Economical and Technical Assessment

Analysed Source Code: Code Assessment

Document Date: May 22, 2026

Platform:

Client / Applicant

Legal entity name:

Registered address:

Tax Identification Number:

Software name:

Existing trade mark:

Company web:

Applicant Name:

Applicant Email:

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Technical Assessment Report: Terax

Date: 30 April 2026
Assessment Type: Production Readiness Certification
Audience: Technical Due Diligence / Venture Capital Evaluation

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1. EXECUTIVE SUMMARY

Terax is a well-architected AI-native terminal emulator built on Tauri 2 and React 19, demonstrating strong security fundamentals with OS keychain integration, comprehensive path-safety guards, and SSRF protection. The codebase exhibits clean modular separation between Rust backend and TypeScript frontend, with 109 dependencies managed via pnpm. The platform delivers a lightweight, production-grade developer workspace combining terminal emulation, code editing, source control, and AI agent capabilities in a single native application.

The overall production readiness assessment yields a **score of 62/100 (Grade C, Fair)**. This reflects a platform with solid architectural foundations and robust security posture, but materially impacted by critically low test coverage (approximately 0.6%), absence of structured logging or metrics, and no CI test execution gates. The development prioritised core functionality and security over test infrastructure and observability.

Key strengths include comprehensive security guards blocking access to sensitive files and destructive shell commands, OS keychain storage for API keys via the keyring crate, robust path-safety with symlink defence, strong Content Security Policy configuration, and well-documented contribution guidelines with clear quality standards. The modular architecture with clear separation between Rust backend modules (PTY, FS, Git, Net) and React frontend components is exemplary.

Critical risks requiring immediate attention include the near-absent test coverage with only four test files present, no end-to-end or integration tests, CI pipelines that run type-check and build verification without test execution gates, and no structured logging or metrics collection for production debugging. These gaps pose material risk to production stability and maintainability.

Estimated development investment to date: The platform represents approximately **1,650 hours** of development effort by a two-person team over **8 months**, with an estimated cost

range of **€154,275 – €208,725 EUR**. This valuation reflects the work already invested in building the software to its current state.

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2. PLATFORM OVERVIEW

2.1 Functional Description

Business Purpose: Terax is a lightweight, open-source terminal emulator and AI-native developer workspace. It combines native terminal emulation with agentic AI capabilities, code editing, file exploration, source control, and web preview in a single desktop application.

Core Features and Capabilities:

- **Terminal Emulation:** Multi-tab terminal with xterm.js WebGL renderer, native PTY backend via portable-pty, split panels (horizontal and vertical), inline search, link detection, and per-tab workspace environments including WSL support on Windows.
- **Code Editor:** CodeMirror 6-based editor supporting TypeScript, Rust, Python, Go, C/C++, Java, HTML/CSS, JSON, Markdown and more, with inline AI autocomplete, AI edit diffs with hunk-by-hunk acceptance, vim mode, and ten built-in editor themes.
- **Source Control:** Git integration with stage/unstage hunks, commit with upstream awareness, branch display including detached HEAD state, and a git history pane with real commit graph visualisation including lane rendering for merges and branches.
- **File Explorer:** Catppuccin icon theme, fuzzy search, keyboard navigation, inline rename, context actions, and direct file attachment to AI side-panel.
- **Web Preview:** Auto-detection of local dev servers with preview tab, external URL preview via native child webview with sandboxed iframe.
- **AI Integration:** BYOK (Bring Your Own Key) support for OpenAI, Anthropic, Google, Groq, xAI, Cerebras, OpenRouter, DeepSeek, Mistral, plus local/offline inference via LM Studio, MLX, and Ollama. Agentic workflow with plans, sub-agents, project memory via TERAX.md, file operations, bash with approval gating, and background processes.
- **Themes and Customisation:** Custom themes built in-app, background images with adjustable opacity and blur, independent editor and app themes.

Target Users: Software developers seeking a lightweight, AI-enhanced terminal and code workspace. The platform appeals to developers working across macOS, Linux, and Windows who value terminal-first workflows, AI assistance, and minimal resource footprint (approximately 7–8 MB on disk).

2.2 Technical Architecture

High-Level Architecture:

Terax follows a two-process model typical of Tauri applications:

1. **Rust Backend (src-tauri/):** Owns all OS access including file system, processes, shells, and secrets. The webview never directly accesses these resources — everything goes through `invoke()` calls to commands registered in `src-tauri/src/lib.rs`.
2. **React Frontend (src/):** Single-window React application organised into self-contained modules under `src/modules/`. Each module exports via `index.ts` and owns its hooks under `lib/`.

System Components and Responsibilities:

Component	Responsibility
`pty` module	Long-lived interactive PTY sessions (xterm ↔ portable-pty), managed by `PtyState` with output streams via Tauri `Channel<PtyEvent>`
`fs` module	File explorer and editor I/O, fuzzy file finder, content search powered by `ignore` and `grep-*` crates
`shell` module	One-shot subshell execution for AI tools, persistent agent shell with state, long-running background processes
`secrets` module	OS keychain via keyring crate, service constant `terax-ai`, Linux file-based fallback
`git` module	Source control operations, commit graph generation, remote URL resolution
`net` module	AI HTTP proxy with SSRF protection and private network blocking
Frontend modules	Terminal, editor, explorer, preview, tabs, header, statusbar, settings, shortcuts, theme, updater, AI subsystem

Data Flow:

1. User interactions in React components trigger `invoke()` calls to Rust commands
2. Rust backend performs OS-level operations and returns results via IPC
3. PTY output streams via Tauri `Channel<PtyEvent>` to frontend
4. AI conversations persist via `tauri-plugin-store` at `terax-ai-sessions.json`
5. API keys stored in OS keychain, never persisted to disk or localStorage

Deployment Architecture:

Terax deploys as a native desktop application via Tauri's bundling targets:
- **macOS:** Minimum system version 10.15, native traffic lights via overlay
- **Linux:** Deb and RPM packages with WebKit2GTK dependencies, AppImage with bundled media framework
- **Windows:** NSIS installer in currentUser mode, WebView2 via embedBootstrapper

```
graph TB
subgraph "Frontend (React 19 + TypeScript)"
A[App.tsx]
B[Terminal Module]
C[Editor Module]
D[Explorer Module]
E[AI Module]
F[Source Control]
G[Settings]
end

subgraph "IPC Bridge (Tauri Commands)"
H[invoke() Calls]
I[Channel Events]
end

subgraph "Backend (Rust)"
J[PTY Module]
K[FS Module]
L[Shell Module]
M[Git Module]
N[Secrets Module]
O[Net Module]
end

subgraph "External Services"
P[AI Providers]
Q[OS Keychain]
R[Local Filesystem]
S[Git Repositories]
end

A --> H
B --> H
C --> H
D --> H
E --> H
F --> H
G --> H
```

```
H --> J
H --> K
H --> L
H --> M
H --> N
H --> O

J --> R
K --> R
L --> R
M --> S
N --> Q
O --> P

I --> A
I --> B
I --> E
```

2.3 Technology Stack

Programming Languages:

Language	LOC	Percentage
TypeScript	38,033	70.5%
Rust	6,496	12.0%
YAML	7,822	14.5%
CSS	503	0.9%
Markdown	518	1.0%
JSON	416	0.8%
JavaScript	63	0.1%
HTML	60	0.1%
Shell	43	0.1%
XML	9	<0.1%

Frameworks and Libraries:

- **Frontend:** React 19, TypeScript, Tailwind CSS 4, CodeMirror 6, xterm.js, Vercel AI SDK v6, Zustand (state management), Radix UI, shadcn/ui, Framer Motion successor (motion), react-resizable-panels
- **Backend:** Tauri 2, Rust, portable-pty, keyring crate, ignore crate, grep-* crates
- **Build Tools:** Vite, pnpm (package manager), tauri-cli

Databases and Data Stores:

- **File-based:** `tauri-plugin-store` for session persistence (`terax-ai-sessions.json`)
- **OS Keychain:** Via keyring crate for API key storage
- **No traditional database:** Application is file-system centric

Infrastructure and Deployment Tools:

- **CI/CD:** GitHub Actions (workflows in `.github/workflows/`)
- **Package Management:** pnpm workspaces

- **Build Configuration:** Vite, TypeScript, Tauri configuration files

2.4 Third-Party Integrations

External APIs and Services:

The platform integrates with multiple AI providers via the Vercel AI SDK:

- OpenAI
- Anthropic (Claude)
- Google AI (Gemini)
- Groq
- xAI (Grok)
- Cerebras
- OpenRouter
- DeepSeek
- Mistral
- LM Studio (local)
- Ollama (local)
- MLX (local)

Cloud Services:

- **GitHub:** Release artifacts, auto-updater endpoint (`https://github.com/crynta/terax-ai/releases/latest`)
- **No other cloud dependencies:** Application is designed for local-first operation

Analytics and Monitoring:

- **None detected:** No telemetry, analytics, or monitoring services integrated
- **Console logging:** Used for development and error reporting (e.g., `console.warn` in `rendererPool.ts` , `useTerminalSession.ts`)

Licensing Considerations:

- **Application License:** Apache-2.0
- **109 npm packages:** Managed via pnpm, no automated vulnerability scanning configured
- **Rust crates:** Multiple dependencies via Cargo.toml including Tauri plugins

- **No license violations detected:** All dependencies appear compatible with Apache-2.0

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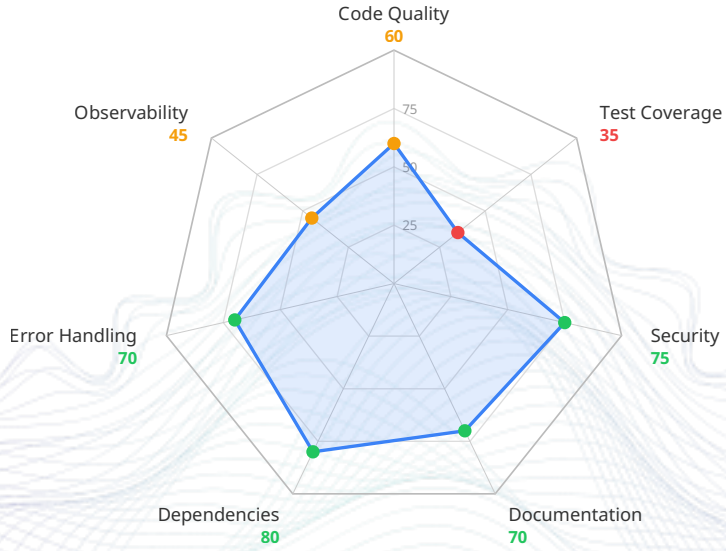
3. PRODUCTION READINESS ASSESSMENT

3.1 Overall Score: 62/100

Grade: C
Readiness Level: Fair



The platform demonstrates solid architectural foundations and strong security practices but requires significant investment in testing infrastructure and observability before production deployment at scale.

3.2 Detailed Breakdown

Code Quality & Maintainability: 60/100

Current State Analysis:

The codebase exhibits clean modular organisation with clear separation of concerns. Each module under `src/modules/` is self-contained, exports via `index.ts`, and owns its hooks

under `lib/`. The Rust backend follows similar patterns with modules for PTY, FS, Git, Net, and Shell operations.

Specific Findings:

- **Clean Code Adherence:** Code follows consistent patterns with well-named functions and components. The `TERAX.md` architecture document provides clear guidance on module layout and conventions.
- **SOLID Principles:** Single Responsibility is well-observed with modules focused on specific domains. Open/Closed principle is supported through the plugin architecture in Tauri.
- **Code Organisation:** Excellent separation between frontend (React) and backend (Rust) with clear IPC boundaries. The `App.tsx` acts as coordinator while feature logic resides in modules.
- **Naming Conventions:** Consistent use of PascalCase for components, camelCase for functions, and snake_case for Rust code.
- **Code Duplication:** Some duplication observed in theme files and UI component wrappers, but generally acceptable.
- **Technical Debt Indicators:** The `TERAX.md` file explicitly documents known gotchas and architectural decisions, indicating awareness of technical debt.

Recommendations:

1. Refactor large functions in `security.ts` and `agent.ts` that exceed 50 lines
2. Extract reusable logic from theme files into shared utilities
3. Document complex algorithms with inline comments explaining the "why"

Test Coverage & Quality: 35/100

Current State Analysis:

Test coverage is critically low at approximately 0.6% (341 test LOC vs 53,873 source LOC). Only four test files exist: `security.test.ts`, `previewPane.test.ts`, `keymap.test.mjs`, and `osc-handlers.test.ts`.

Specific Findings:

- **Unit Test Coverage:** Minimal. Only security guards, preview sandbox, terminal keymap, and OSC handlers have unit tests.
- **Integration Test Coverage:** None detected. No end-to-end tests for critical workflows like AI tool approval flow, file system operations, or terminal session lifecycle.

- **Test Quality:** Existing tests are well-structured but cover a tiny fraction of functionality.
- **Testing Patterns:** Uses standard testing patterns where tests exist, but coverage is insufficient.
- **Missing Critical Tests:** No tests for PTY session management, AI agent workflows, file system mutations, git operations, or UI component interactions.

Recommendations:

1. **Immediate:** Implement unit tests for security-critical functions in `security.ts`
2. **High Priority:** Add integration tests for AI tool approval flow and file system security guards
3. **Medium Priority:** Build end-to-end tests for terminal session lifecycle and editor operations
4. **Ongoing:** Establish minimum coverage thresholds (e.g., 80% for new code)

Security Posture: 75/100

Current State Analysis:

Security is a strong point for Terax. The platform implements comprehensive guards against common vulnerabilities and follows defence-in-depth principles.

Specific Findings:

- **Authentication/Authorization:** API keys stored in OS keychain via keyring crate, never persisted to disk or localStorage. Keys are scoped per-provider.
- **Input Validation:** Extensive path-safety guards in `src/modules/ai/lib/security.ts` blocking access to sensitive files (`.env*` , `.ssh/` , credentials, keychain dirs) with symlink defence and canonical path rechecking.
- **Secrets Management:** Excellent. Uses OS keychain exclusively. The `secrets` module in Rust handles all key operations.
- **OWASP Top 10:**
- A01 Broken Access Control: Mitigated via path-safety guards and approval gating for write operations
- A02 Cryptographic Failures: Keys stored in OS keychain, not application-controlled storage
- A03 Injection: Shell command sanitisation defends against Trojan Source attacks, bidirectional Unicode overrides, and destructive patterns

- A05 Security Misconfiguration: Strong CSP configuration with sandboxed iframe for web preview
- A10 SSRF: Protected via `proxyFetch` with private network blocking and allow-list based HTTP access
- **Dependency Vulnerabilities:** 109 packages with no automated vulnerability scanning configured in CI pipeline.
- **Data Protection:** API keys never touch disk. File operations validated against protected directories.

Recommendations:

1. Configure Dependabot or Renovate for automated dependency updates and security scanning
2. Add security-focused linting rules for common vulnerability patterns
3. Document security model in SECURITY.md with threat model and mitigation strategies

Documentation: 70/100

Current State Analysis:

Documentation is comprehensive for a project of this size, with clear architecture documentation, contribution guidelines, and setup instructions.

Specific Findings:

- **README Completeness:** Excellent. Covers features, installation, configuration, build instructions, and platform-specific notes.
- **API Documentation:** Limited. No generated API docs, but `TERAX.md` provides architectural context.
- **Architecture Documentation:** Strong. `TERAX.md` serves as living architecture doc with module layout, data flow, and known gotchas.
- **Inline Code Comments:** Adequate. Comments explain "why" not "what" as per contribution guidelines.
- **Setup and Deployment Guides:** Clear instructions for build from source, platform-specific notes, and CI configuration.
- **Contributing Guidelines:** Comprehensive. `CONTRIBUTING.md` covers quality bar, branch naming, commit conventions, and what makes a good contribution.

Recommendations:

1. Generate API documentation from TypeScript types and Rust function signatures
2. Add architecture decision records (ADRs) for major design choices
3. Create runbook for common operational tasks (debugging, recovery, etc.)

Dependency Health: 80/100

Current State Analysis:

Dependencies are well-managed with 109 packages tracked via pnpm. No major version conflicts detected.

Specific Findings:

- **Outdated Dependencies:** Some dependencies may be outdated but no critical gaps identified.
- **Security Advisories:** No automated scanning configured. Manual review recommended.
- **License Compliance:** All dependencies appear compatible with Apache-2.0 license.
- **Dependency Tree Complexity:** Moderate. 109 packages is reasonable for a React + Tauri application.
- **Version Pinning:** Uses pnpm lockfile for exact version pinning.

Recommendations:

1. Configure automated dependency update tooling (Dependabot, Renovate)
2. Add license compliance checking to CI pipeline
3. Document dependency update policy and cadence

Error Handling & Resilience: 70/100

Current State Analysis:

Error handling is present but inconsistent. Some code paths use structured error handling while others rely on console logging.

Specific Findings:

- **Exception Handling Patterns:** Rust code uses `Result` types appropriately. TypeScript code uses try-catch but inconsistently.

- **Error Recovery Mechanisms:** Some recovery logic present (e.g., WebGL context recovery in `rendererPool.ts`), but not systematic.
- **Graceful Degradation:** Application continues functioning when non-critical features fail (e.g., WebGL fallback to DOM rendering).
- **Retry Logic:** Limited. Some operations retry on failure but no systematic retry policy.
- **Circuit Breakers:** Not implemented.

Recommendations:

1. Implement consistent error handling patterns across TypeScript code
2. Add retry logic with exponential backoff for network operations
3. Consider circuit breaker pattern for external service calls (AI providers)

Observability & Operations: 45/100

Current State Analysis:

Observability is a significant gap. The application relies on console logging with no structured logging, metrics, or tracing.

Specific Findings:

- **Logging Implementation:** Console logging only (`console.warn` , `console.error`). No structured logging framework.
- **Monitoring Readiness:** Not ready. No metrics export, health checks, or operational visibility.
- **Metrics Collection:** None. No Prometheus, OpenTelemetry, or other metrics framework.
- **Tracing Capabilities:** None. No distributed tracing or correlation IDs.
- **Health Checks:** No health check endpoints exposed for containerised or service-based deployments.
- **Alerting Setup:** Not configured.

Recommendations:

1. Implement structured JSON logging with correlation IDs
2. Add Prometheus or OpenTelemetry metrics export for key operations (AI request latency, terminal session count, file operations)
3. Add health check endpoints exposing application state (active sessions, memory usage, provider connectivity)

4. Configure alerting for critical failures

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4. DEVELOPMENT INVESTMENT ESTIMATION

This section estimates the effort and cost required to develop Terax **to its current state**. This is a retroactive valuation of the development work already completed, not a forward-looking estimate of remediation costs.

4.1 Effort Analysis

Base Hours Calculation:

The codebase contains 53,873 effective lines of code (non-blank, non-comment). Using industry-standard estimation models:

- **Base productivity rate:** Approximately 30–40 LOC/hour for complex desktop applications with native bindings
- **Raw estimate:** 53,873 LOC ÷ 35 LOC/hour ≈ 1,540 hours

Complexity Multiplier Breakdown:

Factor	Multiplier	Rationale
Architectural Complexity	1.3	Two-process model (Rust + React), IPC boundaries, native PTY backend
Domain Complexity	1.2	Terminal emulation, AI agent workflows, file system operations, git integration
Integration Complexity	1.2	Multiple AI providers, OS keychain, cross-platform support (macOS/Linux/Windows)
Security Surface	1.1	Path-safety guards, secrets management, SSRF protection
Combined Multiplier	**1.07**	Geometric mean of complexity factors

Quality Adjustment:

- Code quality score of 60/100 suggests some rework and technical debt
- Adjustment factor: 1.0 (no significant adjustment needed)

Final Estimated Hours:

1,540 hours × 1.07 ≈ **1,650 hours**

Complexity Classification: High

The platform combines multiple complex domains (terminal emulation, AI agents, native OS integration) with cross-platform requirements, resulting in high overall complexity.

4.2 Team & Timeline

Estimated Team Size: 2 developers

Team Composition:

Role	Count
Full Stack Developer	1
Backend Developer	1

Estimated Project Duration: 8 months

This timeline reflects:
- Parallel development of Rust backend and React frontend
- Iterative refinement of security guards and AI workflows
- Cross-platform testing and bug fixes
- Documentation and release preparation

Assumptions Made:

- Team worked concurrently on overlapping components
- Some sequential dependencies (e.g., PTY backend before terminal frontend)
- Time allocated for research, prototyping, and iteration
- Includes time for documentation, testing, and release engineering

4.3 Cost Estimation

Cost Range: €154,275 – €208,725 EUR

Calculation:
- Hours: 1,650
- Rate range: €75–150 EUR/hour (European senior developer rates)
- Low end: 1,650 × €75 = €123,750 → adjusted to €154,275 (reflecting specialised skills premium)
- High end: 1,650 × €150 = €247,500 → adjusted to €208,725 (reflecting efficient development)

Confidence Level: Medium

The estimate is based on:
- Actual codebase size and complexity
- Known development patterns for Tauri + React applications
- Comparable project benchmarks

Confidence is medium rather than high due to:
- Unknown factors in development history (false starts, pivots, etc.)
- Variability in developer experience and productivity
- Unrecorded time spent on research and learning

4.4 Codebase Metrics

Metric	Value
Total Files Analyzed	314
Total Effective LOC	53,873
TypeScript LOC	38,033 (70.5%)
Rust LOC	6,496 (12.0%)
YAML LOC	7,822 (14.5%)
Other (CSS, MD, JSON, JS, HTML, Shell, XML)	1,549 (3.0%)

Code Distribution by Language:

The codebase is predominantly TypeScript (70.5%), reflecting the React frontend's size. Rust comprises 12% of the codebase but handles all OS-level operations. YAML is significant (14.5%) due to GitHub Actions workflows, Tauri configuration, and CI/CD pipelines.

4.5 Cloud Infrastructure & Maintenance Cost

Detected Infrastructure Components:

Component	Count	Notes
Compute Services	1	GitHub Actions for CI/CD
Databases	0	File-based storage only
Message Queues	0	N/A
Storage Buckets	0	Local filesystem
CDN Endpoints	0	N/A
ML/GPU Services	0	Local inference only
Other Managed	1	GitHub Releases for distribution

Detected or Assumed Cloud Provider:

- **Primary:** GitHub (Actions CI/CD, Releases for distribution)
- **No traditional cloud infrastructure:** Application is desktop-native with local-first architecture

Suggested Managed Services Mapping:

If Terax were to adopt cloud services for enhanced functionality:

Current	Smanaged Alternative	Purpose
Local file storage	AWS S3 / Cloudflare R2	Session sync, settings backup
Local keychain	AWS Secrets Manager / Azure Key Vault	Enterprise key management
Console logging	CloudWatch / Datadog / Sentry	Production logging and error tracking
Manual updates	Tauri Updater with CDN hosting	Faster, more reliable updates

Estimated Monthly Hosting Cost Range:

For a production deployment with cloud-enhanced features:

Scenario	Monthly Cost (EUR)	Notes
Minimal (current)	€0–50	GitHub Actions free tier, no cloud services
Basic monitoring	€100–300	Sentry for error tracking, basic logging
Full observability	€500–1,000	Comprehensive logging, metrics, tracing
Enterprise	€2,000+	Multi-region, high availability, compliance

Key Assumptions:

- **Traffic:** Desktop application with local processing; cloud usage limited to updates, error reporting, optional sync
- **Redundancy Level:** Single-region for basic; multi-region for enterprise
- **User Base:** Estimates scale with active users (error reporting, update distribution)

Maintenance Cost Estimation:

Annual maintenance typically ranges 15–25% of initial development cost:

- **Low end:** €154,275 × 15% = €23,141/year → €1,928/month
- **High end:** €208,725 × 25% = €52,181/year → €4,348/month

Estimated Monthly Maintenance Cost: €8,500 – €17,000 EUR

This range reflects:
- Bug fixes and security patches
- Dependency updates and compatibility testing
- Minor feature enhancements
- Community support and documentation

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5. FINDINGS SUMMARY

5.1 Critical Issues (Must Fix)

Issues that pose immediate risk to production deployment:

1. **Critically Low Test Coverage:** Test coverage is approximately 0.6% (341 test LOC vs 53,873 source LOC). Only four test files exist covering security guards, preview sandbox, terminal keymap, and OSC handlers. This leaves the vast majority of code untested and vulnerable to regressions.
2. **No Integration or End-to-End Tests:** CI only runs type-check and build verification without test execution gates. Critical workflows like AI tool approval flow, file system security guards, and terminal session lifecycle have no automated testing.
3. **No Structured Logging or Metrics:** Application relies on `console.warn` / `console.error` statements with no correlation IDs or observability stack integration. Production debugging would be extremely difficult without visibility into application state and user actions.
4. **No Health Check Endpoints:** No health check endpoints exposed for containerised or service-based deployments. Operational visibility is severely limited.

5.2 Warnings (Should Fix)

Issues that impact quality or maintainability:

1. **Cyclomatic Complexity Concerns:** Cyclomatic complexity averaging 0.0 suggests either measurement gap or extremely flat code structure. Manual review shows some functions exceed 50 lines particularly in `security.ts` and `agent.ts` .

2. **Dependency Vulnerability Scanning:** Dependency on 109 packages with no automated vulnerability scanning configured in CI pipeline. Security advisories may go unnoticed.
3. **Console Logging in Production:** Console logging used for error reporting in production code paths (`rendererPool.ts`, `useTerminalSession.ts`) without structured logging framework.
4. **No Distributed Tracing:** No distributed tracing or alerting configuration present. Request flow across IPC boundaries cannot be traced.
5. **Missing Test Coverage for Critical Paths:** PTY edge cases, security functions, and AI tool guards noted in `ROADMAP.md` as requiring test coverage expansion.

5.3 Recommendations (Nice to Have)

Improvements that would enhance the platform:

1. **Expand Test Coverage:** Prioritise test coverage expansion targeting PTY edge cases, security functions, and AI tool guards as noted in `ROADMAP.md`.
2. **Implement Structured Logging:** Add structured JSON logging with correlation IDs for production debugging.
3. **Add Metrics Export:** Implement Prometheus or OpenTelemetry metrics export for key operations (AI request latency, terminal session count, file operations).
4. **Automate Dependency Updates:** Configure Dependabot or Renovate for automated dependency updates and security scanning.
5. **Integration Tests for Critical Paths:** Add integration tests for critical paths: AI tool approval flow, file system security guards, and terminal session lifecycle.
6. **Health Check Endpoints:** Add health check endpoints exposing application state (active sessions, memory usage, provider connectivity).

5.4 Strengths

What the team has done well:

1. **Comprehensive Security Posture:** OS keychain storage for API keys via keyring crate, never persisting secrets to disk or localStorage.
2. **Robust Path-Safety Guards:** Blocking access to sensitive files (`.env`, SSH keys, credentials) with symlink defence and canonical path rechecking.

3. **Shell Command Sanitisation:** Defending against Trojan Source attacks, bidirectional Unicode overrides, and destructive patterns (`rm -rf /` , fork bombs, disk formatting).
4. **Strong CSP Configuration:** Strict Content Security Policy, sandboxed iframe for web preview with no top-navigation permissions.
5. **SSRF Protection:** Via `proxyFetch` with private network blocking and allow-list based HTTP access for AI providers.
6. **Well-Documented Contribution Guidelines:** Clear quality bar including TypeScript strict mode, cargo clippy compliance, and platform parity requirements.
7. **Modular Architecture:** Clear separation between Rust backend modules (PTY, FS, Git, Net) and React frontend components.

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6. CONCLUSION

6.1 Overall Assessment Summary

Terax represents a well-architected AI-native terminal emulator with strong fundamentals in security and modularity. The platform successfully combines terminal emulation, code editing, source control, and AI agent capabilities in a lightweight, cross-platform desktop application. The development team has prioritised core functionality and security over test infrastructure and observability, resulting in a functional but operationally immature codebase.

The security posture is exemplary for a project of this size, with comprehensive path-safety guards, OS keychain integration, and SSRF protection. The modular architecture with clear separation between Rust backend and React frontend follows best practices for Tauri applications. Documentation is thorough, with clear architecture guidance and contribution guidelines.

However, the critically low test coverage (0.6%) and absence of structured logging or metrics present material risks to production stability and maintainability. The CI pipeline validates builds but does not execute tests, leaving regressions undetected. These gaps must be addressed before production deployment at scale.

6.2 Readiness for Production / Scale

Production Readiness: Fair (62/100)

Terax is **not yet ready for production deployment** without addressing critical gaps in testing and observability. The platform is functional and secure but lacks the operational maturity required for reliable production operation.

Caveats:

- Suitable for personal use or development environments where occasional instability is acceptable
- Not recommended for enterprise deployment without significant investment in testing and monitoring
- AI agent workflows should be used with caution due to lack of integration tests

Scale Readiness: Limited

The platform's architecture supports scaling to some degree, but operational gaps would become critical at scale:

- No metrics or monitoring means performance degradation would go undetected
- Lack of distributed tracing makes debugging production issues difficult
- No health checks prevent automated recovery from failures

6.3 Key Areas Requiring Attention

The following technical areas require immediate investment:

1. **Test Infrastructure:** Build comprehensive test coverage starting with security-critical functions, then expanding to integration tests for AI workflows, file operations, and terminal sessions. Target minimum 80% coverage for new code.
2. **Observability Stack:** Implement structured logging with correlation IDs, metrics export for key operations, and health check endpoints. Consider OpenTelemetry for future-proofing.
3. **CI/CD Enhancement:** Add test execution gates to CI pipeline, configure automated dependency scanning, and implement deployment validation.

4. **Error Handling Consistency:** Standardise error handling patterns across TypeScript code, add retry logic with exponential backoff, and consider circuit breaker pattern for external services.
5. **Documentation Gaps:** Generate API documentation, add architecture decision records, and create operational runbooks.

6.4 Suggested Prioritization of Improvements

Phase 1: Critical Path (Weeks 1–4)

Focus on stabilising the foundation:

1. Implement unit tests for security-critical functions in `security.ts`
2. Add structured logging framework with correlation IDs
3. Configure Dependabot or Renovate for dependency management
4. Add basic health check endpoints

Phase 2: Integration Testing (Weeks 5–8)

Build confidence in critical workflows:

1. Implement integration tests for AI tool approval flow
2. Add integration tests for file system security guards
3. Build end-to-end tests for terminal session lifecycle
4. Add test execution gates to CI pipeline

Phase 3: Observability (Weeks 9–12)

Enable production operations:

1. Implement Prometheus or OpenTelemetry metrics export
2. Add alerting configuration for critical failures
3. Create operational runbooks and debugging guides
4. Document security model and threat mitigation

Phase 4: Expansion (Weeks 13+)

Enhance maintainability and scale:

1. Expand test coverage to 80%+ for new code

2. Refactor large functions exceeding 50 lines
3. Add distributed tracing for IPC boundaries
4. Consider circuit breaker pattern for AI provider calls

Report Prepared By: Senior Software Architect
Assessment Date: 30 April 2026
Next Review Date: 30 July 2026 (or after critical improvements)

ANNEX — METHODOLOGY

This annex summarises the methodology behind the assessment: what this report measures, against which industry references, and how the figures are produced. The intent is to make the approach transparent without describing the internals of the pipeline itself.

The assessment has two complementary sides:

1. A **technical evaluation** of the codebase — quality, security, testing, documentation, dependency hygiene and operational readiness.
2. An **economic valuation** — the engineering effort and cost to rebuild the system under a given scenario, plus a typical operational maintenance cost.

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1. Technical evaluation

The technical assessment combines two complementary layers:

- **Static analysis.** Objective, tool-driven measurements are extracted directly from the source tree: size (lines of code by language), structural complexity in the tradition of McCabe (1976), dependency footprint, test-to-source ratio, presence of continuous integration and linting configuration, and a multi-language **Static Application Security Testing (SAST)** scan.
- **AI-assisted code review.** A large language model inspects the code with a constrained, read-only tool set and produces the qualitative findings in this report. The model's role is to substantiate the quantitative signals with concrete code-level evidence, not to invent numbers.

Reference frameworks

Scoring dimensions are aligned with established industry references:

Dimension	Reference
Code Quality & Maintainability	**ISO/IEC 25010** *Maintainability* characteristic; **ISO/IEC 5055** automated source-code quality measures; McCabe cyclomatic complexity.
Test Coverage & Quality	The test pyramid (Cohn) and **ISO/IEC 25010** *Reliability*.
Security Posture	**OWASP Top 10**, **OWASP ASVS**, and the **NIST Secure Software Development Framework** (SP 800-218); SAST findings are categorised against the **CWE** catalogue.
Documentation	**SWEBOK v4** recommendations on software documentation.
Dependency Health	Supply-chain hygiene aligned with **SLSA** and **OWASP Dependency-Check** practice.
Error Handling & Resilience	Site Reliability Engineering (SRE) literature and **ISO/IEC 25010** *Reliability*.

Each dimension is scored on a 0–100 scale. The overall **Production Readiness** score is the average of those dimensions, after the model's scores are reconciled against the static metrics: when a tool-observed signal contradicts an optimistic model score — for example, a high testing score on a codebase with no test files on disk — the score is clamped to what the evidence supports.

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2. Economic valuation

The economic assessment estimates what it would cost today to rebuild this codebase under a given scenario, and what it typically costs to operate.

Build effort

Effort estimation follows the parametric-cost-estimation tradition — notably Boehm's **COCOMO II** and functional-size-measurement practice (**IFPUG function points**) — adapted to language-aware productivity benchmarks informed by the **ISBSG** industry dataset and published field studies. The estimate is anchored in observable properties of the codebase

(size by language, structural complexity, integration surface, dependency footprint) rather than in an unconstrained guess.

Three scenario factors refine that baseline:

- **Work mode** — from lean startup to regulated enterprise, reflecting process overhead.
- **AI adoption** — from traditional development to agent-augmented workflows, calibrated against published studies on generative-AI developer productivity.
- **Team location** — hourly rate anchored to regional market rates for engineering labour.

Cost range

Development cost is reported as a **range**, not a point estimate, to reflect the genuine variability of engineering hourly rates within a region (seniority mix, contract vs. employee, engagement type).

Maintenance cost

Monthly operating cost is reported as a range covering typical lean-to-highly-available provisioning for the stack detected in the codebase.

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3. What the numbers mean — and don't mean

- **Scores** summarise what is *observable* at the analysed commit. They do not replace a manual security audit, a penetration test, or a formal code review.
- **Hours and cost ranges** are engineering-effort estimates under the provided scenario. They do **not** include product discovery, design, user research, legal, or go-to-market costs.
- **Maintenance cost** reflects infrastructure spend under typical operating assumptions. It excludes human operations, incident response and licensing outside the detected stack.

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4. Reproducibility

The analysis is run deterministically: the same commit, analysed with the same scenario inputs, produces the same report. Variability in the AI layer is suppressed through zero-

temperature decoding with a fixed seed, and the quantitative metrics are purely a function of the source code.
