



UNSW
CANBERRA

Empowering Supply chains Resilience: LLMs-Powered BN for Proactive Supply Chain Risk Identification

Maryam shahsavari, Omar Hussain, Morteza Saberi, Pankaj Sharma

Presenter: Maryam Shahsavari

University of New South Wales

D2R2'24: Third International Workshop on Linked Data-driven Resilience Research 2024

May 2024

Greece



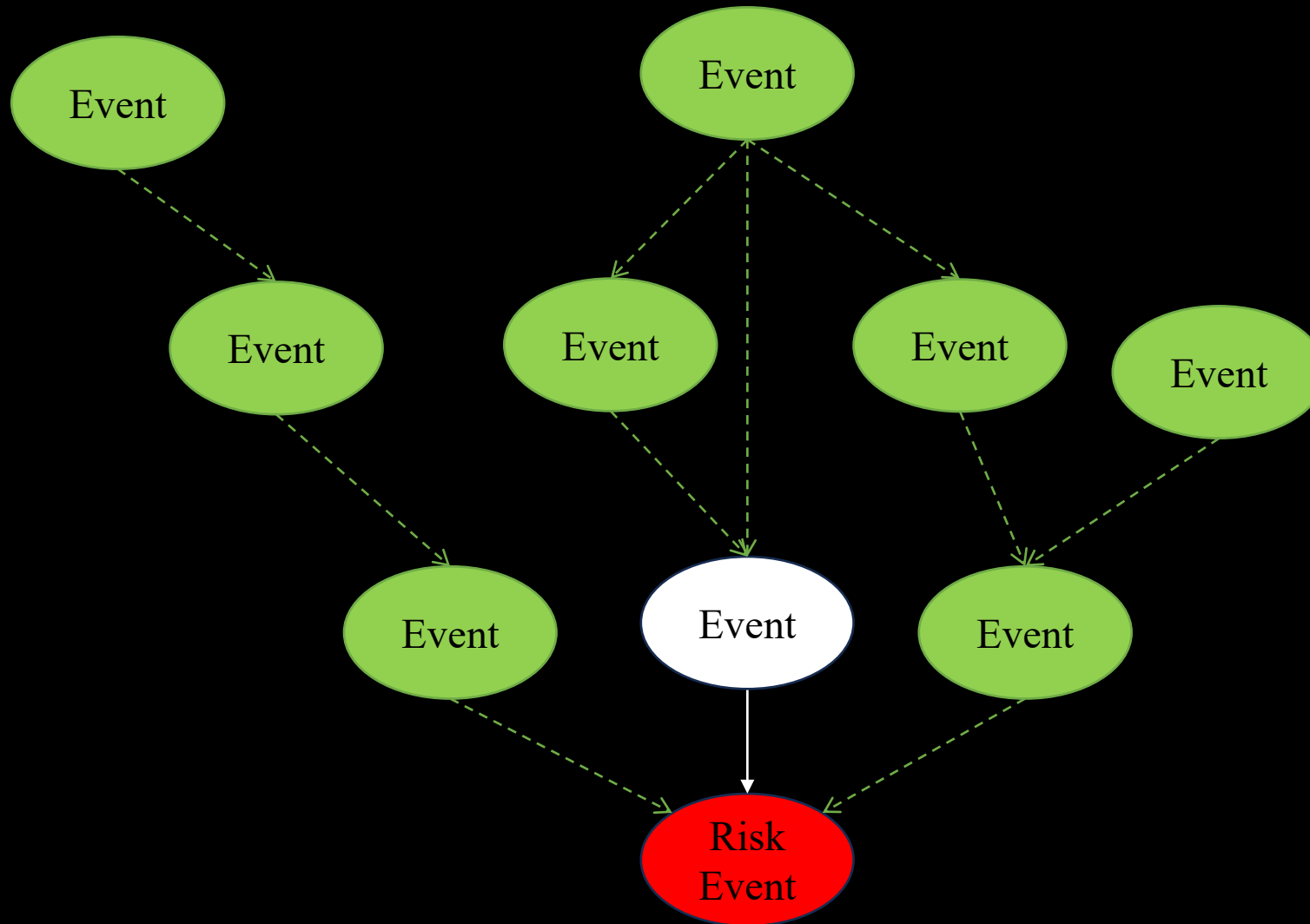
UNSW
CANBERRA

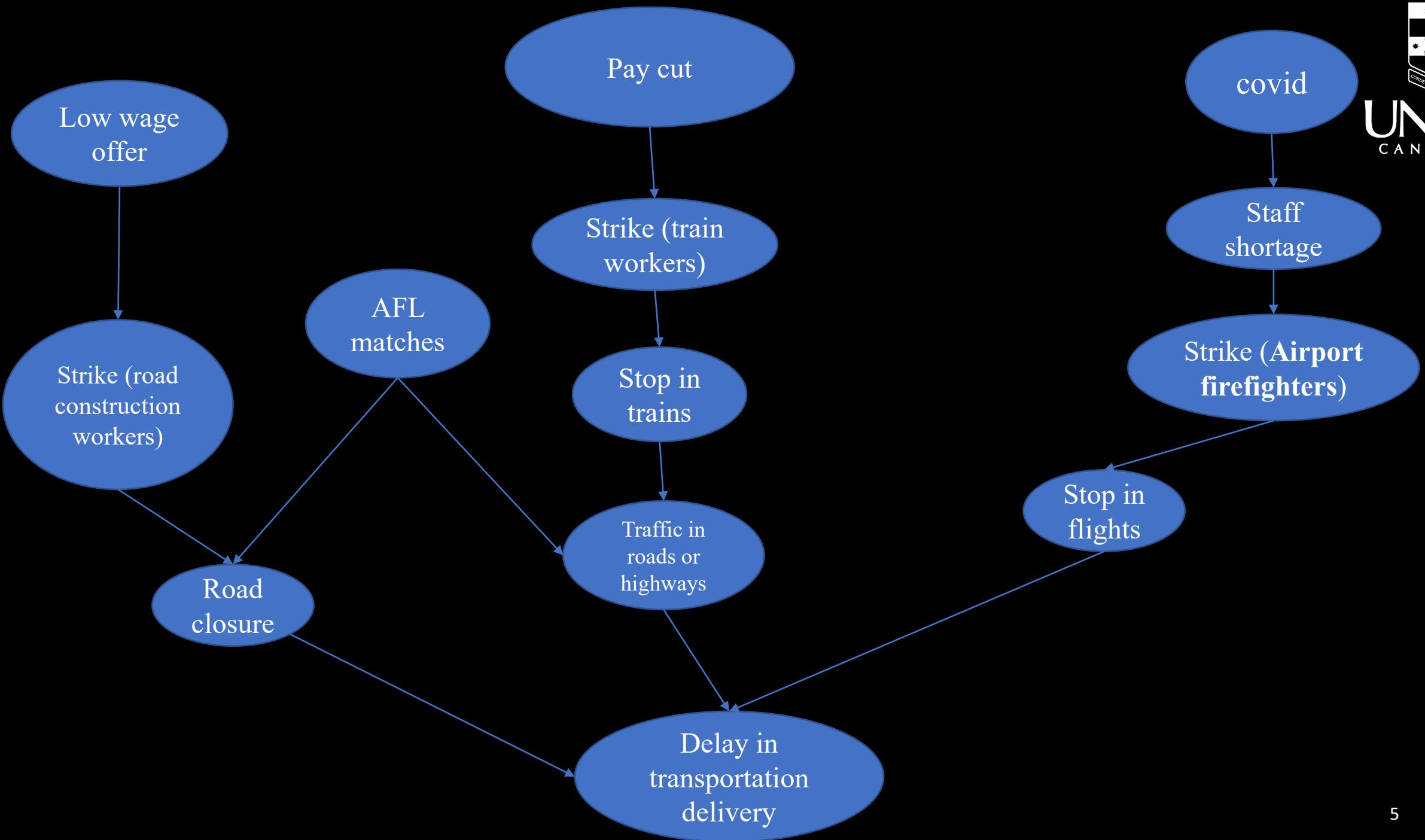
Table of Contents

- Introduction
- Methodology
- Event Detector Module
- Probability Assigner Module
- Evaluation



Cause-effect Network





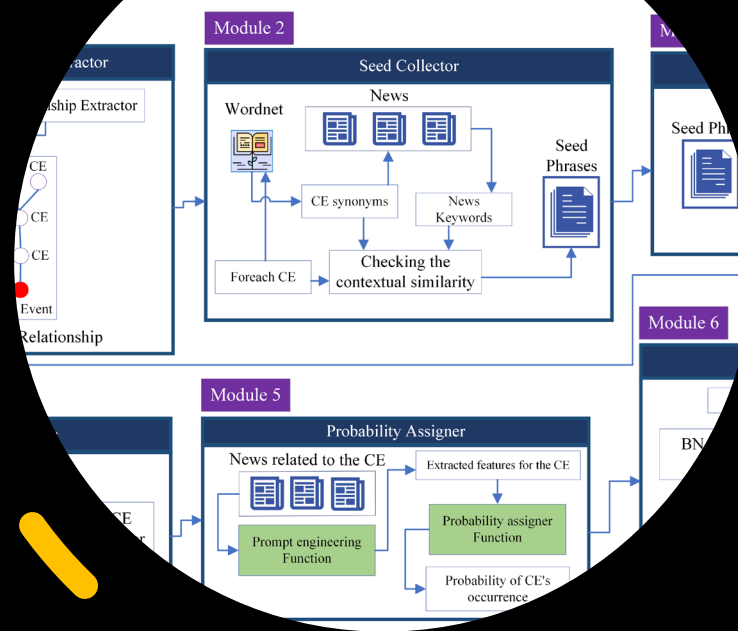
Introduction

- **Proactive Risk Management with CERIA**

- Contributing Event-based Risk Identification and Assessment
- AI, specifically NLP and LLMs, to predict and manage supply chain risks
- systematically identifies causative events through daily news scanning,
- employing Bayesian Networks to model causal connections and assess risk probabilities

- **Application and Impact**

- quantifying the likelihood of risk events, offering a dynamic early warning system.
- not only aids in navigating complex supply chains but also enhances resilience against potential disruptions.



Methodology (CERIA Framework Overview)

- **Module Descriptions:**

- 1. Causal Relationship Extractor Module:**

Identifies causal connections between contributing events (CEs) and risk events using historical news data, represented in a Bayesian Network.

- 2. Seed Collector Module:**

Collects and aggregates relevant keywords for each risk event/CE, termed as seed-phrases.

- 3. News Crawler Module:**

Uses seed-phrases to search for and collect news articles related to each CE.

- 4. Event Detector Module:**

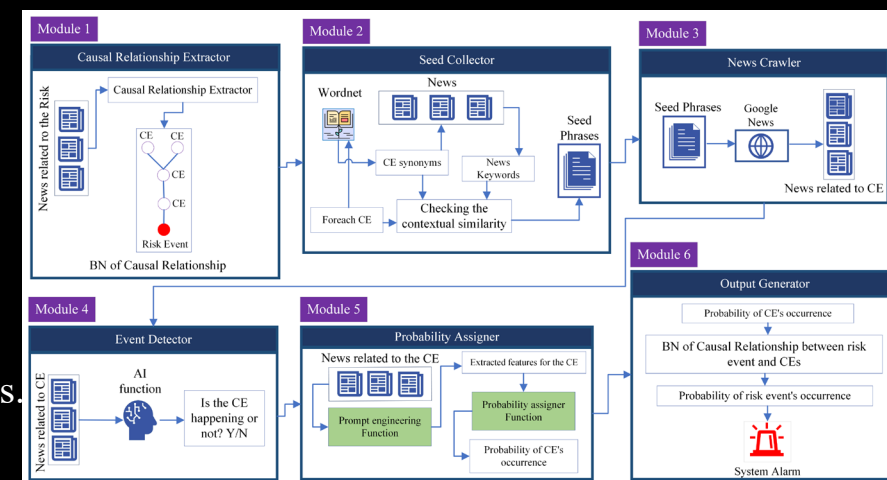
Employs AI and LLMs to determine the relevance of news articles to specific CEs.

- 5. Probability Assigner Module:**

Analyzes data to assign probabilities to events, enhancing predictive capabilities.

- 6. Output Generator Module:**

Forecasts the probability of main risk events and notifies risk managers of potential risks.



Methodology (Event Detector Module)

1. Outputs:

CEs that have been detected as happening.

List of the news confirming that.

Their score (between 0.5 and 0.7)

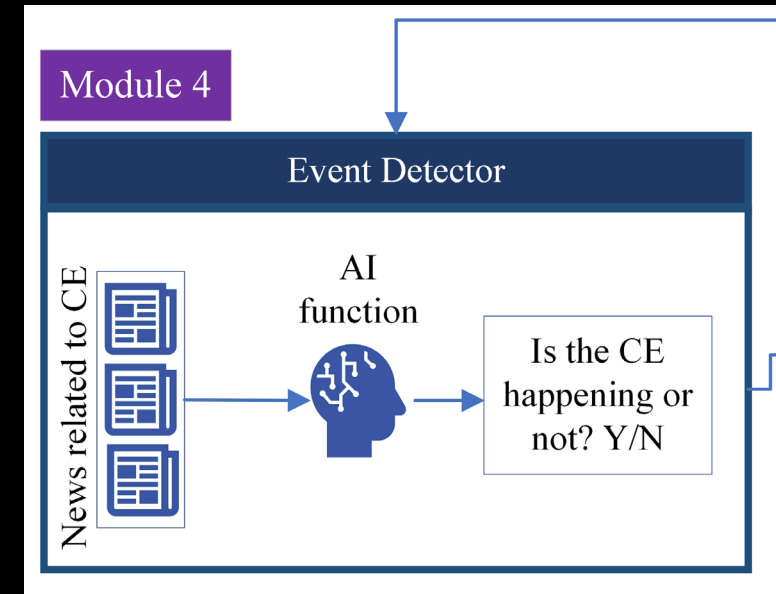
Example:

Staff shortage is happening.

News 1: 0.58

News 2: 0.6

News 3: 0.52



Methodology

1- Is the detected event impacting the SC?

Important features of event for our use case:

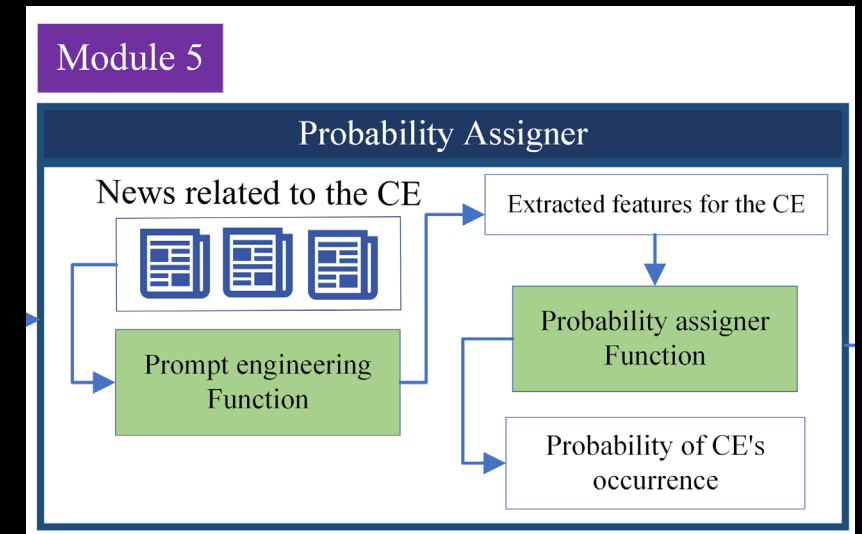
- Location
- Time and Duration

Prompt engineering approach (GPT-3.5-Turbo)

“within the text which is in triple backticks, answer these questions about *CE_x*:

- 1- where is the location of the *CE_x*?
- 2- What is the date of the *CE_x*.
- 3- For how long will the *CE_x* happen?

“ news_body “ ”



Methodology (Probability Assigner Module)

2- Understanding Event Probability Through News Relevance Scoring

○ Score Range Breakdown

❖ The range from 0.5 to 0.7 is divided into three equal parts to reflect the likelihood of event occurrence:

- Range 1 (0.5 to 0.57): Low chance
- Range 2 (0.57 to 0.64): Medium chance
- Range 3 (0.64 to 0.7): High chance

○ Empirical Estimation Method

The proportion of news articles within each score range relative to total articles scored between 0.5 and 0.7 serves as an empirical estimate of event likelihood

Methodology (Probability Assigner Module)

Probability Calculation Formula

$$P(CE \text{ in range } x) = \frac{N_x}{N_{total}}$$

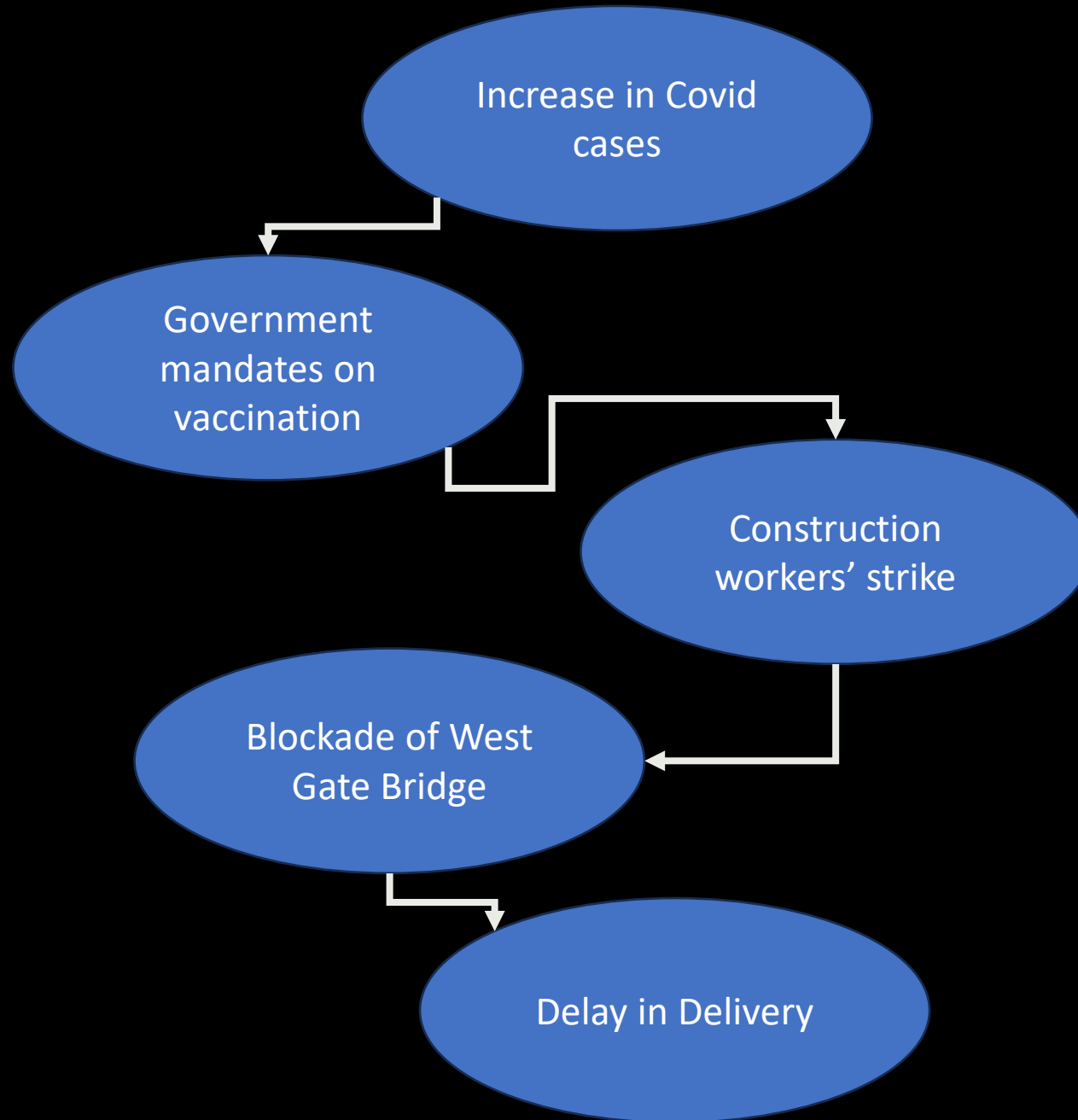
$P(CE \text{ in range } x)$ is the probability of the event happening within the specified range x .

N_x is the number of articles with scores in range x .

N_{total} is the total number of articles scored between 0.5 and 0.7.

Evaluating CERIA Framework Performance Using Historical News Data

- Analyzing the past news related to the risk event of interest in transportation sector in Australia
- The system found the following CEs as contributors to delay in delivery (output of Module 1 of CERIA):
 - 1- There is an increase in Covid cases
 - 2- Government mandates on vaccinations for construction workers
 - 3- Construction workers hold strike
 - 4- Blockade of the West Gate Bridge
 - 5- Risk event: Delay in delivery of products



Evaluation

For each CE:

- 1- Module 2: Extracted seed phrases
- 2- Module 3: Search the seed phrases in Google News
- 3- Module 4: Scored the relevance of News to CEs
- 4- Module 5: Extracted the features of the event, along with its probability



UNSW
CANBERRA

Important COVID-19 update: Mandatory vaccination for construction workers

Friday, 17 September 2021

The Victorian Government has announced that construction workers across Victoria will need to show evidence to their employer that they have had a first dose of a COVID-19 vaccine by 11.59pm on Thursday 23 September.



Public health officials have become increasingly concerned about COVID-19 transmission and exposure in construction settings. Construction workers are often highly mobile and the risk of spreading coronavirus in these settings as evidenced by recent outbreaks is concerning. Therefore, the Victorian Government has announced that construction workers across Victoria will need to show evidence to their employer that they have had a first dose of a COVID-19 vaccine by 11.59pm on Thursday 23 September.

Limited medical exemptions and proof-of-booking exceptions will apply, in line with previous requirements for residential aged care workers.

Employers will be required to keep a record of their employees' COVID-19 vaccinations.

In a further tightening of COVIDSafe settings for the industry to slow the spread of coronavirus, construction workers will not be able to cross the metropolitan-regional boundary for work effective immediately, in light of COVID-19 cases seeding from Melbourne into regional Victoria. We understand this may be difficult to manage but we have to play our part to keep the industry and its workers safe.

From 11.59pm Friday 17 September, tea rooms will also close and food or drink cannot be consumed indoors at work.

Increase in Covid cases

Government mandates on vaccination

Construction workers' strike

Blockade of West Gate Bridge

Delay in Delivery

Victoria records 473 new local COVID cases as state puts construction industry 'on notice'



Victoria has recorded 473 new locally acquired cases of COVID-19 as the state government launches a compliance and vaccination crackdown for the construction industry.

Of the new cases, 202 have so far been linked to known outbreaks.

It's the highest daily case count in Victoria since August 6 last year, when 616 cases were recorded.

There are 157 people in hospital with COVID-19, with 38 requiring intensive care and 24 of those people are on ventilators.

There were 49,027 test results received and 30,026 doses of vaccine were administered at state-run sites.

Treasurer Tim Pallas said construction workers would be given vaccine priority and there would be extra enforcement measures to try to curb spread in that industry.

Over the next week, 20,000 Pfizer appointments will be targeted at construction workers and there will be additional access to the AstraZeneca vaccine.

Key points:

- It represents the highest single-day count of the outbreak so far and the largest tally in more than a year.
- Scores of teams will begin inspecting construction sites to ensure compliance with COVID restrictions.
- There is evidence of transmission between employees in workplace tearooms.

In Pictures

Gallery | Coronavirus pandemic

Protesters against vaccine mandate in Melbourne clash with police

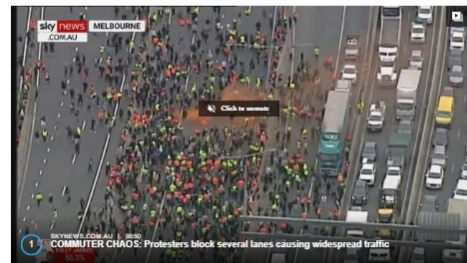
Violent protests break out in the Australian city after authorities imposed vaccine mandates on construction workers.

Australia News

Melbourne protesters swarm West Gate Freeway, blocking traffic in both directions

Hundreds of protesters have swarmed the West Gate Freeway in Melbourne reportedly stopping traffic in both directions - with Vic Traffic warning drivers to exit the freeway 'as soon as possible'.

Dominica Funnell Digital Reporter



Hundreds of protesters have blocked off several lanes along Melbourne's West Gate Freeway, leading to commuter chaos and widespread traffic. Construction workers have taken to the streets in Melbourne, protesting against vaccine mandates.

Traffic has been stopped in both directions on the West Gate Freeway in Melbourne as hundreds of protesters flood the road, blocking cars and trucks from passing.

Aerial footage showed one car slow down, before speeding around the group, who threw umbrellas and other projectiles at the vehicle.

It comes as the protest nears its fourth hour.

Vehicles have been slowed or stopped altogether due to the crowds across at least 10 lanes.

Results

Event	Location	Time	Duration
1	Victoria, Australia	September 13, 2021	Not specified
2	Victoria, Australia	September 17 to September 23, 2021	Indefinitely, starting from the specified date
3	Melbourne, Australia	September 21, 2021	Not specified
4	Melbourne, Australia	September 21, 2021	Not specified

Probability of occurrence of four CEs

CE	Low chance	Medium chance	High chance
There is an increase in Covid cases	3.13%	10.94%	85.94%
Government mandates on vaccinations for construction workers	13.33%	28.89	57.78%
Construction workers hold strike	12.33%	35.71%	51.94%
Blockade of the West Gate Bridge	10%	33.25%	56.75%



Thank you for your attention

Any questions?