CognInfra Project Proposal

Chua Thian Poh Pinnacle Prize 2026—— AI for Good/Smart City

Demo: truedawn.xyz/cogninfra-demo/

1. Problem Statement

In today's digital work environment, frequent notifications, multitasking, and asynchronous collaboration are continuously intensifying cognitive overload.

Research shows that information workers switch tasks every 3 minutes on average, and after each interruption, it takes more than 23 minutes to fully regain the original task context. Task switching also creates "attention residue," where part of one's cognitive resources remains occupied by the previous task, reducing performance on the next one. Under AI-native workflows, this asynchronous human–machine switching is further amplified, leading to lower efficiency, higher stress, and increased risk of job burnout.

Cognitive overload not only undermines individual productivity, but also affects organisational performance and public mental health. Globally, low job engagement and long-term cognitive fatigue are estimated to cause approximately USD 8.8 trillion in economic losses each year. In Singapore, around 62% of employees show symptoms of burnout.

Prolonged exposure to high cognitive load further increases the risks of decision fatigue, anxiety, and burnout, adding pressure to both enterprises and society as a whole.

2. Smart City Impact

CognInfra improves both productivity and mental well-being among urban knowledge workers by directly addressing cognitive fatigue, fragmented attention, and burnout risk. In Singapore's high-intensity digital work environment, where burnout is already widespread, the solution can function as a preventive cognitive health infrastructure. By reducing interruption costs and stabilising attention, it also lowers decision errors that affect organisational and urban governance quality.

3. Value Proposition

CognInfra aims to build a human-centric architecture for cognitive environments. We draw on the concept of "Genius Loci" from physical architecture to create virtual spaces for Knowledge workers that are ritualistic, have a sense of boundary, and follow the state of flow of the human individual.

In CognInfra, we preserve essential information flow and task switching in production, but instead of forcing humans to adapt to tools, our architecture enables tools to adapt to each user's unique individual rhythms—reducing cognitive load and occupational burnout.

4. Market Overview

CognInfra serves a user base overlapping with leading productivity platforms such as Motion and Notion, particularly AI-native knowledge workers and enterprise teams. As a productivity infrastructure layer rather than a standalone application, its market potential extends beyond existing platform user scales to a broader segment of cognitively intensive professionals facing fragmented workflows and burnout risks.

4.1 Pricing Benchmark

To ensure realistic market sizing, our pricing assumptions are benchmarked against leading AI productivity SaaS platforms and adjusted using a blended annual user value.

Segment	Benchmark Product	Monthly Price	Annual Price	Pricing Logic
Individual (ToC)	Motion / Notion	USD 9.99	USD 120	Benchmark against premium AI productivity SaaS
Team / Enterprise (ToB blended)	Motion Business AI	USD 19–20 / seat	USD 240	Standard seat-based SaaS pricing
Blended benchmark	CognInfra working assumption	USD 15 blended	USD 180	Used for SAM / SOM calculations

4.2 Singapore Market Size Funnel

We adopt a bottom-up approach to derive the Singapore serviceable market, starting from the digitally active population and narrowing down to high-frequency knowledge workers.

Stage	Assumption	Estimated Users
Internet-active population	Singapore digital population	**5.6M**
Core working-age users	Age 18–39	**2.1M**
AI-active workforce	73.8% AI tool usage at work	**1.57M**
High-frequency knowledge workers	35% working assumption	**550K**

Resource from IMDA 2025 Singapore Digital Economy Report for AI workplace adoption

4.3 Market Size

Based on blended benchmark pricing and conservative penetration assumptions, we estimate the following market opportunity.

Market Layer	User Segment	Estimated Users	Pricing Assumption	Market Size
TAM	Global cognitively intensive workforce / high-skill workers	724M	USD 120 / user / year	USD 86.8B
SAM	Singapore AI-native high-frequency knowledge workers	550K	USD 180 / user / year	USD 99.0M
SOM (3-5%)	Conservative 2–3 year penetration	16.5K–27.5K users	Blended pricing	USD 3.0M–5.0M ARR

5. Solution Overview

In terms of design, we adhere to the following three design principles:

- By hinting to guide the cognitive state, do not force users to perform actions.
- Make the implicit cognitive consumption and control processes visible, avoiding black-box decisions from AI.
- Respect the individual rhythms of human beings, allowing the system to adapt to people rather than people adapting to the system.

On top of this, the "human-centric architecture for cognitive environments" is built on three dimensions.

- **Physical layer** - Take control of the hardware environment to create a more immersive cognitive environment， and collect data to assist in the operation of other layers
- **Digital layer** - Reconstruct the digital production environment to guide internal cognition and shield against noise.
- **Cognitive layer** - Guide and regulate the human internal cognitive environment

5.1 Measure and protect cognition

The Cognitive Margin Engine(CME)

A real-time system that quantifies cognitive state through behavioural signals (rhythm, switching, duration) and physiological data (HRV). Triggers three response levels:

- Flow Zone: Standard intervention.
- Alert Zone: Decompression mode.
- Guard Zone: Full protection.

Cognitive Inertia Protection

When Flow is detected:

- Blocks notifications, buffers AI results
- Shows "switching cost" on app changes
- Batches all alerts upon exit

Cognitive Budget Panel & Insights

Visualises long-term cognitive drain like a financial bill—transparent, not a black box. After 2–4 weeks of data accumulation, unlocks fatigue early-warning trends.

5.2 Contextual container and enhance continuity

The Task Sanctuary

Project-specific virtual rooms with visual themes for automatic context isolation. Anchored by two rituals:

- **Cognitive Warm-up**: Snapshot replays + intention setting
- **Cognitive Cooling**: Auto-summaries + "next-day relay lists" to close loops and kill Zeigarnik residue

Mind Snapshots & Memory

Persistent foundation capturing visual, semantic, and emotional thought states:

- **Mind Flashbacks**: 3-second dynamic playbacks for instant recall.
- **Mind Threads**: "Git log" of thought evolution for seamless cross-session continuity.

Seamless AI Integration

Linked to the Cognitive Margin Engine, learns users' natural pause modes. Delivers AI results during off-peak moments—assistance without interruption.

5.3 Bridge physical and digital environments

The physical layer bridges cognitive state and the digital space, transforming the environment from a passive background into an active interface that supports cognition.

Environment Initialization

Gradual changes in lighting, sound, and space, with a short warm-up ritual inspired by mindfulness, guide users into focus and reduce entry friction.

Adaptive Regulation

Continuously adjusts environmental conditions:

- Reduce stimuli under high load.
- Increase activation under low arousal.
- Restore rhythm during stagnation.

Acts as a dynamic buffer to stabilize cognitive fluctuations.

Flow Protection

When stable focus is detected, the environment remains unchanged to preserve continuity.

Feedback & Learning

Lightweight summaries and gentle suggestions improve self-awareness and enable smoother future focus entry.

6. AI Innovation

A real-time multimodal system that models user's cognitive state dynamically—not through static rules, but through continuous inference.

Signal Fusion
Three layers power the engine: behavioural (window switches, keystroke rhythm, task complexity), physiological (HRV from wearables), and visual (blink rate via on-device camera). Behavioural signals work standalone; adding physiological data sharpens accuracy. All data sources remain visible to user—never a black box.

The Margin Score
Outputs a 0–100 score mapped to three zones—Flow, Alert, Guard—governing AI verbosity, notifications, information density, and task gating in real time.

Semantic Context
Mind Snapshot: LLM analysis of open files and recent edits for instant context
Cross-Session Mind Thread: Persistent, AI-curated reasoning log—like a git history for ideas—enabling seamless continuity across days

Smart Delivery
Learns users' natural pause signatures (file saves, build waits, passive scrolling) to deliver AI results precisely at cognitive gaps—no interruption, no anxiety.

Fatigue Detection
Activates once sufficient data accumulates. Detects multi-signal convergence—declining deep-work duration, rising switch frequency, session fragmentation—and surfaces private cognitive health reports grounded in validated markers (HRV SDNN/RMSSD decline, behavioural pattern shifts).

Explainable Trust
Every AI judgment expands into readable evidence. User remains in control of a system that learns them.

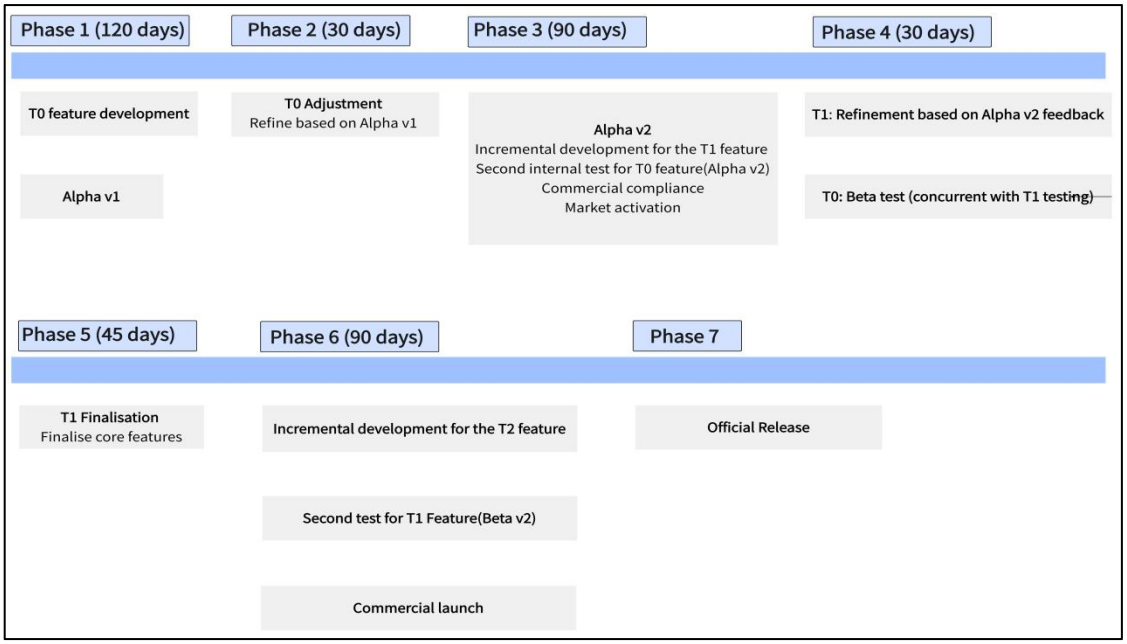
7. Business Model

We employ a dual-track SaaS model (ToB/ToC) with a three-tier pricing structure:

- Freemium: Core features to drive mass user acquisition.
- Individual Premium: Monthly/annual subscriptions for power users seeking advanced cognitive optimization.
- Enterprise Tier: Scalable licensing providing organizations with team-level burnout analytics.

Through this Product-Led Growth (PLG) approach, we leverage individual adoption to secure high-value B2B contracts, ensuring a low-cost, scalable entry into Singapore's high-intensity knowledge market.

8. Roadmap



9. Our Team

Our team unites elite graduates from NUS, NTU and RMIT. Beyond academic excellence, we represent a complete execution loop of serial entrepreneurship, top-tier investment banking/strategy, and hardcore physical IoT engineering.

1. Li Shangyuan | Product & Venture Lead

our Venture & Product Lead and a serial entrepreneur, has a proven track record of steering early-stage ventures from conceptualization to market dominance. He previously spearheaded the LanternDao project, where he orchestrated the product architecture and community ecosystem for a million-dollar scale venture, driving it towards successful commercialization.

2. Penny Peng | Business & Growth

Penny have managed IPO-related investment projects with a total fundraising scale exceeding RMB 1.9 billion, and directed go-to-market (GTM) strategies for tier-1 global brands such as Juvederm. Her core strengths lie in strategic pricing, commercialization, and complex market analysis.

3. Zhenhao Shi | Technology & Engineering

Deep expertise in intelligent sensing systems, wireless communication, and real-time data acquisition, supported by advanced research experience at **NTU** in scalable sensing and engineering systems.

Email: ZHENHAO002@e.ntu.edu.sg/lsy1036470131@gmail.com