

Method and System for Risk Determination in a Food Supply Chain

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Bibliographic particulars

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Title	Method and System for Risk Determination in a Food Supply Chain
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Claims	Twelve. Claims 1–6 are method claims; claims 7–12 are corresponding system claims.

The problem addressed

Disasters and threats — macro-environmental events, socio-political upheaval and corporate risk — have direct and indirect impact on food supply, and therefore on food security and the resilience of the food supply chain. Macro-environmental events include climatic and weather change, pandemics such as Covid-19, bird flu and swine fever, natural disasters such as typhoon, flood and drought, and long-run climate change. Socio-political upheaval includes geopolitical tension, political turmoil, policy decisions and work stoppages. Corporate risk includes bankruptcy, supplier distress and scandal.

These threats have not been dealt with effectively or efficiently. The invention responds to the need to make food supply chains robust and resilient by providing an early warning system to stakeholders in the food ecosystem, together with the guidance to plan for disruption and to take strategic and operational steps to prevent or mitigate its impact.

The invention in outline

The patent claims both a method and a corresponding system for determining and managing risk in a food supply chain, unified as a single digital platform for enhancing food security and resilience in response to disruption risk. The system comprises a processor, a memory and a risk determination module communicatively coupled to the processor, supported by three further coupled modules — a natural language processing module, a natural disaster prediction module, and a plant growth monitoring module — with a classifier grading the resulting risk.

The claimed sequence

- **Receive** a preliminary set of data from a plurality of data sources, comprising trigger event data and non-trigger event data.
- **Identify** the trigger event data from that set by machine learning for natural language processing.
- **Obtain** weather forecast data from the set — air temperature, humidity, wind speed, air pressure, air density and surface temperature, or any combination.
- **Validate** the trigger event data through the natural language processing module.
- **Identify**, from the preliminary set, the occurrence of natural disaster at a geospatial location indicated by geospatial data.
- **Monitor**, based on the identified natural disaster, the growth of crops and plants at one or more physical farms at that geospatial location.
- **Compare** the identified trigger event data with the geospatial data, obtained in real time, and with the weather forecast data.
- **Calculate** a risk value based on that comparison, the risk value including a positive score and a negative score.
- **Determine** risk in the food supply chain by calculating the impact percentile of the calculated risk value; risk is determined where the calculated impact value is greater than a threshold value, which may be preset or dynamically set by a user.
- **Classify** the determined risk into at least one of supply-side risk and demand-side risk.
- **Alert** at least one entity of the food supply chain, based on the determined risk and its classification, via Internet of Things based sensors.

Dependent claims

- A classifier grades identified trigger event data as high, intermediate or low risk based on the calculated risk value, and the risk values of classified events are added to determine risk in the food supply chain.
- Trigger event data comprises one or more keywords relating to pandemic, natural disaster, geopolitical tension and corporate bankruptcy.
- Actions performed on the determined risk include notifying a user where the risk value exceeds the threshold; determining a response plan, including changing suppliers and increasing or decreasing orders from suppliers; and activating that response plan for each identified trigger event by implementing machine learning algorithms.
- The threshold value is preset or dynamically set by a user.
- The preliminary data set is obtained by integrating one or more of social media data, government data, news data, weather data and company data.

Supporting embodiments in the specification

- **Command-and-control centre** — an establishment equipped with control and communication instruments, including weather radar, performing monitoring and control across demand and supply in the food supply chain, issuing warnings to the distribution network and activating response plans across a supplier network spanning multiple countries.
- **IoT sensing** — light sensors, soil moisture sensors, temperature sensors and chemical sensors installed on physical farms, together with rainfall, snow, wind direction and speed detectors, and monitoring by drone

and satellite.

- **Rainfall prediction** — a deep neural network model over radar maps at differing heights and corresponding meteorological information sequences, producing time-sequenced rainfall prediction values.
- **Credibility sub-module** — a natural language processing sub-module that scores structured behavioural data against corresponding text data in order to detect and eliminate fraudulent, inaccurate or misleading text.
- **Financial expression of risk** — a supply chain risk score derived by factoring an economic impact score against a supply risk score, each normalised, expressed as $SCR = EI \times SR \div 10$, enabling risks across different production inputs or suppliers to be compared and ranked and an ameliorating action taken.

Where the method sits in the FSX platform

The five stages of the FSX platform map directly onto the granted claims: data ingestion; AI event detection; risk computation; risk classification; and action and control. The Food Security Command & Control Centre (FSC3) is the operating instantiation of the command-and-control centre described in the specification — the layer at which alerts are issued and response plans are executed, with every prediction terminating in a ranked, costed, owner-assigned intervention.

1 Data Ingestion Multi-source data and IoT sensor inputs collected in real time	2 AI Event Detection NLP identifies and validates trigger events against geospatial and weather data	3 Risk Computation Risk value and impact percentile calculated against threshold	4 Risk Classification High / intermediate / low, split supply-side and demand-side	5 Action & Control Alerts issued and response plans executed via the C3
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Commercial significance

The patent protects the conversion of food security signal into a computed, classified and actioned risk position. It gives FSX.ai a defensible position at the layer where prediction becomes decision — the layer that general-purpose AI tooling does not occupy — and a priority date of September 2020 that predates the current generation of AI platforms. Around the patent sit three further layers of advantage: the enterprise ontology of the food system, proprietary decision memory and outcome scoring, and institutional access across ASEAN and the GCC.

Note on this summary. This document is prepared for general information and is not a legal opinion on the scope, validity or infringement of the patent. The granted claims as published by the Intellectual Property Office of Singapore are the operative text and prevail over any summary. The patent is held by Zaid Bin Hamzah as inventor and proprietor and is deployed through FSX.ai.

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