

Democratizing Software Development: A Review of Generative AI's Impact on Freelance Engineering and Code Security

Mr. Tayabur Rahman Laskar

Freelancer, BCA Graduate, Gauhati University, Assam

ORCID: <https://orcid.org/0009-0009-0241-5123>

Abstract

The software engineering landscape is currently navigating a pivotal transformation driven by the integration of Large Language Models (LLMs) and Generative AI (GenAI) into the development lifecycle. This review article examines the dual impact of these technologies on the freelance economy and software security. While industry data from 2024–2025 indicates that GenAI tools can accelerate coding tasks by up to 45%, they simultaneously introduce significant risks, including the propagation of vulnerable code patterns (such as CWE-787 and CWE-89) and the erosion of entry-level opportunities. We analyze how the role of the freelance developer is shifting from manual syntax construction to "AI-assisted system architecture," necessitating a fundamental re-evaluation of computer science education and freelance business models. This paper argues that while the barrier to entry for coding has lowered, the barrier to *competence* regarding security and architecture has risen.

Keywords: Generative AI, Software Engineering, Freelance Economy, Code Security, LLM Vulnerabilities, GitHub Copilot.

1. Introduction

The democratization of technology has historically been defined by the abstraction of complexity. From the shift from assembly language to high-level languages like Python, computer science has consistently moved toward human-centric logic. However, the period between 2023 and 2025 marks a distinct discontinuity: the emergence of "AI Pair Programmers" capable of generating functional code from natural language prompts.

For the freelance sector in India and globally, this shift is profound. Freelancers, who often operate with limited resources compared to large enterprise teams, are adopting AI tools at rapid rates to remain competitive. Recent studies indicate that AI adoption among developers has reached nearly 84% as of 2025, fundamentally altering the economics of software delivery. This paper reviews the

current literature to assess whether this technological leap represents a sustainable productivity boom or a hidden accumulator of technical debt and security risks.

2. The Productivity Paradox in Freelancing

The primary allure of GenAI for freelancers is speed. In a gig economy where income is directly tied to project turnover, the ability to generate boilerplate code, unit tests, and documentation instantly is a significant financial multiplier.

2.1 Quantitative Gains

Research conducted by widespread industry analysis in 2024 demonstrated that developers using AI assistants (such as GitHub Copilot) completed tasks significantly faster than those without. Specifically, code documentation tasks saw a 45–50% reduction in time, while code generation itself was approximately 35–45% faster. For a freelancer, this theoretically doubles the capacity for taking on new clients without increasing working hours.

2.2 The "Reviewer" Bottleneck

However, productivity gains are not uniform. While code *generation* is faster, code *review* has become more burdensome. The cognitive load shifts from "writing logic" to "debugging AI logic." A study by MIT Sloan highlighted that while junior developers saw productivity jumps of nearly 30% using AI, they often lacked the expertise to verify the output, leading to a "quality trap" where faster delivery resulted in less maintainable software.

3. Security Risks in AI-Generated Code

A critical concern for the *International Comprehensive Technology and Science Journal* is the integrity of the systems being built. Freelancers often work on unmanaged codebases for SMEs, where rigorous security audits are rare. Relying on AI in these contexts presents specific dangers.

3.1 Propagation of Vulnerabilities

Large Language Models are trained on vast repositories of open-source code, which inevitably contain historical security flaws. When an LLM generates code, it often reproduces these flaws. A 2025 analysis of LLM-generated code found that approximately 40% of generated snippets contained security vulnerabilities, often aligning with the "CWE Top 25" (Common Weakness Enumeration).

- **Common Flaws:** The most recurring issues include SQL Injection (CWE-89), Out-of-Bounds Write (CWE-787), and Improper Input Validation (CWE-20).
- **Hallucinated Dependencies:** A novel risk identified in 2024 is "dependency hallucination," where an AI suggests importing a package that does not exist. Attackers can register these "hallucinated" package names to inject malicious code into the developer's environment, a vector that did not exist prior to GenAI.

4. Economic Implications for the Freelance Workforce

The economic structure of freelancing is moving from "effort-based" pricing to "value-based" pricing.

4.1 The Disappearance of Junior Roles

Traditionally, freelance platforms offered a wealth of entry-level jobs (e.g., "convert this HTML to React," "write a Python script for scraping"). These tasks are now fully automatable. Data from 2025 suggests a softening demand for junior developers, as companies and clients prefer to hire senior "AI supervisors" who can orchestrate AI tools rather than hiring juniors to write code manually.

4.2 The Rise of the "Solution Architect"

To survive, freelancers must pivot. The successful freelancer of 2026 will not be a "Coder" but a "Solution Architect." The value proposition is no longer technical execution but the ability to integrate disparate AI systems, ensure security compliance, and understand business logic. This requires a curriculum shift in degrees like BCA and B.Tech, emphasizing system design and ethics over rote memorization of syntax.

5. Conclusion

Generative AI is a double-edged sword for the software engineering community. It offers unprecedented leverage for freelancers to compete with larger agencies, but it demands a higher tier of vigilance regarding security and architectural integrity. As we advance, the definition of "technical expertise" must evolve. It is no longer sufficient for code to merely "work"; it must be vetted for the subtle, probabilistic errors introduced by AI. For the freelance community, the future belongs to those who can treat AI not as a replacement for human intellect, but as a powerful, yet unreliable, subordinate that requires constant, expert supervision.

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