

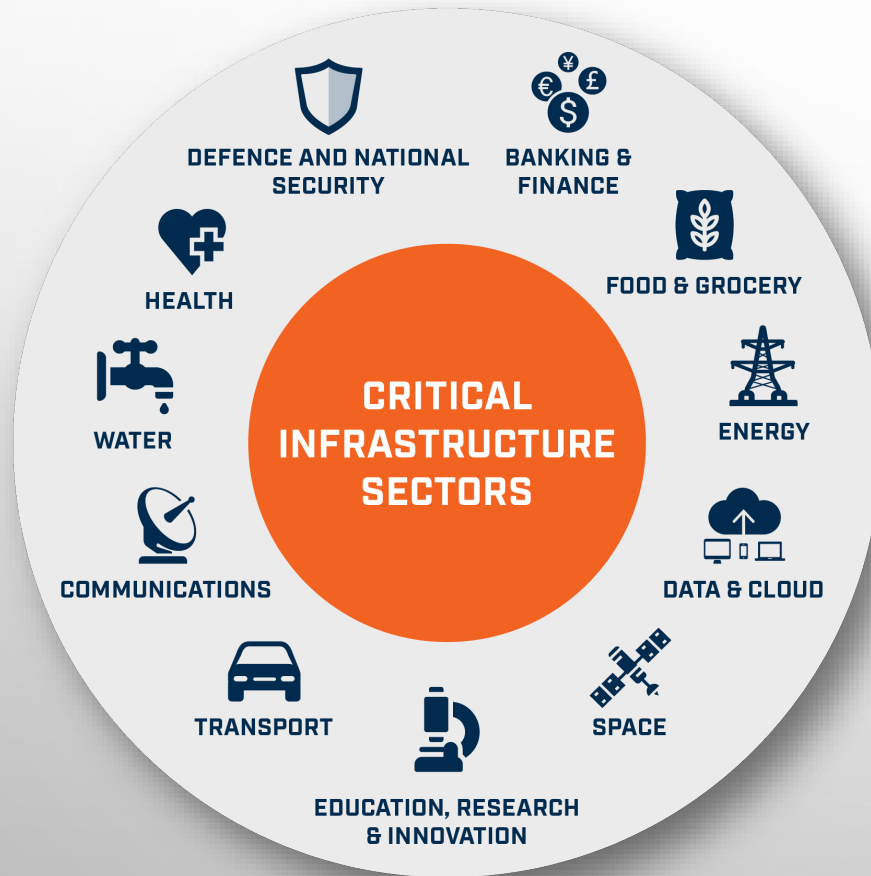
# GOVERNING RESILIENT AND SUSTAINABLE CRITICAL INFRASTRUCTURES

Computational-based Approaches  
to Evidence Informed Policy



Disaster Resilience  
Research Group

## WHAT ARE THEY?

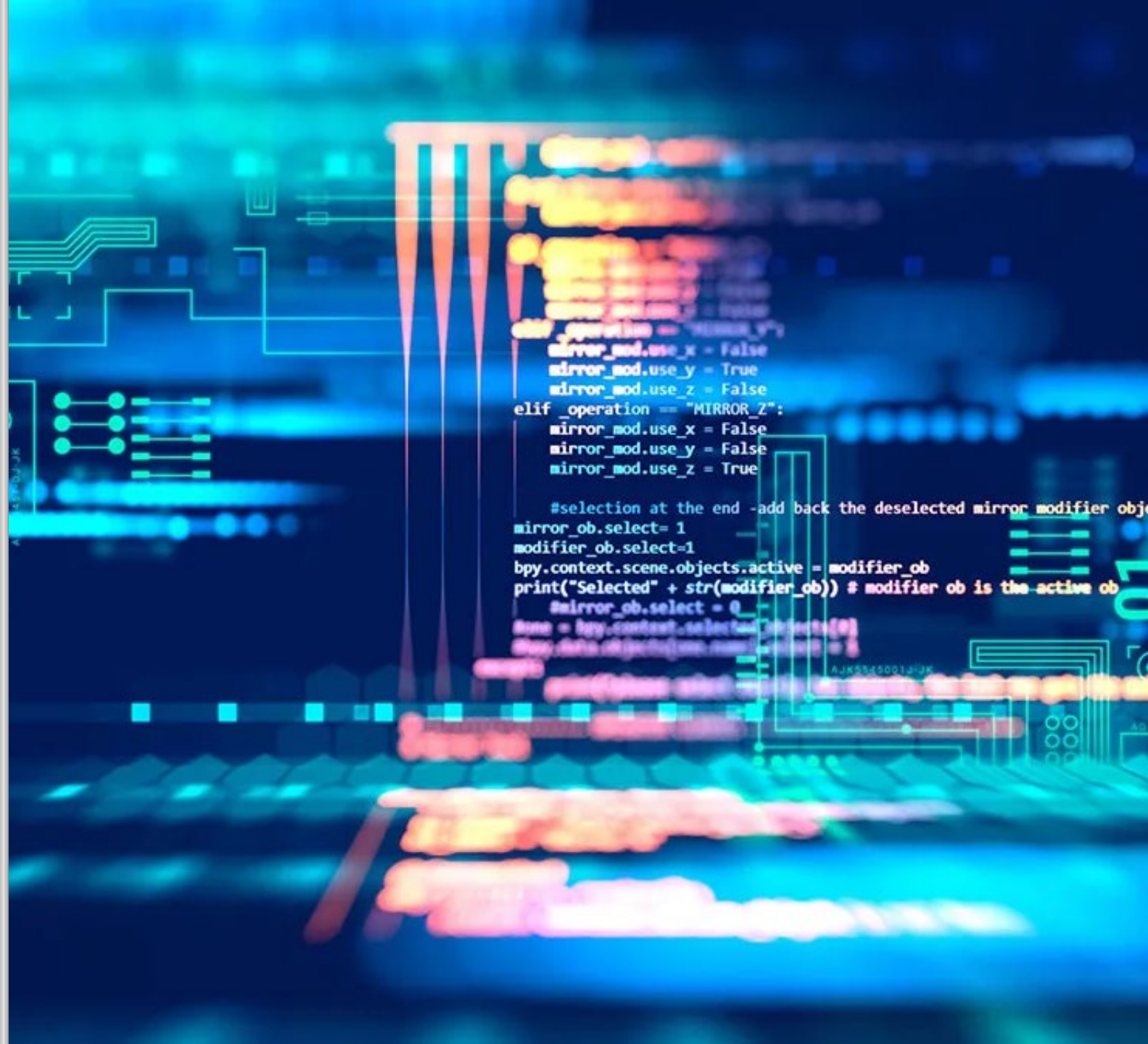


## HOW CAN GOVERNANCE MAKE THEM MORE RESILIENT AND SUSTAINABLE?

- Address cross sector challenges – Develop strategies to mitigate issues arising from disruptive events, policy inconsistencies, and gaps in information sharing across critical sectors.
- Better understand, respond to, and prepare for extreme events and emergencies.
- My research concentrates on Energy and Transport sectors, which are fundamental to the functioning of all other infrastructure systems.
- Propose the creation of a data repository that enhances coordination and information sharing, helping to resolve disruptive event impacts, policy inconsistencies, and information deficits across critical sectors.

# COMPUTATIONAL- BASED APPROACHES TO EVIDENCE INFORMED POLICY.

- Increase the efficacy of gathering and synthesising the ever-increasing output of research (scholarly /industry /government).
- Automate and streamline what are normally repetitive manual tasks.
- Can increase the rigor of research projects by making them easily repeatable
- Through the publication of coding utilised, research becomes transparent



# GATHERING 'GREY' INFORMATION

Systematic gathering of grey literature that is transparent, rigorous, and repeatable has hitherto proven problematic.

## TWO NEW INNOVATIONS TO SYSTEMATICALLY GATHERING GREY LITERATURE

- 1. Web-scraping data repositories using python.
- 2. Utilising Google's Programmable Search Engine to scrape website URLs (e.g., GOV.AU or UN.ORG) to collect PDF files of governmental documents.

```
def main():
    queries = {
        'site:gov.au (("energy resilience" OR "energy sustainability") AND ("governance")) filetype:pdf': 'AU_Gov_results1.csv',
        'site:un.org (("energy resilience" OR "energy sustainability") AND ("governance")) filetype:pdf': 'UN_Gov_results1.csv',
        # Add more queries and filenames as needed
    }
    api_key = "AIzaSyAbHjixwVD2zLoVWU_otRVb5_DblqZLecA"
    cx = "e6d97feb94798425c"

    for query, csv_filename in queries.items():
        full_csv_path = os.path.join(r"C:\Users\cfa\OneDrive - University of Tasmania\PhD\Chapter 1_LITERATURE REVIEW\Systematic Lit Review", csv_filename)
        try:
            search_results = search_AUST_energy_policy_documents(query, api_key, cx)
            if search_results:
                save_to_csv(search_results, full_csv_path)
            else:
                print(f"No results found for {query}")
        except Exception as e:
            print(f"An unexpected error occurred while processing {query}: {e}")

if __name__ == "__main__":
    main()
```

100 results saved to C:\Users\cfa\OneDrive - University of Tasmania\PhD\Chapter 1\_LITERATURE REVIEW\Systematic Lit Review\LITERATURE

100 results saved to C:\Users\cfa\OneDrive - University of Tasmania\PhD\Chapter 1\_LITERATURE REVIEW\Systematic Lit Review\LITERATURE

# SYNTHESISING EVIDENCE WITH TOPIC MODELLING - LDA

- The central thrust of the model is that texts are signified as random mixtures over latent topics, where each topic is distinguished by a distribution over words (Blei et al., 2003).
- This means that each text is a collection of topics or themes, such as climate change and disruptions from hazards (natural and human), and that the existence of each word can be assigned to one of the texts topics or themes. This in turn allows for deeper analysis.

```
ldamodel = gensim.models.ldamodel.LdaModel(corpus, num_topics=2, id2word = dictionary, passes=20, alpha='auto', per_word_topics=True)
ldamodel.save('model.gensim')
```

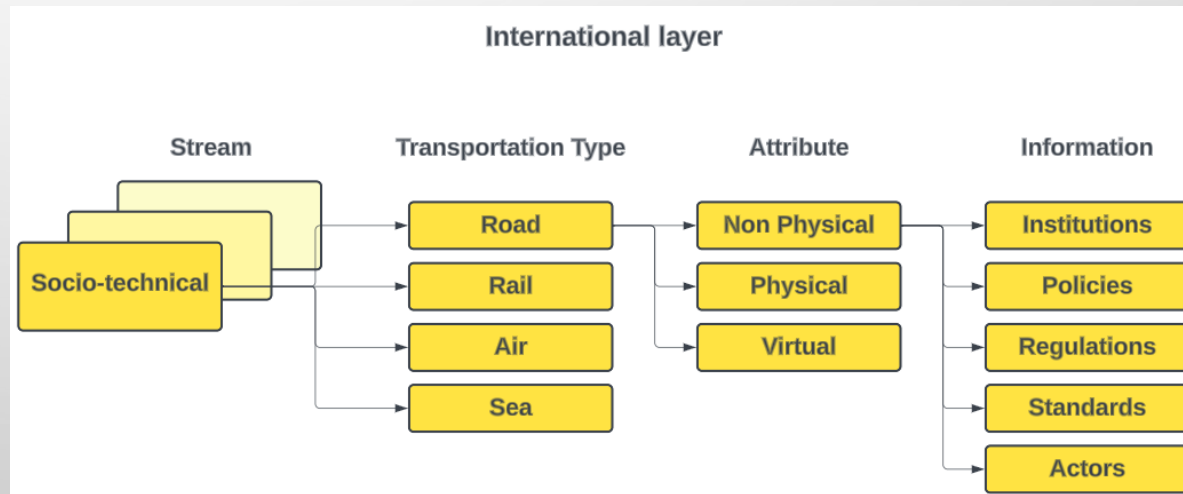
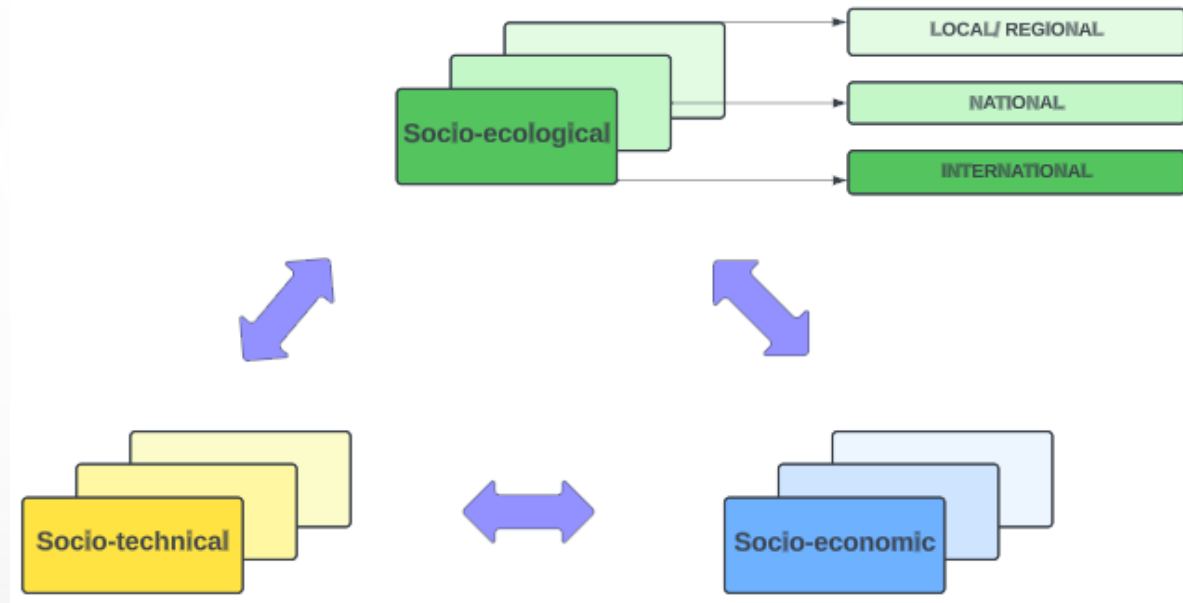
```
for el in ldamodel.print_topics(num_topics=2, num_words=10):
    print(el, '\n')
```

```
(0, '0.011*"system" + 0.010*"climate_change" + 0.008*"infrastructure" + 0.008*"cost" + 0.007*"water_energy" + 0.007*"emission" + 0.005*"gene
(1, '0.011*"energy" + 0.008*"fossil_fuel" + 0.007*"system" + 0.006*"climate_change" + 0.006*"grid" + 0.006*"challenge" + 0.005*"electricity"
```

# INFUSING AI AND MACHINE LEARNING INTO THE REVIEW PROCESS

What does this mean for my research on CI governance?

- System of systems approach
  - Different aspects of CIs (social/economic/ecological/ technical)
  - By breaking down the system into individual components it facilitates a more holistic understanding of complex systems such as transportation CIs
  - A policy repository based on this framework will allow industry to leverage big data to create an information network of documents. Saving time and money.



# HOW CAN THESE INNOVATIONS HELP?

- Provides a firm foundation to make research claims and Increases the speed of reviewing literature
- Gives both researchers and industry confidence in results
- Outcomes such as the proposed holonic policy repository allow insights to the multilayered and interactive nature of CIs.
- A repository facilitates the development of strategies to mitigate issues arising from natural events, resolves policy inconsistencies, and gaps in information sharing across critical sectors.
- Publications are how researchers speak to one another; policy for governments; CIs talk to one another with strategies, plans, frameworks, polices, standards, procedures. Getting them together in one place makes communication within and across CIs infinitely quicker, and cheaper.



# PUBLICATIONS

- **Cheap, Quick, and Rigorous: Artificial Intelligence and the Systematic Literature Review.** 2023. CF Atkinson. Social Science Computer Review 42 (2), 376-393.
- **ChatGPT and computational-based research: benefits, drawbacks, and machine learning applications.** 2023. CF Atkinson. Discover Artificial Intelligence 3 (1), 42.
- **Cheap, Rigorous, and Transparent: How Web-scraping with Python can Improve Collecting Grey Literature for Systematic Literature Reviews.** 2023 C Atkinson. Grey Journal (TGJ) 19 (3).
- **Generative Artificial Intelligence, Python, and Gathering Grey Literature for a Systematic Literature Review with Google's Programmable Search Engine.** 2024. CF Atkinson - 2024 - europepmc.org
- **Resilient and Sustainable Energy Infrastructure: A Systematic Literature Review Protocol.** 2022. C Atkinson, S Curnin, H Murphy-Gregory. Social Science Protocols 5 (1), 1-13.
- **Engendering resilient and sustainable transportation infrastructure: introducing a computational-based rapid systematic literature review.** Journal of Computational Social Science. CF Atkinson – Under Review



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**Thank you**