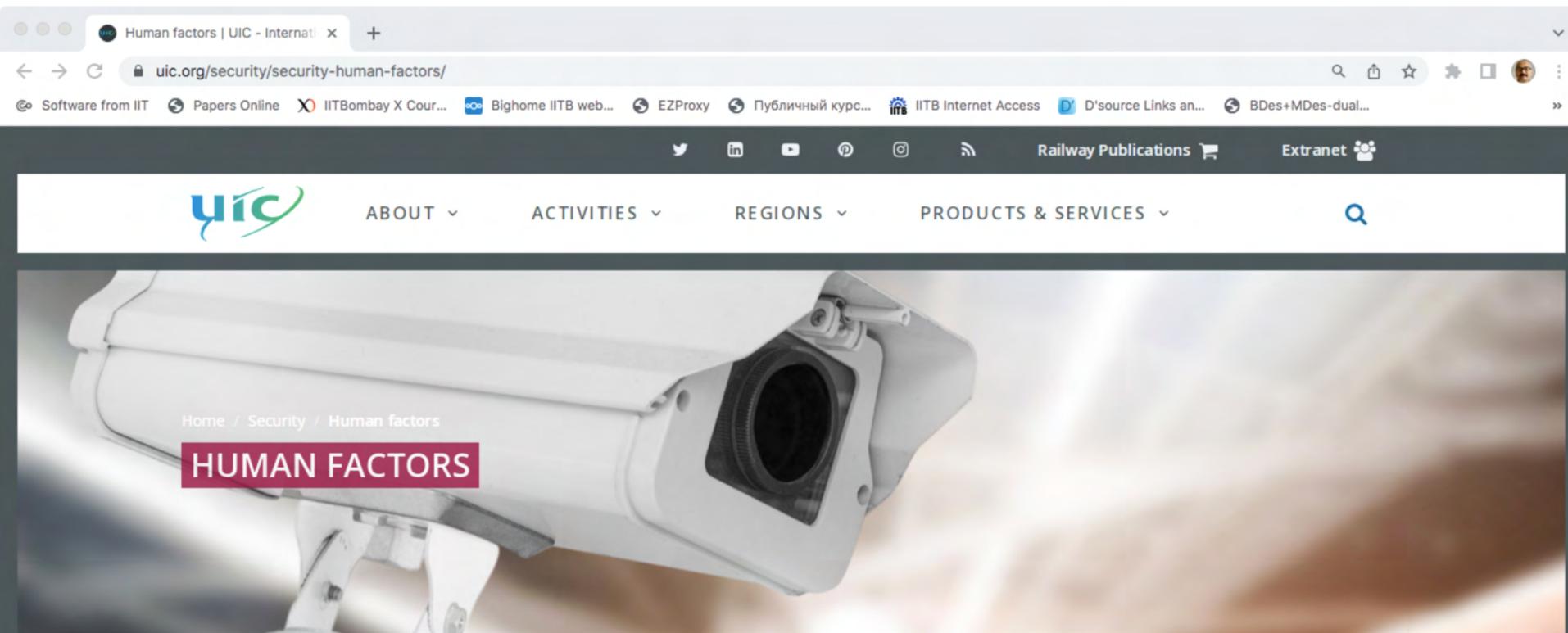


Human Factors and Accident Analysis in Complex Systems

Vivek Kant

IIT Bombay

Human factors in the railway sector - worldwide



Home / Security / Human factors

HUMAN FACTORS

Human Factors working group
Documents | Events | News | Projects

Human Factors working group

Chaired by Via (Rail Canada) since January 2023

Two aspects will be examined as priorities in order to further develop or reinforce activities in progress:

SECURITY

> Human factors

Strategy

Technology

Organisation

Human factors in the railway sector – UK

The screenshot shows a web browser window with the URL rssb.co.uk/en/safety-and-health/improving-safety-health-and-wellbeing/understanding-human-factors. The page header includes the RSSB logo, navigation links for 'Login' and 'Register', and a search bar. The main navigation menu contains: 'Who We Are', 'What We Do', 'Services and Resources', 'Safety and Health', 'Standards', 'Sustainability', 'Research and Innovation', and 'Join RSSB'. The breadcrumb trail is: 'Home > Safety and Health > Improving Safety, Health & Wellbeing > Human Factors'. The main content area features a large image of a railway worker in a high-visibility vest and a blue face mask, holding a mobile phone. A white overlay on the left side of the image contains the text 'Human Factors' and four social media icons: Facebook, LinkedIn, Twitter, and Email.

Introduction

Human factors (HF) is concerned with the optimisation of human performance in the workplace. In the rail sector, it considers working environments from a human-centred point of view by studying how the whole system influences the way people behave and interact with the railway.

In this section

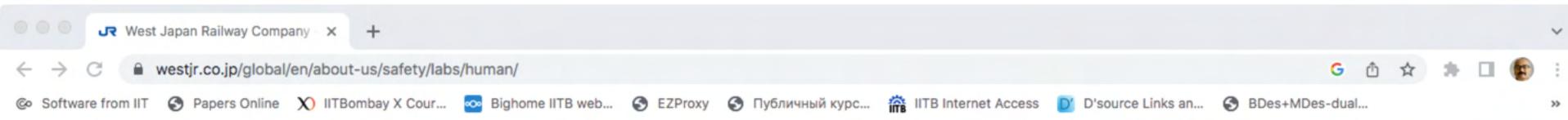
[Applying Human Factors to Improve Perf...](#) >

[Competence Management](#) >

[Design and Use of Technology](#) >

[Fatigue, Workload and Health](#) >

Human factors in the railway sector – Japan



| [Human Errors and Human Factors](#) | [Characteristics of human beings](#) | [Human characteristics appearing in groups](#) | [Interfaces with devices and equipment](#) |

Human errors and human factors

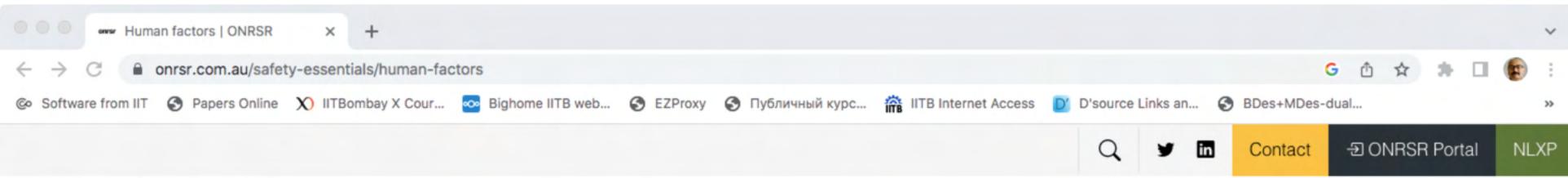
In systems operated by many people, such as a railroad system, major accidents might be caused by errors made by one person and railroad operation could be disturbed for a long time. It is necessary to know the roles of people in the system as well as characteristics of human beings (human factors) and develop systems in which major problems are not caused by human errors. The Safety Research Institute deals with the following human factors based on the perspective of human errors and human factors.

What are “human errors”?

Human beings make various mistakes in daily life, such as spilling tea, forgetting to post a letter, and mixing up the time, among others. When such failures affect only personal matters, people just have to be more careful the next time. On the other hand, there is a need to fully examine the causes and take countermeasures when the mistakes cause a computer system crash, or when all company business is



Human factors in the railway sector - Australia



[About Us](#)

[Operator Essentials](#)

[Safety essentials](#)

[Enforcing RSNL](#)

[Publications](#)

[Industry information](#)

[Home](#) / [Safety essentials](#) / [Human factors](#)

Human factors

• [Safety Alert - Independent Competent Persons \(ICPs\) that certify rolling stock](#) [Read more](#)

Human factors is the discipline that applies knowledge of human capabilities and limitations to the design, operation and maintenance of technological systems.

It draws from established disciplines such as psychology, ergonomics, physiology and engineering.

Safety essentials

[Safety alerts](#)



Human factors in the railway sector

Why should you care?

“Human Error”, Accident Analysis and Prevention

- traditional or “person” approach : the “old” culture
 - “just try harder” – train people more
 - Remove the person and change his “job”

Vs.

- “systems” approach
 - the “new look”

Person approach

- see errors as the product of carelessness
- remedial measures directed primarily at the
- error-maker
 - naming
 - blaming
 - shaming
 - retraining

An individual failing?

Doesn't work!

- people don't intend to commit errors
 - only a very small minority of cases are deliberate violations
- countermeasures create a false sense of security :
“we've 'fixed' the problem”
- won't solve the problem - it will make it worse
 - operators/workers/managers will hide errors

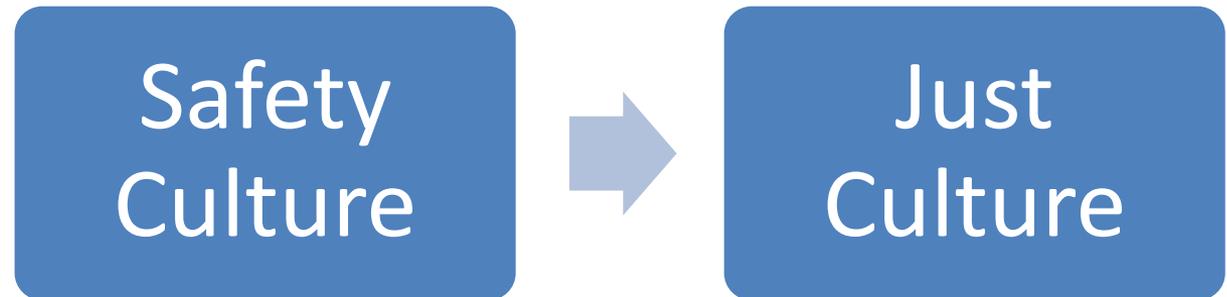
The culture of blame?

Why does it exist?

Blame and Shame Culture,

VS.

Just Culture



“systems” approach:

the “new look” towards complex systems

How to deal with Complex Sociotechnical Systems?

What is “Human Factors”?

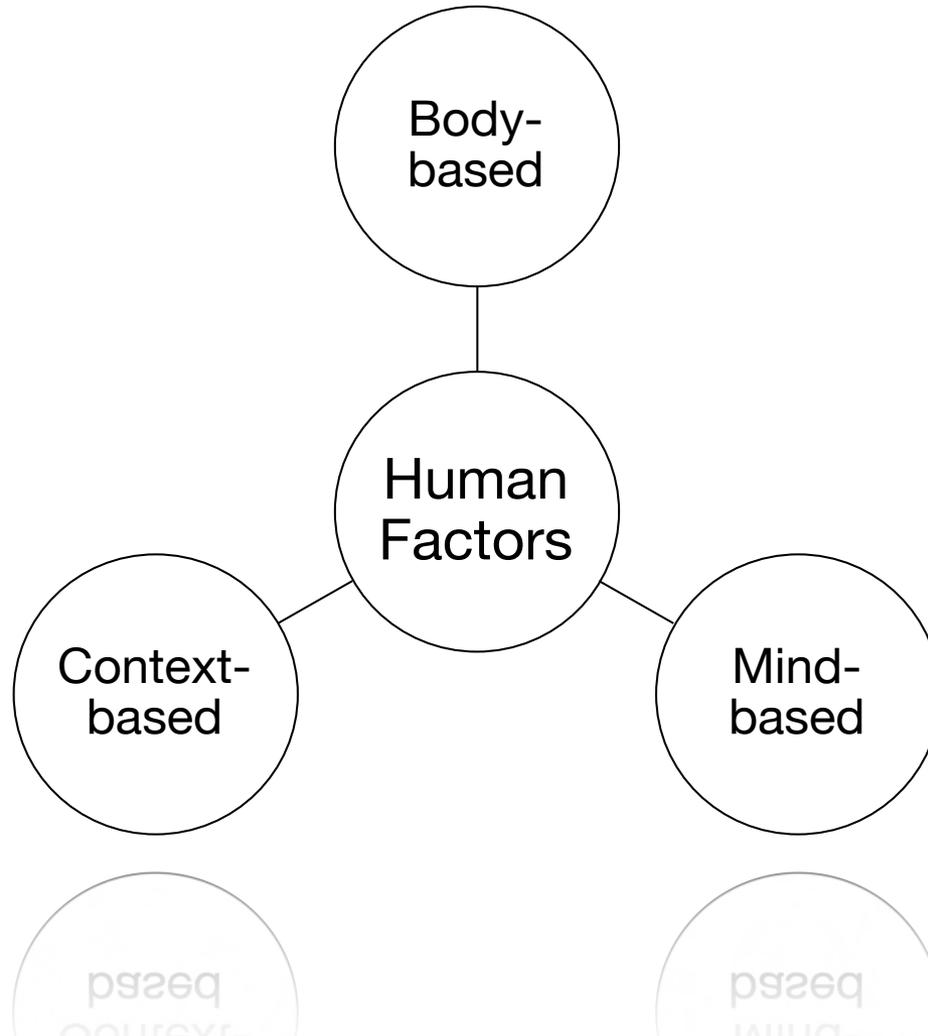
Human Factors is a scientific and engineering discipline

- It is not common sense (common sense is not very common, unfortunately!)
- It is not personality traits or characteristics!
- It is not a limited set of principles that can be imbibed with short trainings

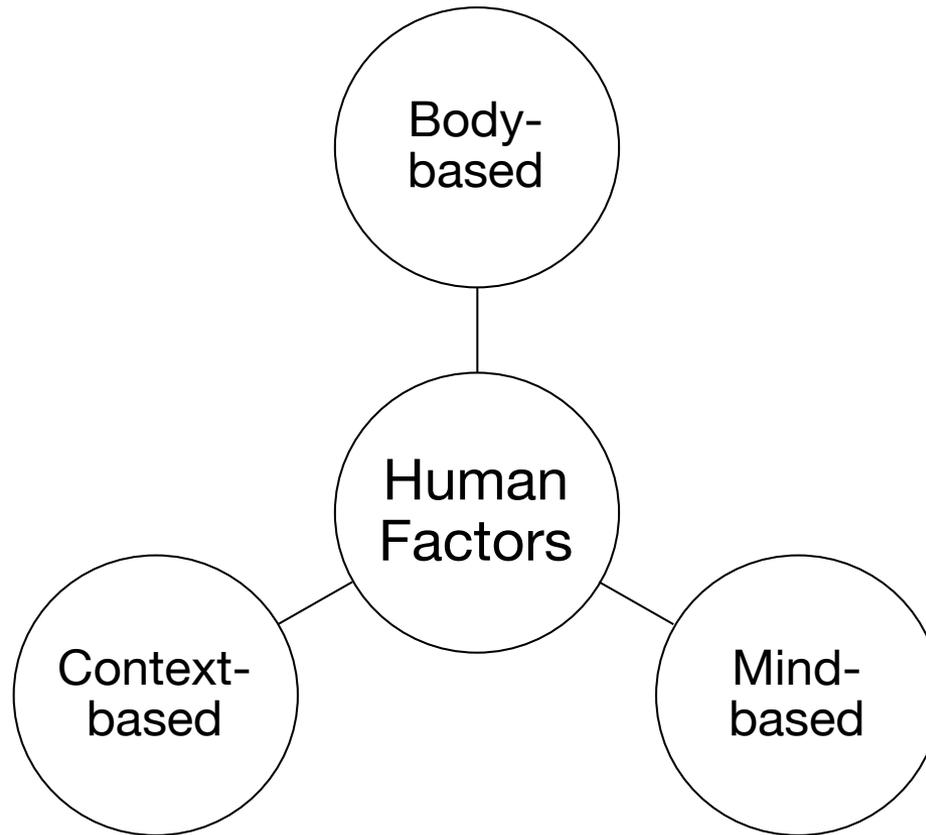
What is “Human Factors”?

Human factors is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance. (IEA, 2020)

Scope of Human Factors?



Scope of Human Factors?



How did Human Factors evolve?

Where does my expertise lie?

- **Resilience in Sociotechnical systems**
- **Process Improvement**

Body-based

- **Cognitive Systems Engineering**
- **Interaction Design in Complex systems**

Human Factors

Context-based

Mind-based

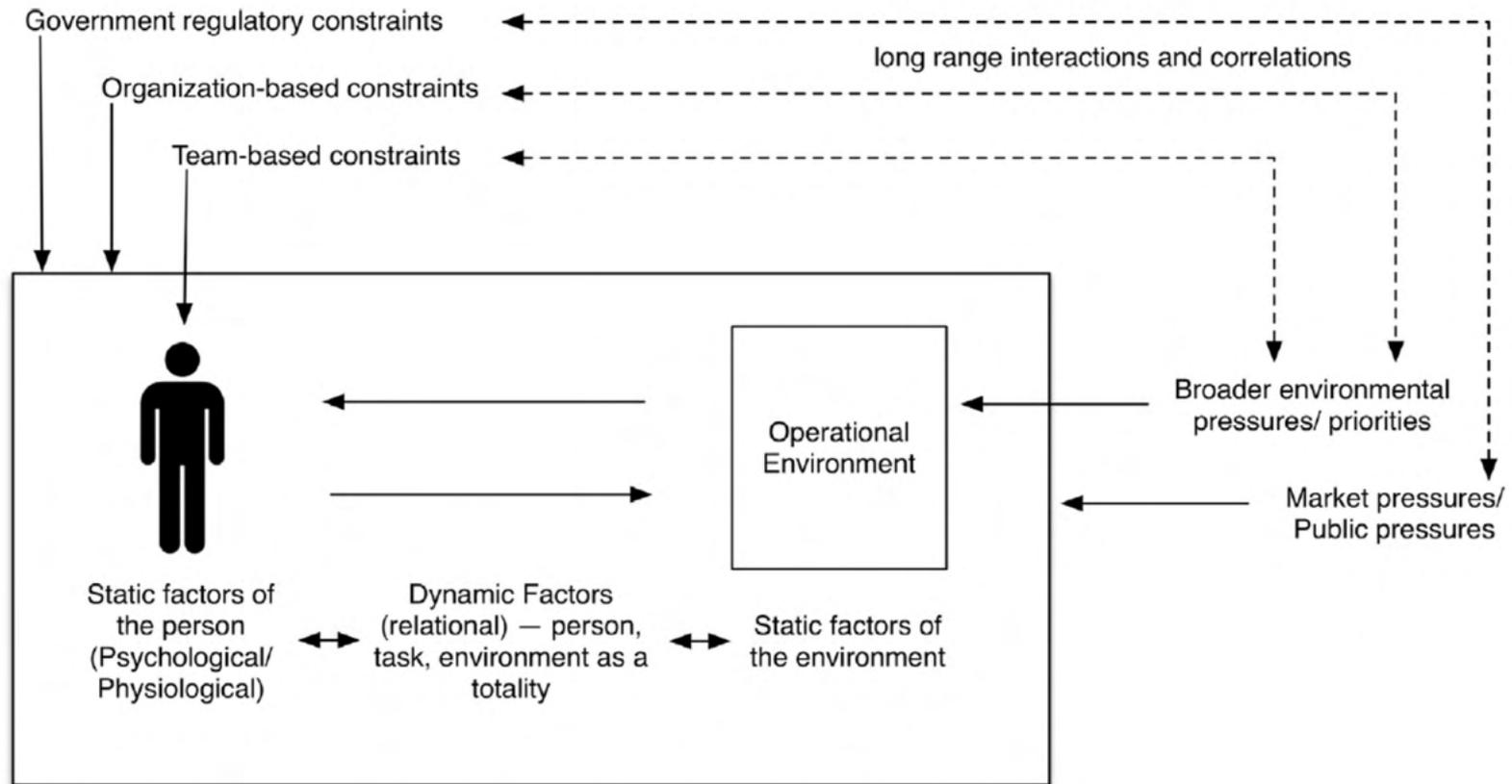
Context-based

Mind-based

How to deal with Complex Sociotechnical Systems?

Why is the problem so tough?

How to deal with Complex Sociotechnical Systems?

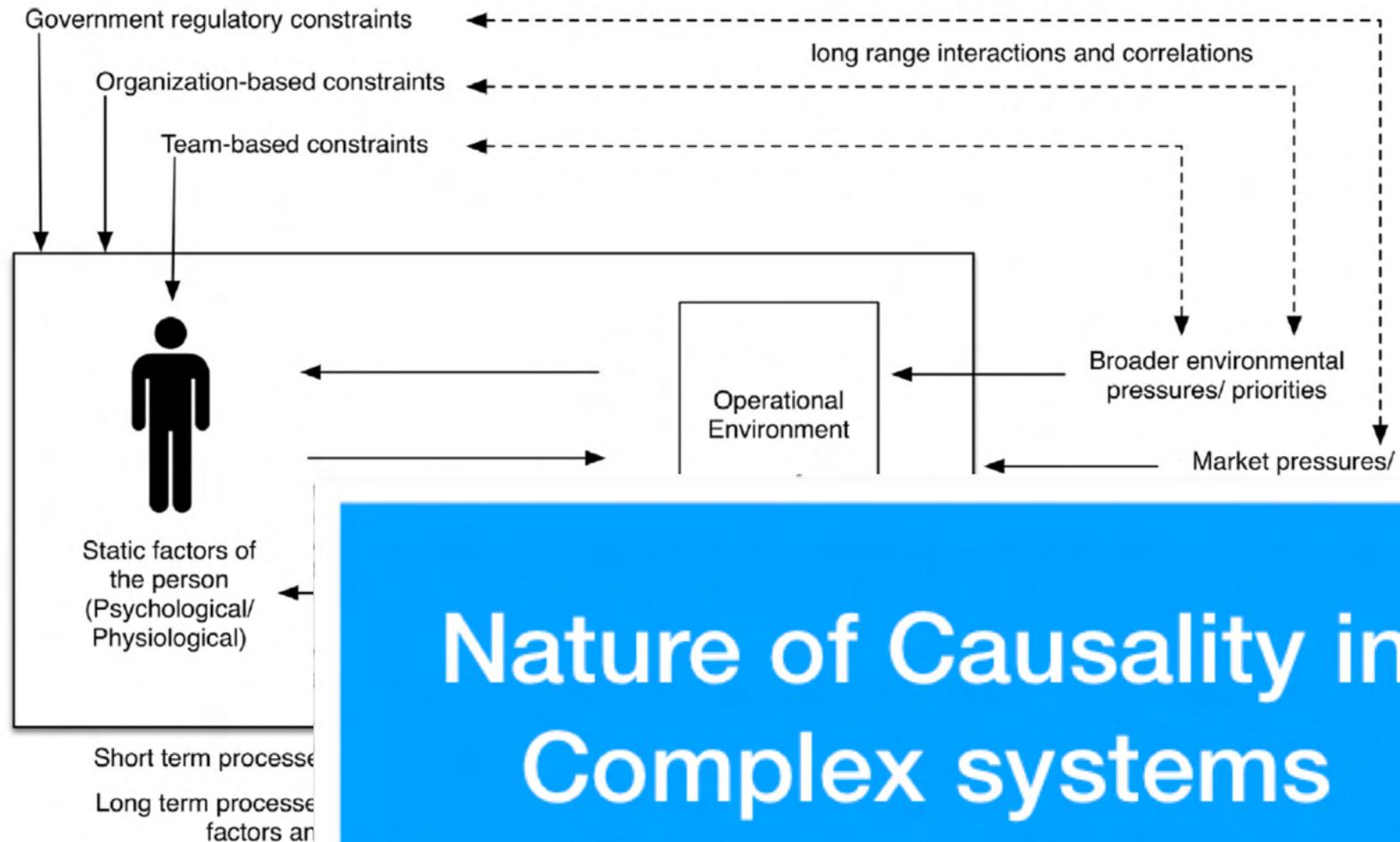


Short term processes - immediate threats and failures - dynamic factors

Long term processes - slow disasters/buildup towards accidents - static factors and long range interactions and correlations

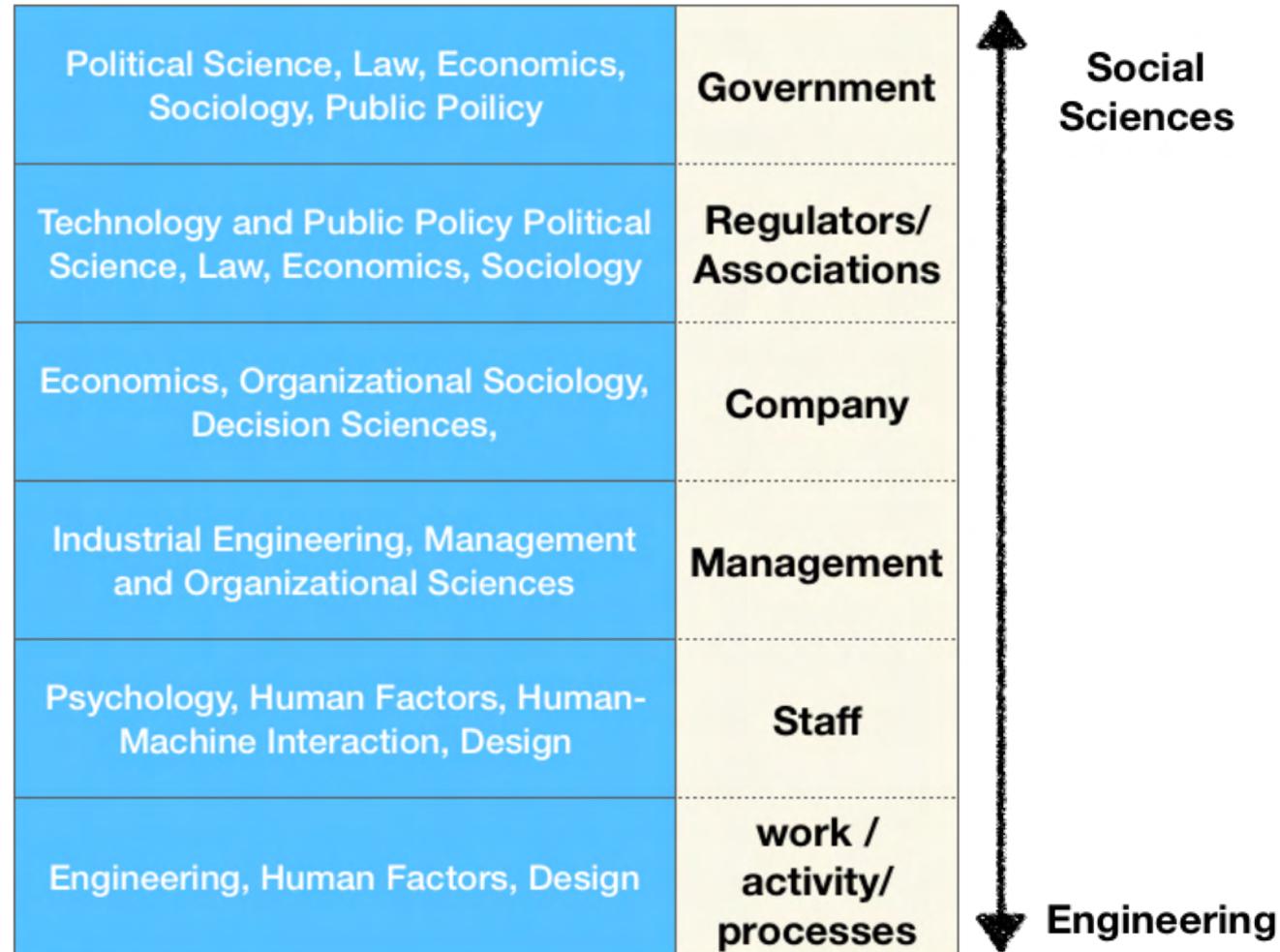
Basic Unit of Human Performance

How to deal with Complex Sociotechnical Systems?



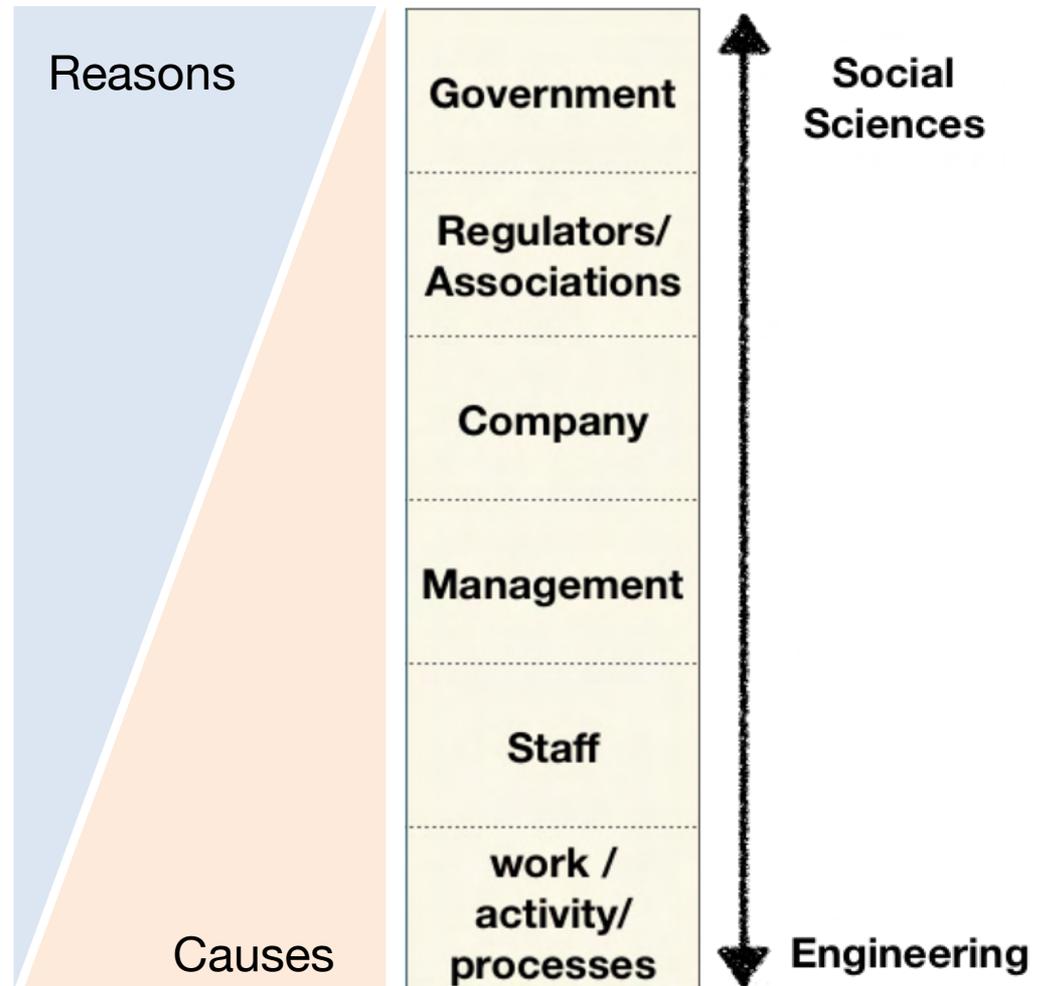
What are the disciplines required for dealing with complex systems?

- Multiple Layers of Abstraction
- Transdisciplinary orientation

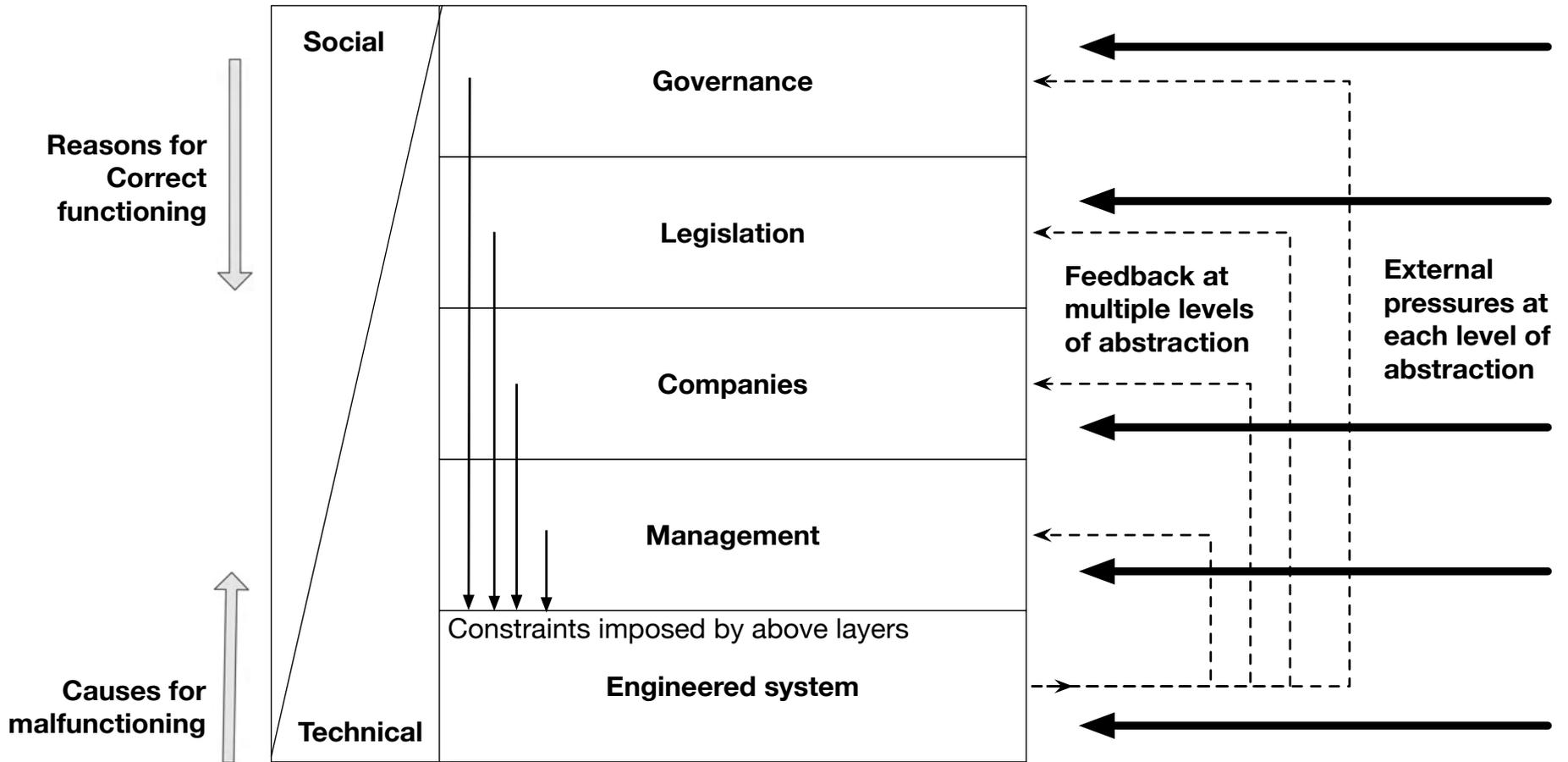


How do accidents propagate in complex systems?

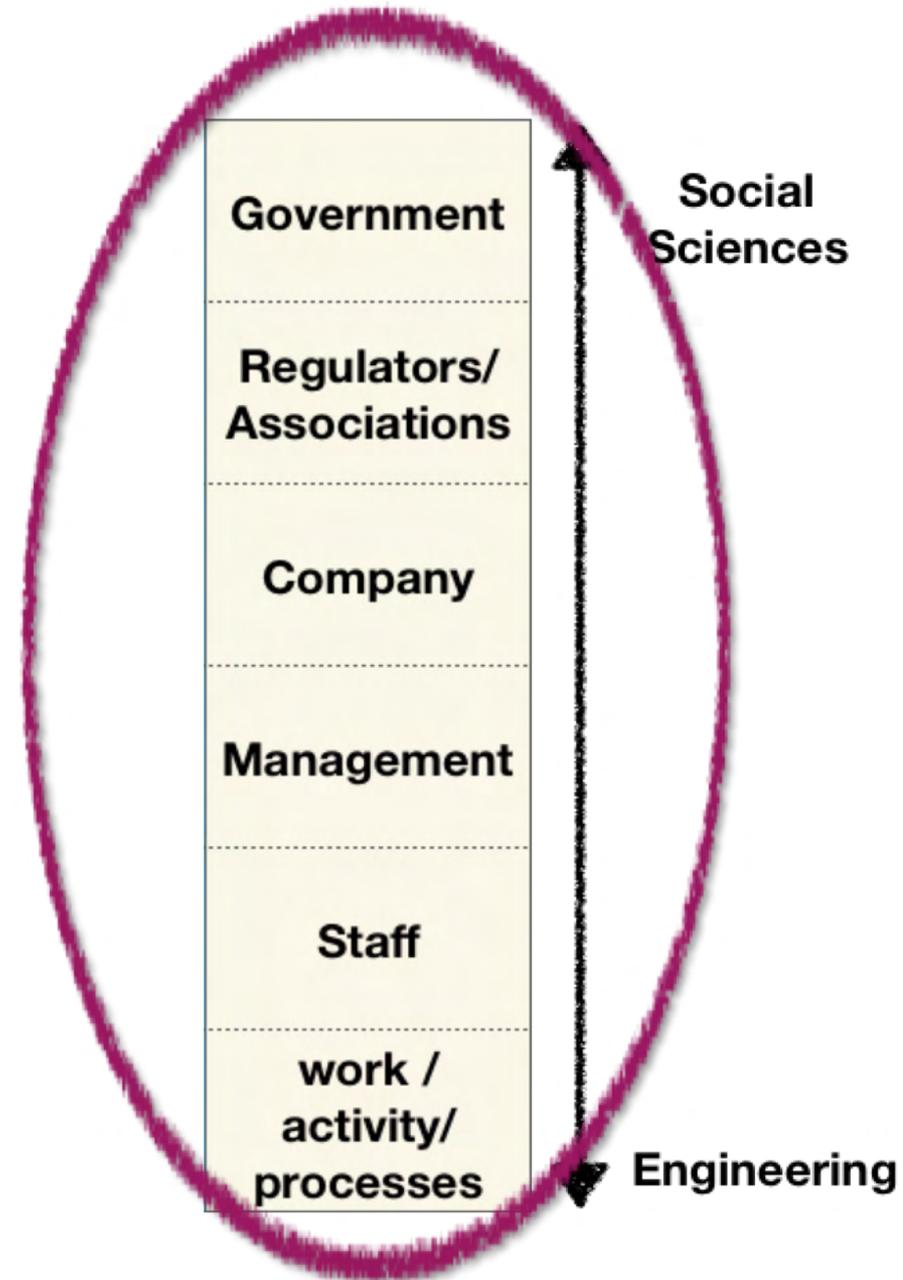
- Role of the Human
- Reasons vs. Causes in accidents



How do accidents propagate in complex systems?



Sociotechnical Systems design (Accident Analysis)



Case Study for Sociotechnical Systems: Train Incident Analysis

- MRT (Train Transit) breakdown in Singapore of July 7, 2015
- Around 250,000 commuters were stranded
- a penalty of 5.4 million SGD paid by the operating organization



Government
(Minister of Transport)

Regulatory Bodies
and associations
(Land Transport Authority)

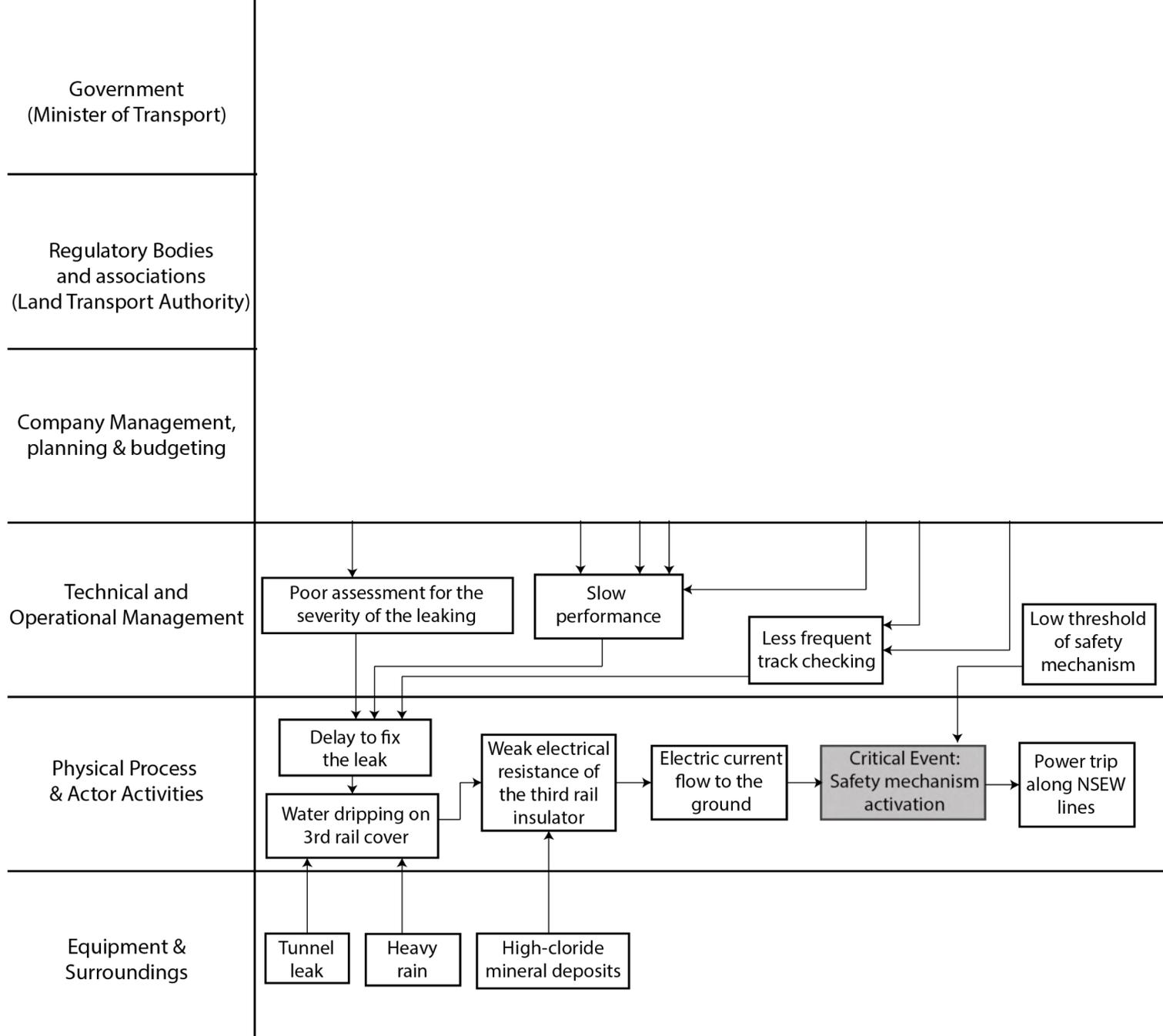
Company Management,
planning & budgeting

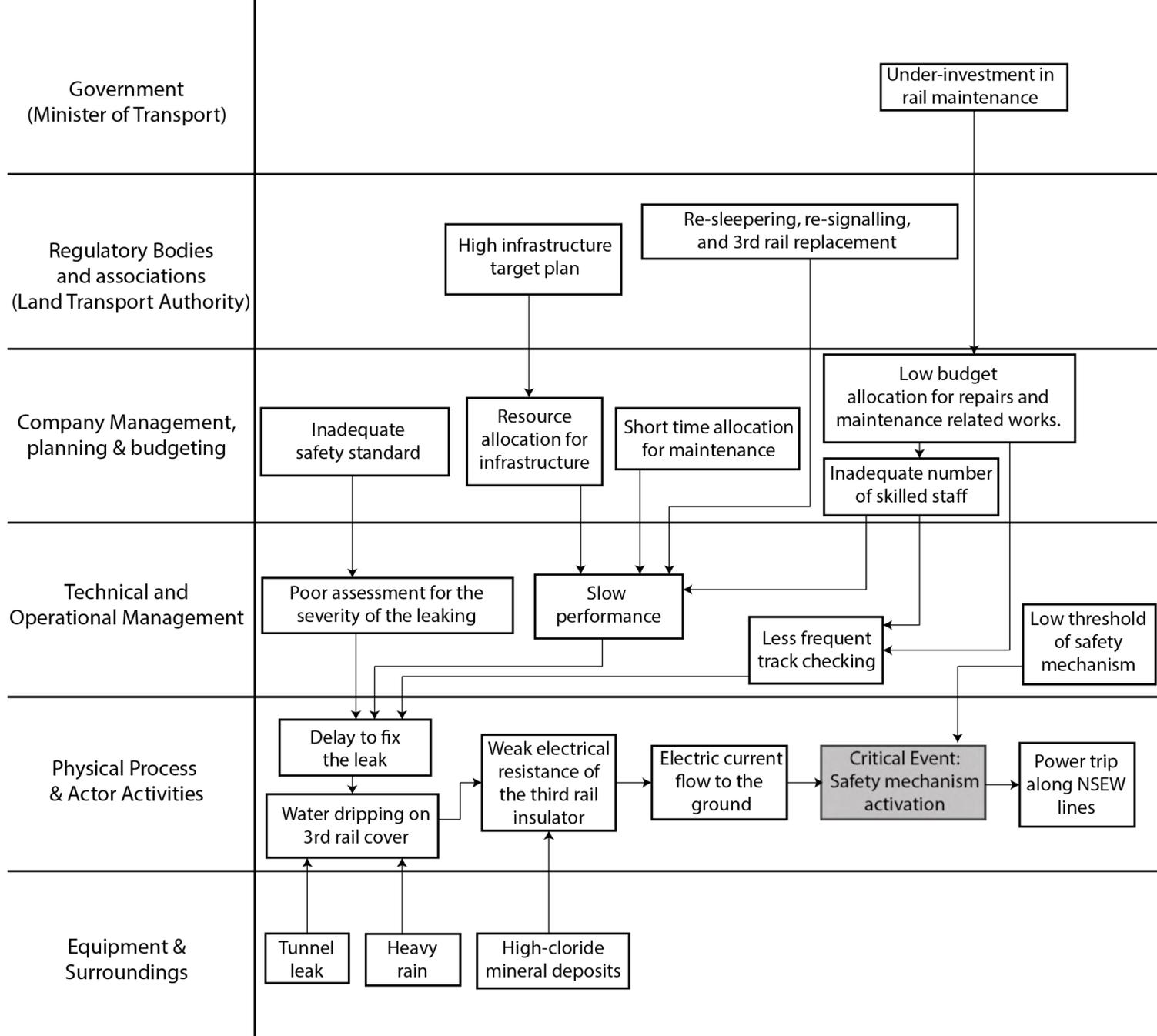
Technical and
Operational Management

Physical Process
& Actor Activities

Equipment &
Surroundings

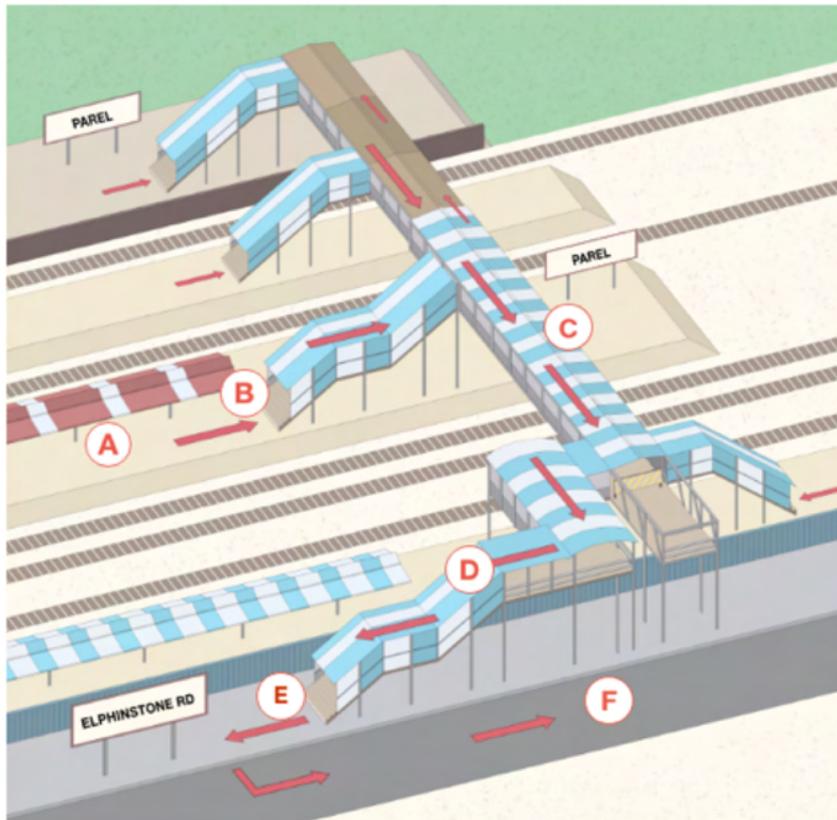


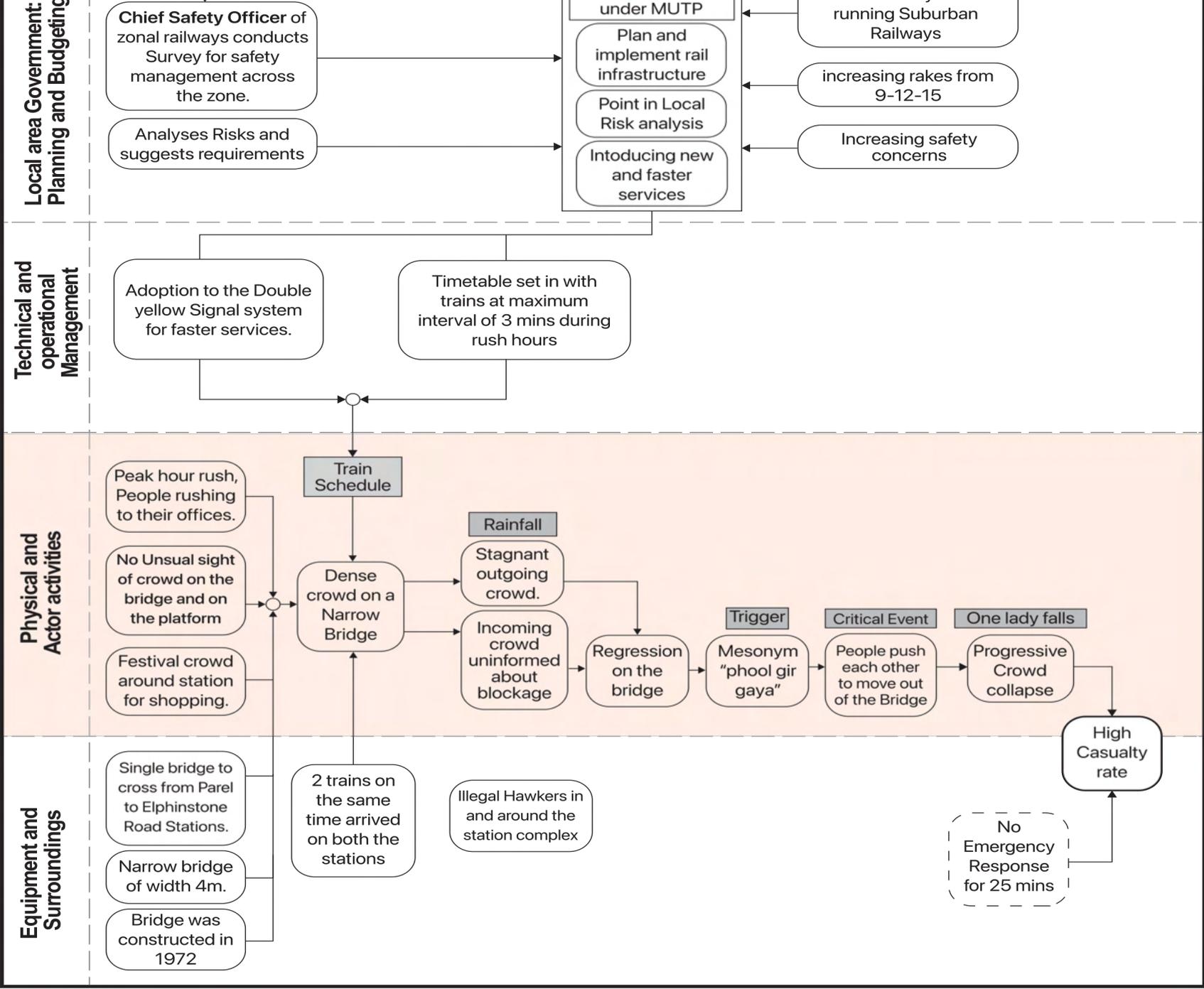




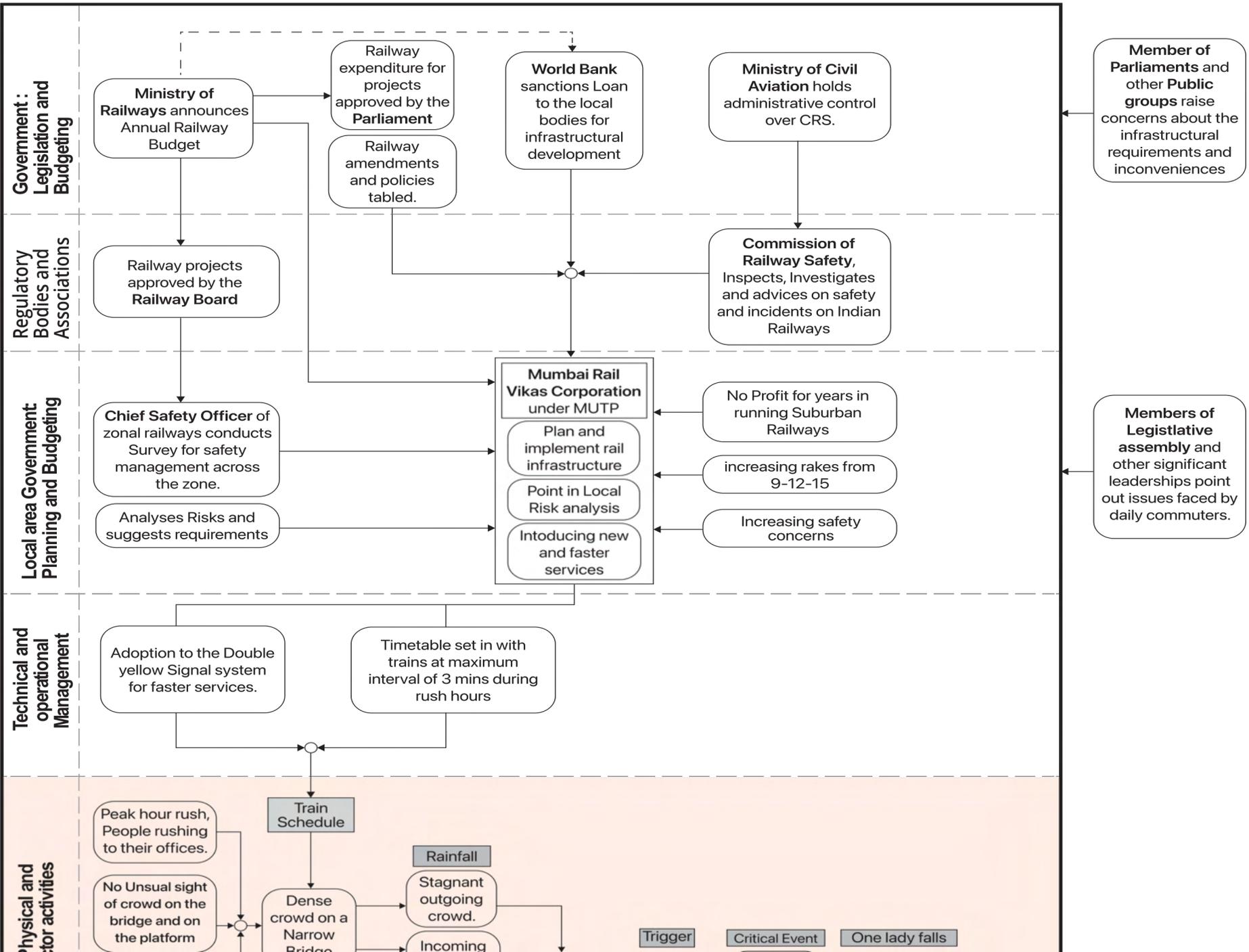
Case Study for Sociotechnical Systems: Elphinstone Railway station tragedy

- analysis on 200 newspaper reports
- understanding the railway station stampede





M
Le
ass
othe
lead
out is
daily



Putting it all together...

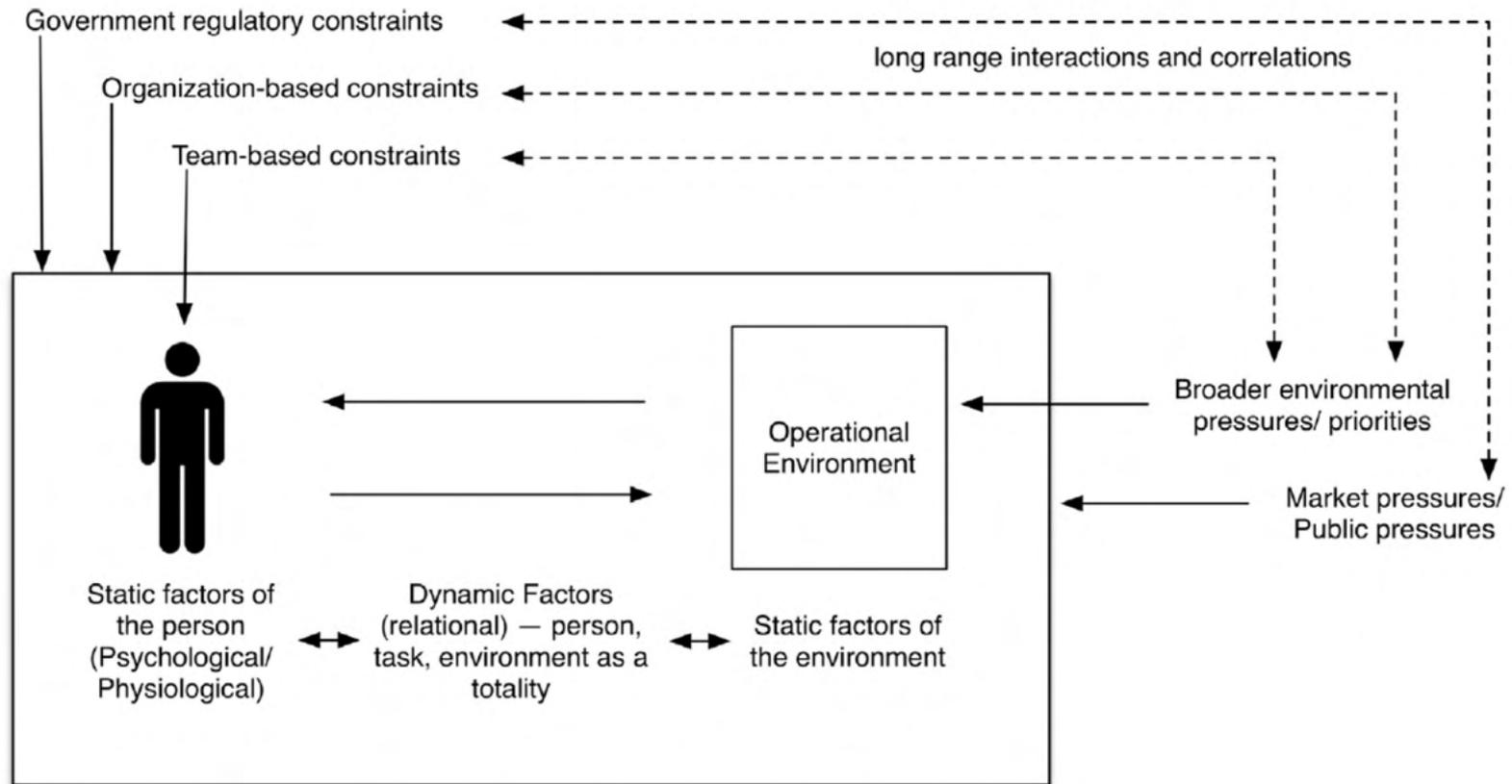
“systems” approach:

the “new look” towards complex systems

How to deal with Complex Sociotechnical Systems?

Why is the problem so tough?

How to deal with Complex Sociotechnical Systems?



Short term processes - immediate threats and failures - dynamic factors

Long term processes - slow disasters/buildup towards accidents - static factors and long range interactions and correlations

Basic Unit of Human Performance

