Comparative Analysis of Platforms for Analysis, Design and Product Development with a Focus on AI-Based Tools

Borce Ugrinovski[1], Andrijana Bocevska[2], Kostandina Veljanovska[3] and Blagoj Ristevski[4]

[1,2,3,4] Faculty of Information and Communication Technologies - Bitola, University "St Kliment Ohridski" – Bitola

Partizanska bb, Bitola, Republic of North Macedonia

ugrinovski.borce@uklo.edu.mk; andrijana.bocevska@uklo.edu.mk; kostandina.veljanovska@uklo.edu.mk
blagoj.ristevski@uklo.edu.mk

Abstract:
This paper explores the integration of artificial intelligence (AI) in the product lifecycle (PLC), with a specific focus on the footwear industry, utilizing advanced AI tools to optimize processes and support informed decision-making. The application of platforms such as Google Trends, Mention, AnswerThePublic, Adobe Firefly, Bing Image Creator, Leonardo.ai, and Grok enables creative concept generation, visual presentation, and iterative design development. The results show that the use of AI not only automates existing processes but also drives innovation, improves design quality, and enhances the potential for sustainable development. A comparative analysis of the selected platforms evaluates their applications, advantages, and limitations across research, design, and product development phases
Keywords:
Artificial Intelligence, Product Lifecycle, Creative Concept Generation

1. Introduction

The product life cycle (PLC) is a complex process that encompasses all aspects of the creation, maintenance and development of a product. In the modern era of rapid technological change, the use of AI is emerging as a key solution for optimizing each of these phases. This paper explores the possibilities of integrating AI into the PLC, with a particular focus on the platforms Google Trends, Mention, AnswerThePublic, Adobe Firefly, Bing Image Creator, Leonardo.ai and Grok, which are used for analysis, design and development of products. By simulating these processes with such advanced tools, proper decision can be made.

The vision for integrating AI into the PLC is not limited to automating processes, but goes further to providing deep insights to make better decisions and enhance creativity in product development. The process starts with research and planning, where AI can be used to analyze the market, identify user needs, and predict trends. Platforms like Google Trends and Mention enable trend tracking and public opinion analysis, while AnswerThePublic helps identify key consumer questions and needs.

In the development and design stage, AI helps with prototyping, material optimization, and simulation of real-world usage conditions. Adobe Firefly, Bing Image Creator, and Leonardo.ai platforms are used to generate visual concepts and designs, while Grok enables the creation of innovative ideas and concepts. These tools not only speed up the design process but also enable rapid iteration and testing of different ideas.

By applying AI, companies can create more efficient and innovative solutions, enable sustainable development and increase competitiveness in the global market. This paper aims to explore the opportunities and benefits of integrating AI into the PLC, focusing on a specific example from the footwear industry.

2. Previous work

Several studies have explored the integration of AI into product lifecycle management, particularly in the design and development of footwear. The impact of Generative artificial intelligence (GenAI) on

footwear design creativity and feasibility is investigated in [1]. Using a text-to-image GenAI tool called Midjourney, 17 prompts were tested to generate footwear concepts. According to [2], AI-based predictive systems enable real-time adaptation of manufacturing processes, which is crucial for responding to dynamic market conditions. The role of machine learning in reducing product development time is highlighted in [3]. In the systematic review by [4], 37 studies are analyzed that highlight the role of AI in reducing waste and improving efficiency in the fashion industry. The role of AI-based tools in promoting design sustainability has been increasingly emphasized in recent studies, such as [5]. The study by [6] demonstrates how Google Trends can serve as an indicator of the market success of new products. The analysis shows that search volume correlates with future sales, allowing companies to adjust marketing strategies early in the development process. Generative tools, such as Adobe Firefly, are revolutionizing the creation of marketing content. According to [7], these platforms enable automatic generation of visual concepts from text descriptions and personalization for specific target groups. Ethical considerations surrounding this integration are discussed in works like [8].

3. Research and planning

Running shoes were chosen as an example in this research due to their functionality and wide application in sports and everyday life. They represent a key part of sports and recreational equipment, meeting the needs of a variety of users, from professional athletes to recreational users. The running shoe industry is constantly investing in innovation, including new cushioning technologies, materials that increase durability, and sustainable manufacturing methods. This makes it suitable for the application of AI at various stages of the product lifecycle – from design to manufacturing process optimization and quality testing. Additionally, running shoes have a direct connection to the health and performance of their users, which places them at the center of research to improve design, materials, and user experience. This relevance justifies their selection as a case study in the research.

Several research and analysis tools will be used in this phase:

- Google Trends: for tracking seasonal and regional trends related to running shoe demand.
- Mention: for monitoring online discussions and consumer perceptions of different brands and technologies.
- AnswerThePublic: for gaining insights into the most frequently asked questions and consumer interests related to running shoes.

This combined analysis will provide data that will serve as a basis for further research and the creation of strategies for innovation and product improvement.

3.1. Research with Google Trends

Google Trends [9] is a powerful tool that uses AI to provide advanced analysis of Google search trends across time periods and geographic regions. This tool reveals valuable insights into the terms users search for most often and how their popularity evolves over time. To begin the research, the term "Running Shoes" was entered into the Google Trends search box, and the term "Sports Shoes" was added via the Add comparison option. This way, up to five terms can be compared simultaneously.

To provide relevant data, "Worldwide" was selected for the region, the time period was set to "2004-present", and as category "All categories" was selected. "Web Search" was selected as the search type, but "Image Search", "News Search", "Google Shopping" or "YouTube Search" can be selected depending on the needs. The results are shown in Figure 1.

3.2. Research with Mention

Mention [10] is an advanced research and analytics tool that uses AI-based technologies to enable in-depth monitoring of online mentions and trends related to topics, brands, or products. This platform is particularly useful in the research phase of the product lifecycle, as it leverages advanced algorithms to analyze data in real time. In continuation of this research, the Mention platform was used to analyze the term "running shoes". To start using the Mention platform, an alert must be set up to monitor content

related to selected keywords. The platform allows filtering of sources such as news, blogs, forums, social networks, and others, as well as selecting the relevant languages in which results will be received.

Figure 2 presents data obtained from research focusing on the term "running shoes", examining the volume of mentions, dominant sources, sentiment and emotional analysis. This analysis is useful for understanding trends and public opinion related to running shoes.
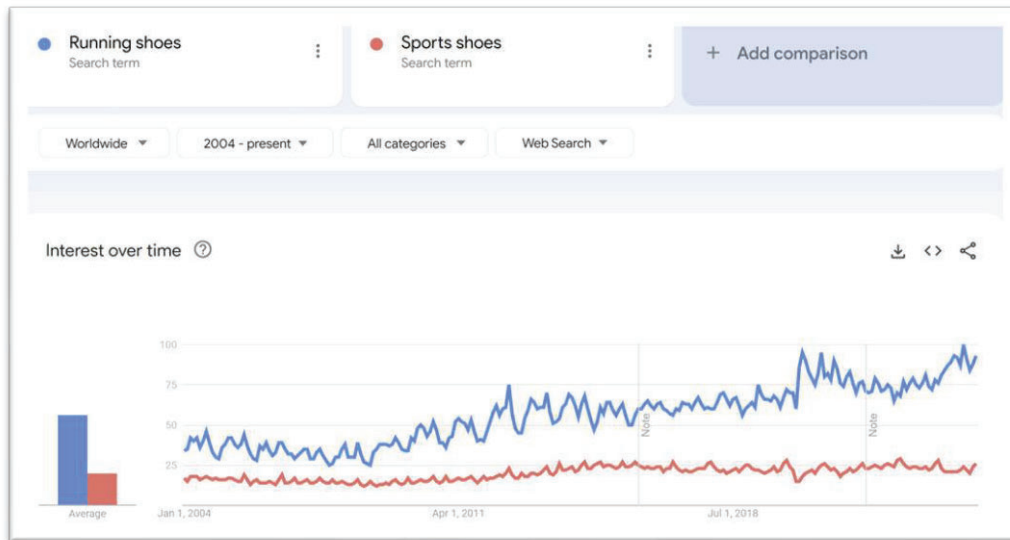

Figure 1: Interest in Running shoes and Sports shoes since 2004 – worldwide, by Google Trends

Figure 2: Mention – The control panel for the term "running shoes"

3.3.   Research with AnswerThePublic

AnswerThePublic [11] is a web-based tool designed for keyword research and analyzing user search intent. Using data from Google Autocomplete, the tool collects and transforms information into visual representations. This process provides quick and comprehensive insight into how people formulate their questions and phrases related to a given topic or keyword, making it ideal for a variety of areas such as digital marketing, SEO optimization, content creation, and market research. In the following section, a practical example is presented that illustrates how the AnswerThePublic platform works in the context of the sneaker market. This example aims to confirm and reinforce the argument that interest in sneakers is extremely high, while also illustrating specifically how the tool can be used to create effective strategies in digital marketing and new product development.

Figure 3 shows the results of a search for the term "sneakers" in Germany in English. The tool has found 2,153 results, which are questions and phrases related to this term, and the search volume is 165,000 per month, which is in the "Good" category, marked in green (more than 3,600 searches per month). The average cost per click for ads related to this term is $0.55, which falls into the "Cheap" category.

There are three options for visualizing the results: Wheels, List, and Tables. This data is especially useful for digital marketers and researchers who want to understand how users search for information about sneakers in Germany and how to optimize their content and advertising strategies.
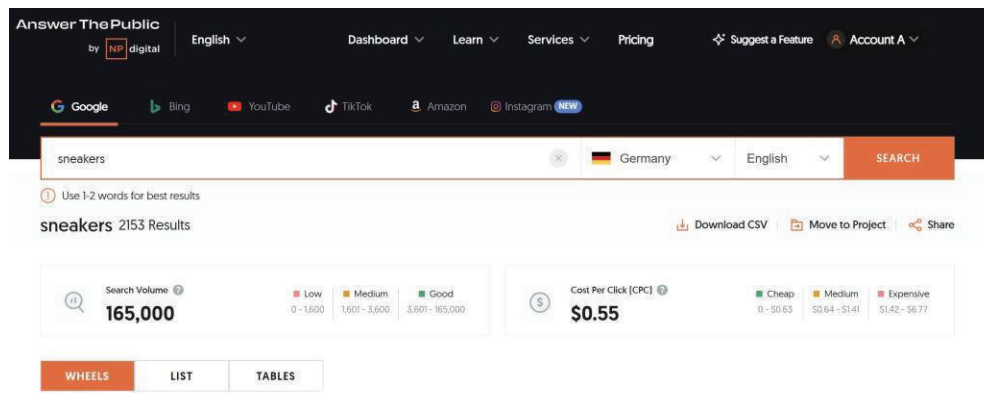

Figure 3: Answer ThePublic platform screen for the term "sneakers" in Germany in English

4. Development and Design

Product development and design are essential phases in the product life cycle, where creativity and innovation play a central role. These phases are focused on transforming ideas and research results into concrete solutions that meet user needs and expectations. With the application of AI, the development and design processes gain significant advantages, including faster prototyping, material optimization, and simulations of real-world usage conditions. AI enables the prediction of product performance even before its physical production, resulting in reduced costs and time required for development. Reports indicate that AI can reduce the duration of design development processes by up to 50% [12]. The goal of this chapter is to demonstrate the importance of AI in transforming traditional design and development processes, enabling products that not only meet but also exceed the expectations of modern users.

4.1. Development and design with Adobe Firefly

Adobe Firefly [13] is a generative AI model developed by Adobe, designed for creative tasks such as designing sneakers through text instructions. This tool offers extensive possibilities for innovation and design personalization. In this paper, Adobe Firefly was experimented with using the textual description: "Create a minimalist running shoe design that is lightweight and constructed with breathable honeycomb-patterned mesh. The shoe should feature a sleek silhouette with clean lines, using eco-friendly materials like recycled polyester and sustainable rubber for the sole." The result is shown in Figure 4. Additional adjustments can also be made to the generated images in the Color and tone, Lighting, and Camera angle fields.

4.2. Development and design with Bing Image Creator (DALL·E 3)

Bing Image Creator [14] is an innovative platform that allows users to create unique visual content through text descriptions. This tool, developed by Microsoft, uses the power of AI to generate images and designs based on detailed instructions. With Bing Image Creator, users can experiment with different styles, concepts and visual effects, making it an ideal tool for creatives, designers and anyone

who wants to explore their ideas in visual form. In addition, the Bing Image Creator tool was used to generate a conceptual sneaker design based on a text description (prompt), also used for the Adobe Firefly tool. This description is aimed at creating a minimalist sneaker design with eco-friendly materials and a contemporary look. Through this visualization, a better insight into possible design solutions and style variations will be gained, which will help in the product research and development process.

The tool generates several visual suggestions based on the description, shown in Figure 5. Bing Image Creator has proven to be an extremely useful tool for exploring and visualizing concepts, especially in the process of designing minimalist sneakers. The variety of results obtained, as well as the possibility of quick adjustments through additional prompts, allow for flexibility and efficiency in the creative process.
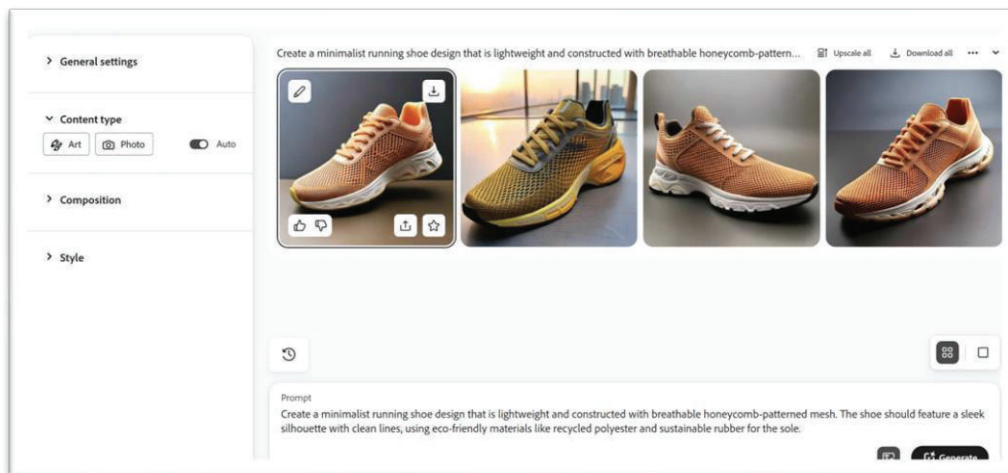

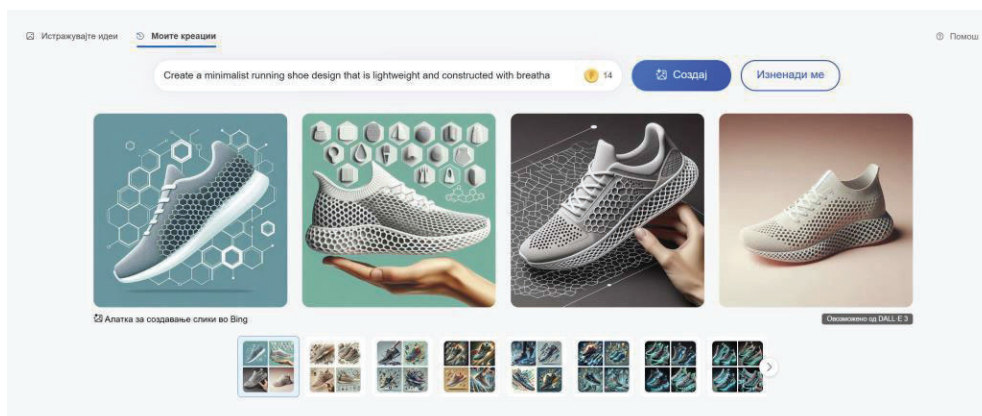Figure 4: Images generated by Adobe Firefly according to the given descriptive instruction

Figure 5: Visual suggestions by Bing Image Creator according to the given descriptive instruction

4.3. Development and design with Leonardo.ai

Leonardo.ai [15] is a relatively new platform distinguished by its focus on creativity and innovative capabilities. It offers various options that make the platform powerful and flexible for creative projects, including creating and editing images in real time, creating animated content, increasing the resolution of generated images without losing quality, as well as advanced image editing tools. The same prompt as for the previous two tools was used to explore Leonardo.ai's functionality. The images show all the key elements of the description, including the honeycomb grid, minimalist design, and use of eco-friendly materials (Figure 6). The platform was able to create realistic and detailed visual representations of the sneakers, highlighting its ability to generate high-quality designs.
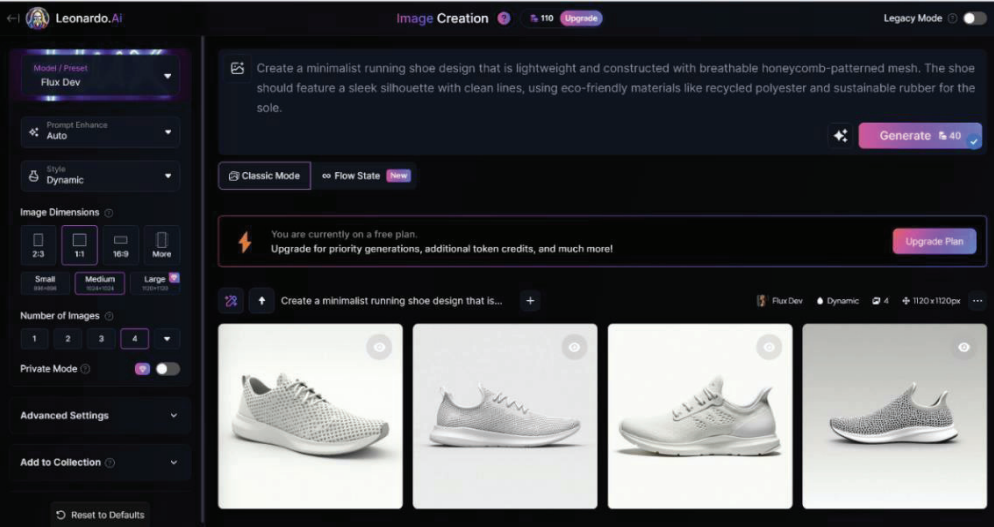
447

Figure 6: Variations of sneakers by Leonardo.ai according to the given descriptive instruction

4.4. Development and design with Grok

The Grok platform [16] is an innovative AI-based tool designed to rapidly generate creative concepts and solutions in the product development process. With its intuitive interface and powerful algorithms, Grok enables easy experimentation with text prompts, freeing designers from the need for traditional drawing and giving them the freedom to focus on innovation and functionality.

Within the life cycle of a product, Grok can contribute to all phases: conceptual phase - through rapid ideation and generation of visual concepts; prototyping and testing - enabling iterative improvement of ideas and final optimization - whereby the generated concepts can be used to further refine the product and its market positioning.

As part of the research, the Grok platform was used to generate creative ideas for eco-friendly sneakers, using the prompt: "Generate 3 creative ideas for eco-friendly sneakers". Three ideas were generated by the platform, namely algae sneakers, mycelium sneakers (fungal leather) shown in Figure 7, and sneakers made from recycled plastic bottles. Research with the Grok platform has shown that this tool is a valuable resource for generating creative ideas and conceptual solutions. By experimenting with different text instructions, innovative suggestions are obtained that meet the design goals of eco-sneakers. The speed of generating results and the ability to adjust ideas with additional prompts significantly facilitate the process of creating concepts.

5. Comparison of AI-Based Research and Design Platforms

Table 1 provides a comparative analysis of selected AI-based tools, highlighting their focus, data types, visualization options, key advantages, and limitations.

Google Trends provides real-time insights into search behavior and trends, making it ideal for understanding consumer interests, though it lacks detailed demographic data. Mention enables monitoring of online mentions across multiple sources, offering sentiment and trend analysis, but its full capabilities require paid plans and careful keyword setup. AnswerThePublic excels in uncovering user intent and popular queries, supporting marketing and SEO strategies, yet it is limited by the availability of historical data and filtering options.

For design and content creation, Adobe Firefly generates high-quality images from text and offers seamless integration within the Adobe ecosystem. Leonardo.ai, on the other hand, focuses on creating detailed product visuals and provides advanced fine-tuning options, although its outputs may be unpredictable without prior experience. Grok supports rapid concept generation and brainstorming, particularly for MVP development, yet its visual capabilities remain limited as the platform is still under development.

Although Table 1 presents the general limitations of the analyzed AI-based tools, several specific challenges were identified during the running shoe case study that illustrate these limitations in practice. When using Adobe Firefly, one of the main challenges was the technical feasibility of the generated shoe designs. While the images produced were visually appealing and creative, some of them contained unrealistic elements such as overly thin soles, missing seams between different materials, or inconsistent proportions between the upper and the sole. Additionally, the tool sometimes ignored technical details specified in the prompt, such as ventilation areas or particular material textures. Similarly, Bing Image Creator (DALL·E 3) provided diverse and aesthetically attractive results, but several designs were found to be impractical for manufacturing — for instance, non-continuous sole patterns, asymmetric geometry, or unrealistic curvature of the shoe structure. In the case of Mention, sentiment analysis presented certain inconsistencies, as some neutral or humorous user comments were classified as negative due to sarcasm or ambiguous tone. These examples demonstrate that, while AI-based tools can significantly accelerate ideation, visualization, and data analysis, human expertise remains essential to interpret results correctly, identify unrealistic outputs, and translate creative concepts into technically feasible product designs.

During the design experiment, the refinement of prompts played a central role in improving the quality and realism of the generated outputs. In the minimalist running shoe example, the initial prompt used only general descriptive terms such as "minimalist shoe design" or "modern running shoe concept." These produced visually creative but technically inconsistent results, with variations in shape and missing construction logic. To obtain more coherent outcomes, the prompts were gradually refined through several iterations by specifying aspects such as style (minimalist running shoe), material appearance (fabric or mesh upper, rubber sole), and intended function (lightweight running model). Each refinement step led to outputs that better reflected the design intent and reduced unrealistic elements in the generated images. This iterative approach demonstrated that careful and structured prompt formulation significantly influences both the creativity and technical plausibility of AI-generated designs.

Taken together, the results suggest that while each platform contributes valuable capabilities within its domain—creative visualization, trend analysis, or sentiment monitoring—none of them can operate fully autonomously without expert supervision and contextual understanding.
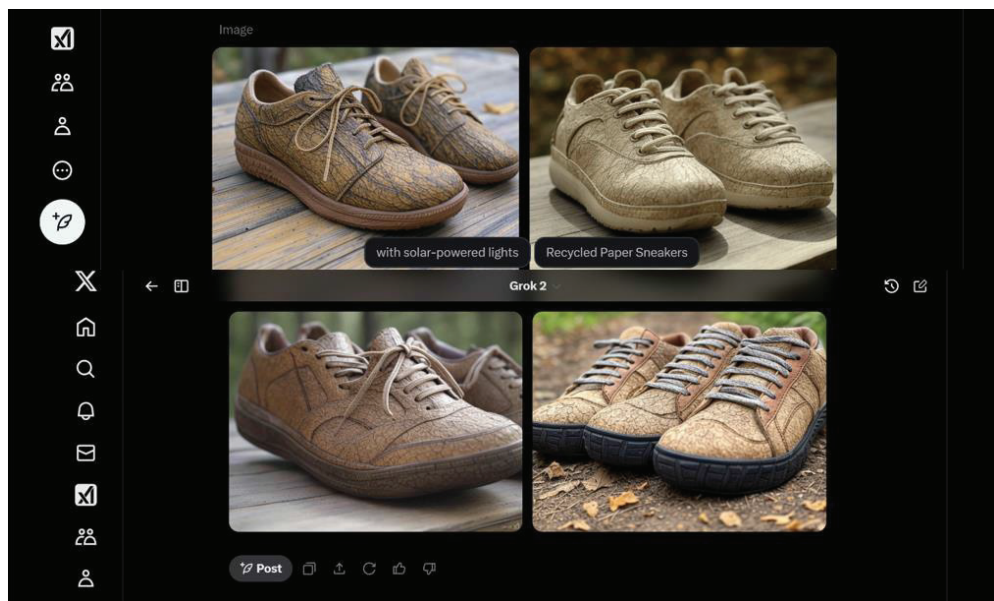

Figure 7: Mycelium Sneakers generated by Grok as an idea for eco-friendly sneakers

Table 1: Comparative Analysis of Selected AI-Based Tools

Platform	Focus/ Application	Data Processed	Visualization	Key Advantages	Limitations

Google Trends	Analysis of interests and trends through searches	Time series of searches by region and category	Line charts, comparison of up to 5 terms	Free access, real-time data, comparison of multiple	Limited demographic data, no detailed user information, limited visualization types, does not show specific URLs
Mention	Online mentions and public opinion monitoring	Posts from news, blogs, forums, social networks	Dashboard (mentions, sentiment, sources)	Real-time monitoring, source and language filtering, sentiment and emotion analysis	Limited functionality in the free version, some platforms/social networks may be uncovered, requires keyword optimization
AnswerThePublic	Research on user intent and keywords	Questions, phrases, keywords	Visualization options: Wheels, Lists, Tables	Detailed insight into how users formulate queries, useful for SEO, marketing, and product development	Free version is limited, no historical data, limited filtering by location or demographics, does not always display all related phrases
Adobe Firefly	Generating realistic images from text	Text-to-image conversion	High-quality images	High-quality results, easy integration with the Adobe ecosystem, creative	Registration required, limited control over details, cannot create complex animations, Internet connection
Bing Image Creator	Concept visualization and creative design generation	Text-to-image	Image gallery	Multiple design variations, ease of prompt-based editing, high image quality	Some generated sneaker designs visually inconsistent or impractical for manufacturing (e.g., asymmetric soles, disconnected elements)
Leonardo.ai	Visual product design and variants	Text-to-image, 3D product variants	Images, product variants	Creative styles, possibility for fine-tuning, easy to use	Occasionally unpredictable results, experience needed for optimal results, limited support for complex
Grok	Generation of concepts, texts, and strategies	Text, ideas, short strategies	Conversational format	Quick concept generation, suitable for brainstorming and MVP ideas	Limited visual results, still in development, does not always provide concrete solutions, dependent on

6. Conclusions

This paper demonstrates the significant potential of AI in enhancing the product lifecycle, particularly in the context of the footwear industry. By integrating AI-based tools such as Google Trends, Mention, AnswerThePublic, Adobe Firefly, Bing Image Creator, Leonardo.ai, and Grok, companies can optimize research, design, and development processes. Market research tools like

Google Trends, Mention, and AnswerThePublic enable deeper insights into consumer behavior, trends, and user intent, which support informed decision-making. Meanwhile, design and development tools, including Adobe Firefly, Bing Image Creator, Leonardo.ai, and Grok, facilitate rapid concept generation, visualization, and iterative improvement of products in terms of simulated processes.

The application of AI not only accelerates traditional workflows but also fosters innovation, creativity, and sustainability. The case study on running shoes illustrates how AI can support eco-friendly design, material optimization, and the creation of multiple design alternatives in a short period. Overall, AI integration into the product lifecycle provides a competitive advantage, enhances design quality, and promotes efficient and sustainable product development, offering significant implications for companies aiming to remain competitive in the global market.

As future work, the quantitative impact of AI integration on PLC metrics such as time-to-market and cost efficiency could be explored. In this regard, we need to revise, adapt, and standardize the usual evaluation metrics to ensure they can be effectively applied when AI-based tools are incorporated into the PLC. Furthermore, comparative studies across different industry sectors can validate the generalizability of these AI tools.

References:
[1] Cheng, S. H., Impact of Generative Artificial Intelligence on Footwear Design Concept and Ideation. *Eng. Proc.* 2023, *55*, 32. https://doi.org/10.3390/engproc2023055032.
[2] Lee, J., Lapira, E., Bagheri, B., & Kao, H.-A, Recent advances and trends in predictive manufacturing systems in big data environment. Manufacturing Letters, 1(1), 38–41, 2013 https://doi.org/10.1016/j.mfglet.2013.09.005.
[3] Chen, Y., Zhang, J., Intelligent product lifecycle management based on AI technologies. Journal of Intelligent Manufacturing, 31(3), 545–556, 2020 https://doi.org/10.1016/j.jclepro.2019.119423.
[4] Chatterjee, S., Chaudhuri, R., Ray, S., & Ghosh, S. K. (2023). Artificial intelligence and sustainability in the fashion industry: A review from 2010 to 2022. Discover Applied Sciences, 3(1), Article 55. https://doi.org/10.1007/s42452-023-05587-2.
[5] Younus, M., Pathan, S. H., Amin, M. R., Tania, I., Ouboucetta R., Sustainable Fashion Analytics: Predicting the Future of Eco-friendly Textile. Global Mainstream Journal of Business, Economics, Development & Project Management, 3(3), 13-26, 2024, https://doi.org/10.62304/jbedpm.v3i03.85.
[6] Chumnumpan, P., Shi, X., Understanding new products' market performance using Google Trends. Australasian Marketing Journal, 27(2), 91–103, 2019, https://doi.org/10.1016/j.ausmj.2019.01.001.
[7] Kumar, P. A., Generative AI in Social Media Marketing: A Focus on Adobe Firefly, 2024, https://www.researchgate.net/publication/379862333_Generative_AI_in_Social_Media_Marketi.
[8] Agboola, O. P., The Role of Artificial Intelligence in Enhancing Design Innovation and Sustainability (2024). Smart Design Policies, 1(1), 6-14. https://doi.org/10.38027/smart-v1n1-2.
[9] Google Trends. (n.d.), Google Trends Documentation, https://trends.google.com/trends/.
[10] Mention. (n.d.), Mention Blog, https://mention.com/blog/
[11] AnswerThePublic. (n.d.), AnswerThePublic Guide, https://answerthepublic.com/
[12] How is generative design revolutionizing the automotive industry?, Knauf Industries Automotive, 2024, https://knaufautomotive.com/how-is-generative-design-revolutionizing-the-automotive-industry/.
[13] Adobe Firefly Tutorials, https://www.adobe.com/solutions/ai.html.
[14] Microsoft. (n.d.), Bing Image Creator Documentation, https://www.bing.com/create.
[15] Leonardo.ai. (n.d.), Leonardo.ai Resources, https://leonardo.ai/.
[16] Grok. (n.d.). Grok Documentation, https://grok.com/.