**About Emmanuel questions**

**1. Performance Gap Calculation & Technical Boundaries**

**Issue:** The performance gap formula (δᵢ = |xᵢ - x̄ᵢ| / xᵢ) risks division-by-zero

* If xᵢ = 0, then δᵢ = 1, meaning no vulnerability (if zero is the ideal performance).
* If xᵢ = 0, set xᵢ = 0.0001 (if zero is not the ideal performance).

**2. Sensitivity Parameter (αᵢ) Calibration**

**Issue:** The parameter αᵢ governs resource-to-performance efficiency but requires calibration for different food system components.

Using Elasticities for αᵢ Calibration

Elasticities provide a data-driven method to estimate αᵢ, where:

αi=%Δxi/%Δfi

where:

* xi = observed performance (e.g., crop yields, distribution efficiency).
* fi = financial allocation.

This approach ensures:

* Higher αᵢ values for components highly responsive to investment.
* Lower αᵢ values where financial inputs have limited effects.

**3. Weight Assignment (ωᵢ) Methodologies**

**Issue:** The FSFVI framework assigns weights based on criticality, but static weight assignments do not account for interdependencies.

Since real-world food systems are interconnected, expert-driven weighting methods can improve FSFVI accuracy:

* Delphi Method
  + Experts iteratively rank component criticality.
  + A consensus-based weighting system emerges.
* Analytic Hierarchy Process (AHP)
  + Experts compare components in pairs (e.g., "Is production or distribution more critical?").
  + Generates a hierarchical ranking of component importance.
* Scenario-Based Weighting
  + Experts assign weights based on stress scenarios (e.g., climate shocks, financial crises).

*a) Have you developed metrics (e.g., network centrality scores) to dynamically adjust ωᵢ?*

While FSFVI prioritizes financial vulnerability, integrating network centrality-based metrics (e.g., PageRank, Eigenvector centrality) could better capture systemic importance.

*b) How should weights account for cascading failures?*

Using a dependency matrix, weights can:

* Increase for components whose failure causes systemic collapse.
* Adjust dynamically based on real-time interdependency data.

**4. Real-Time Monitoring Intervals**

**Issue:** The FSFVI requires dynamic updates, but not all components need the same frequency.

Optimal Monitoring Intervals

* High-volatility components (e.g., retail prices, market supply) → Hourly/Daily.
* Medium-volatility components (e.g., food storage, logistics) → Weekly.
* Low-volatility components (e.g., infrastructure resilience) → Monthly.

a) Should high-volatility components update more frequently?

Yes, real-time monitoring of price fluctuations and supply chains is critical.

**5. Threshold Flexibility & Contextualization**

**Issue:** Fixed FSFVI thresholds may not reflect regional disparities.

* Contextualized thresholds may be adjusted.

**6. Optimization Trade-Offs**

**Issue:** The prioritization rule (fᵢ ≥ fⱼ if δᵢ ≥ δⱼ) may conflict with minimizing overall system vulnerability.

* A strict δᵢ-driven prioritization may not minimize overall FSFVI.
* Allowing controlled deviations (e.g., if FSFVI improves by ≥ 5–10%) enhances resilience.

Yes, controlled FSFVI optimization should balance localized vs. systemic vulnerability.

**7. Non-Financial Data Integration**

**Issue:** The FSFVI focuses on financial vulnerability, but other factors (e.g., climate and social metrics) affect system resilience.

* **Machine learning models** could combine **financial + climate/social data**. Let’s keep this for further refinement