



INTERNATIONAL UNION
OF RAILWAYS

IRSC 2021

Safety Management & Convergence of New Techs

Re-engineering Railway Safety via digitalization of Safety Management

Frédéric HENON

Head of Operations and Safety

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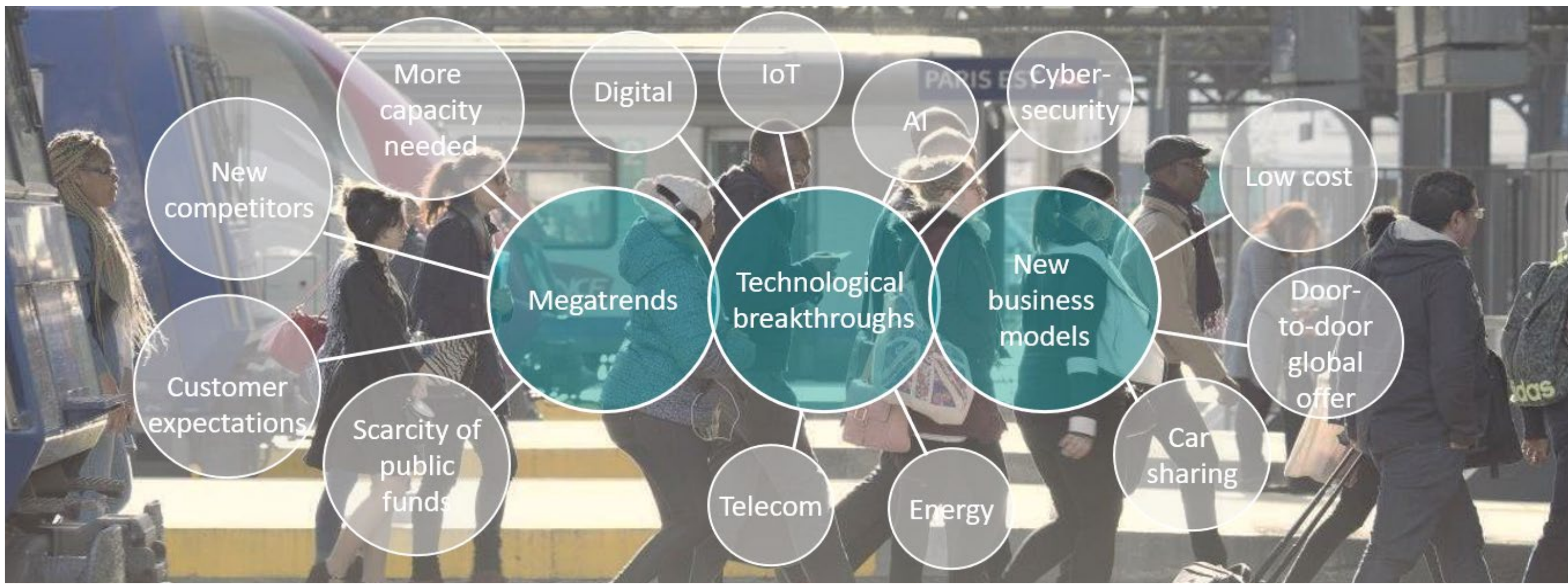
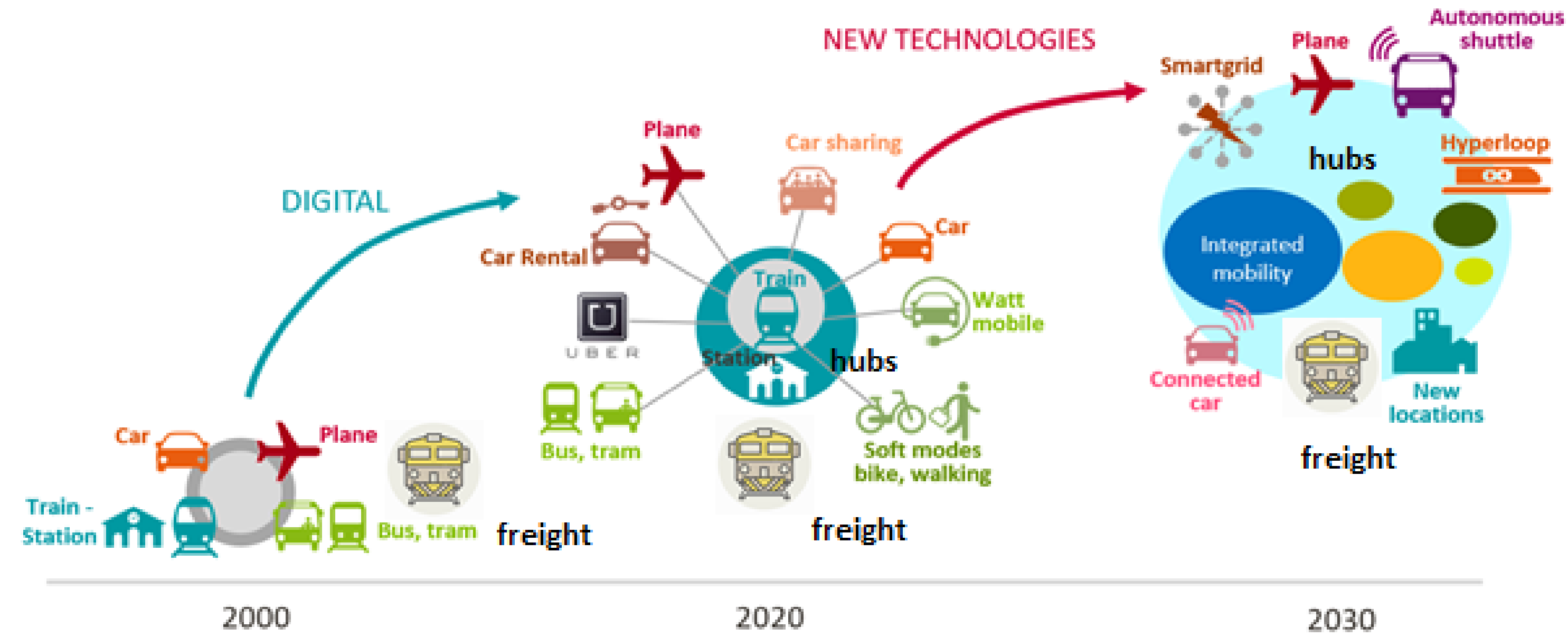
INTRODUCTION

Frédéric Hénon – Head of Operations and Safety - UIC

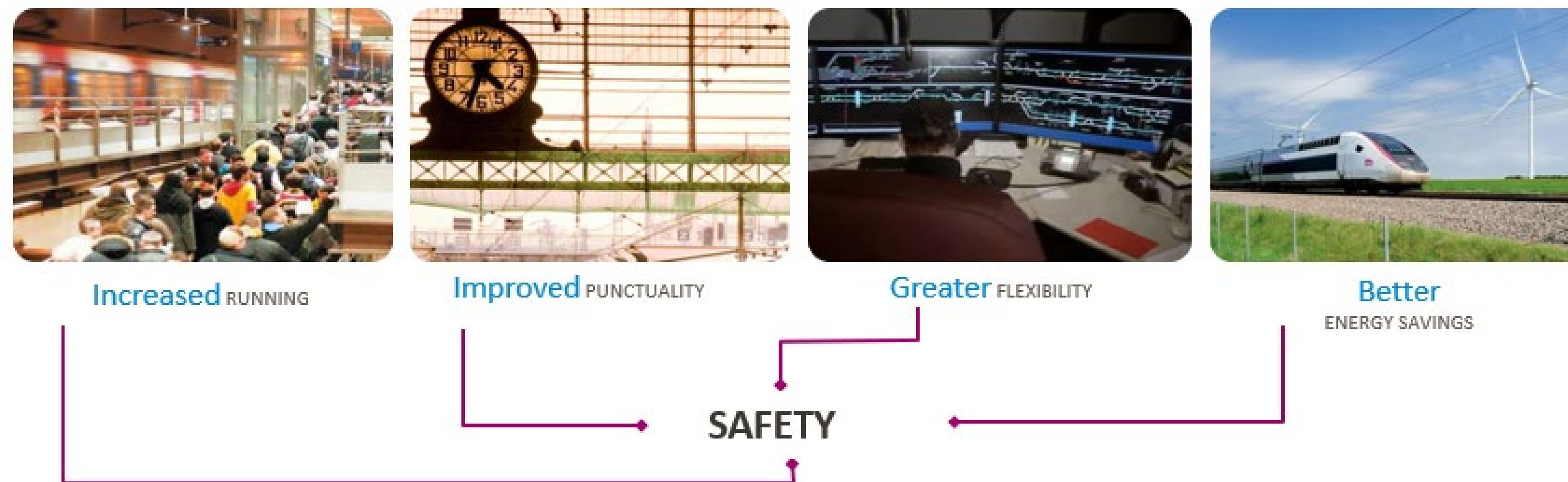
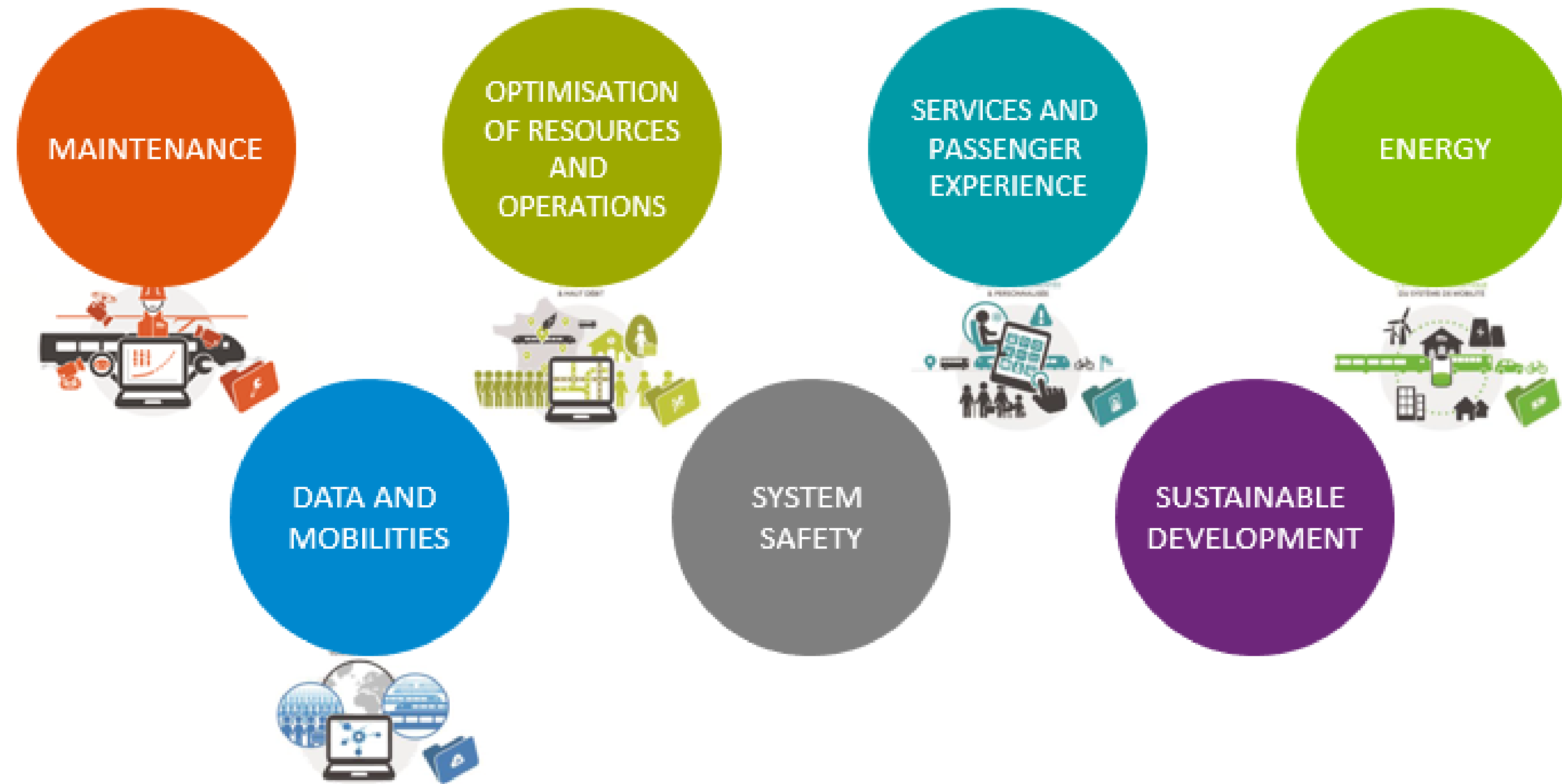
- 1991-2005 - Eurotunnel (Channel Tunnel Rail Link, railway system commissioning phase, and start of operations in may 1994). Successively « French Railway Planning Officer », « Train Crew Leader », « Duty Operations Manager », and « Head of Infrastructure Maintenance Logistics »
- 2005-2009 - RFF (Reseau Ferré de France) as Operations and Maintenance Manager
- 2009-2013 - EPSF (French National Safety Authority), as Interoperability and Safety Officer, working mainly with French Transport Ministry and ERA for the development of TSIs and CSMs. Was at this time Railway Inspector for the IGC (intergovernmental commission) for the Channel Tunnel.
- 2013-2017 - Eurostar HS, deputy Head of Safety / Head of Railway Operations Planning and Performance.
- 2017-2020 - SNCF Safety Directorate, working on the settlement of a reformatted safety culture within SNCF group. SNCF delegate (e.g. UIC Safety Platform Steering group, ERA and other bodies for the development of safety culture , safety leadership, risk model, etc.)
- July 2020 - Head of Operations and Safety – UIC

Entitled with a Mathematics Degree, and a Master in Transportation's Economy

FROM DIGITALIZED TO INTEGRATED MOBILITY



HOW and WHAT ? INNOVATION FIELDS



« SAFETY AS A SERVICE » IS THE NEW DEAL FOR THE SYSTEM ?

5

Digitalization in railways is coming of age :

- Increase of the amounts of data collected
- must benefit also for an even better safety management of the railways
- towards an increasingly complex world, increasing the uncertainties and the limits of models. At the same time, digitalization increases the feeling of total control. **illusion or reality ?**

New societal issues to be considered :

- Serious accidents are less and less tolerated on the railways
- Railway engineering for safety is of high integrity
- Pandemy Covid-19 :
 - Health and Safety of people and customers: **top priority n°1**
 - Health and Safety of the workforce: **idem**

New topics to be considered:

- **Cyber-Security** becoming a mandatory criteria for safety
- **Green Deal / Climate Change / Environment** and related consequences and objectives
 - Establish a crises and risks typology
 - Adopt crisis and risk-oriented planning methodologies
 - Data as a resource

Digitization of safety management is a global effort that paves the way for “**Safety as a Service**”

GREEN DEAL

CYBER-SECURITY

SAFETY AS A SERVICE IS ALL ABOUT THAT

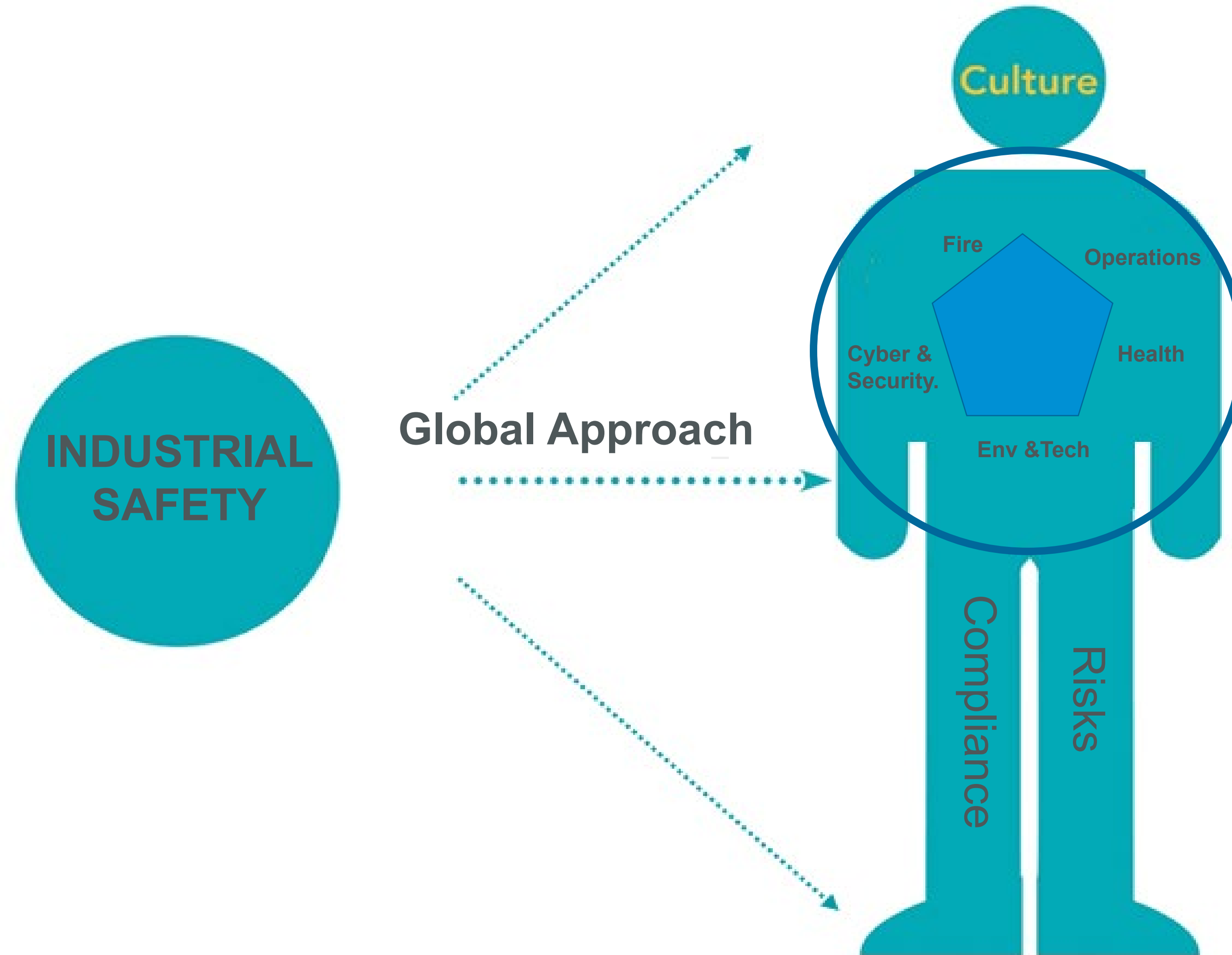
CLIMATE CHANGE

HEALTH & SAFETY OF
STAFF AND
CUSTOMERS

Biggest challenge for the industry of tomorrow: properly positioning the cursor between **full control** and **adaptability to hazards**

DIGITALISATION

SaaS MEANS ... INDUSTRIAL SAFETY



INDUSTRIAL SAFETY



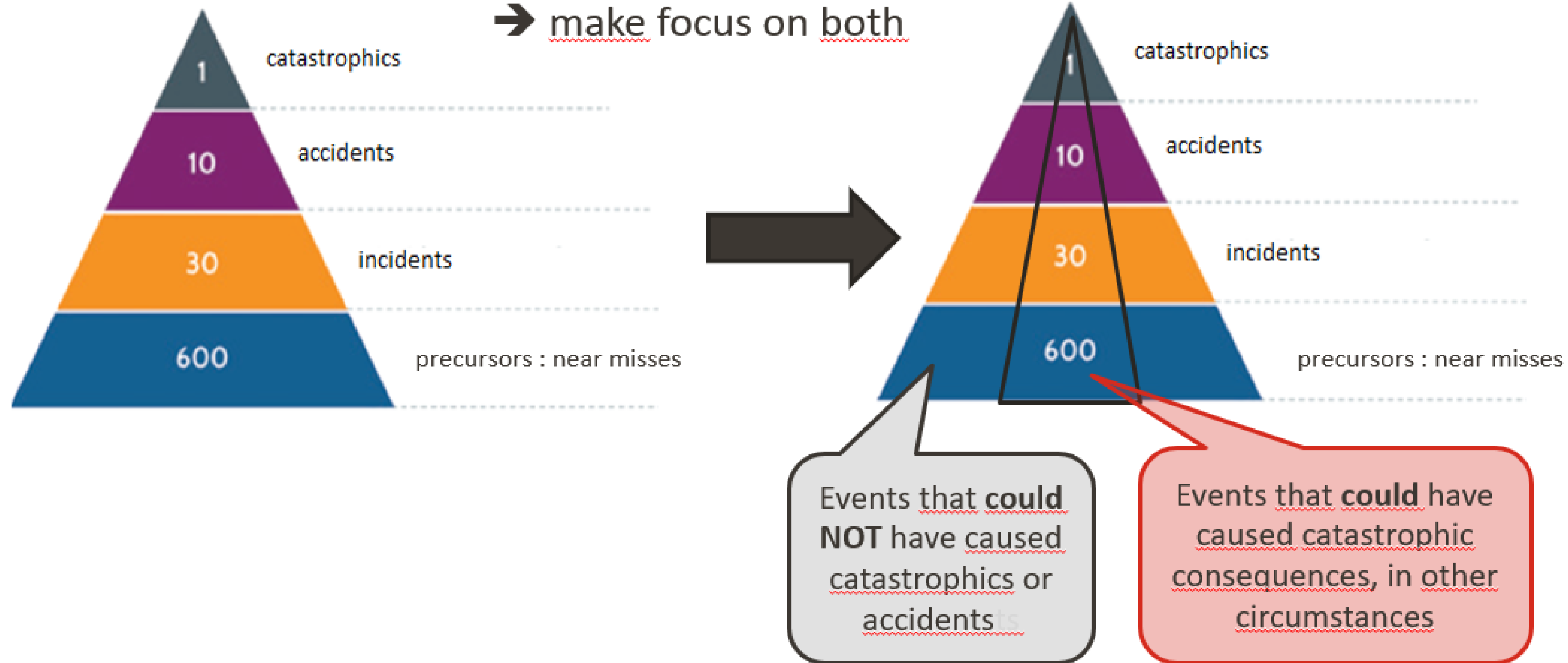
- balance between rule-based and risk-based safety
- depends and varies according to the industry involved
- Including the “positive” safety culture

BIRD'S ACCIDENT PYRAMID WEAKNESS

Get to know everything, including near misses
but also

Get to know what could have been catastrophic

→ make focus on both

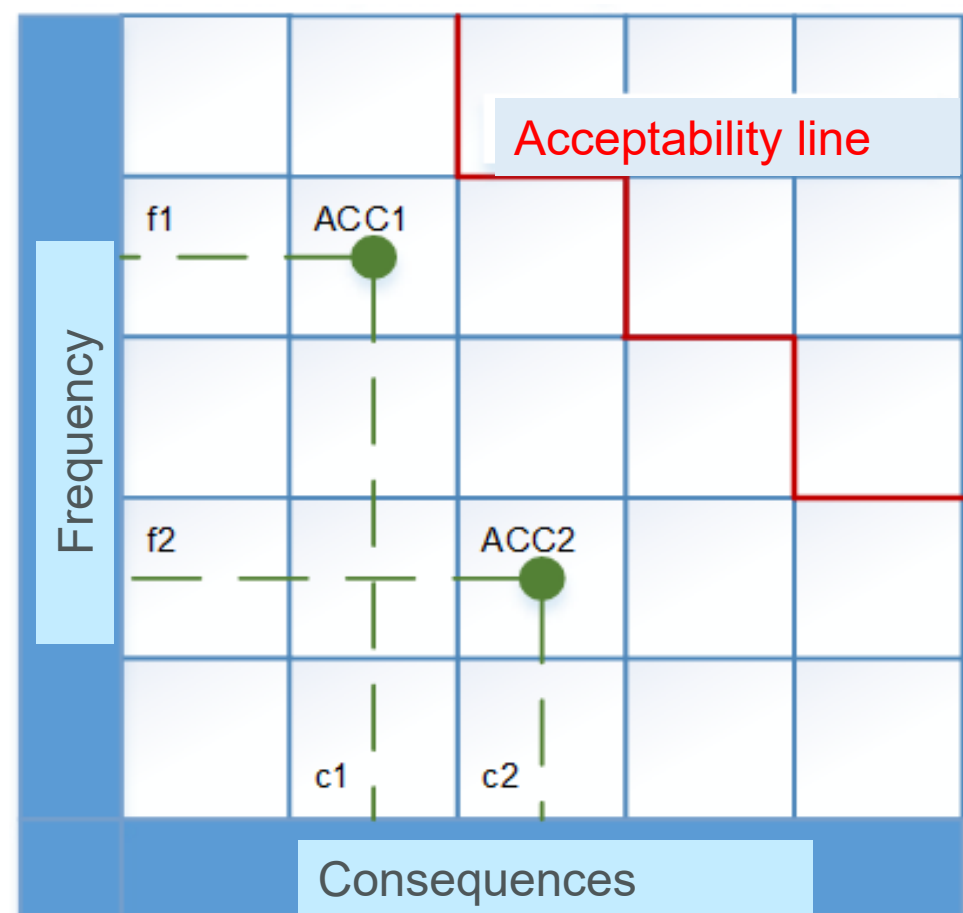


- Inaccuracy of the “Bird” Pyramid predictions, at the edge of industrial systems safety cycles, becoming more and more complex
- Focus in reducing minor incidents that influence on major accidents

HIERARCHY OF SAFETY MEASURES

« SAFETY INDEX » UIC SAFETY DATABASE INSPIRATION

1. Method involving a risk matrix



2. Method leading to a hierarchy of risks

Hierarchy of accident-related risks

$$r_{ACC1} = f_1 * c_1$$

$$r_{ACC2} = f_2 * c_2$$

$$\dots$$

$$r_{ACCI} = f_i * c_i$$

3. Method assessing cost/efficiency of measures

Hierarchy of measures (m) in relation to their cost-benefit analysis (rce) results

$$rce_{m1} = \frac{\text{costs of measure } m_1}{\text{reduction of risk per } m_1}$$

$$rce_{m2} = \frac{\text{costs of measure } m_1}{\text{reduction of risk per } m_1}$$

$$rce_{mi} = \frac{\text{costs of measure } m_1}{\text{reduction of risk per } m_1}$$

$$GSI = \sum ((Cv \times Cn) + Ca) \times Cr$$

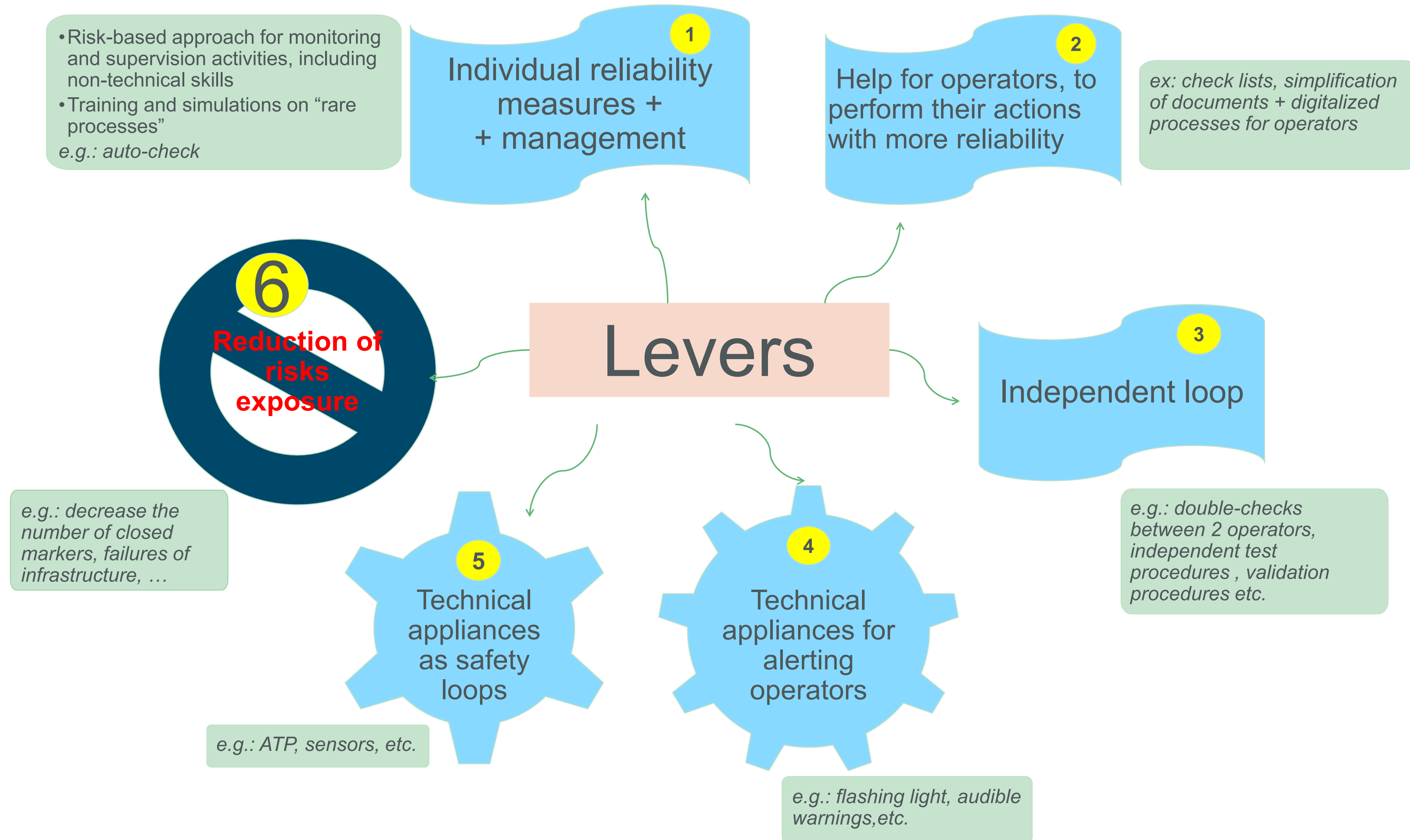
Cv	Type of victim	
1	Fatality : passenger	8
2	Serious Injury: passenger	4
3	Fatality: staff	8
4	Serious Injury: staff	4
5	Fatality : LC user	2
6	Serious Injury: LC user	1
7	Fatality: unauthorised	2
8	Serious Injury: unauthorised	1
9	Fatality: other	4
10	Serious Injury: other	2
11	No victim	0

Ca	Type of accident	
1	Train collision with an obstacle	2
2	Train collision with another train	7
3	Derailment	7
4	Individual hit by a train	1
5	Individual falling from a train	1
6	Electrocution by overhead line or third rail	1
7	Fire in rolling stock	4
8	Accident involving dangerous goods (no release)	4
9	Accident involving dangerous goods (with release)	7

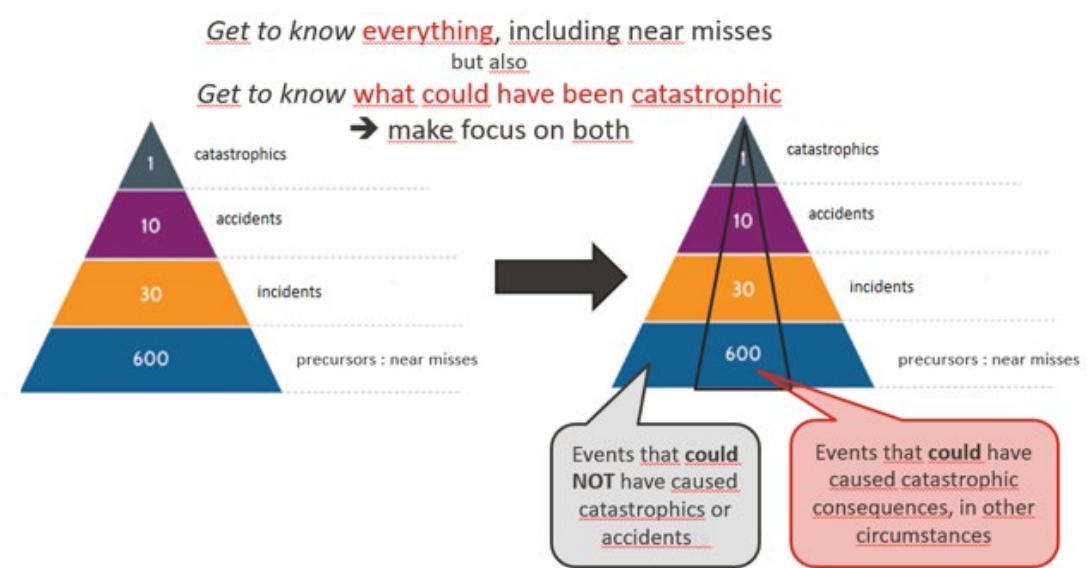
Cn	Number of victims	
0	No victim	0
1	One victim	1
2	between 2 and 5 victims	2
6	more than 5 victims	3

Cr	Causes	
1	External causes	1
2	Internal causes	2

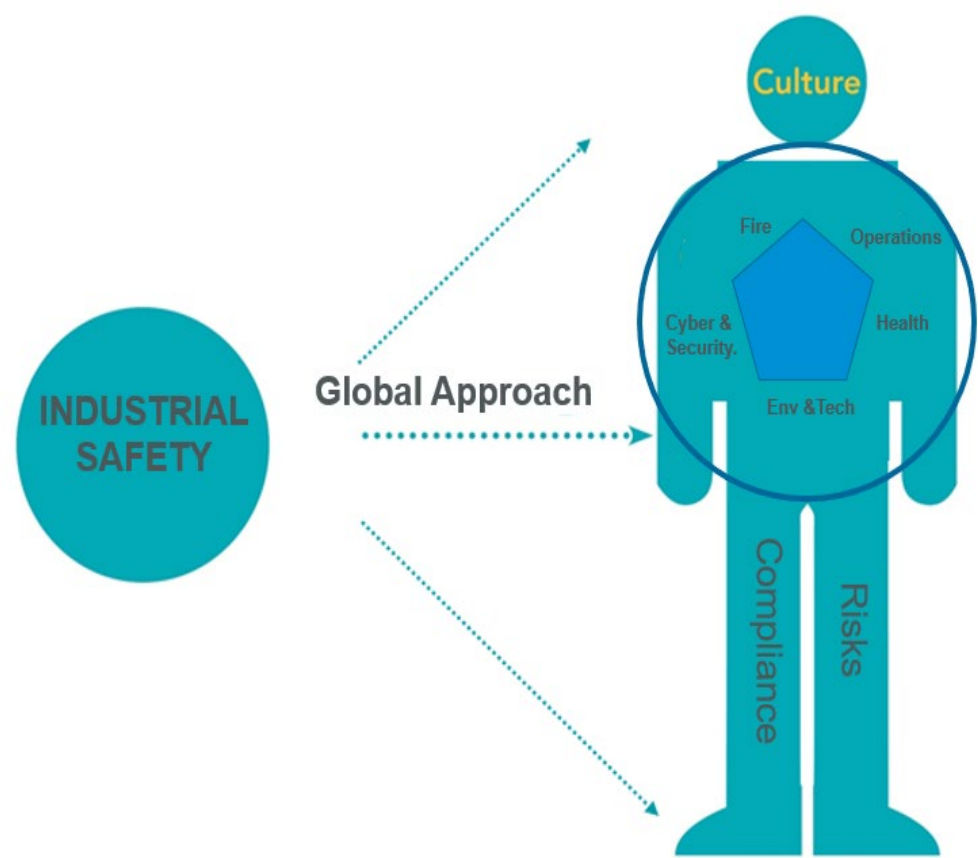
« FUNCTIONAL » HIERARCHY OF LEVERS (RAMS)



How to deal best in monitoring all these criteria The Bow-Tie



- Inaccuracy of the "Bird" Pyramid predictions, at the edge of industrial systems safety cycles, becoming more and more complex
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Biggest challenge for the industry of tomorrow: properly positioning the cursor between full control and adaptability to hazards

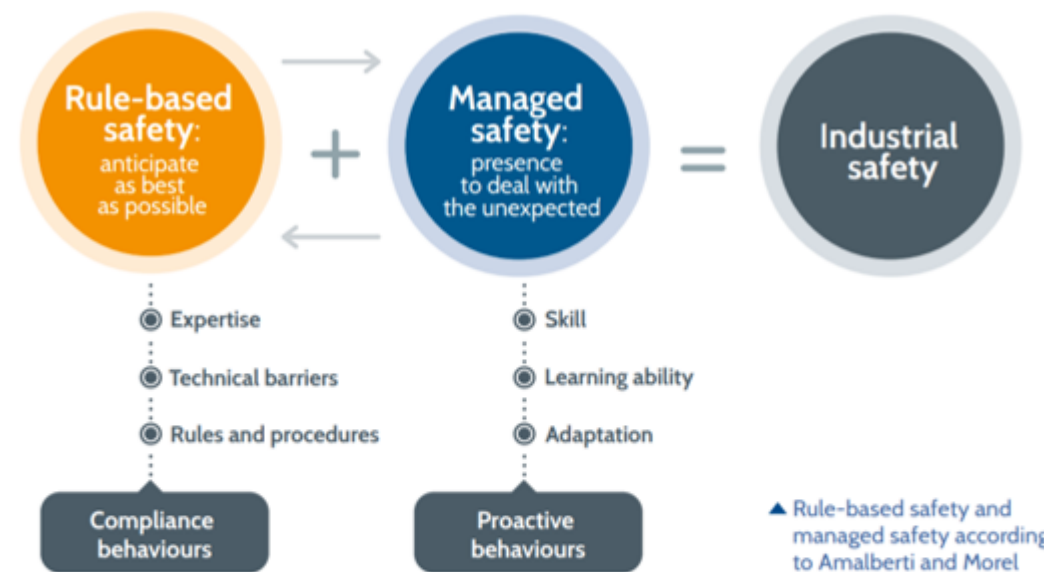
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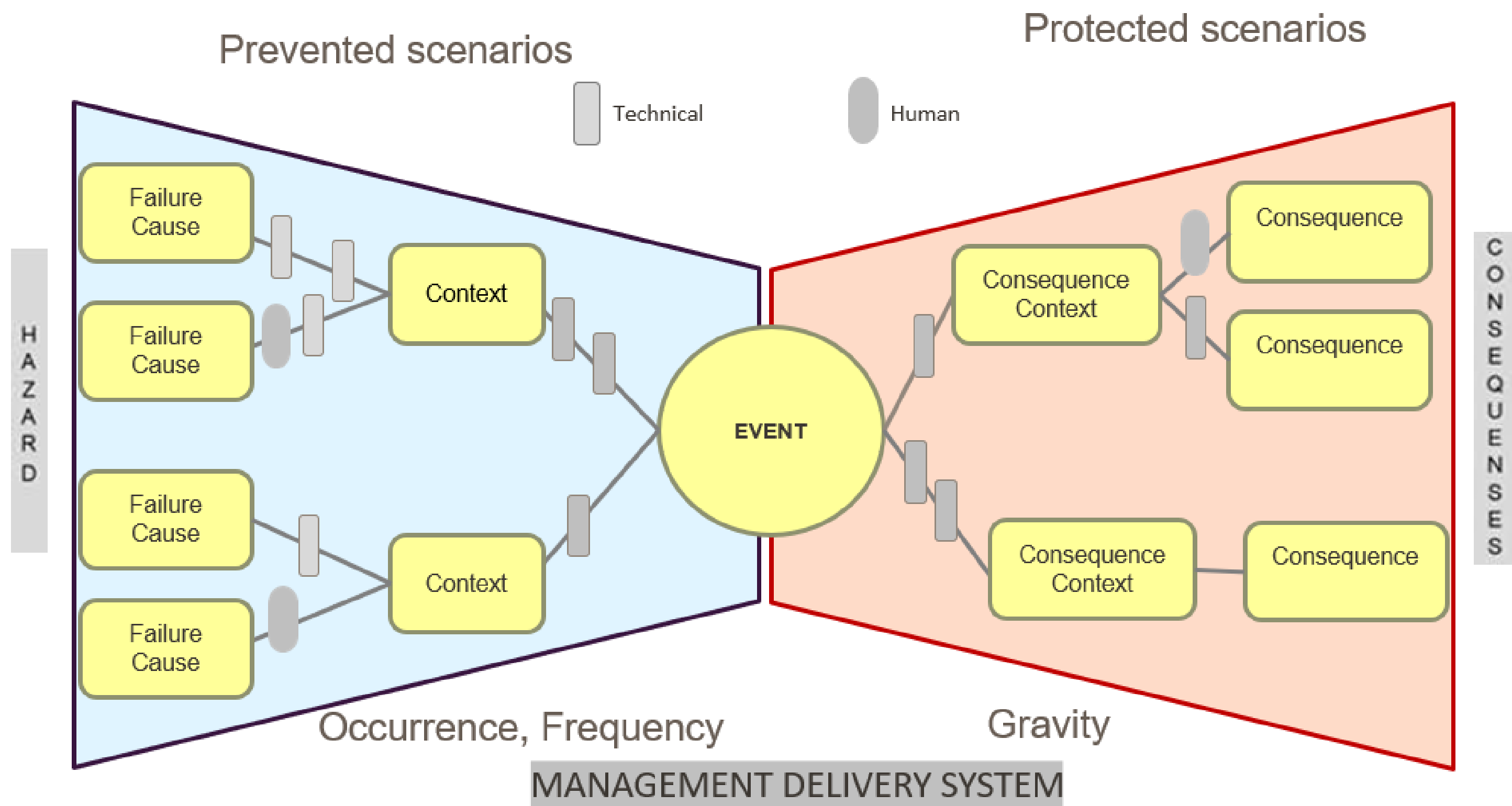
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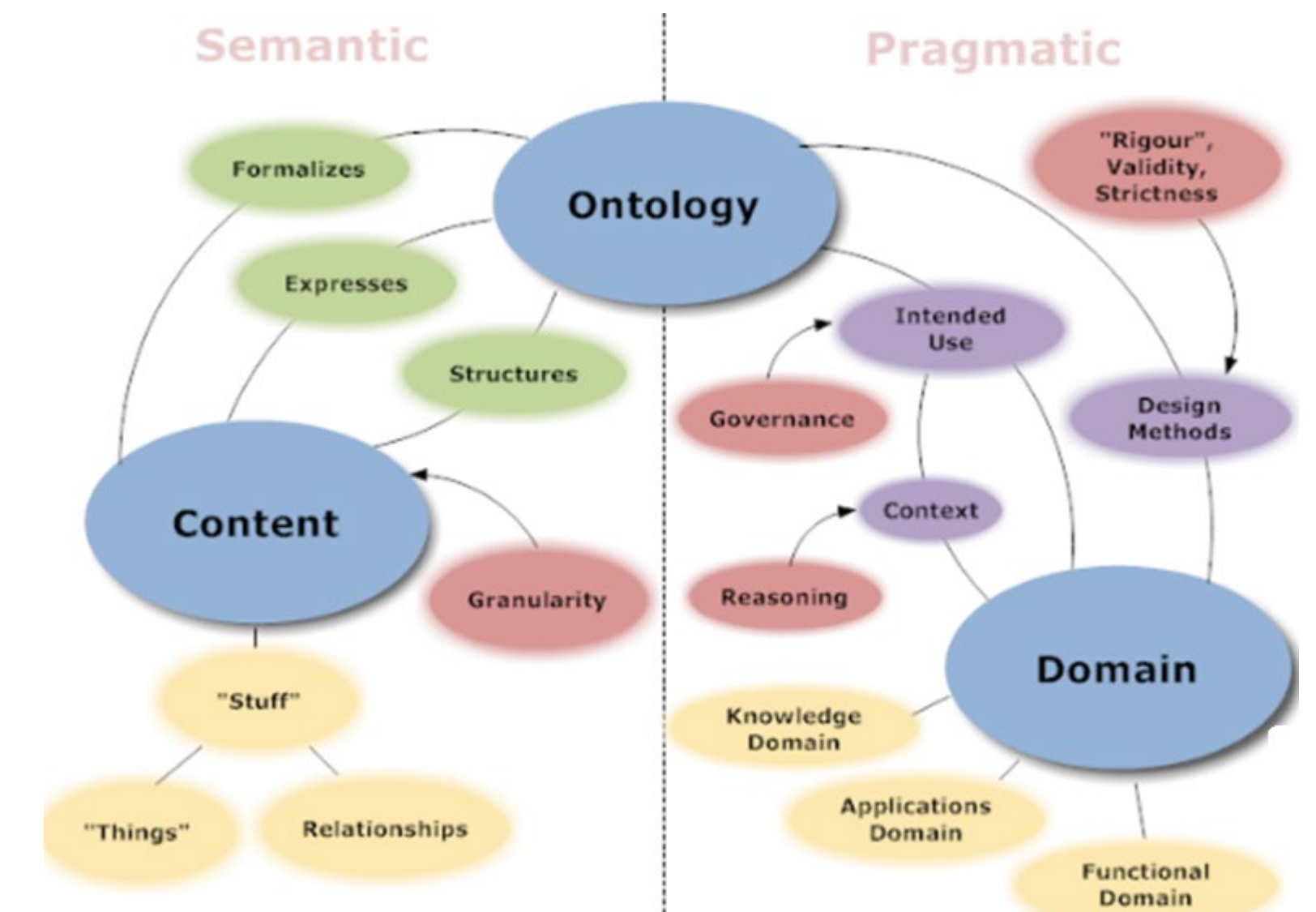
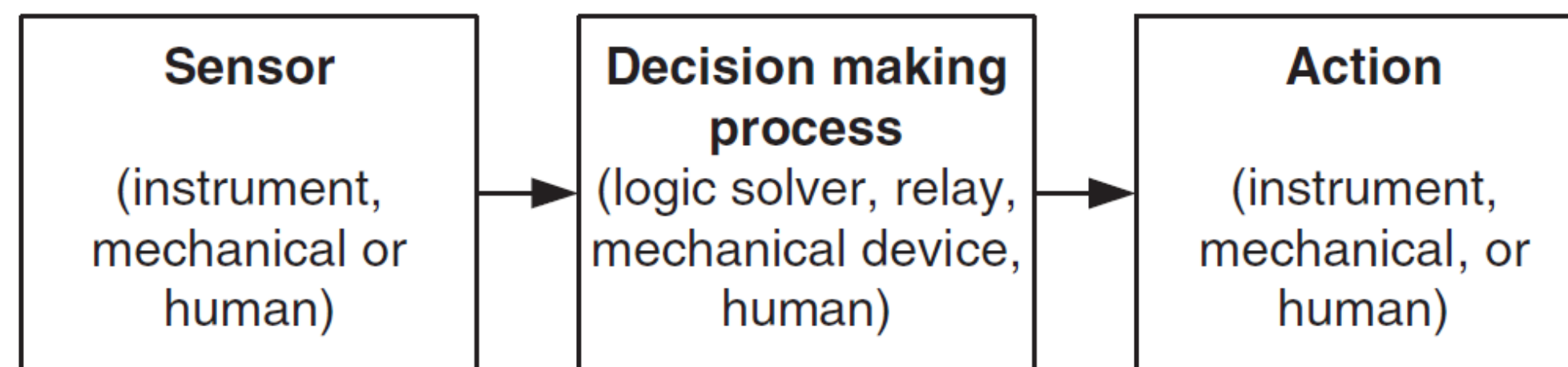
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Global Railway Definition for Safety Barrier

Active and passive protection layers is to take an action in order to achieve its function in reducing risk in the global railway industry:

- Generic enough to cover different safety and barrier systems and usage
- Simple and accurate for easy use
- Clear enough to facilitate exchange and digitalization.
- The cornerstone of the tryptic “taxonomy, ontology, and tool”



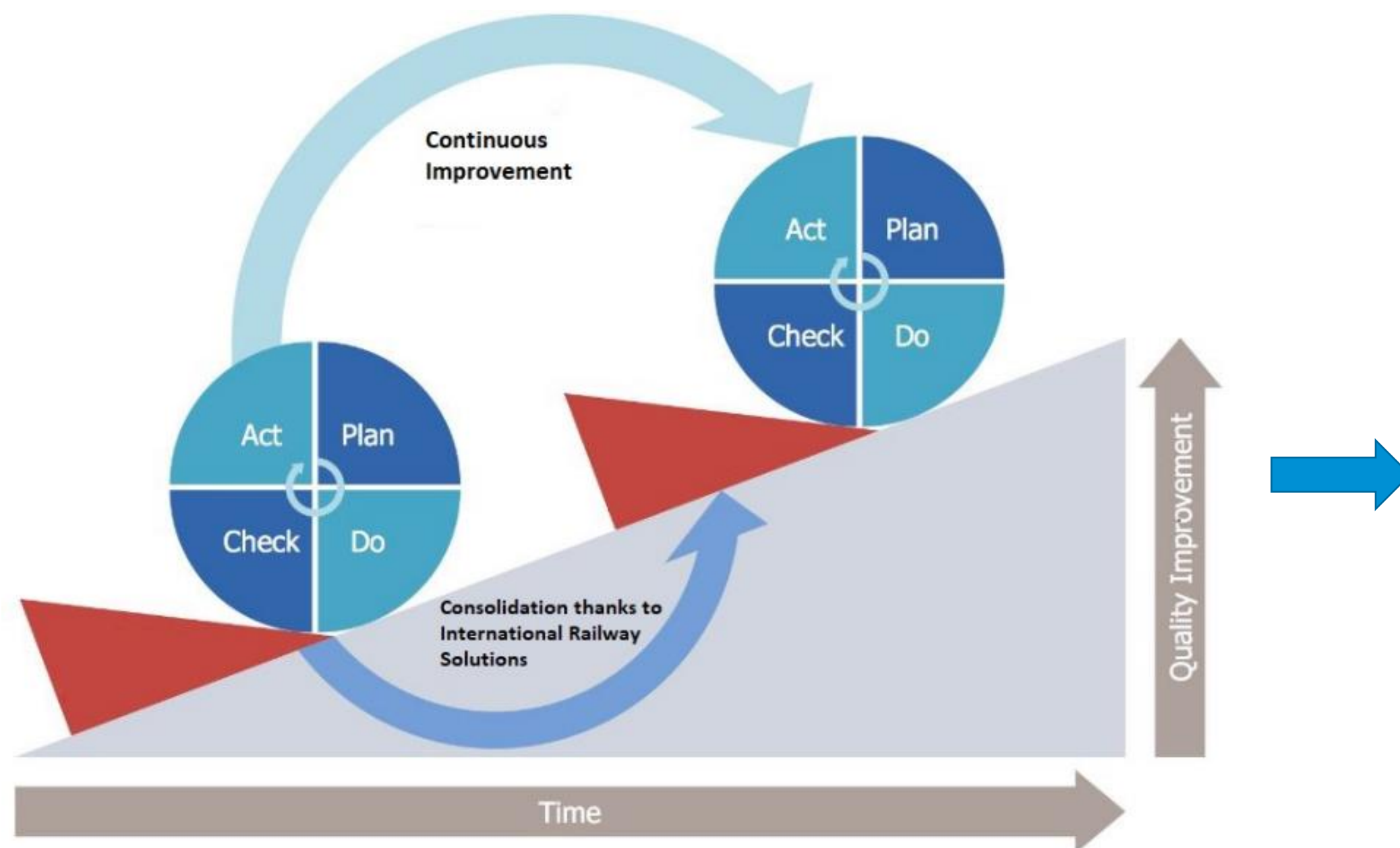
Next to UIC inputs

We require industrial involvement for developing :

- Safety Organization Architecture
- Common understanding of a “safety barrier”
- Augmented Bow-Tie Library
- BaseData and Risk Analysis Production Process
- Risk models easy to access and use and support the development of local and predictive risk profiles

UIC: strategic support to a **convergent Railway System Model & Railway Data Model**

- Definition of requirements & priorities: assets, functions, life cycle, operations, project management, ...
- Alignment with Global Railway Architecture & associated modelling
- Definition of major use cases with several instances: infrastructure management, CCS, TMS, ATO, etc



Acceptable Means of Compliance (AMoC) = best way for innovations leading standardisation/regulation : REX, Trainings, Tools, Guidances

- **Technical Standards**
- **Organisational Standards**
- **Managerial Standards**
- **Operational Standards**



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Thank you for your attention.