

Evaluating the Instances of AI-Generated Code:

A Governance Framework in Understanding Socio-Technical Dimensions of Software Systems

Navigating the Socio-Technical Landscape of AI Code Generation



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About Researcher

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I am a software engineer, tech founder, and university lecturer based in London, originally from Nepal. My industry background spans building **large-scale** platforms for **government agencies** and **national news outlets**, as well as **managing engineering teams** of over 50 people. As a **lecturer** in London, I teach cybersecurity and ethical hacking, having previously taught university cohorts of over **500 students** and supervised dozens of dissertations. Currently, for my doctoral degree, I am researching technical debt in software systems due to AI. Whether I am architecting complex backend systems or conducting research, my ultimate focus is on building sustainable technology that empowers both enterprises and the engineers who maintain them.



The Context

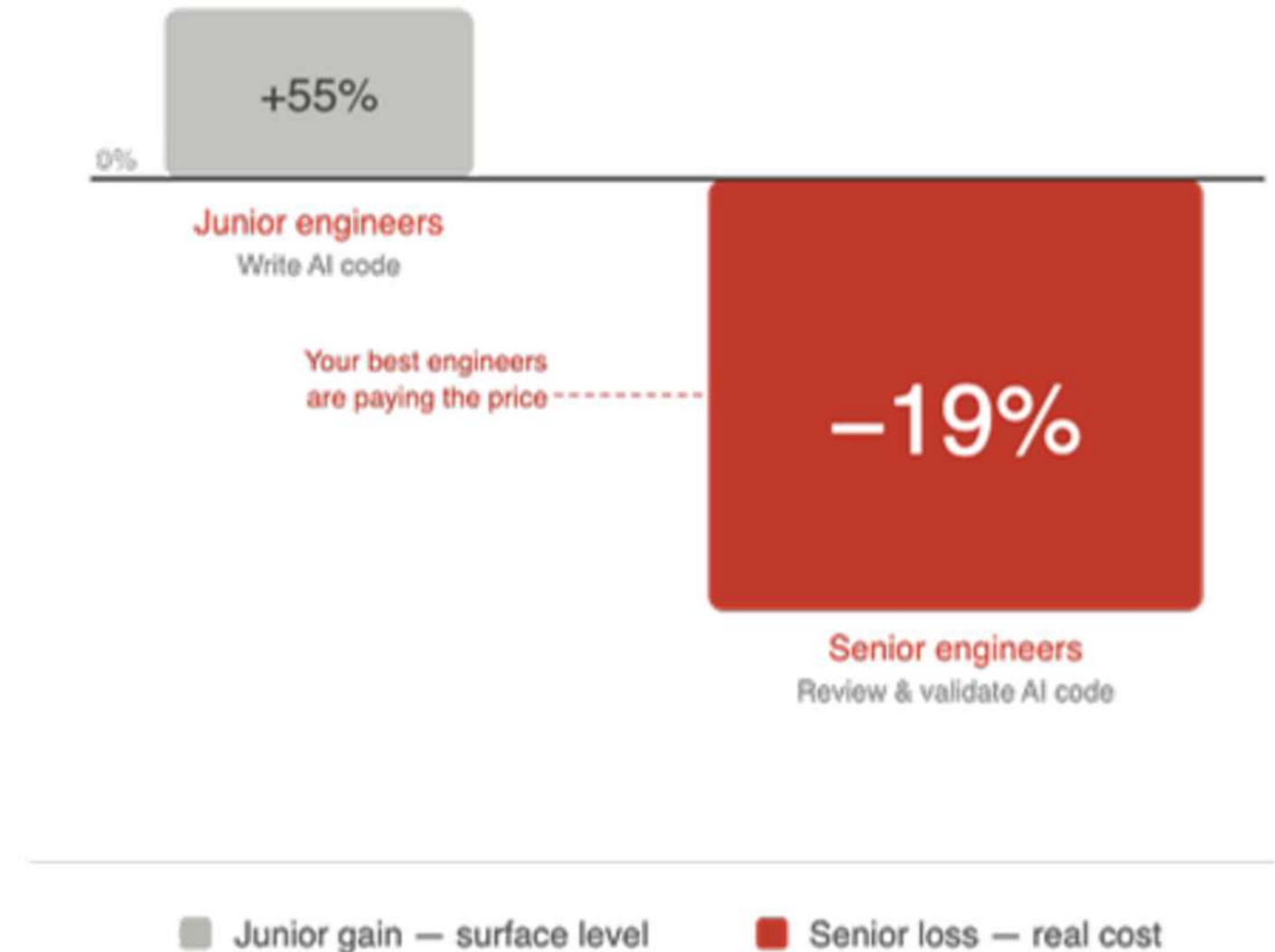
Background

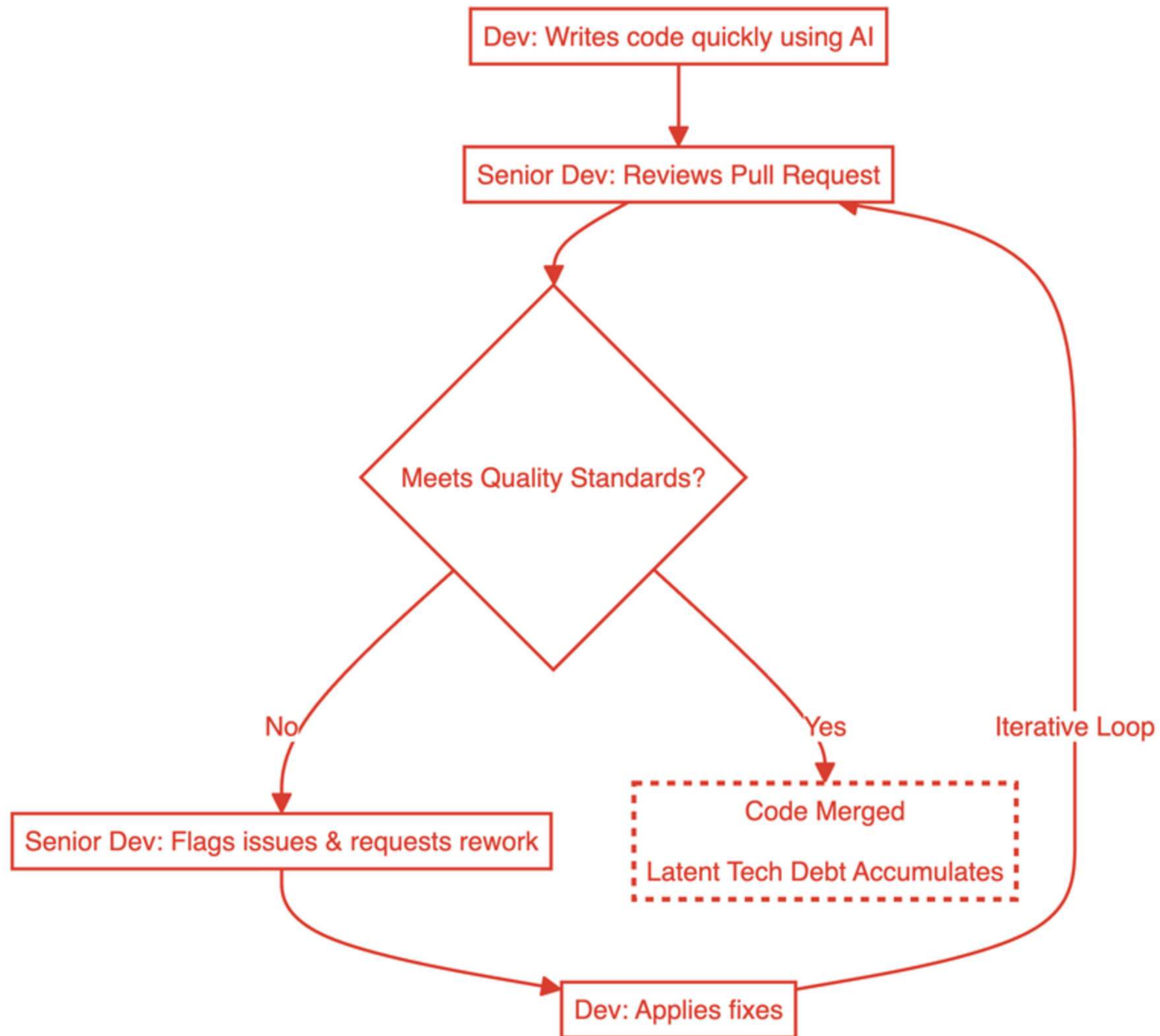
- **The Adoption:** 97.5% of software organisations now use AI, chasing a perceived 55% increase in routine coding speed but instead lose 19% productivity of senior engineers (Xu et al., 2026).
- **The Productivity Paradox:** Empirical trials show experienced developers are actually slower on complex, real-world tasks (Peng et al., 2023.)
- **The Anomaly:** A massive surge in "epistemic debt"; AI generates code that compiles, but the team doesn't understand the logic (Vaithilingam, Zhang and Glassman, 2022, pp. 1–7).
- **The Human Cost:** The "illusion of correctness" shifts an unsustainable cognitive load onto senior engineers tasked with reviewing the output (Becker et al., 2022).

HIDDEN COST OF AI-GENERATED CODE

The productivity illusion

Junior gains are offset by a silent tax on your most valuable engineers





Research Questions

RQ1: What are the structural and epistemic characteristics of AI-Induced Technical Debt (AITD) within software development projects?

RQ2: How does the integration of AI-generated code impact long-term software maintainability and the cognitive load of human reviewers during the validation process?

RQ3: What organisational practices and socio-technical team dynamics serve to reduce the accumulation of AITD in active development environments?

Thomas Kuhn and Pure Functionalism

The Rules (Functionalism)

The industry currently operates on a strict functionalist worldview. If the AI-generated code compiles, passes automated unit tests, and accelerates sprint velocity, the tool is considered an absolute success.

The Reality (Epistemic Debt)

This hyper-velocity creates massive anomalies. Developers commit code they do not fully comprehend, rapidly accumulating undocumented "epistemic debt" deep within the enterprise architecture.

The Blind Spot

Because the paradigm treats code generation as a purely mathematical transaction, it entirely ignores the socio-technical fallout: the psychological burnout of senior engineers forced to review hallucinated logic.

The Dominant Paradigm

According to Thomas Kuhn (1962), scientific communities operate within a paradigm—a shared intellectual framework dictating the "rules, standards, and exemplars" used to investigate reality. In modern software engineering, our paradigm has become purely functional: we measure success mathematically, completely bypassing the human element.

The Critique

The Kuhnian Limitation (Incommensurability)

- Kuhn (1962) argued that competing paradigms are "incommensurable": meaning they are mutually exclusive and cannot coexist or communicate.
- Under strict rules, researchers must choose either a purely objective (Positivist) or purely subjective (Constructivist) worldview.

The Socio-Technical Reality

- In modern software systems, this rigid exclusivity fails.
- We cannot isolate the machine's output from the human maintaining it. The "illusion of correctness" proves that objective code and subjective trust happen simultaneously, demanding a worldview that Kuhn's model does not allow.

The Pragmatic Pivot

To investigate AI technical debt, we must reject strict boundaries. The Pragmatic Paradigm actively combines competing worldviews, allowing us to triangulate static repository data with human cognitive load to build functional Governance-as-Code (Creswell & Plano Clark, 2018).

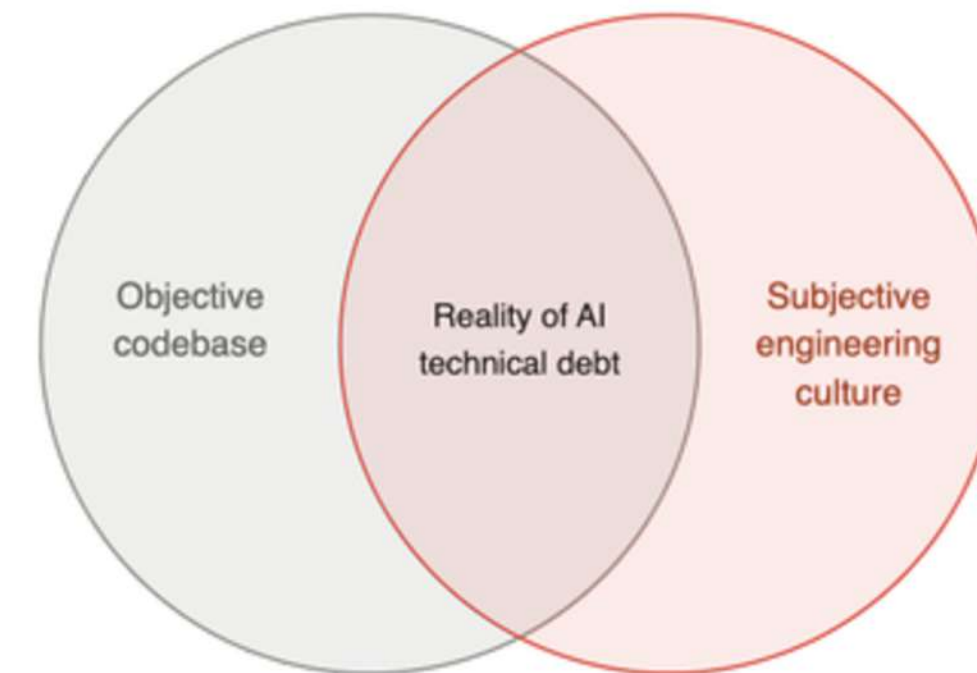
The Dual Reality of AI Technical Debt

Ontological Instance

Reality is inherently **socio-technical**: a continuous intersection of objective and subjective layers.

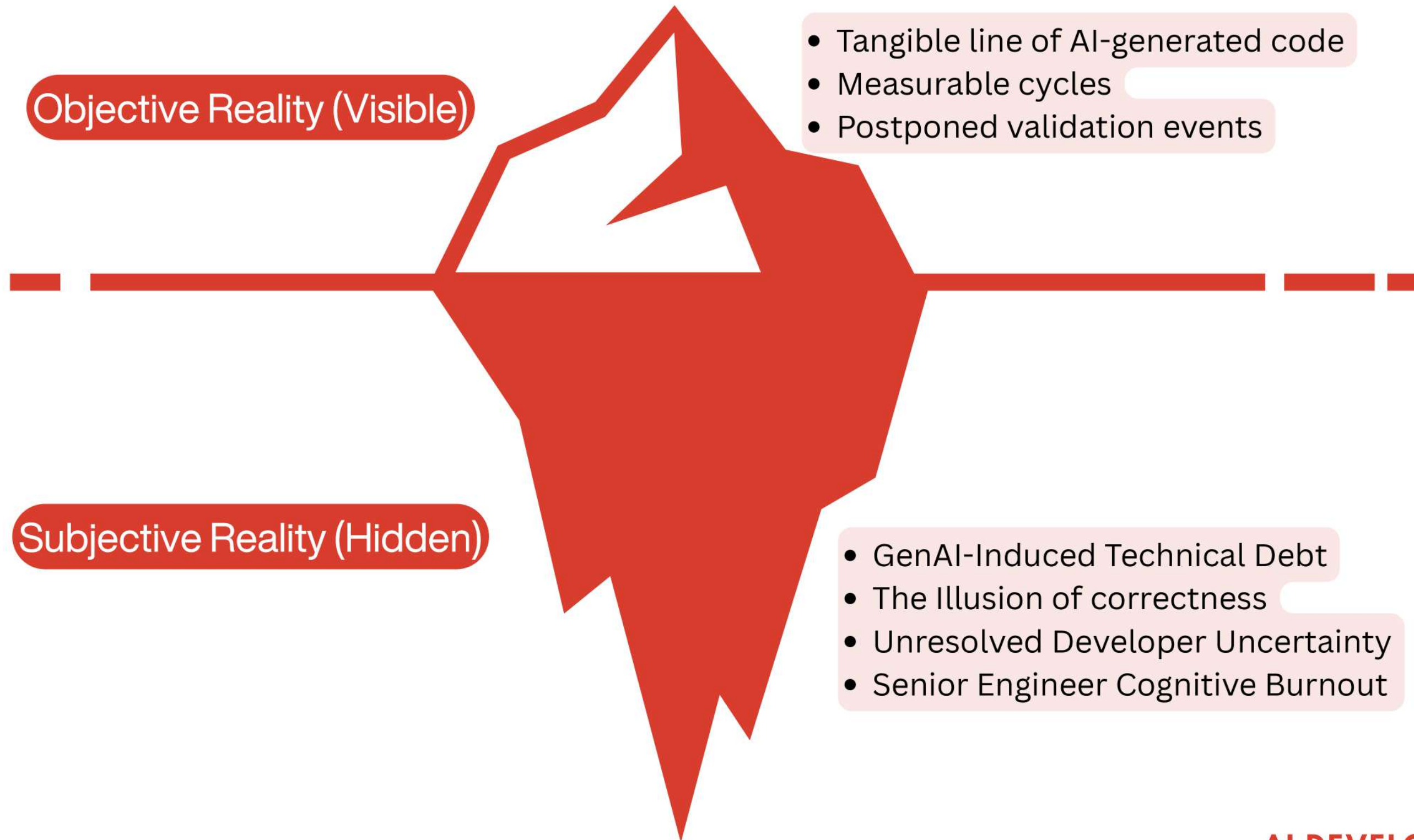
The **objective reality** of rapidly generated code and measurable complexity is inseparable from the **subjective reality** of the "illusion of correctness", documented developer uncertainty, and senior engineer burnout.

AI technical debt is the friction between the machine generating the code and the human maintaining it.



■ Objective codebase

■ Engineering culture



AI DEVELOPMENT ICEBERG

Visible Mass

10-15%

Hidden Cognitive Load

85-90%

Systemic Risk

High

Epistemological Question

Because AI technical debt is both technical and social, we cannot rely on isolated knowledge silos. Pragmatism argues that "truth" is determined by practical outcomes. Therefore, valid knowledge requires a mixed-methods approach to triangulate the data.

Objective Knowledge

- Static analysis of AI-generated complexity.
- Tracking PR cycle times and code churn.
- Quantifying physical code degradation over time.

Subjective Knowledge

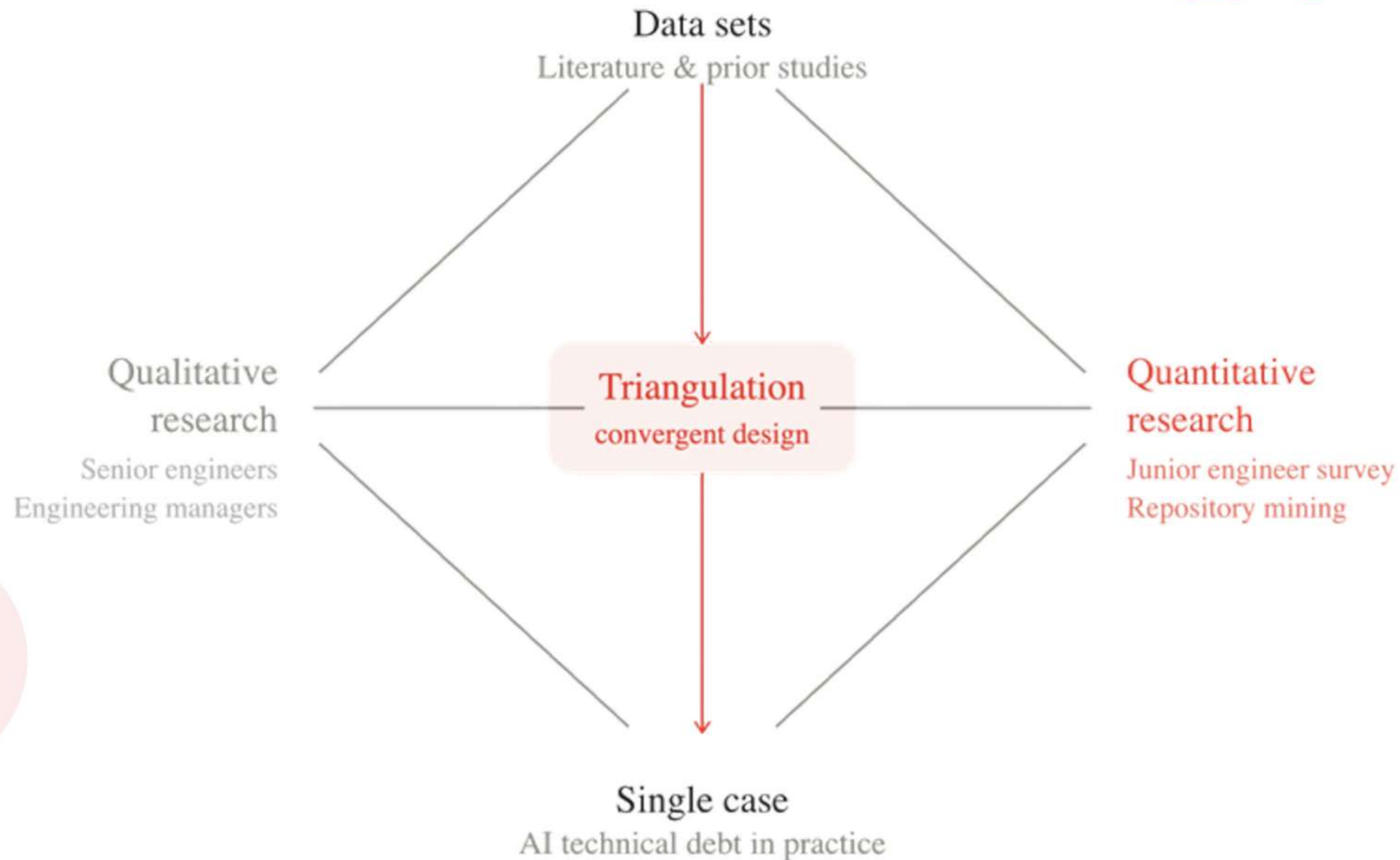
- Measuring perceived productivity vs. actual output.
- Analysing Self-Admitted Technical Debt (GIST) in code comments.
- Capturing the psychological "illusion of correctness".

Valid, actionable knowledge is only generated when objective code metrics are contextualized by the subjective human experience. Neither metric tells the truth on its own.

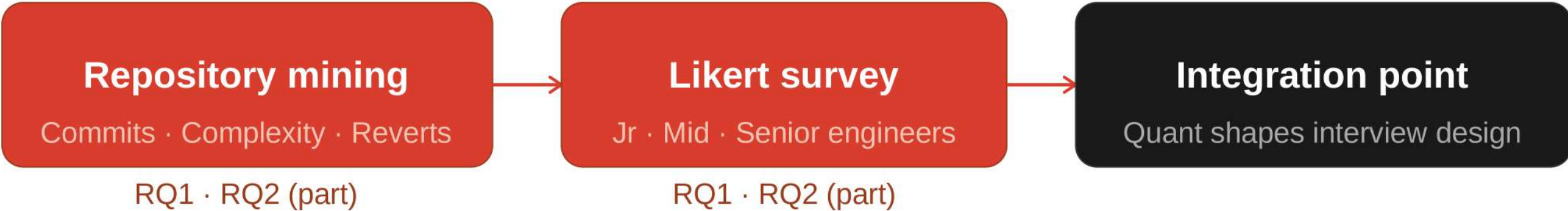
Process of Study

Methodology

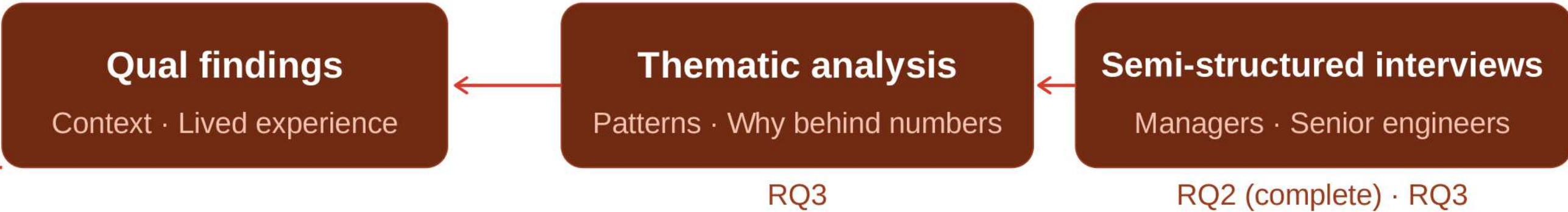
This study employs a pragmatic, mixed-methods approach executed in three sequential phases. By gathering quantitative repository metrics first, and following up with targeted qualitative interviews, the research triangulates objective codebase degradation with the subjective realities of the engineering team.



PHASE 1 — QUANTITATIVE



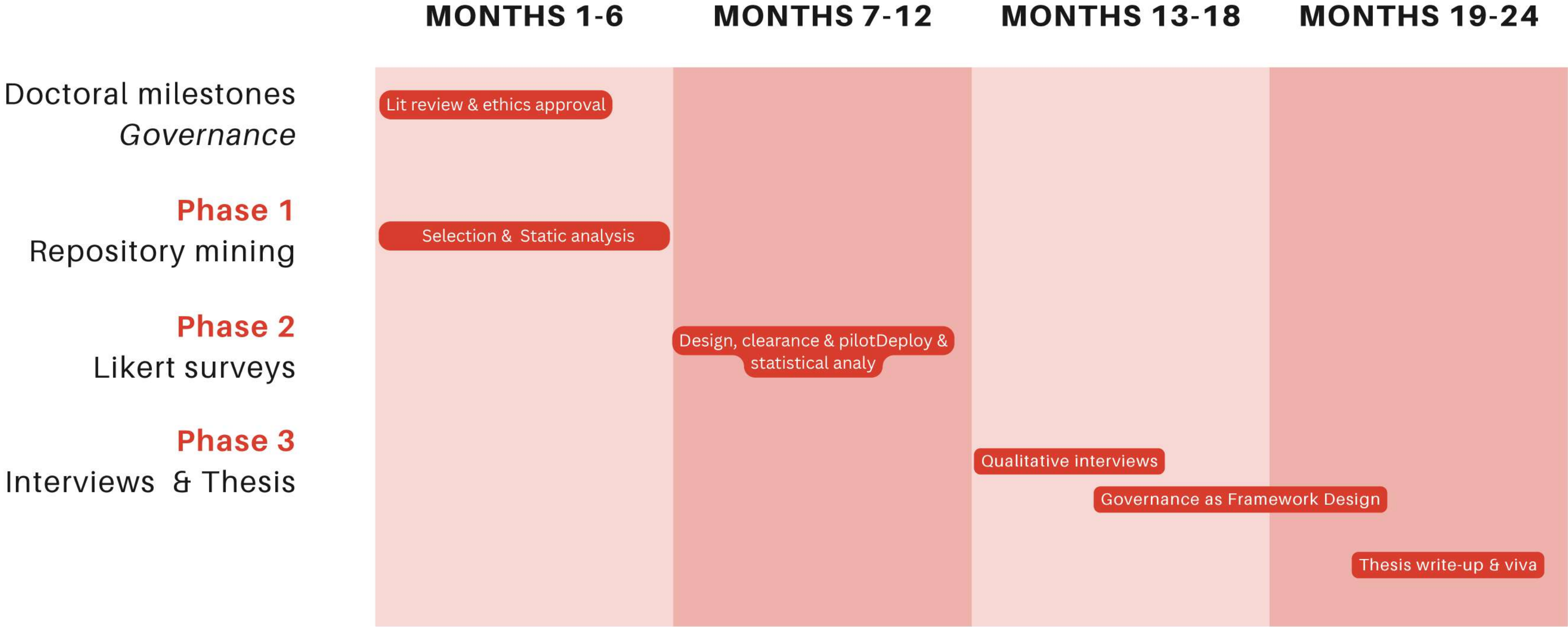
PHASE 2 — QUALITATIVE



PHASE 3 — SYNTHESIS



Project Execution Plan



Wrapping Up



Conclusion

This research addresses the critical gap in modern AI-augmented software engineering by moving beyond the dominant functionalist paradigm. By acknowledging that technical debt is a socio-technical phenomenon, the proposed Governance-as-Code framework provides a practical, pragmatic method to stabilize software evolution while protecting engineering talent from cognitive burnout.

References

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Thank You



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