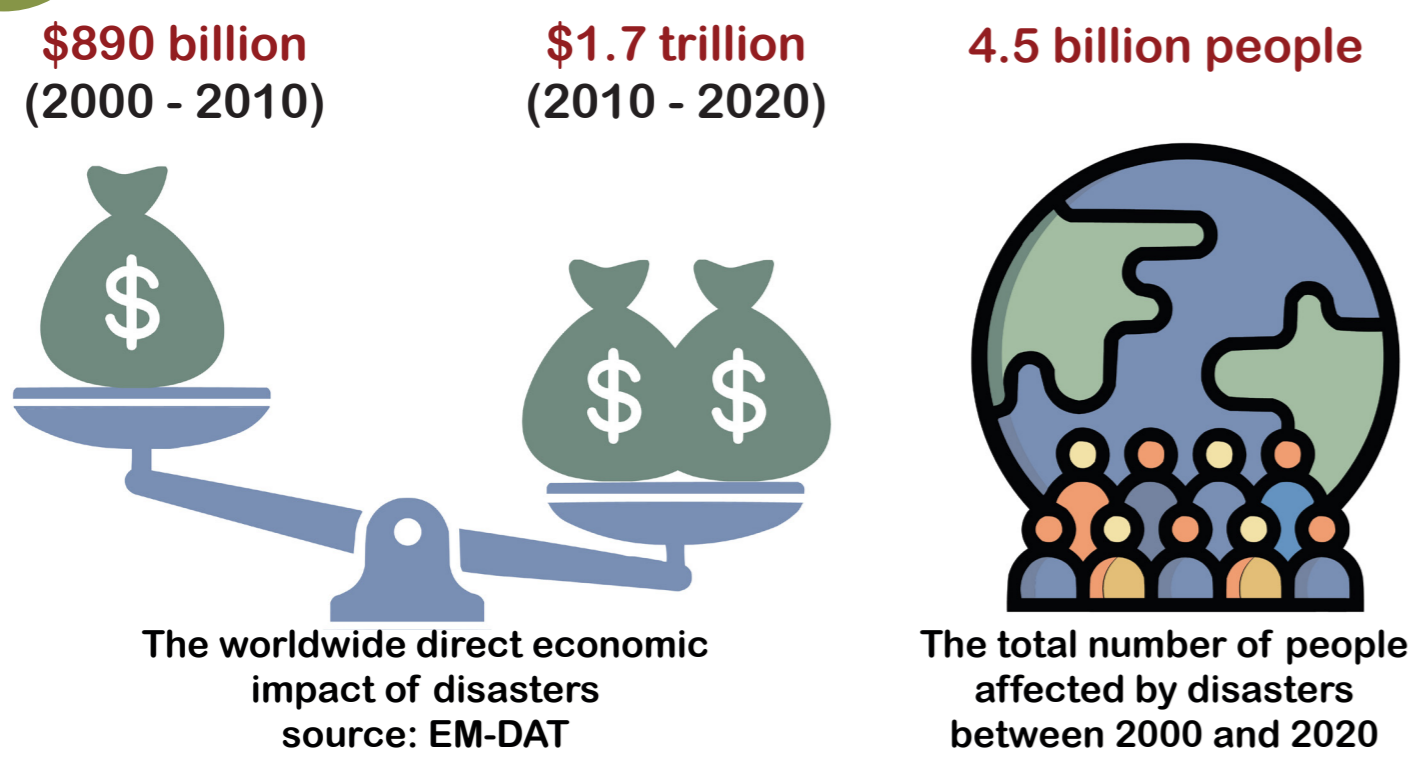


# Digital Post-Disaster Risk Management Twinning: A Review and Improved Conceptual Framework

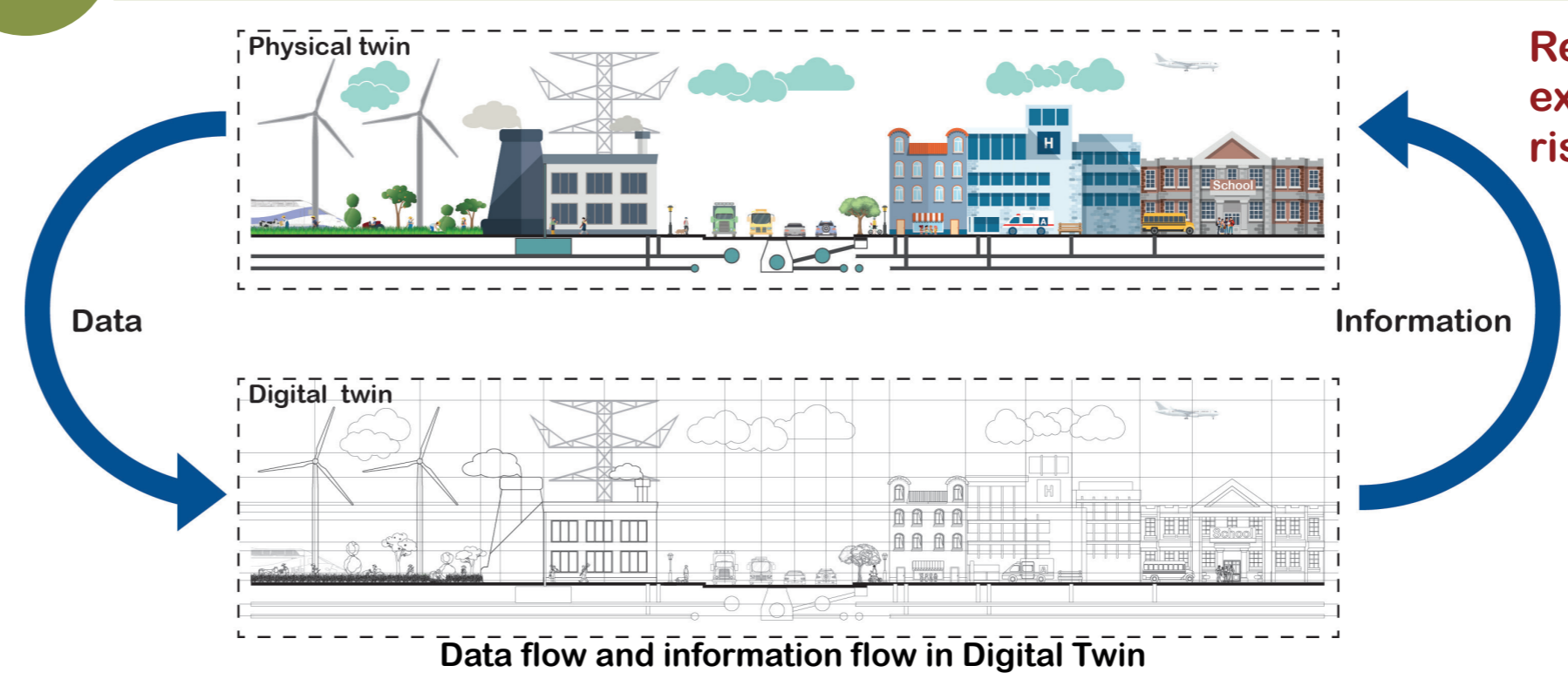


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## 1 Background



## 2 Digital Twin in Urban Environment

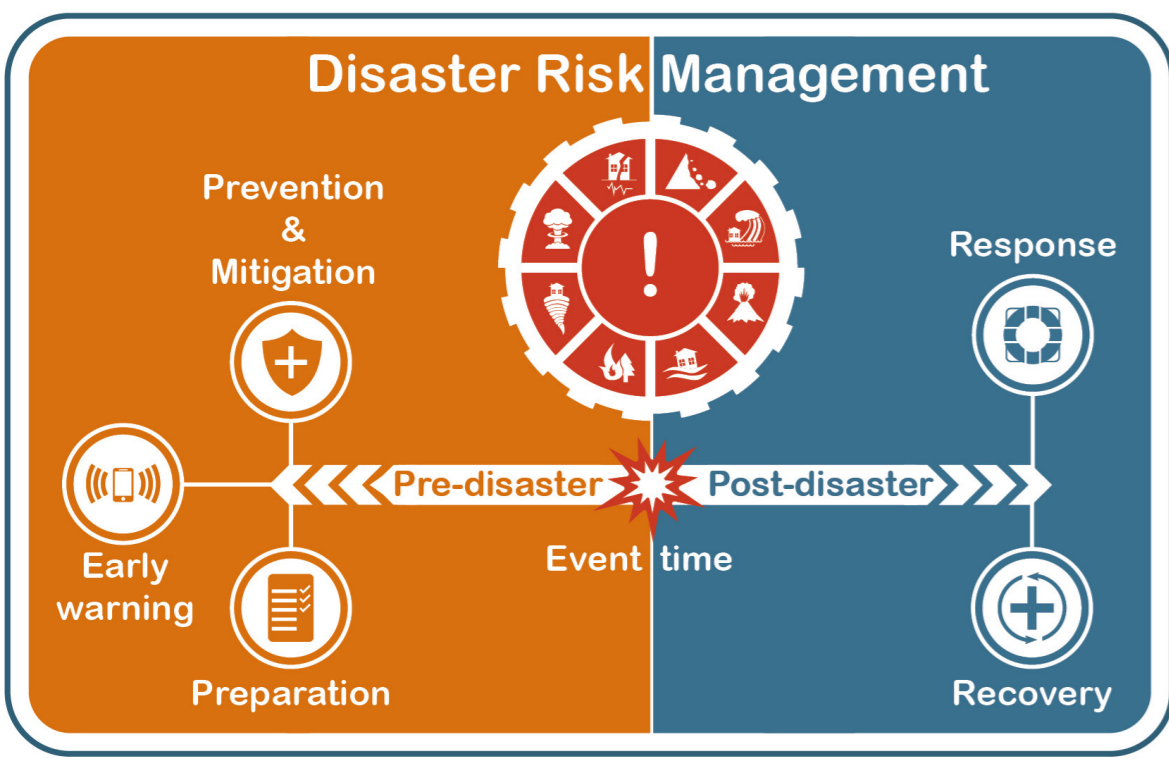


**Results and further challenges of existing simulation based post-disaster risk management approaches**

- ignores the interconnected and interdependent components of built environments,
- insufficient to capture the dynamic and evolving nature of disasters,
- often rely on one or two static data sources and test limited/predetermined scenarios.

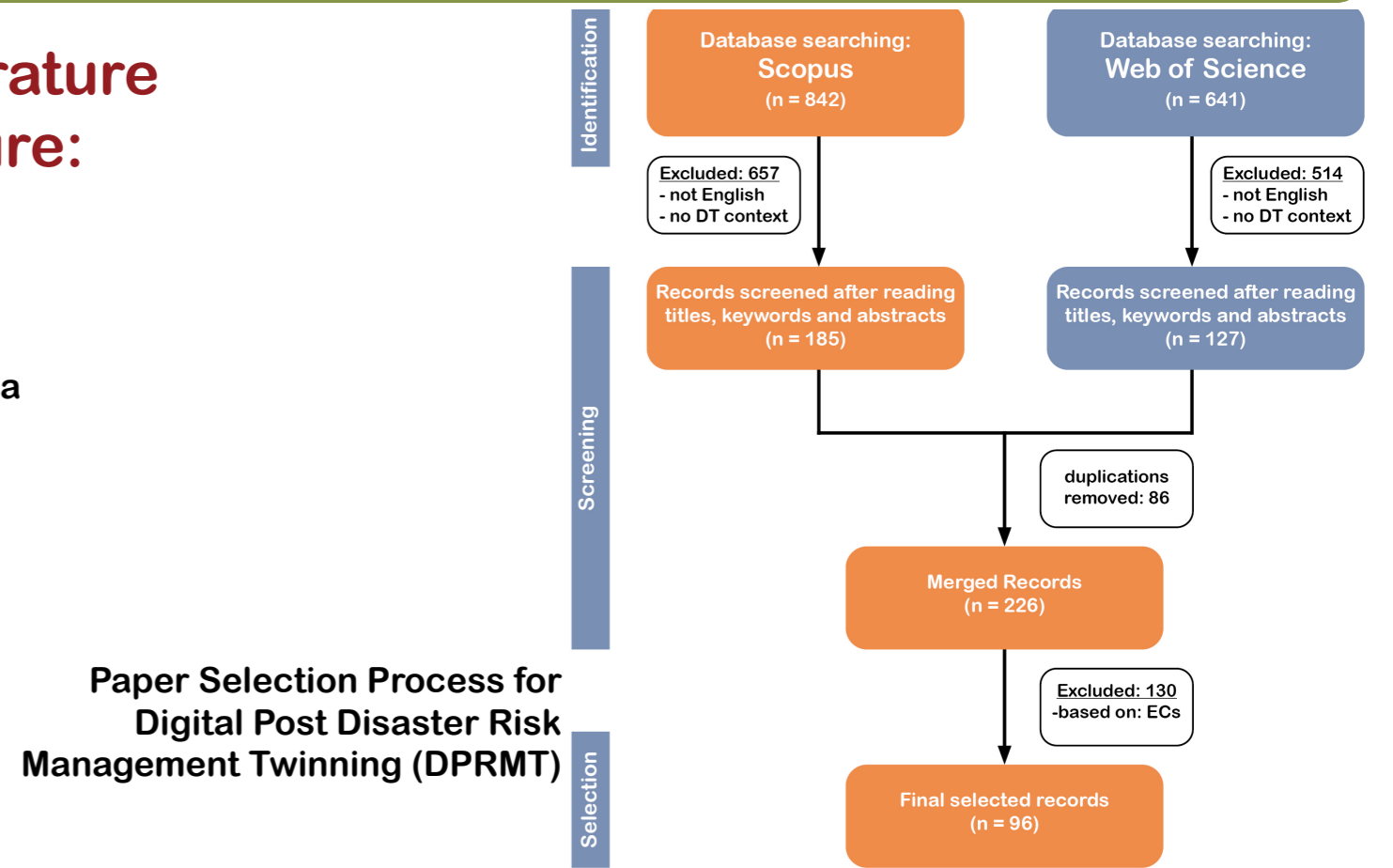
There is a need for advanced methods dynamically updating itself from various sources, and processing and analyzing this data to inform decision-makers about different scenarios and improve overall recovery process.

## 3 Systematic Literature Review

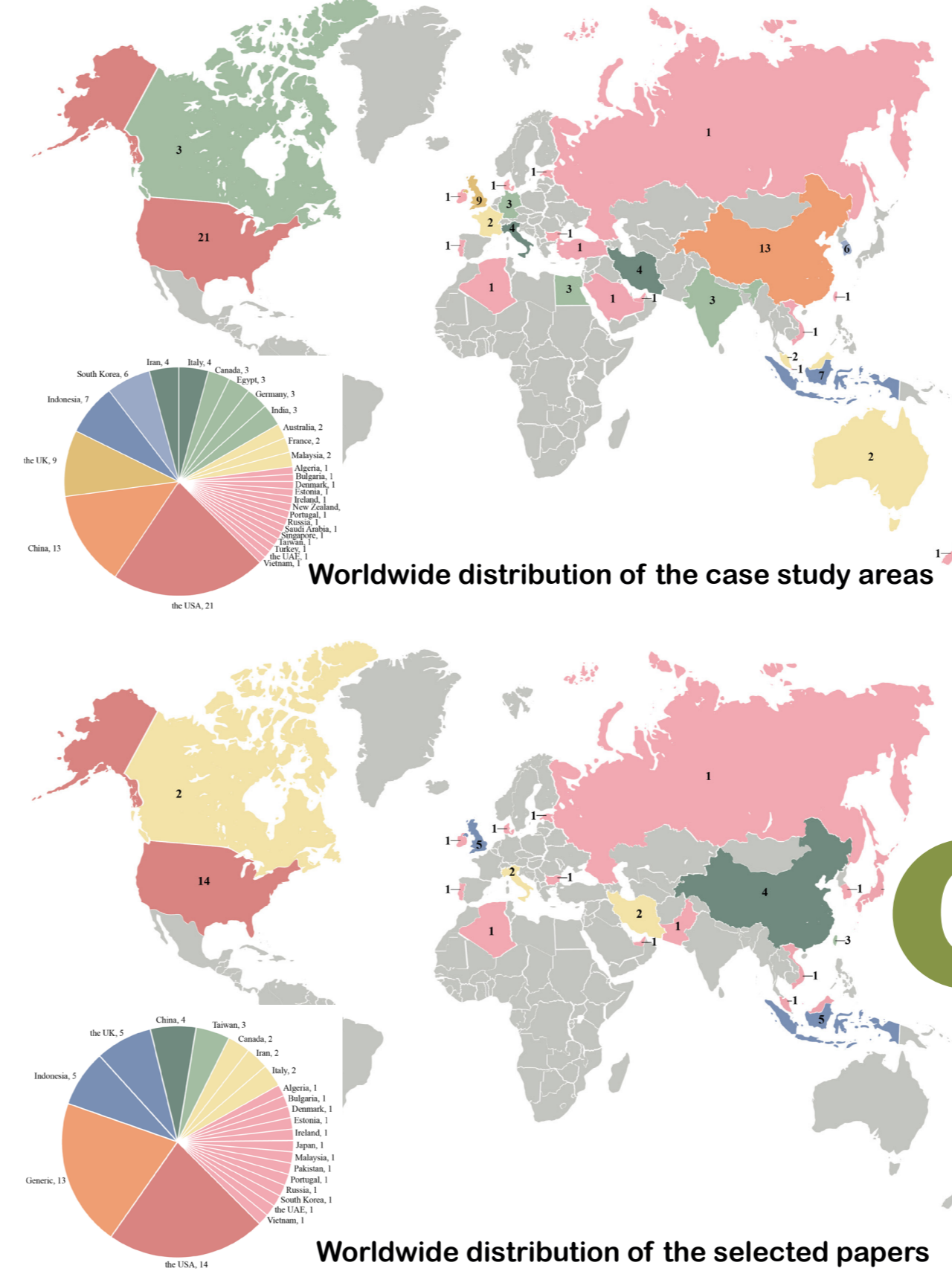
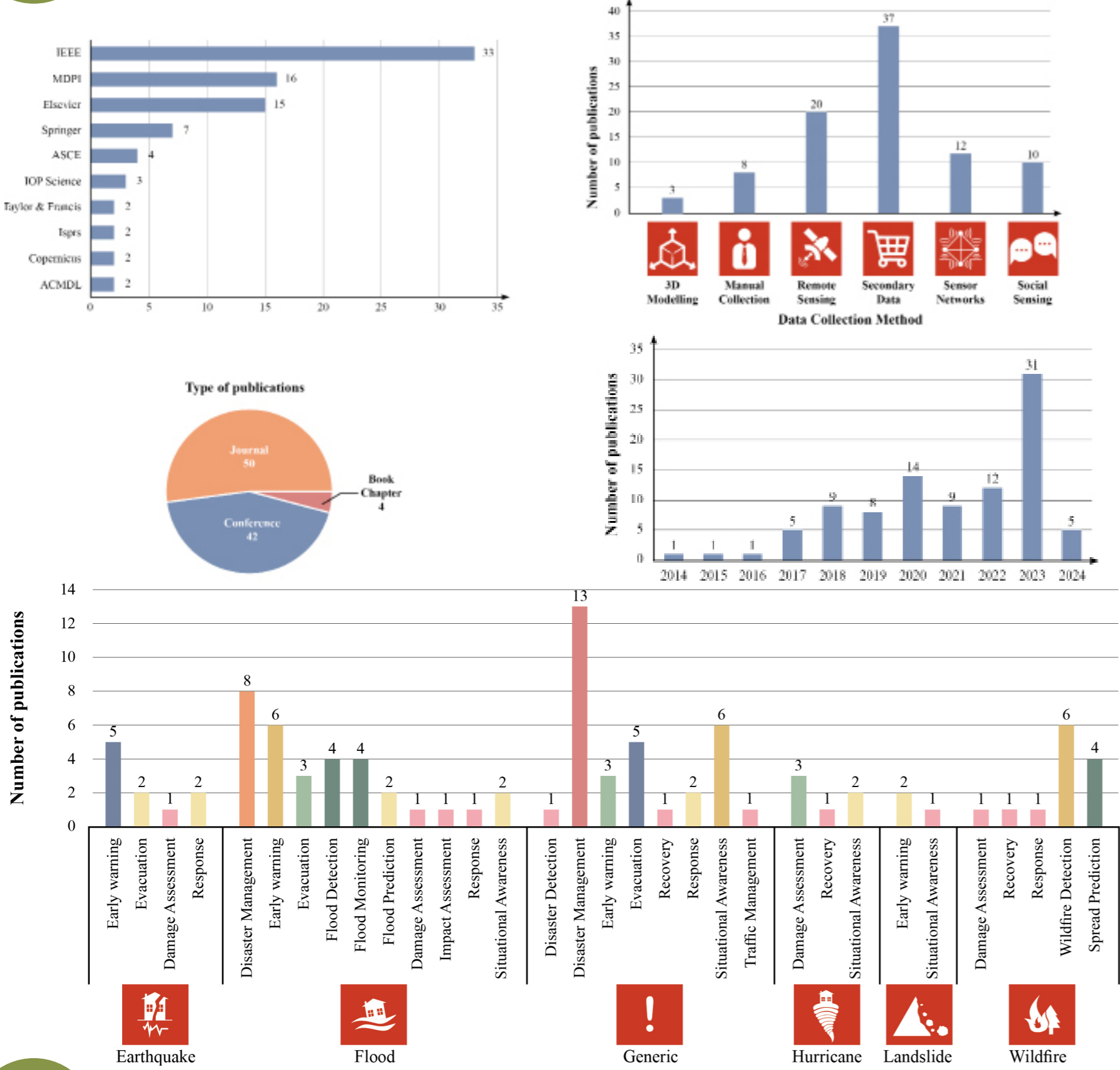


- Research Questions:**
- RQ1. Which countries and case studies contributed to the use of DPRMT?
  - RQ2. What are the disaster types and domains those studies are focusing on?
  - RQ3. What are the data collection methods, and what types of data have been used to address DPRMT?
  - RQ4. What machine learning algorithms have been used to address DPRMT?
  - RQ5. What are the existing research directions, achievements, and challenges?

- Systematic Literature Review Procedure:**
- Research Questions
  - Search Strategy
  - Study Selection Criteria
  - Data Extraction
  - Data Synthesis



## 4 Results of Systematic Literature Review



Existing studies relied on **only one or two data collection methods or sources**, which might not be comprehensive enough to represent post-disaster situations successfully,

Existing case studies **did not consider the affected communities' demographic and financial aspects**, which have a crucial impact on the outcome of post-disaster response and recovery policies,

Previous studies did not consider **the social dynamics of the affected communities** and their effects on the post-disaster risk management frameworks,

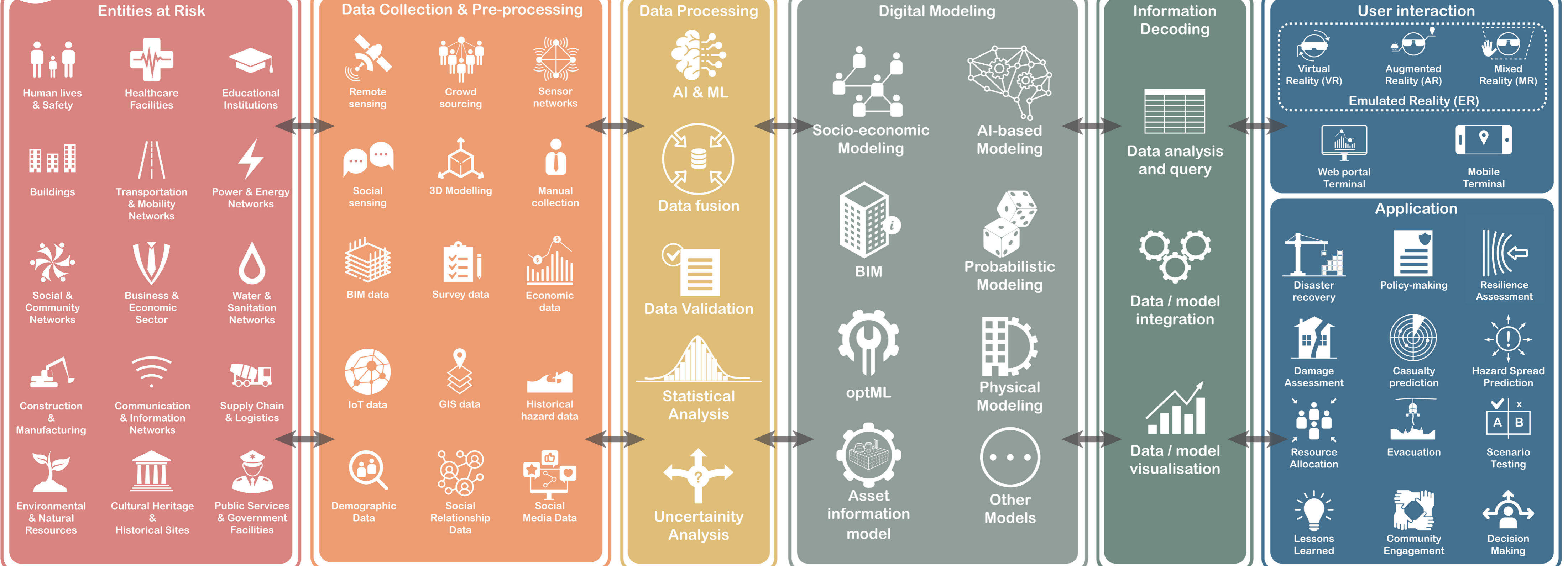
DPRMT studies employing dynamic models where the model is **continuously updated with data and information flow** are somewhat limited,

Previous studies focus on **only one or two elements at risk in isolation** from others which hinder understanding the complex and interconnected systems and subsystems within the study scale,

Studies focusing on **the recovery part of post-disaster risk management** are limited, although they shape the overall outcome,

Studies integrating **Machine Learning and Deep Learning** algorithms into DPRMT are scarce.

## 5 Conceptualization of the Components of Digital Post-Disaster Risk Management Twinning



## 6 References

Lagap, U. and Ghaffarian, S.: Digital Post-Disaster Risk Management Twinning: A Review and Improved Conceptual Framework, International Journal of Disaster Risk Reduction. Ariyachandra, M. R. M. F., & Wedawatta, G. (2023). Digital Twin Smart Cities for Disaster Risk Management: A Review of Evolving Concepts. Sustainability, 15(15), 11910. Cheng, R., Hou, L., & Xu, S. (2023). A Review of Digital Twin Applications in Civil and Infrastructure Emergency Management. Buildings, 13(5). Ghaffarian, S., Taghikhah, F. R., & Maier, H. R. (2023). Explainable artificial intelligence in disaster risk management: Achievements and prospective futures. International Journal of Disaster Risk Reduction, 98, 104123. Hatch, N., Magnussen, W., & Tao, J. (2023). Efforts Towards a Digital Twin-based Testbed for Public Safety. Paper presented at the ACM International Conference Proceeding Series.