial resources and small teams. In such an environment, increasing the productivity of existing employees without significantly expanding the team can become an important competitive advantage. The findings suggest that AI can strengthen the capabilities of small teams and enable them to accomplish work that previously required a larger number of specialists.

At the same time, the results do not support concerns that AI will completely replace human professionals. Throughout the product development lifecycle, AI was used as a supporting tool, while key decisions remained the responsibility of the team. The quality of the final results still depended on the experience, expertise, domain knowledge, and critical thinking of the specialists using AI.

Overall, this study suggests that AI should no longer be viewed merely as a technology for automating isolated tasks. Instead, AI is becoming an integral component of modern product management, supporting decision-making and knowledge-intensive work throughout the entire product development lifecycle. As AI capabilities continue to evolve, future research should focus less on evaluating individual AI tools and more on understanding how AI transforms product organizations, team structures, and product management practices.

5.1. Practical Implications

The findings of this study have several practical implications for technology startups and product teams.

First, startups should not limit the use of AI to software development alone. The results show that AI can support many activities across the entire product development lifecycle, including market research, hypothesis validation, requirements engineering, documentation, design, testing, and product release.

Second, the greatest productivity improvements were achieved in research, requirements engineering, documentation, and information analysis. These activities involve large amounts of information processing and document preparation, making them particularly well suited for current AI tools.

Finally, for lean startups operating with limited budgets and small teams, these activities represent a significant share of total labor effort. Improving efficiency in these areas can reduce overall development costs, accelerate product delivery, and allow existing team members to accomplish more without increasing team size.

Rather than introducing AI as a separate initiative, startups may achieve better results by integrating AI into the team's everyday workflow across the entire product development process.

6. Conclusions

This study examined how artificial intelligence supports activities across the entire product development lifecycle within a lean technology startup. By comparing two highly similar digital product development projects completed before and after AI adoption, the research demonstrated substantial improvements in overall development efficiency while identifying the stages of product development where AI currently provides the greatest practical value.

More importantly, the findings suggest that AI should be viewed not simply as a collection of tools for automating individual tasks, but as an operational capability integrated into the everyday work of product teams. Rather than supporting isolated activities, AI enables a more connected and continuous product development process spanning market research, product discovery, requirements engineering, design, software development, testing, release preparation, and post-release product improvement.

From a theoretical perspective, this study contributes to the growing literature on AI-enabled product management by adopting a lifecycle-oriented perspective that extends existing research beyond software engineering and individual productivity applications. From a practical perspective, the findings provide guidance for technology startups seeking to integrate AI into everyday product development while maintaining human oversight in strategic and creative decision-making.

As AI technologies continue to evolve, future research should examine the long-term organizational effects of AI adoption across different industries, product types, and team structures. Comparative multi-company studies and longitudinal research would further improve understanding of how AI influences product management practices and organizational capabilities over time.

Declarations

Author Contributions. Conceptualization, I.M.; methodology, I.M.; formal analysis, I.M.; investigation, I.M.; data curation, I.M.; writing - original draft preparation, I.M.; writing - review and editing, I.M.; visualization, I.M.; project administration, I.M. The author has read and agreed to the published version of the manuscript.

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Data Availability Statement. The data supporting the findings of this study are derived from internal company project management records and are not publicly available due to commercial confidentiality restrictions.

Acknowledgments. During the preparation of this manuscript, the author used ChatGPT (OpenAI, GPT-5.5) to assist with language editing, translation, literature search, and the preparation of figures. All AI-generated content was carefully reviewed, revised, and verified by the author. The author takes full responsibility for the content of this publication.

Conflicts of Interest. The author declares no conflicts of interest.

Abbreviations. The following abbreviations are used in this manuscript:

Abbreviation	Meaning
AI	Artificial Intelligence
B2B	Business-to-Business
B2C	Business-to-Consumer
MVP	Minimum Viable Product
QA	Quality Assurance
UI	User Interface
UX	User Experience
VPN	Virtual Private Network
iOS	iPhone Operating System
DevOps	Development and Operations

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