Dynamic Risk Management -The need and our vision

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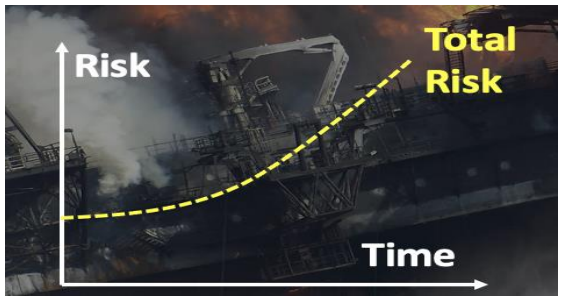


Rotterdam, 16/03/2023

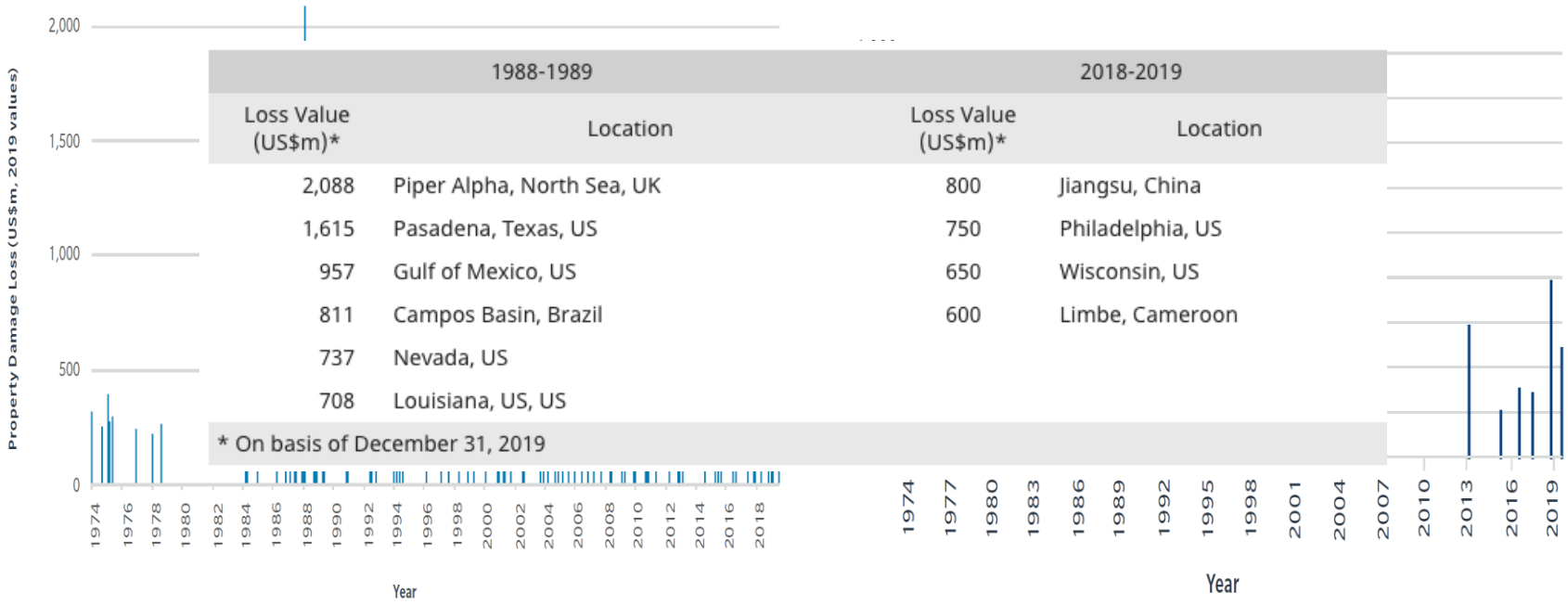
Outline

- **Why** shall we transit to dynamic risk management?
- **What** is dynamic risk management?
- **How** to proceed with a dynamic risk management program?

The loss facts of process accidents

100 largest losses in the hydrocarbon industry (1974-2019)

100 largest losses in the petrochemical sector (1974-2000)



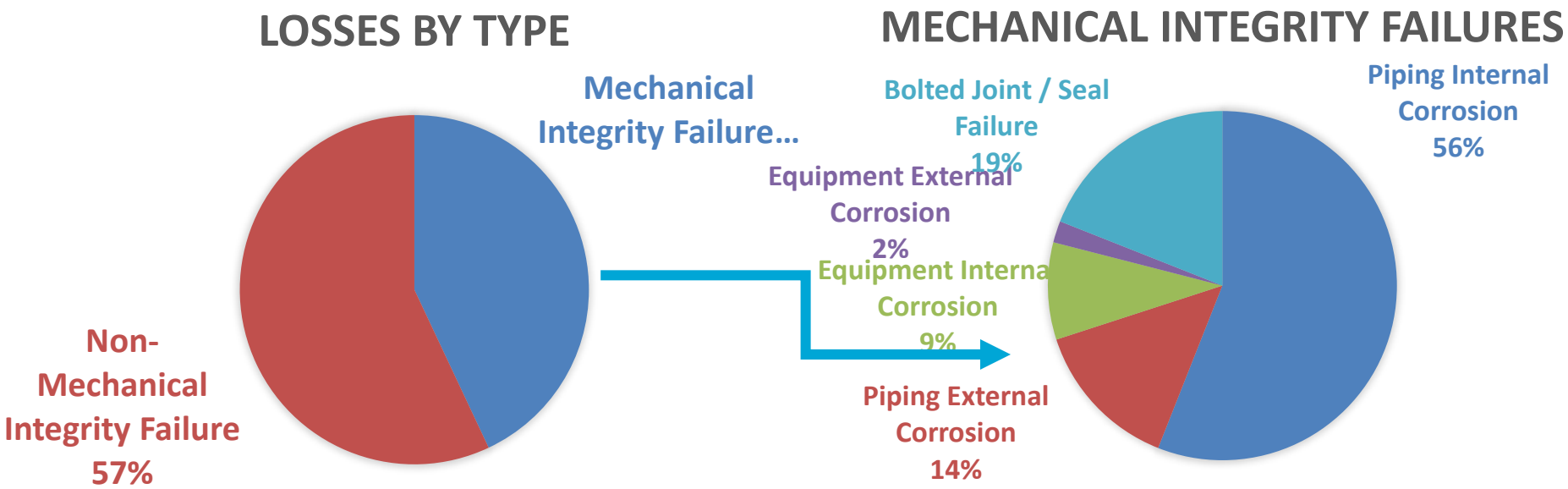
1988-1989		2018-2019	
Loss Value (US$m)*	Location	Loss Value (US$m)*	Location
2,088	Piper Alpha, North Sea, UK	800	Jiangsu, China
1,615	Pasadena, Texas, US	750	Philadelphia, US
957	Gulf of Mexico, US	650	Wisconsin, US
811	Campos Basin, Brazil	600	Limbe, Cameroon
737	Nevada, US		
708	Louisiana, US, US		

* On basis of December 31, 2019

Marsh JLT Specialty's 100 largest losses in the hydrocarbon industry report,

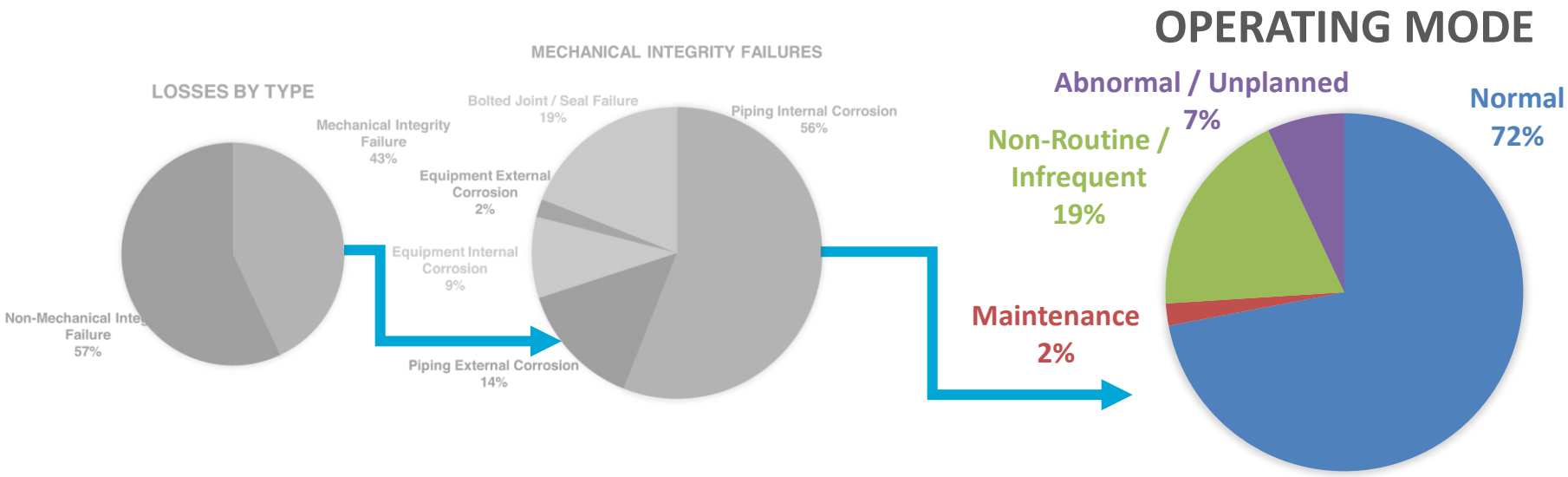
The causes

100 major losses in the onshore oil, gas, and petrochemical industries (1996-2015)



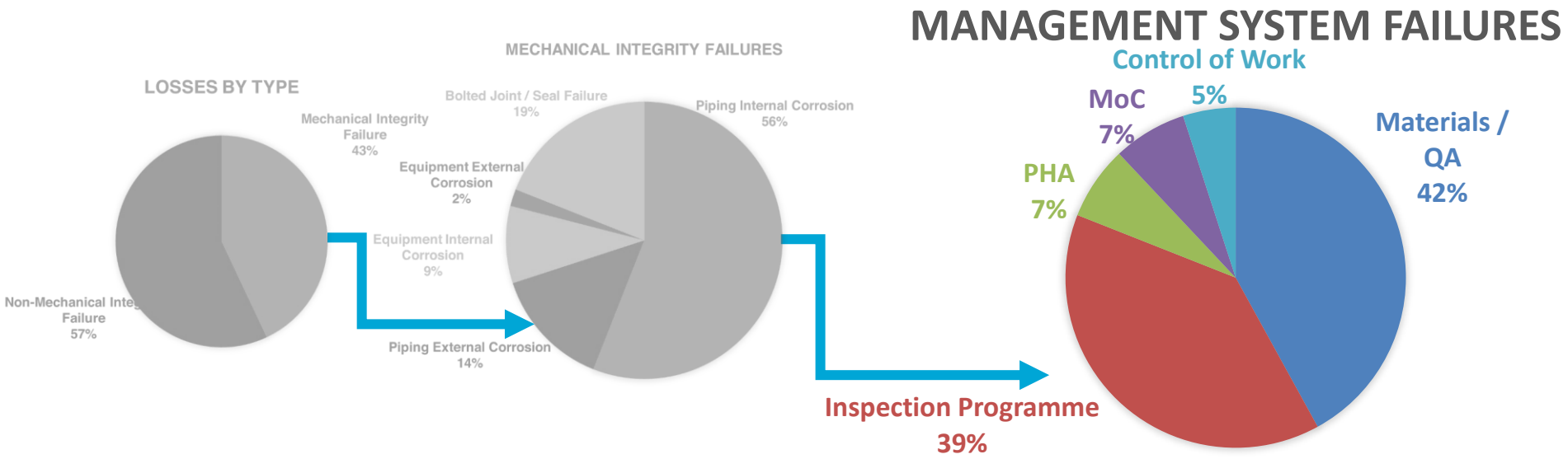
During Normal Operating Mode

100 major losses in the onshore oil, gas, and petrochemical industries (1996-2015)



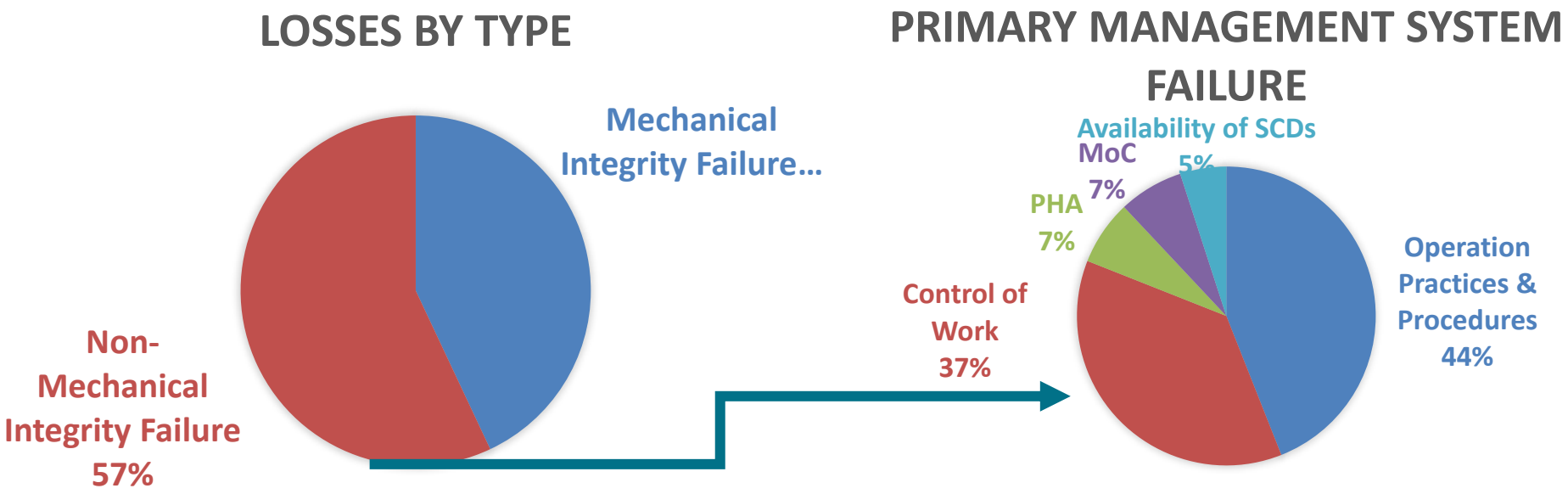
Zoom into the management system

100 major losses in the onshore oil, gas, and petrochemical industries (1996-2015)



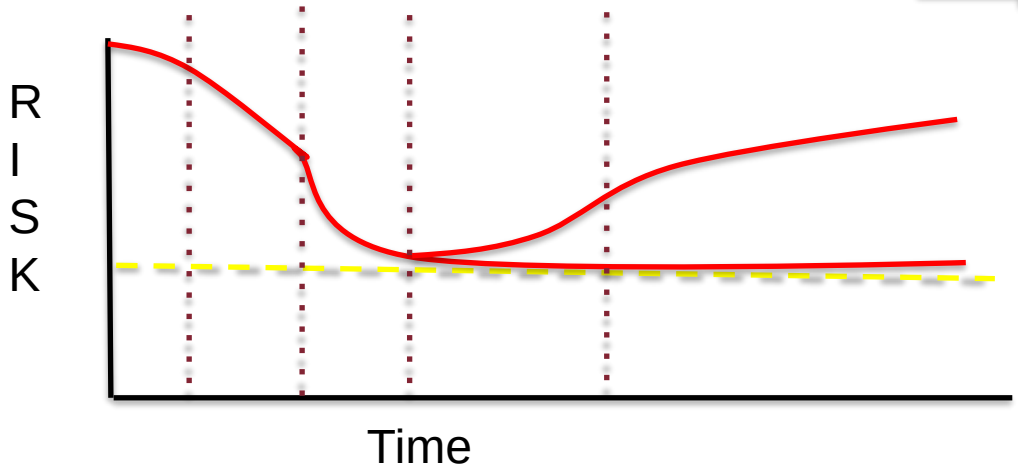
Non-mechanical integrity failure

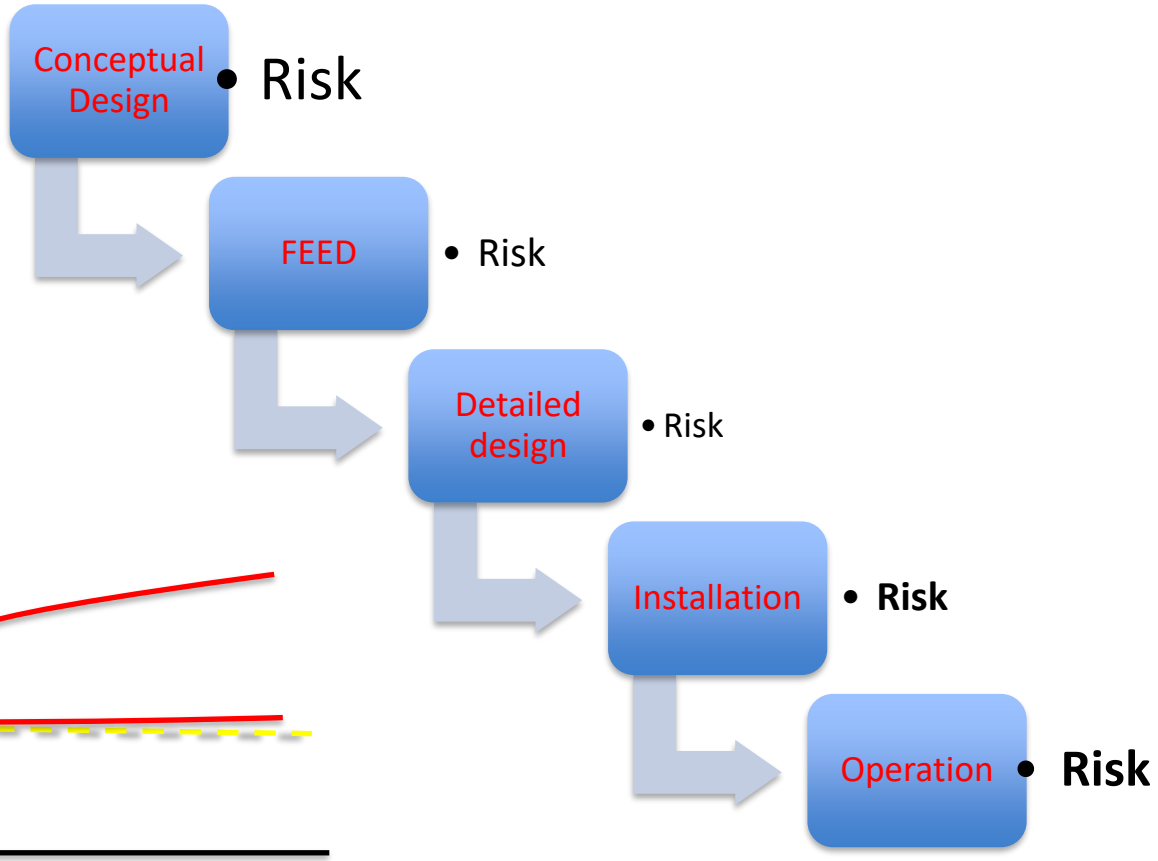
100 major losses in the onshore oil, gas, and petrochemical industries (1996-2015)



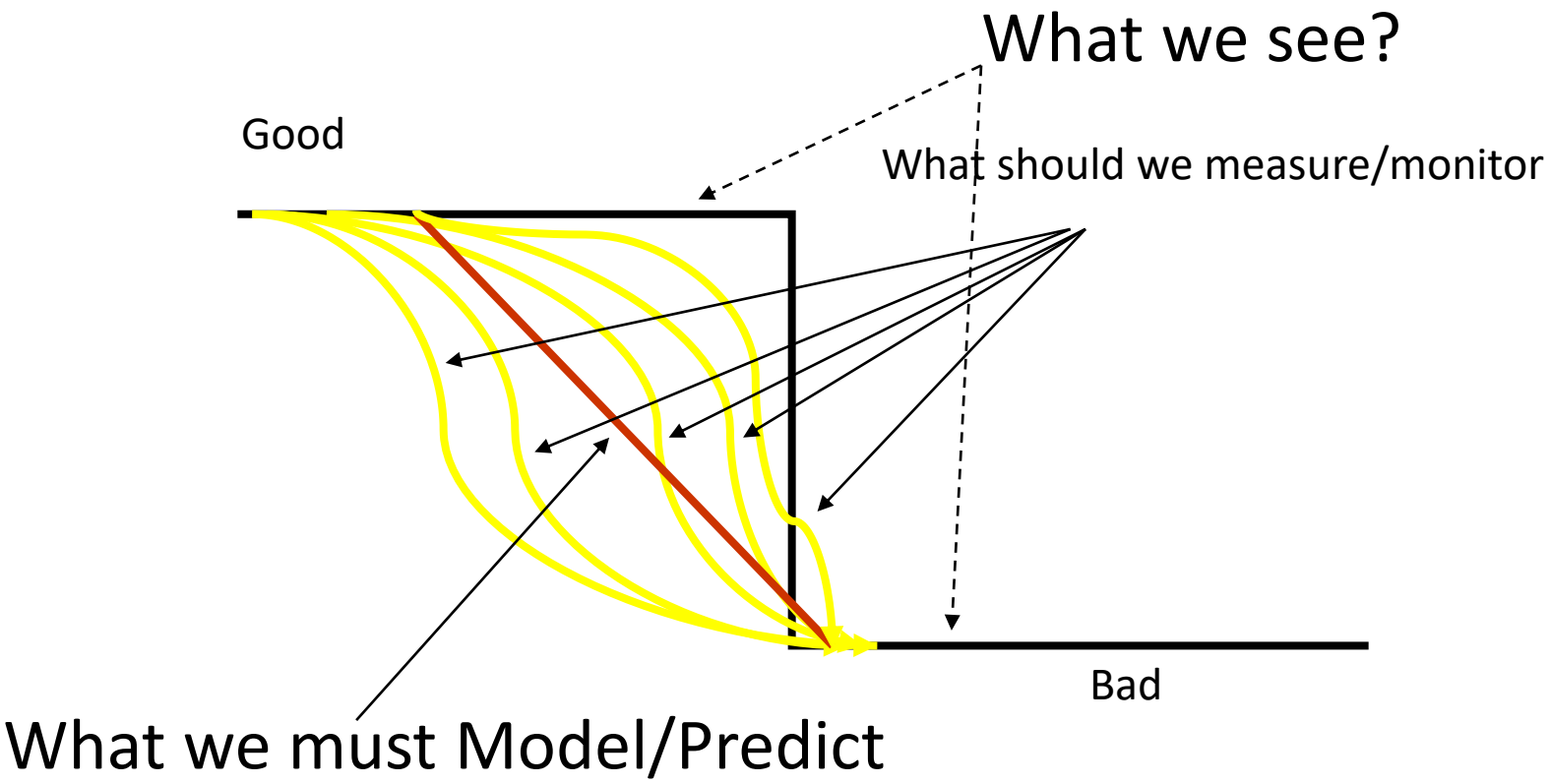
What is going wrong?

*Dynamic Risk= F{s(c, f),**t**}*



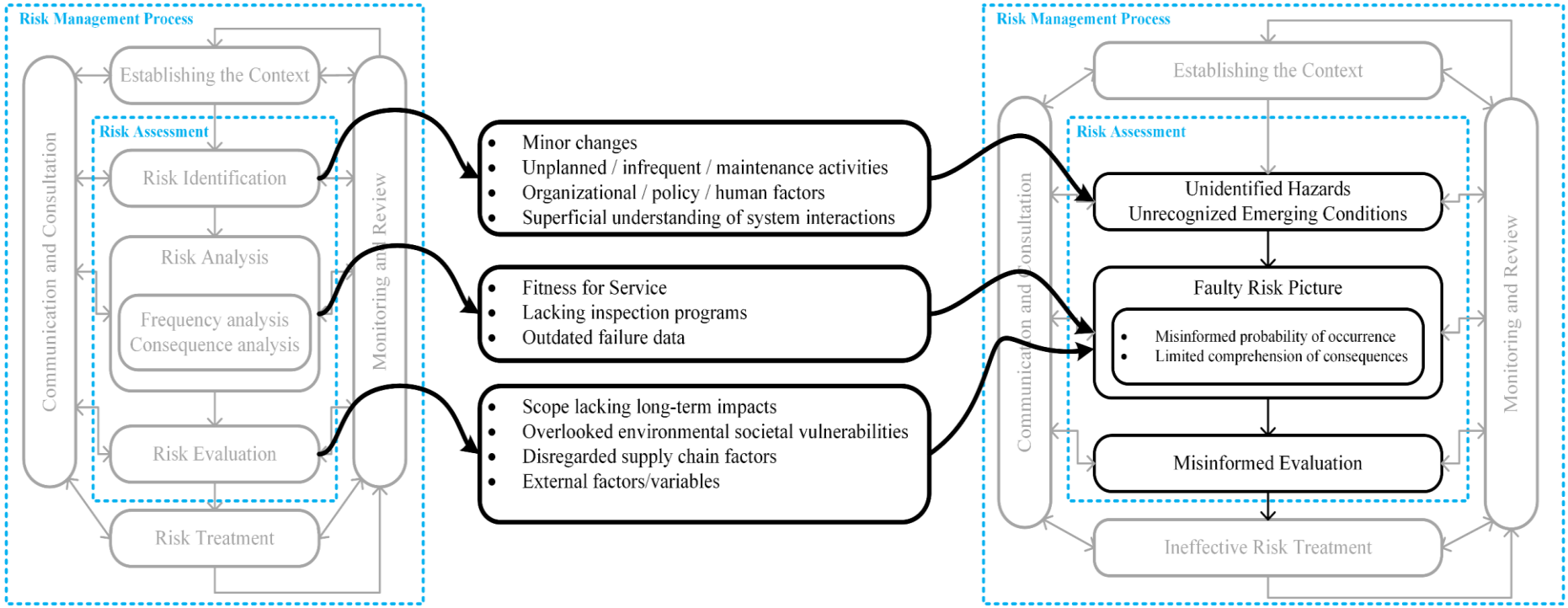


Accident does not happen all-of-a-sudden



Translation into:

Risk Management Shortcomings



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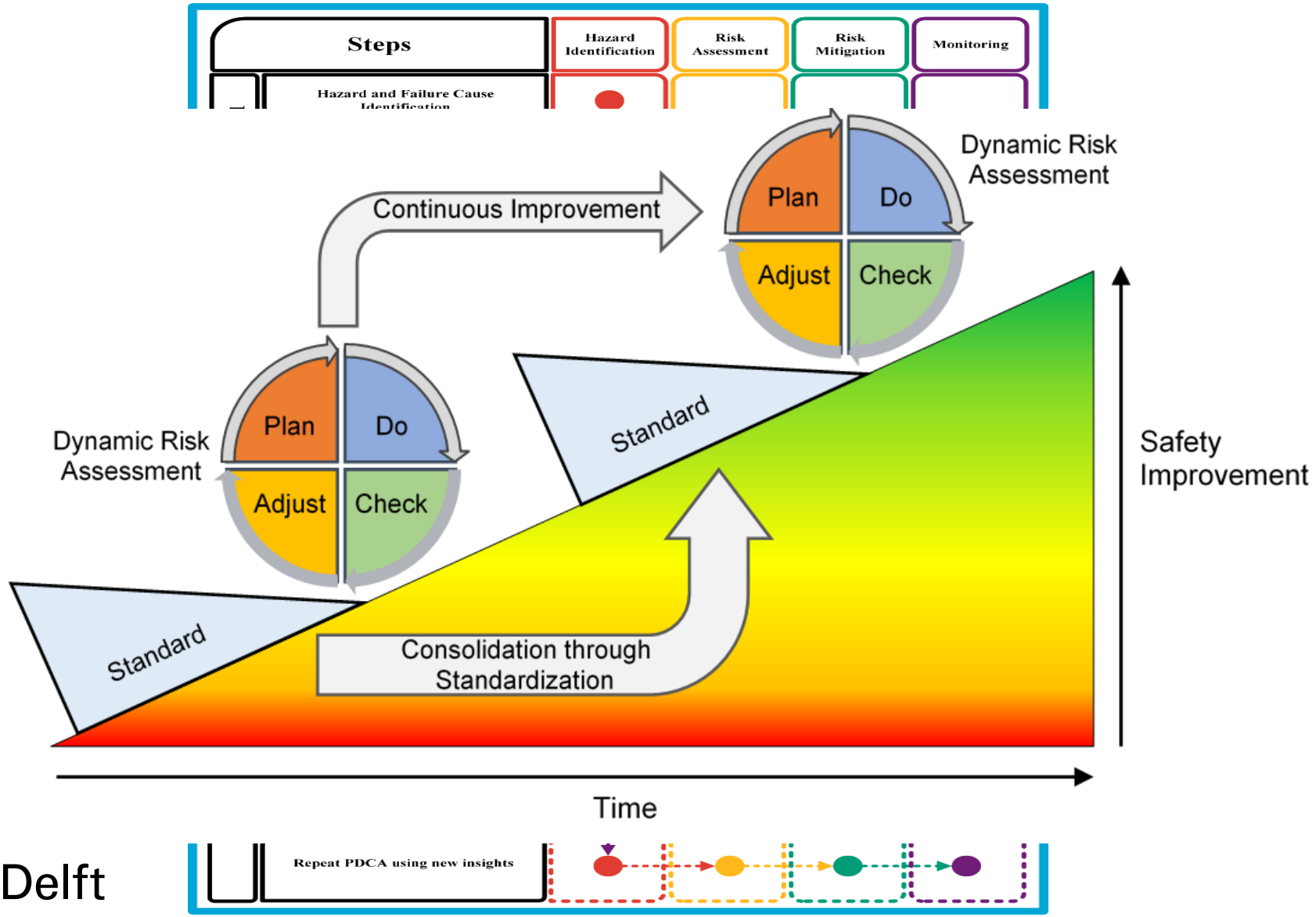
The call to make the transition to "**dynamic risk management**"

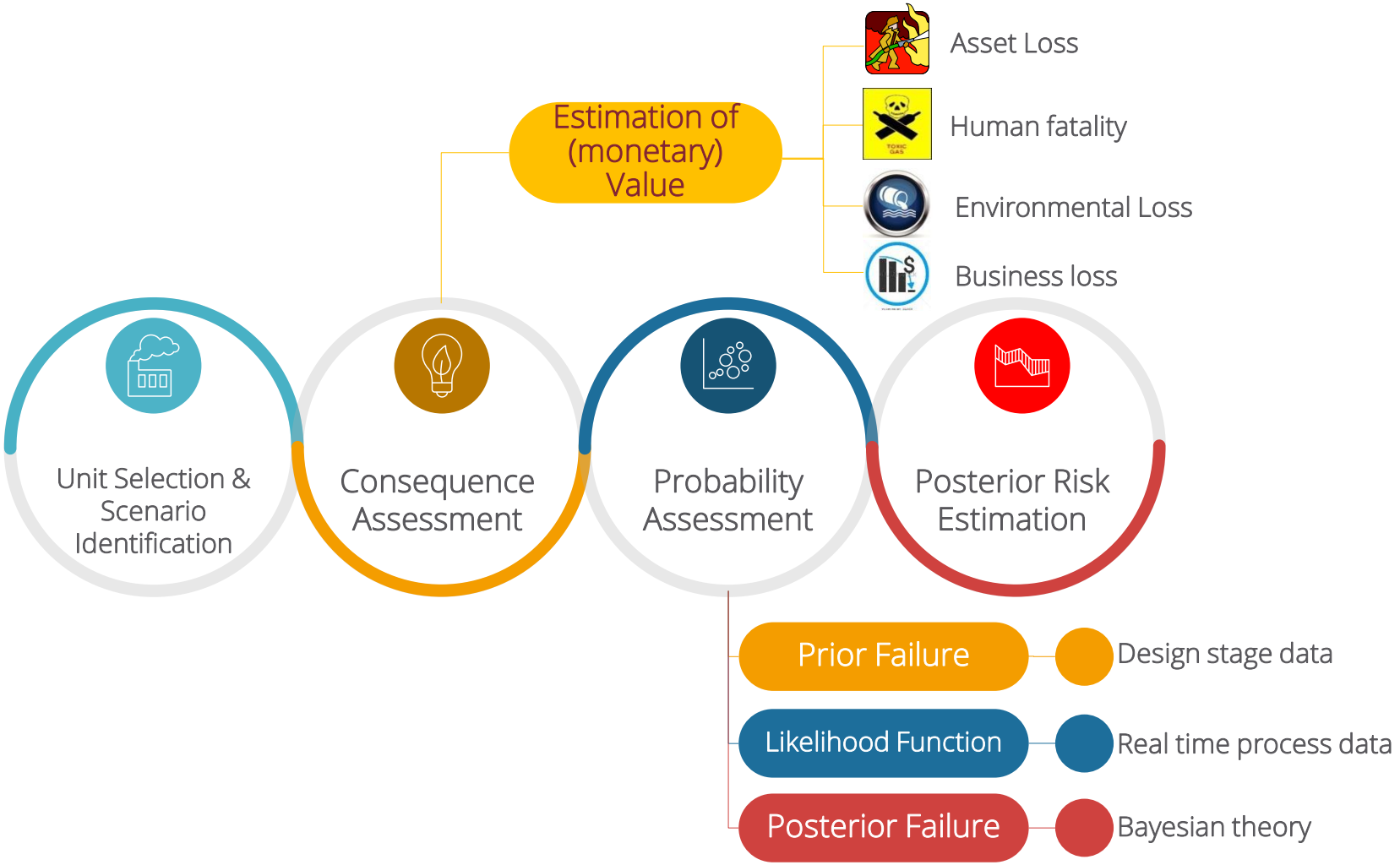
- Our definition-

An integrative approach to a "zero-incident" and "zero-defect" environment through the introduction of formalized data-driven risk-based decision-making processes relying on repetitive risk assessment concerned with organizational and human factors parameters in addition to the physical state of the assets to address new and potentially hazardous conditions arising from deviations from normal operations or changes to the processes, organization, and policy.

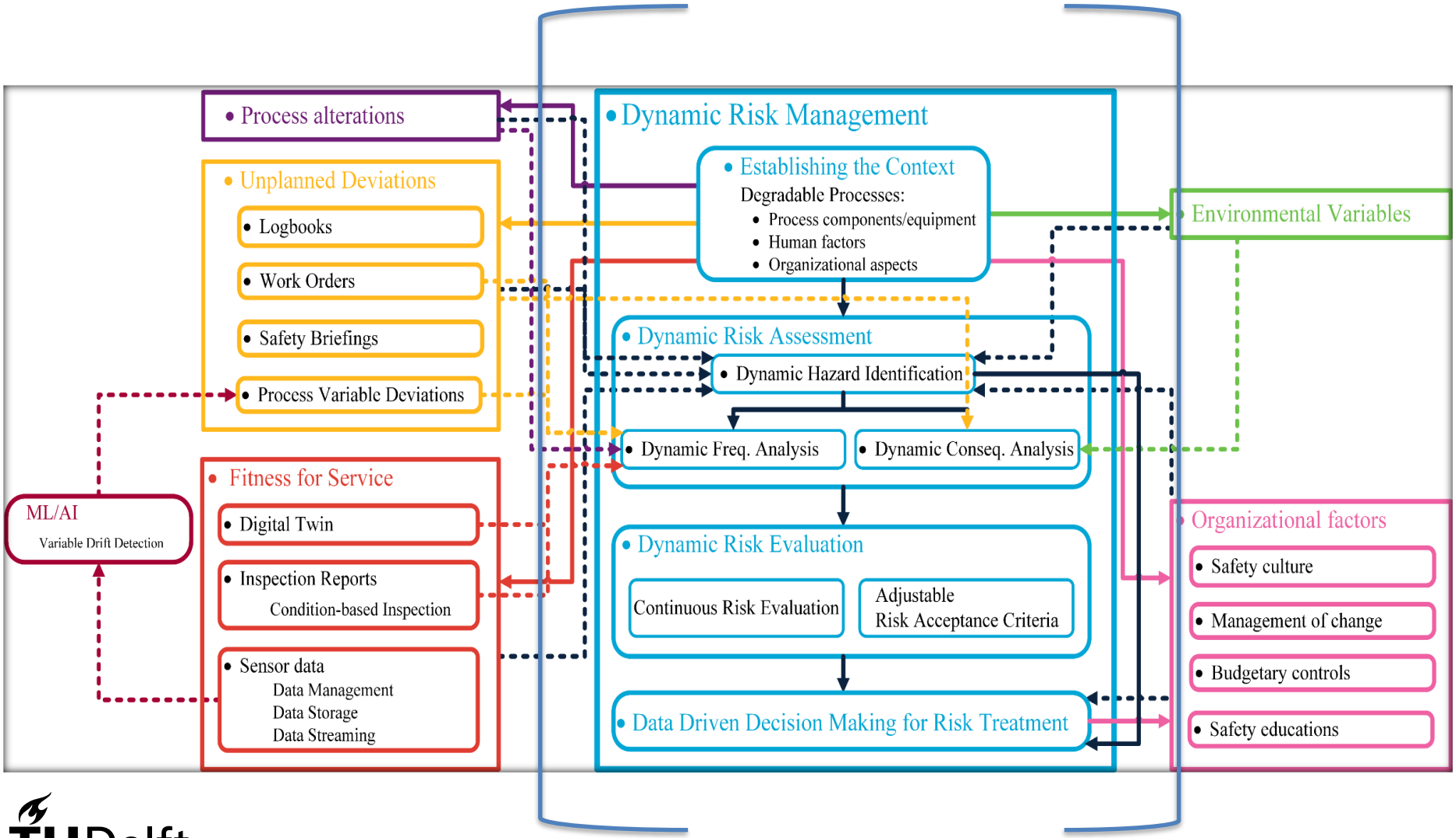
Dynamic Risk Management via PDCA



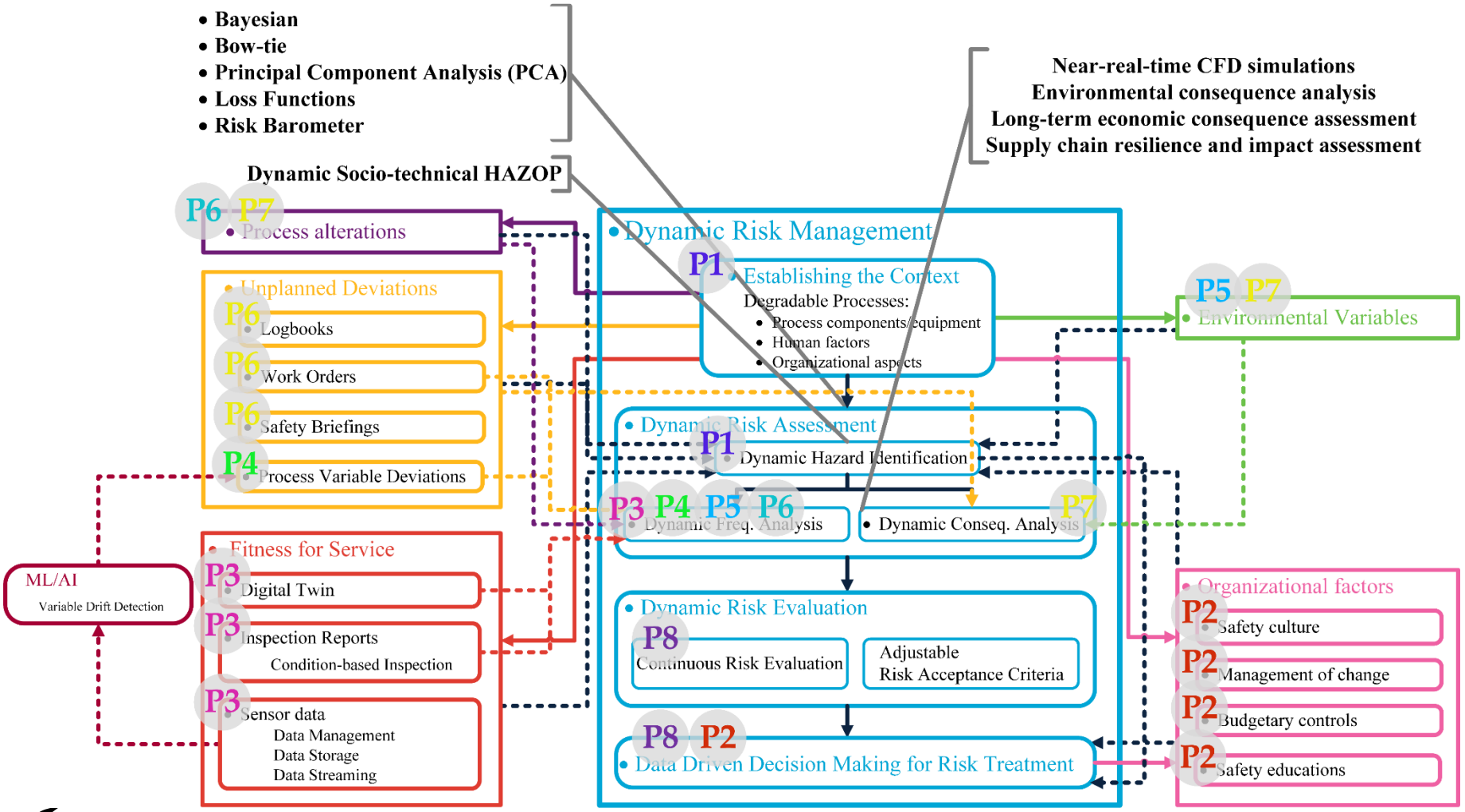
Dynamic risk assessment



The conceptual framework



Implementation phases

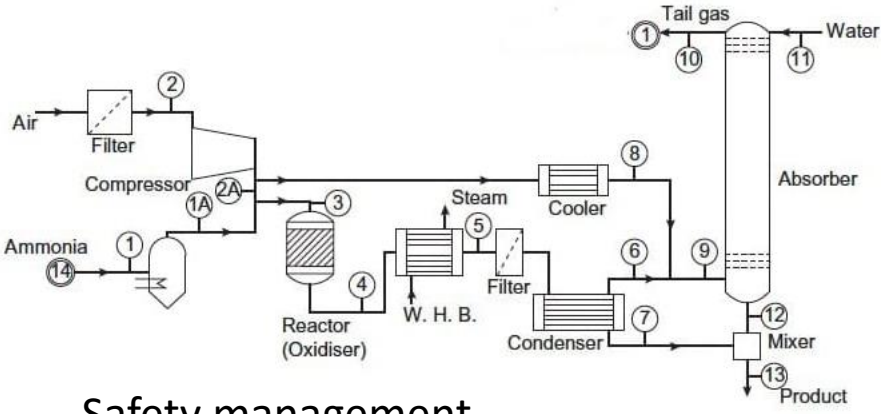


One step forward

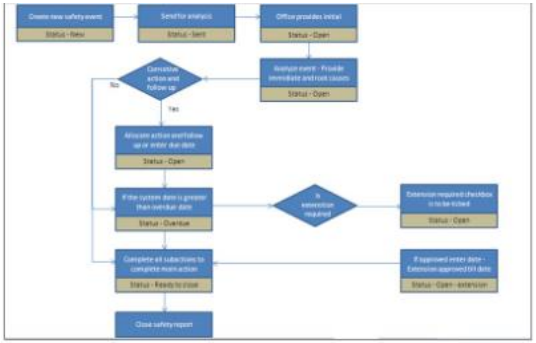
Dynamic Socio-technical HAZOP

- Focus on deviations from normal operations
  - Facilitate repetitive HAZOP studies
  - Societal and organizational factors
  - Facilitating access to information and people
- Increasing operational awareness
  - Organizational culture dedicated to safety
- Taking advantage of leading indicators and early warnings

PFD



Safety management process diagram



Process and Safety Management Flow Diagram

Call for partnerships/co-funders -Dynamic Socio-technical HAZOP

Deadlines:
Pre-proposal: April 11, 2023
Full-proposal: October 3, 2023

Enhancing risk awareness is the key, and Dynamic risk management helps with this!

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