

EXECUTIVE SUMMARY

QuantIA is a data engineering framework engineered to shift procurement strategies from heuristic biases to **Stochastic Optimization**. By leveraging Python-based Monte Carlo simulations, it quantifies risk in high-throughput logistics, specifically targeting the reduction of "Dead Stock" capital traps in volatile markets.

The Operational Challenge

In high-frequency supply chains, traditional ERPs rely on deterministic forecasting (static averages). This creates two structural inefficiencies:

- **Capital Inefficiency:** Significant liquidity is trapped in overstocked items that rarely sell (Dead Stock).
- **Analytical Fragility:** Manual spreadsheets fail to process the non-linear variance of thousands of daily transactions.

The QuantIA Solution

Rather than predicting a single demand number, QuantIA computes the **optimal probability distribution** for inventory buffers.

- **Dynamic ROP:** Reorder Points adapt automatically to demand volatility, not just averages.
- **Risk Scoring:** Each SKU is assigned a probabilistic risk score derived from Log-Normal cost modeling.

Strategic Alignment

The engineering core is operational. The critical next step is to architect a business model that transforms this "code prototype" into a sustainable SaaS solution.

The *Sustainable Business* curriculum at FUBiS provides the necessary framework to ensure QuantIA is viable for the Circular Economy.

Technical Architecture

Built on a strict Layered Architecture to ensure reproducibility and scalability across environments.

- **Infrastructure:** Fully containerized via **Docker** to eliminate dependency conflicts and ensure deployment consistency.
- **Data Engine:** A Python ETL pipeline that generates synthetic stress-test scenarios using **Log-Normal** (Cost) and **Poisson** (Demand) distributions.
- **Optimization:** Powered by **SciPy** and **NumPy** for high-performance vectorized simulation.

Tech Stack

- **Core Logic:** Python 3.10 (Strict Type-Hinting)
- **Orchestration:** Docker Compose
- **Data Layer:** Pandas / PostgreSQL (Planned)

Development Roadmap

- ✓ **Phase 1: Foundation**
Architecture Design, Git Strategy & CI Setup.
- ✓ **Phase 2: Stochastic Engine**
Prototype active. Generates realistic Log-Normal/Poisson simulations.
- **Phase 3: SQL Integration**
Ingestion logic (In progress).
- **Phase 4: Advanced Reporting**
KPI Visualization.