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Can a Safety Culture Be Effectively Measured?

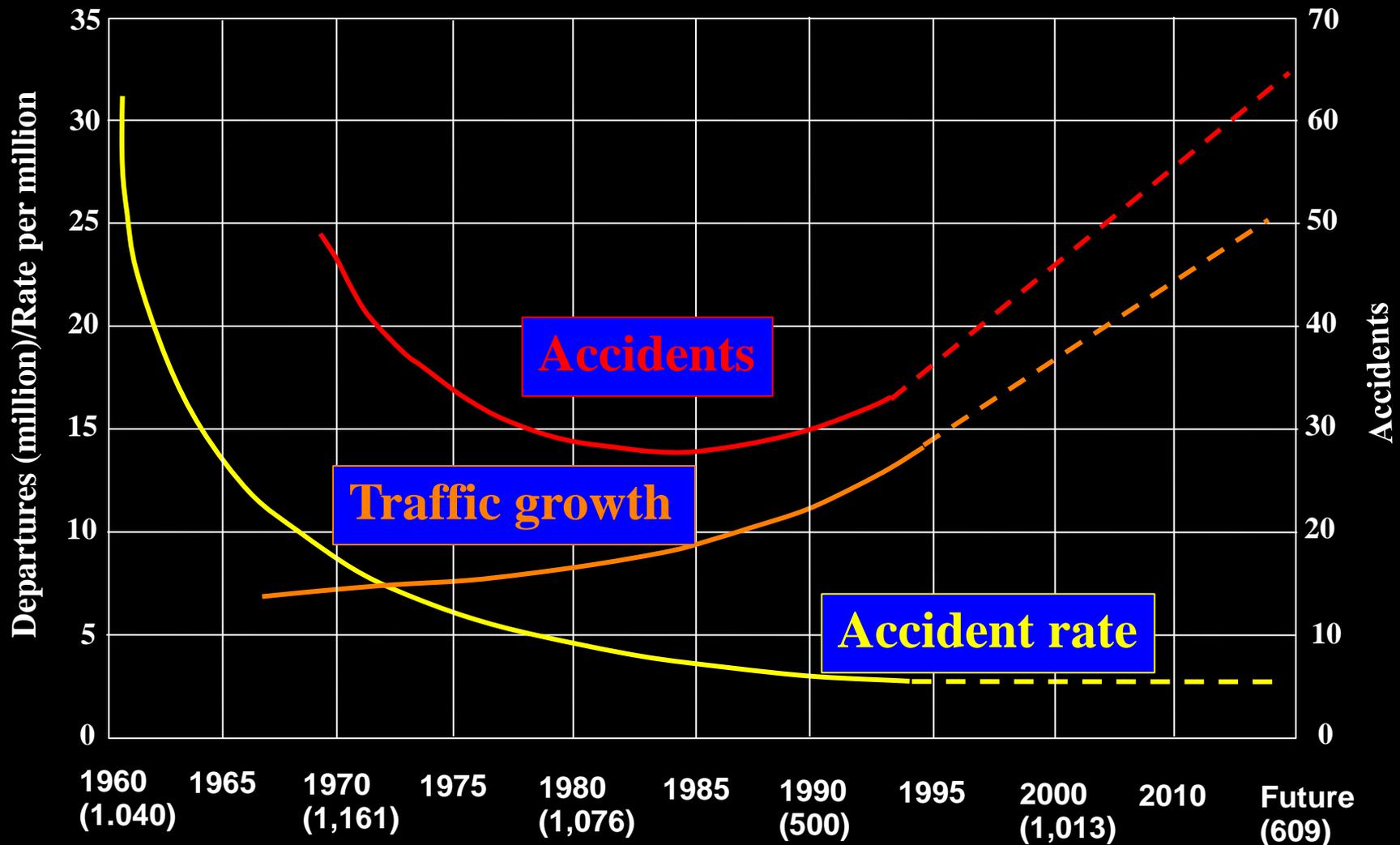
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A brief discussion on...

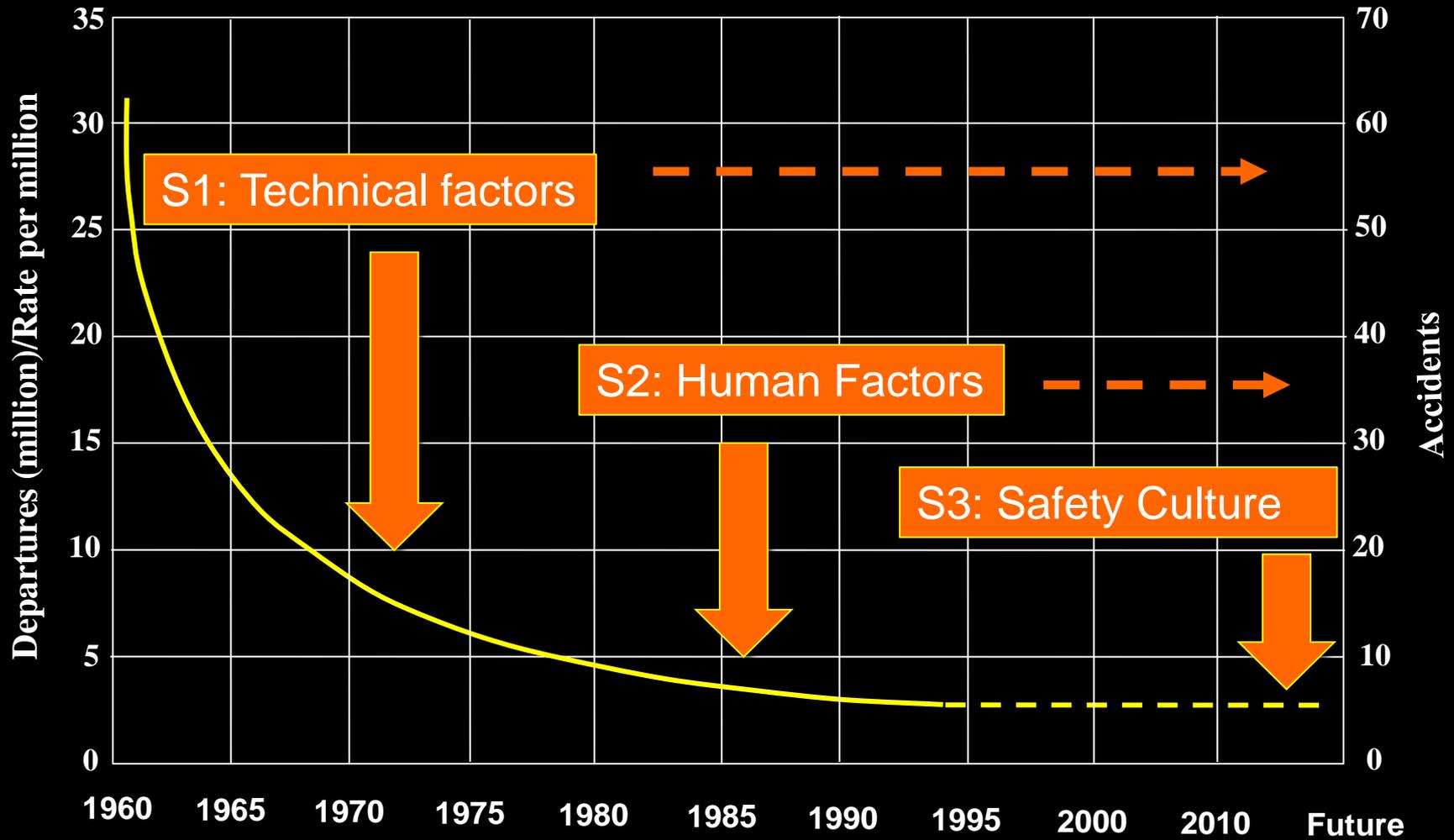
- The role **Safety Culture** plays in shaping reliable and safe operations.
- How focusing on the interdependencies between **attitudes**, **perceptions** and **behavior** can improve an organization's **Safety Culture**;
- Look beyond the current mind-set of viewing **Safety Culture** as a discrete intrinsic trait, but rather toward a **continuum** that is **measurable** and therefore **controllable** at all levels within an organization;
- How **Safety Management Systems**, **Safety Climate** and **Safety Behavior** are interlocked in influencing **Safety Culture**.

Commercial Aircraft Accident Rates



Source: Boeing Co. accident ratios ; (PAX fatalities) Ascend Worldwide, Ltd.

Commercial Aircraft Accidents



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ORIGINS OF SAFETY CULTURE

A perspective in accident investigations...

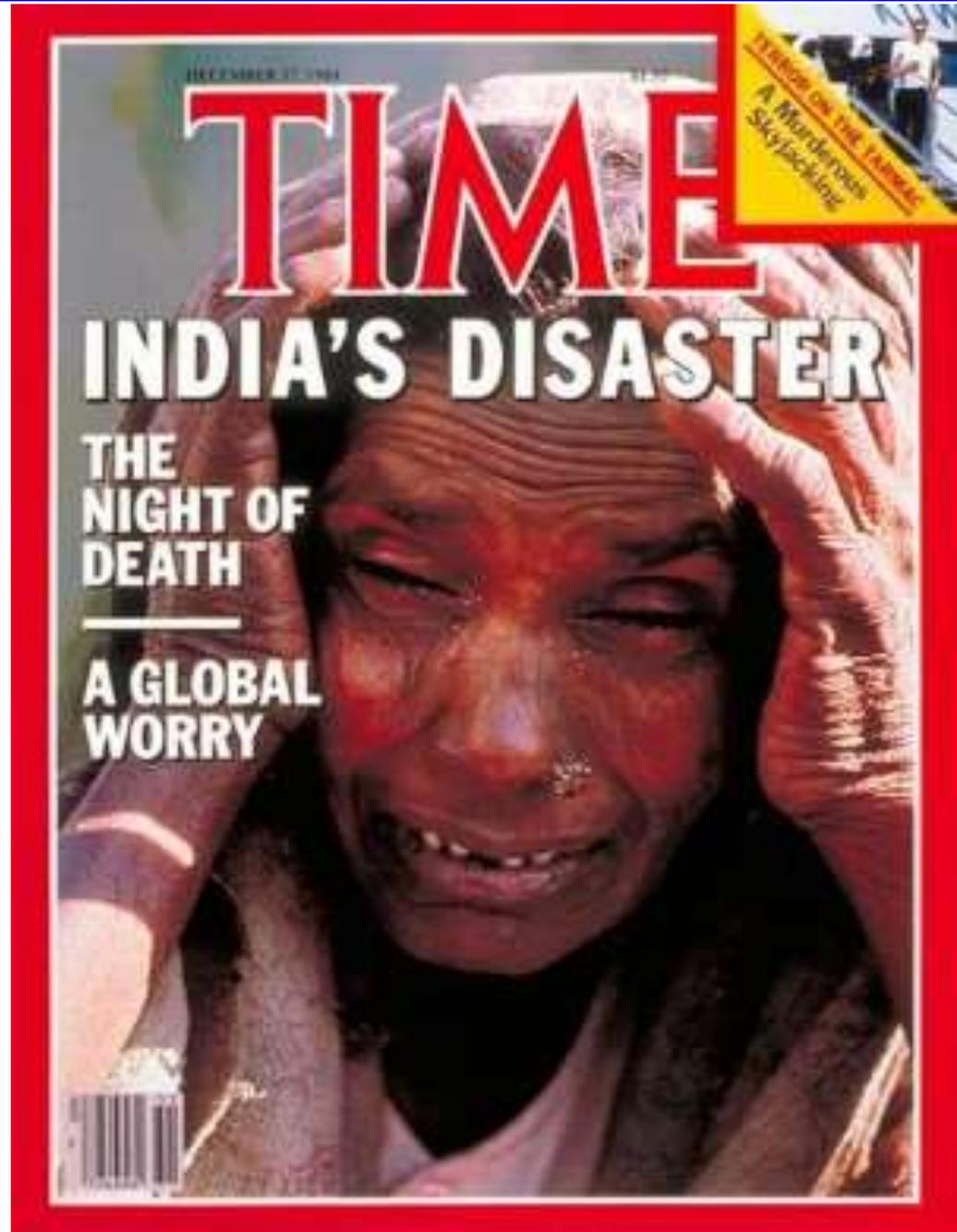
Bhopal, India 1984

Union Carbide
Chemical Release of Methyl
Isocyanate

+3,000 Dead within hours

Failure of:

- maintaining safety protocols
- Inadequate containment
- Failure to follow procedures



Chernobyl, Ukraine USSR 1986

**The worst nuclear power
plant accident of its time.**

31 deaths

**Cause: Flawed reactor
design coupled with
serious mistakes made by
the plant operators.**

**-was a direct
consequence of Cold War
isolation and the lack of
any safety culture.**

(Reference: Cox and Flin 1998; Mearns and Flin 1999; Pidgeon 1998).



Cape Canaveral FL, USA 1986: Challenger Space Shuttle 51-L SRB

8

7 Dead

2+ year delay in program
+\$480 million to fix the
SRB O-ring deign

Political and Management
pressure overriding
engineering evidence
to delay the launch.

Breakdown in Safety Culture



What is safety culture?

Based on the studies of Wiegmann, Zhang, and von Thaden, common definition is posited as follows,

*“**Safety culture** is the enduring value and priority placed on worker and public safety by everyone in every group at every level of an organization. It refers to the extent to which individuals and groups will commit to personal responsibility for safety, act to preserve, enhance and communicate safety concerns, strive to actively learn, adapt and modify (both individual and organizational) behavior based on lessons learned from mistakes, and be rewarded in a manner consistent with these values.”*

Another Definition...

*“...the product of individual and group values, **attitudes**, competencies, and patterns of **behaviour** that determine the commitment to, and the style of proficiency of, an organization’s health and safety programmes.*

*Organizations with a positive safety culture are characterized by communications founded on mutual trust, by shared **perceptions** of the importance of safety, and by confidence in the efficacy of preventive measures.”*

Efficacy: The capacity or power to produce a desired effect.

(ref: Advisory Committee on the Safety of Nuclear Installations (ACSNI) Study Group)

What is Safety Climate?

*“**Safety climate** is the temporal-state-measure of **safety culture**, subject to commonalities among individual **perceptions** of the organization. It is therefore, situationally based, refers to the **perceived** state of safety at a particular place at a particular time, is relatively unstable, and subject to change depending on the features of the current environment or prevailing conditions.”*

(Reference: Wiegmann et al. 2002)

Safety Climate vs Safety Culture

Safety Climate: *“I do not wear eye protection here. I’ve never seen anyone need safety glasses.”*

- Describes the individual’s **perception** based on his/her **attitude** and individual **belief** system.)

VS

Safety Culture: *“Authorized Personnel only – Safety Glasses Required on Job-site”*

- Reflects the organization’s expectations in safeguarding employees from injury (**Safety culture**).

“I don't need to wear eye protection.”

“I've never seen anyone need safety glasses.”



Wire - Oops!

1991: CONTINENTAL EXPRESS FLIGHT 2574 EMB-120RT, In-Flight Breakup



Figure 1c.--Front frame of left side of horizontal stabilizer with lower screw attaching area angled downward.

- Aircraft departed with the L/E only partially installed (upper screws missing), resulting in a catastrophic accident. All perished.
- *“The Safety Board concludes that the GMM contained clear procedures, which, if followed could have prevented the accident”*

NTSB /AAR-92/04 Eagle Lake

*“Departures from approved procedures included **failures to** solicit and give proper shift-change turnover reports, **failures to** use maintenance work cards as approved, **failures to** complete required maintenance/inspection shift/turnover forms, and **a breach in** the integrity of the quality control.”*

EMB-120RT, In-Flight Breakup

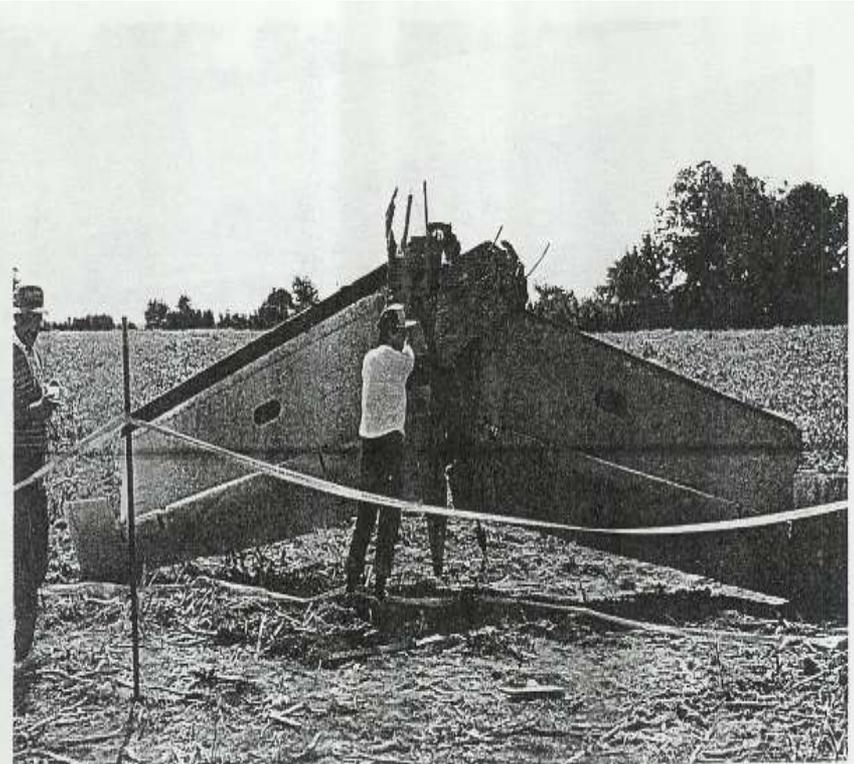


Figure 1a.--View of horizontal stabilizer from underside.

NTSB Probable Cause

NTSB Probable Cause:

“...The probable cause of this accident was the failure of Continental Express maintenance and inspection **personnel** to adhere to proper **maintenance** and **quality assurance procedures** for the airplane’s horizontal stabilizer deice boots that led to the sudden in-flight loss of the partially secured left horizontal stabilizer leading edge and the immediate severe nose-down pitchover and breakup of the airplane.

Contributing to the cause of the accident was the **failure of the Continental Express management** to ensure compliance with the approved maintenance procedures, and the **failure of FAA surveillance** to detect and verify **compliance with approved procedures.**”

How should Safety Culture be viewed?

... as a continuum and not a discrete attribute.

Discrete (binary): A company's Safety Culture viewed as either good or bad; effective or ineffective; safe or dangerous; cautious or reckless.

VS

Continuum: The degree to which a company embraces safety within its overall culture and the community.

Can safety culture be measured?

Yes! – Quantitatively & Qualitatively

Quantitative methods:

- Numerically measure or score safety culture using standardized procedures such as structured interviews, surveys, questionnaires, and Q-sorts.
- Are relatively easy to use, simple to apply, and straightforward to interpret according to a common frame of reference.

(Reference: Wreathall 1995)

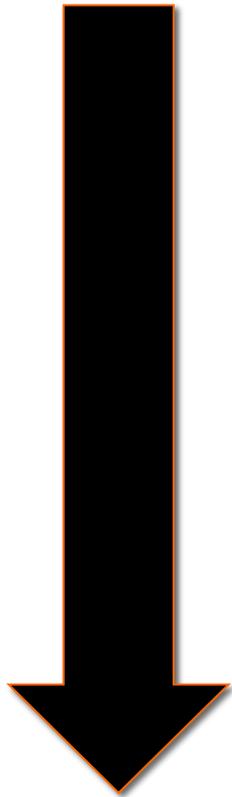
Can safety culture be measured?

Qualitative methods :

- **Ethnographic approaches:** are used to observe an organization from the point of view of the individual:
 - observations
 - employee interviews,
 - focus groups,
 - historical reviews, and
 - case studies.
- **Psychometric measures:** Used to assess individual perceptions and attitudes using questionnaires, tests, personality studies, etc.

(Reference: Wreathall 1995)

Many Safety models have evolved



- Heinrich's "300/30/1" Ratio (1920s)
- Heinrich's Domino Theory (1931)
- Weaver's Domino Theory (1971)
- Adams' Domino Theory (1976)
- Bird and Loftus' Domino Theory (1976)
- Reason's Pathogen Model (1988)
- Cooper's Reciprocal Safety Culture Model (2001)

Cooper's Reciprocal Safety Culture Model

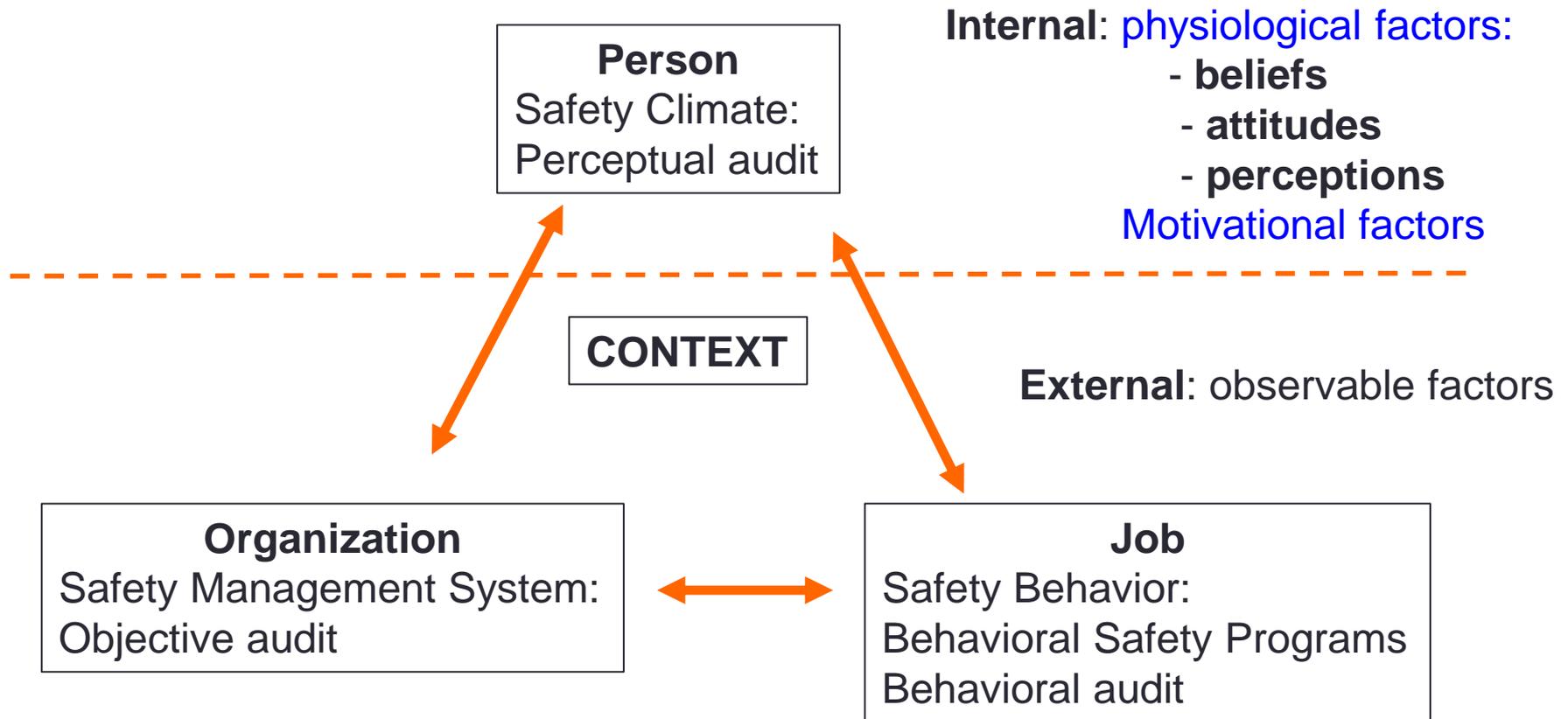
Built upon the **reciprocal relationship** between an organization's:

- Safety Climate (**beliefs, perceptions & attitudes**);
- Safety Management System (processes & procedures);
- Safety **behavior** (Safety Policy).

Each component can be directly measured either independently or in combination;

It is, therefore, possible to quantify **Safety Culture** at many different levels within an organizational.

Cooper's Reciprocal Safety Culture Model



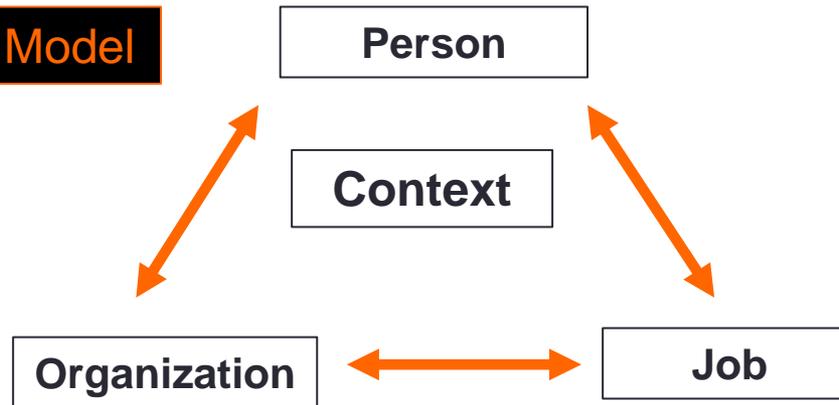
Motivation – where does it fit in?

- **Motivation:** The difference between what a person is capable of doing versus what they are willing to do.
- **Behavior** is not directly correlated with a person's **attitude** without taking into account their **motivational factors** within their environmental sphere of experience (i.e. job factors).
- **Behavior** is not only influenced by **perception** but is also swayed by the rewards & penalties (**Safety Policy**) associated with the **behavior**.

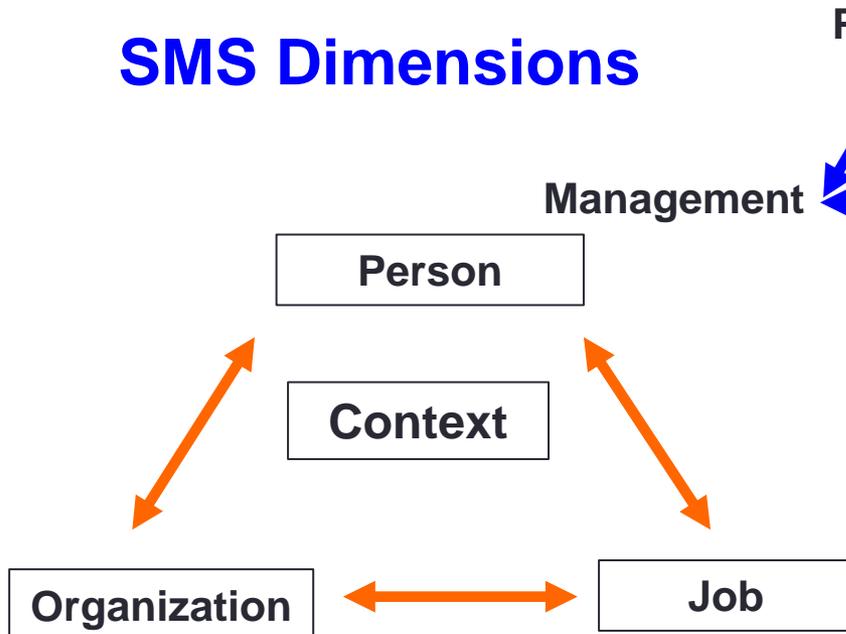
Safety Climate Dimensions

Coopers Expanded Model

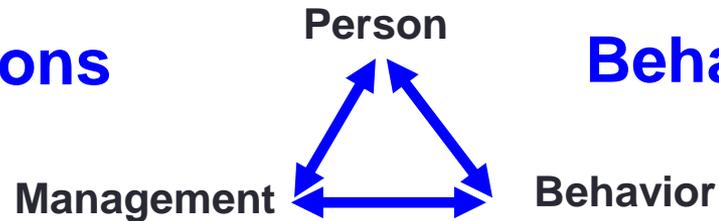
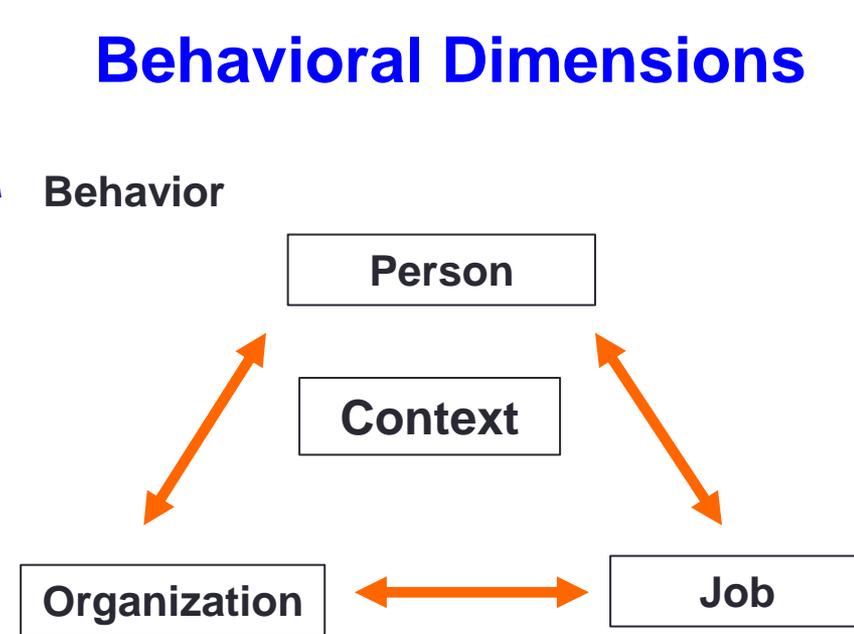
(Reference: Cooper, 2001)



SMS Dimensions



Behavioral Dimensions



On Changing Safety Behavior

Less Effective Approach

- Raising safety awareness
- Publicity campaigns
- Safety training

More Effective Approach

- Define acceptable behavior
- Define unacceptable behavior
- Establish safety goals
- Measure & provide safety performance feedback
- Consistently enforce Safety Policy



On Changing Safety Behavior

Less Effective Approach

- Raising safety awareness
- Publicity campaigns
- Safety training

More Effective Approach

- Institute SMS:
 - Safety Policy
 - Safety Promotion
 - Safety Assurance
 - Risk Management
- Promote a Just Culture
- Train for safety – not for punishment
- Define acceptable behavior
- Establish safety goals
- Measure & provide safety performance feedback

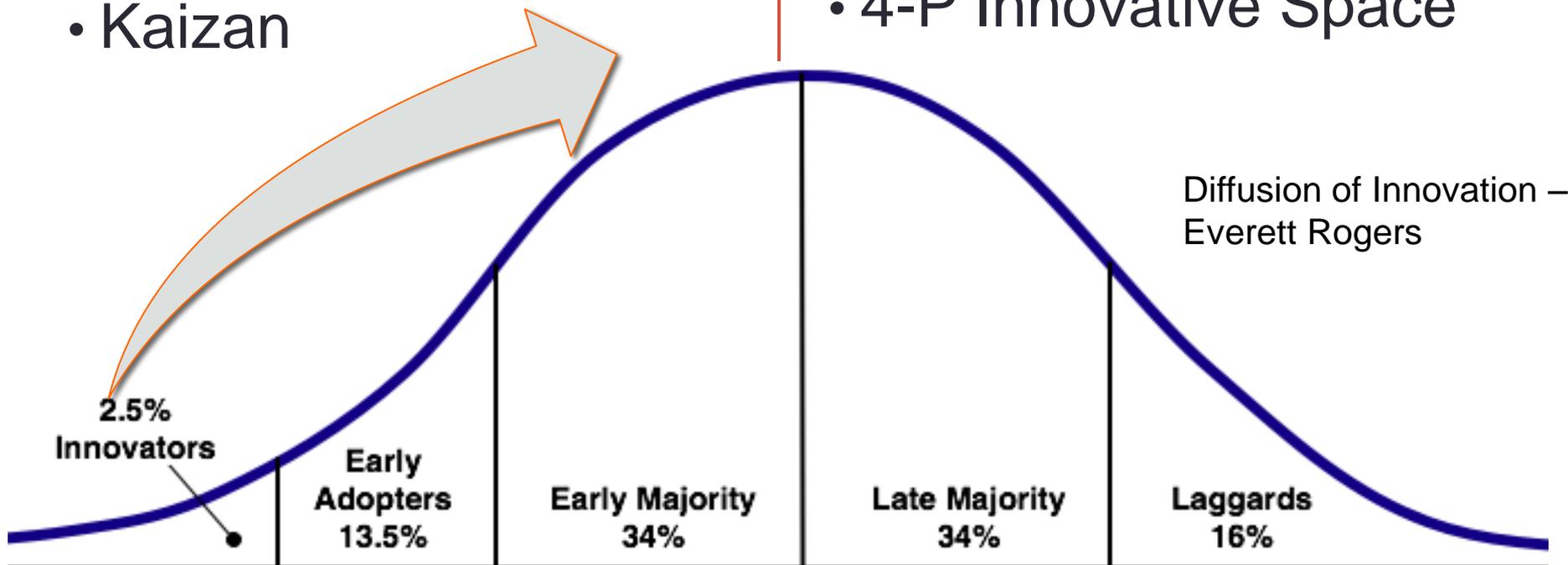
Implementing behavioral safety initiatives

Incremental initiatives

- Plan-Do-Check-Act
- Kaizan

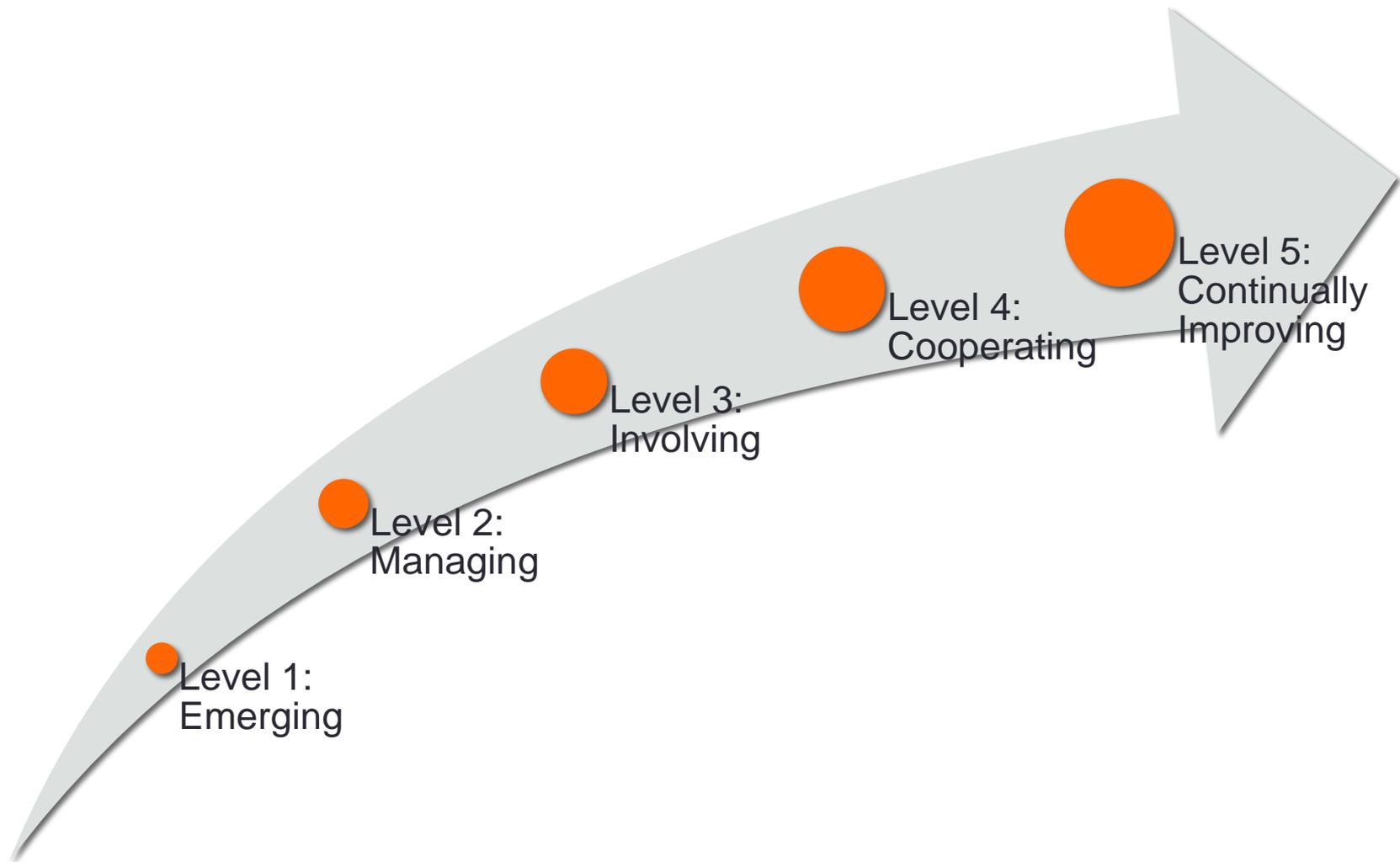
Disruptive initiatives

- Transformational
- 4-P Innovative Space



Maturity of a Safety Culture...

...is a continuum



Summary

- Both an individual's as well as an organization's **perceptions** and **attitudes** dictate their **behavior**;
- **Motivational factors** must be taken into account when implementing **behavioral** techniques to improve an organization's **Safety Climate**;
- **Safety Management Systems, Safety Climate** and **Safety Behavior** are interlocked in influencing **Safety Culture**;
- **Safety Culture** is **measurable, controllable, and auditable** at all levels within an organization:
 - The person
 - The management
 - Person-management behavior

Thank You!

and remember...

“To stop learning.... is to stop living.”

George J. Ringger

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Questions?



“The good news...we only had one piece of FOD !”