APS1049 - Team 4
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From Risk to Resilience: AI Solutions for Canada's Perishable Supply Chain

Executive Summary

Canada’s perishable goods supply chain is under increasing pressure from operational fragility, cold chain lapses, and rising geopolitical uncertainty, particularly around tariff enforcement. These risks not only threaten product quality and availability but also expose businesses to regulatory non-compliance, reputational damage, and financial loss.

This project proposes a modular, AI-powered architecture that enables real-time risk sensing, predictive alerting, and strategic mitigation for the Canadian food and beverage sector, an industry responsible for $167.5 billion in annual output and highly reliant on cold chain integrity and just-in-time logistics.

Through structured risk analysis and industry research, our team identified Cold Chain Disruptions and Tariff Disruptions as the most critical threats to operational resilience. These risks were prioritized based on severity, likelihood, and impact using a quantitative matrix that incorporated stakeholder interviews, government reports, and sector case studies. We developed three targeted use cases to address these threats:

- **Cold Chain Monitoring:** AI models process real-time IoT sensor data (temperature, humidity, location) to predict temperature excursions and reduce spoilage, downtime, and compliance violations.
- **Tariff Forecasting:** Natural language processing (NLP) is applied to policy updates, trade news, and customs data to anticipate tariff changes and reduce delay-related costs.
- **Scenario Simulation:** A dynamic simulation engine evaluates the cascading effects of compound events (e.g., refrigeration failure and tariff hikes) to inform contingency planning and resource allocation.

The solution is built on the Google Cloud Platform, leveraging Vertex AI for model training, monitoring, and automated retraining. The system follows microservices-based architecture, supporting flexible deployment, real-time analytics, and a robust CI/CD pipeline for scalability and governance.

To ensure sustained performance, a model maintenance framework has been embedded, including drift detection, version rollback, and performance auditing, making the platform adaptive and audit-ready for high-stakes environments.

This AI-enabled framework is designed to be client-agnostic and integration-ready. Beyond mitigation, it lays the foundation for long-term supply chain resilience, regulatory alignment, and cost optimization.