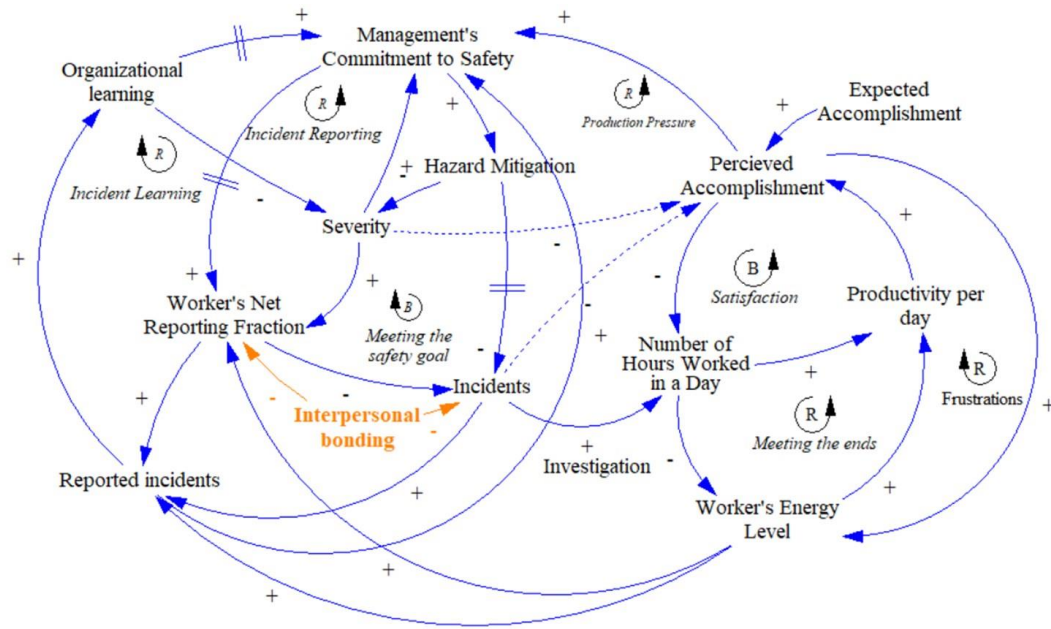


System dynamics study of interactions between interpersonal bonding and reporting culture for High-Speed Railway organizations



Nikhil Bugalia
IIT Madras

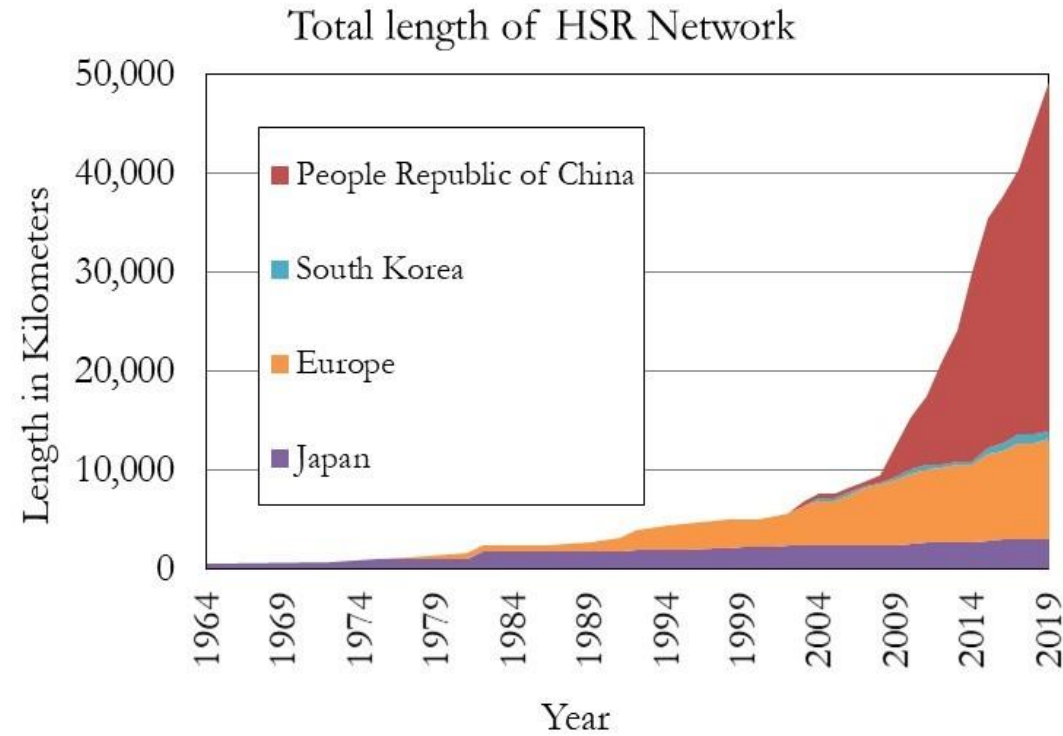


Yu Maemura
University of Tokyo

International System Dynamics
Conference
21 July 2022



Background and Motivation



2011, PRC

Number of Fatalities : 40



2013, Spain

Number of Fatalities : 80



2020, Italy

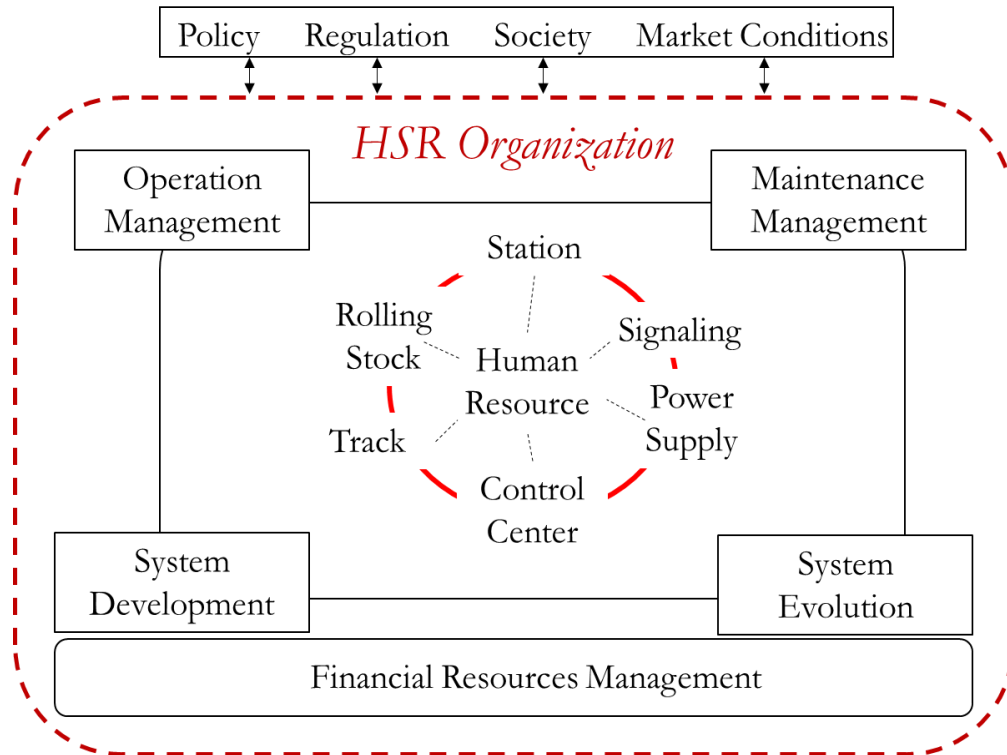
Number of Fatalities : 2

(a)

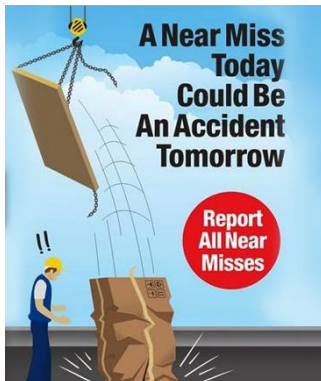
(b)



Japan, Zero Passenger Fatalities due to railway operations, in more than 55 years



HSR System



- Recommendations for improving “Safety Culture” are generally applicable for “Reporting Culture”
- An assumption that requires critical evaluation



- Interpersonal bonding/coordination and Reporting culture – tension, tradeoffs and dilemma

- Insights towards understanding the systemic tradeoff between interpersonal bonding and incident reporting culture among employees within safety-critical organizations like HSR
- System-Dynamics (SD) based numerical simulation model approach to understand the impact of interpersonal bonding on reporting culture within HSR organizations
 - **Explores and draws lessons from an existing SD model on reporting culture,** developed by the authors (Bugalia et al., 2021).
 - **Case studies:** Utilize SD model structure to review the organizational practices of two Japanese HSR operators that have successfully improved reporting culture.
 - **Combined lessons from two case studies and policy simulations,** the current study draws lessons for the near-miss reporting management for HSR systems worldwide

Safety Science 142 (2021) 105368



Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Safety Science

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A system dynamics model for near-miss reporting in complex systems

Nikhil Bugalia^{a,*}, Yu Maemura^b, Kazumasa Ozawa^b

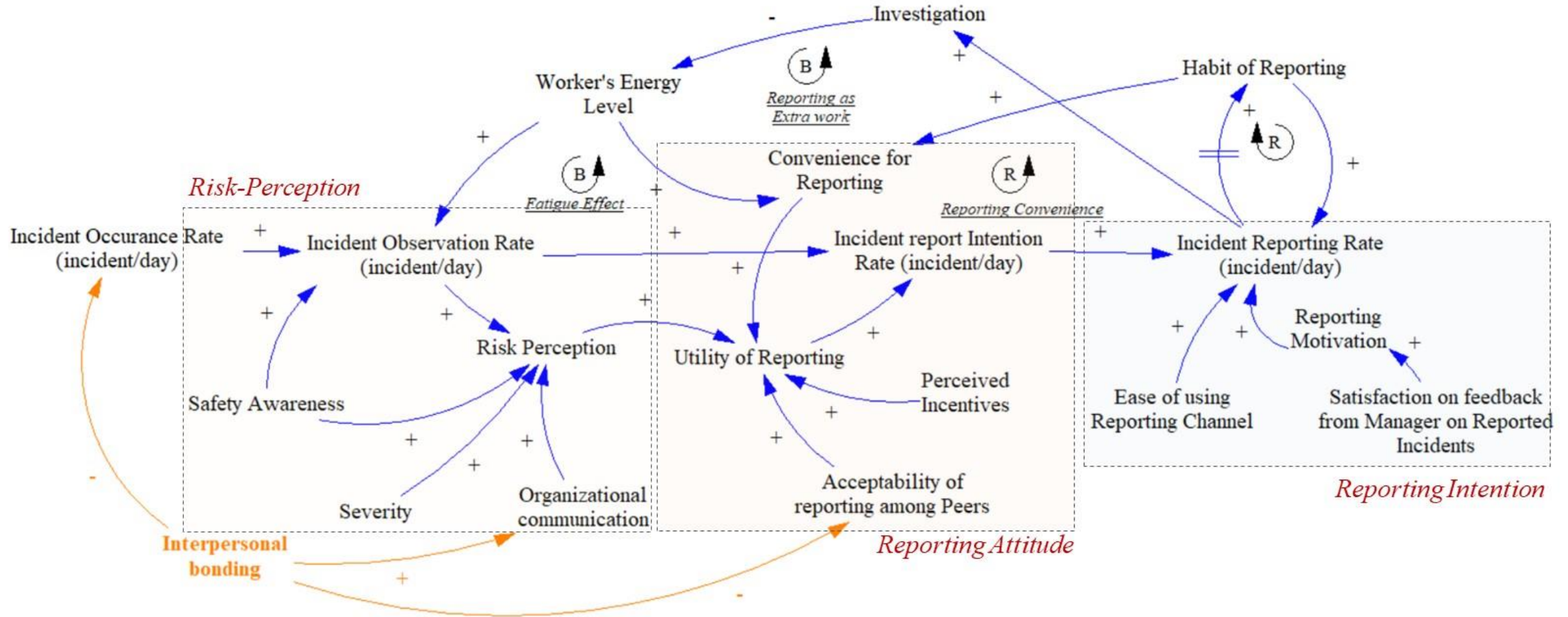
^a Department of Civil Engineering, Indian Institute of Technology Madras, Chennai, India

^b Department of Civil Engineering, The University of Tokyo, Tokyo, Japan



Overview of the SD model on Reporting Culture

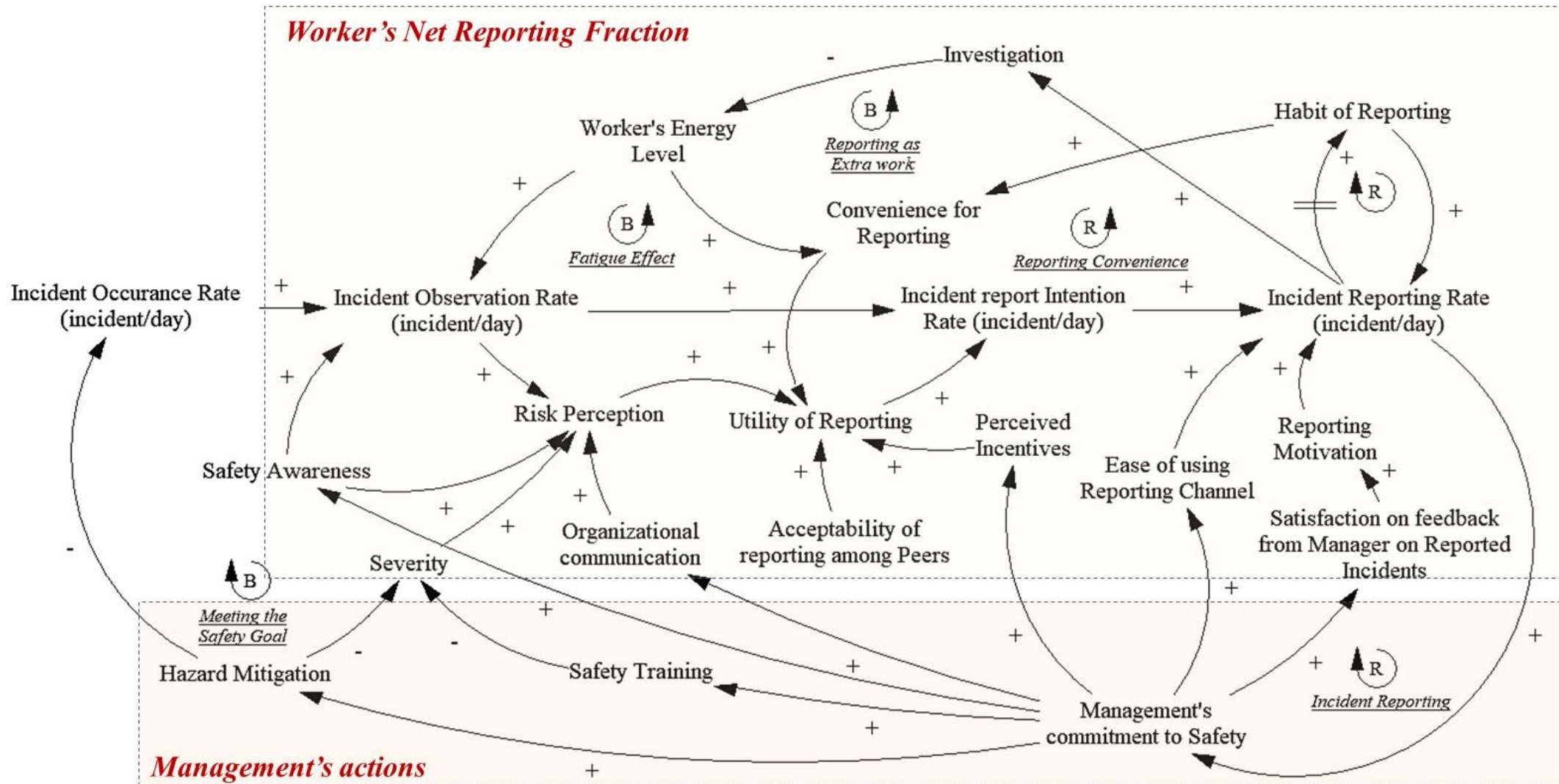
6



Micro (worker level) dynamics – Net Reporting Fraction

Overview of the SD model on Reporting Culture

7



Interactions between Micro and Macro Level Dynamics

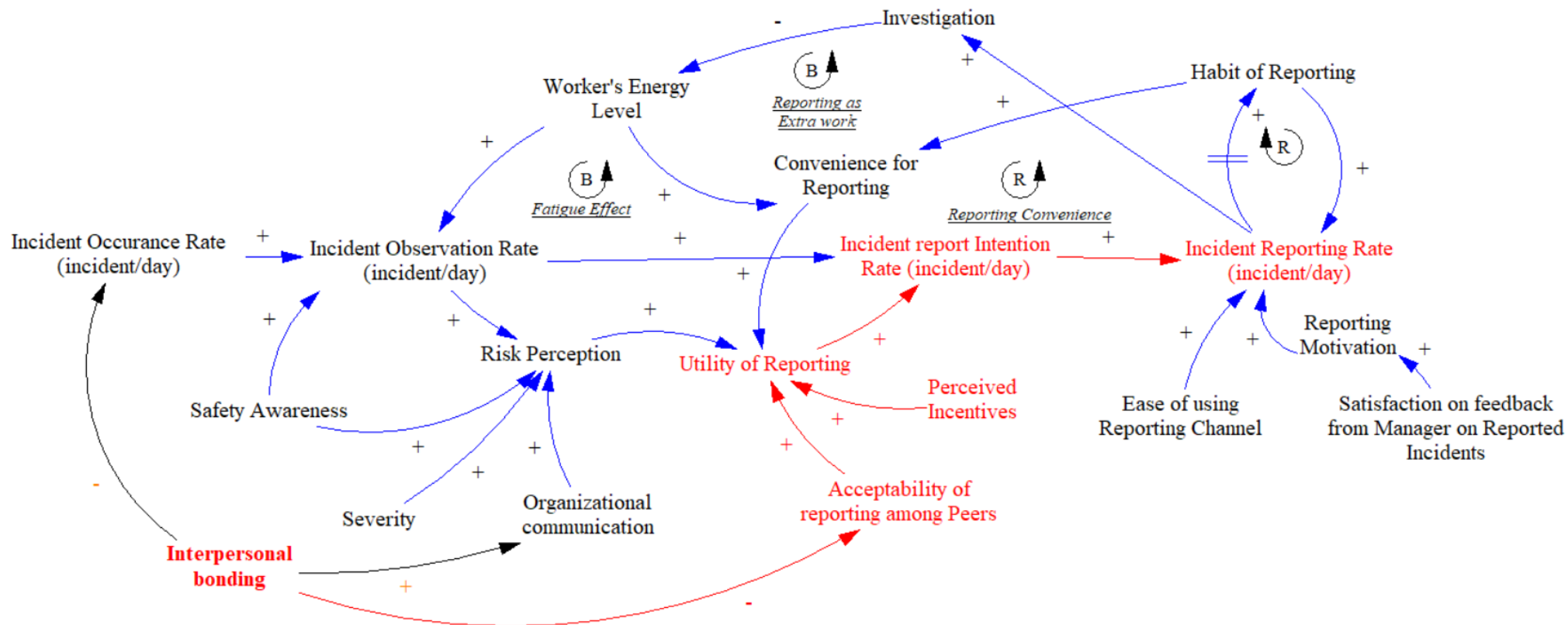
8



➤ On-the-job-training :

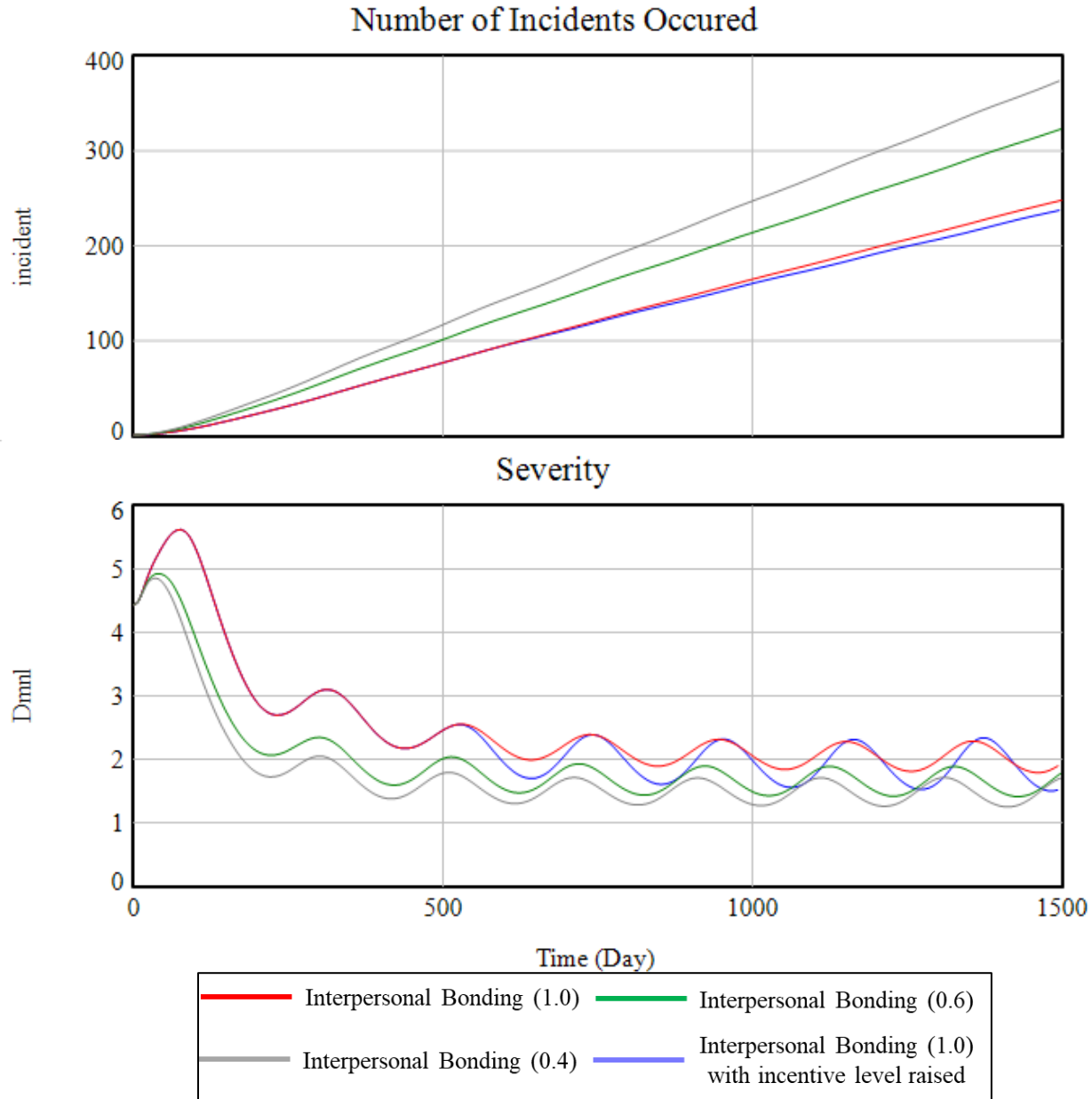
- Improves risk-perception for young employees
- Creates barrier for reporting against seniors

➤ Family-like-organizational culture and Penalties



Policy Simulation – with no tangible effect of accidents

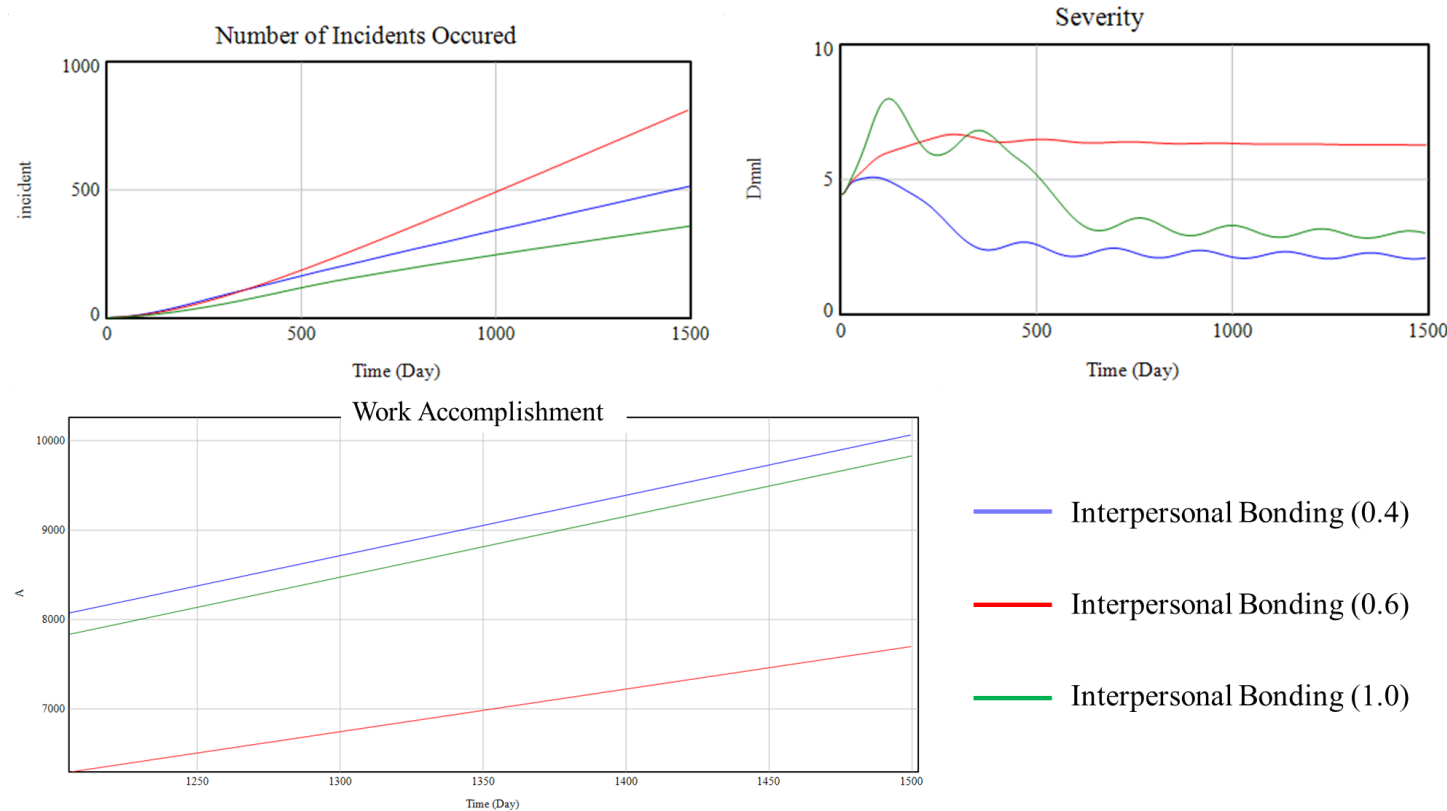
10



- Variation with interpersonal bonding parameter (1 (High) – Base Case; 0.6 (Medium); 0.4 (low)
- High Interpersonal Bonding → Reduction in number of incidents → Reduced Organizational Knowledge → Severity of the accidents
- Organizations face issues in simultaneously reducing the number of incidents and severity
- **A multi-pronged approach :**
High-interpersonal bonding + with increased incentive (positive effects of reporting)

Policy Simulation – with tangible costs of accidents

11

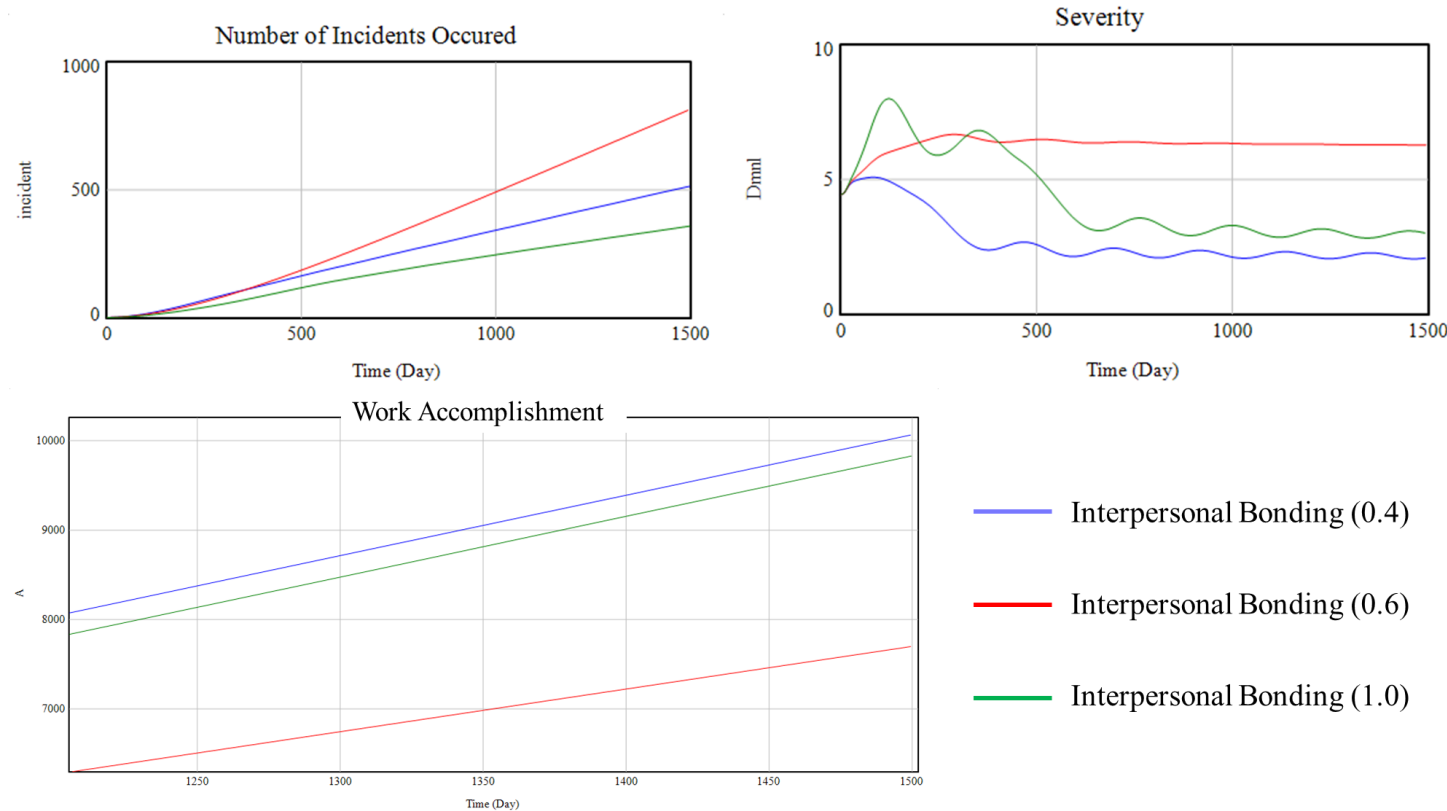


The loss in production arising from incidents results into production pressure, that can reduce management commitment to safety

- For low interpersonal bonding : Large number of low severity events → Increases Organizational Knowledge → High Safety and High Production
- For high interpersonal bonding scenario : Low number of incidents, leading to high severe events, thereafter, increasing the organizational knowledge and sustaining the safety and productive pressure.

Policy Simulation – with tangible costs of accidents

12



The loss in production arising from incidents results into production pressure, that can reduce management commitment to safety

- **However, the moderate interpersonal bonding scenario :** constant battle to establish a commitment to safety and alleviate production pressure
- Overall, a high interpersonal bonding is desired, but organizations transitioning from low to high must be cautious.



The current study makes HSR organizations understand the impact of interpersonal bonding on reporting culture through a System-Dynamics (SD) numerical simulation model



The case studies from Japan validate the SD model. Trade-offs between various factors, such as incentives, interpersonal bonding, and the perceived negative consequences of reporting.



High level of interpersonal bonding is desired for overall safer work environment. Journey of moving employee teams from low to high interpersonal bonding stages can present significant obstacles. Multi-pronged approaches : interpersonal bonding coupled with positive perception on reporting



Specific practices aimed at positive and negative effects of reporting could also manifest differently for different organizations. The current model is limited and needs to be adapted to reflect such practices

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