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Assessment of Human Reliability and Human Performance In an Italian Multinational Energy Company

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Outline



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- Model Overview
- Performance Shaping Factors
- Human Factors and Human Barriers
- Cultural Values
- Field-test of the methodology



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The development of the methodology

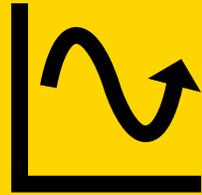
- A multinational Energy Company asked support for the development of a **new methodology**
- They asked for a **comprehensive methodology** to assess **Human Reliability and Safety Performance** in a predictive way for every possible task and in every possible context of the organization
- Accounting for the **complexity of human and organisational factors** shaping the overall safety performance and the **active role of operators and teams in preventing human error** and maintaining safety + **cultural factors** influencing behaviours
- Drawing from different disciplines and approaches:
 - Process Safety (Design and Engineering)
 - Occupational Health and Safety
 - Human Factors & Ergonomics
 - Work, Organization and Personnel Psychology

Model Overview

Investigating safety performance within the organizational and cultural context

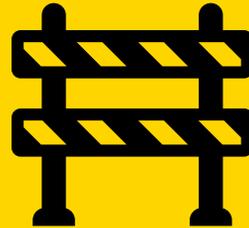
Focus on the “Work As Done”

3 Components:



Performance Shaping Factors

To assess the variability of workers' performance and human reliability



Human Barriers

To assess what can foster safety in everyday operations, also playing a preventive and protective role



Cultural Values

Accounting for the cultural context within which work activities are performed

Human Reliability Analysis

- Estimate human performance associated with the actions and decisions of operators and teams, aiming to determine the impact of human actions on a system
- Drawing from HRA methods - Attempting to overcome their limitations
 - Not accounting for complexity, uncertainty, variability
 - Somehow still anchored to a reactive approach
 - Integrating Human and Organizational Factors
- System Engineering and Cognitive Science



Performance Shaping Factors (PSF)



- Inspired by the improvements suggested by Laumann & Rasmussen (2016)
- Main challenge: formulate PSFs in a way that were comprehensive yet clear and unambiguous
- Different mental models and jargon between researchers and professionals

The role of Human Barriers

Human and Organizational Factors have an important role of prevention and protection with respect to the onset and consequences of adverse events

Assessing “when things went right”



Human Barriers



Depending on their characteristics, they can perform one or more safety functions

Two types of Human Barriers

Derived from the psychosocial scientific literature on personal and social antecedents of safety outcomes

Proximal Barriers

Distal Barriers

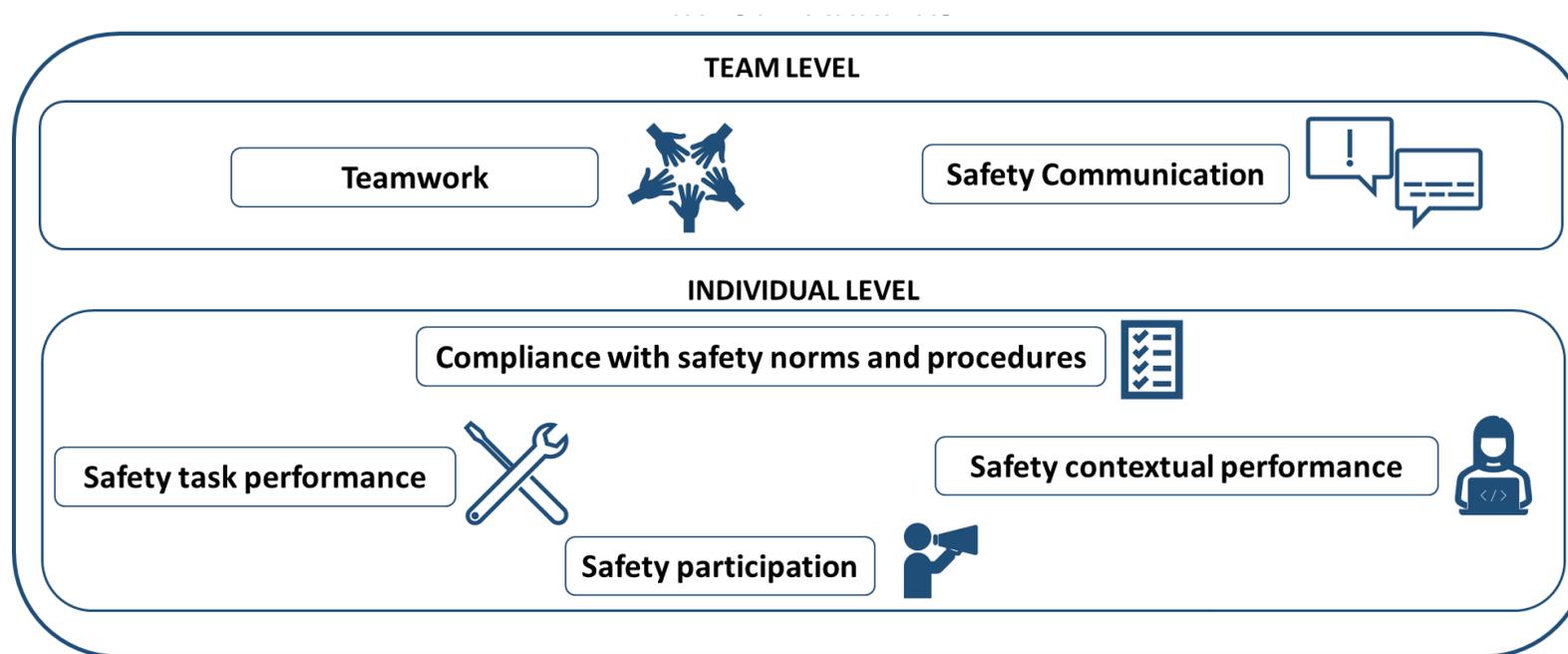
Within each type, different levels of analysis are also distinguished:

- **Individual level**
- **Team level**
- **Organizational level**

Proximal Barriers

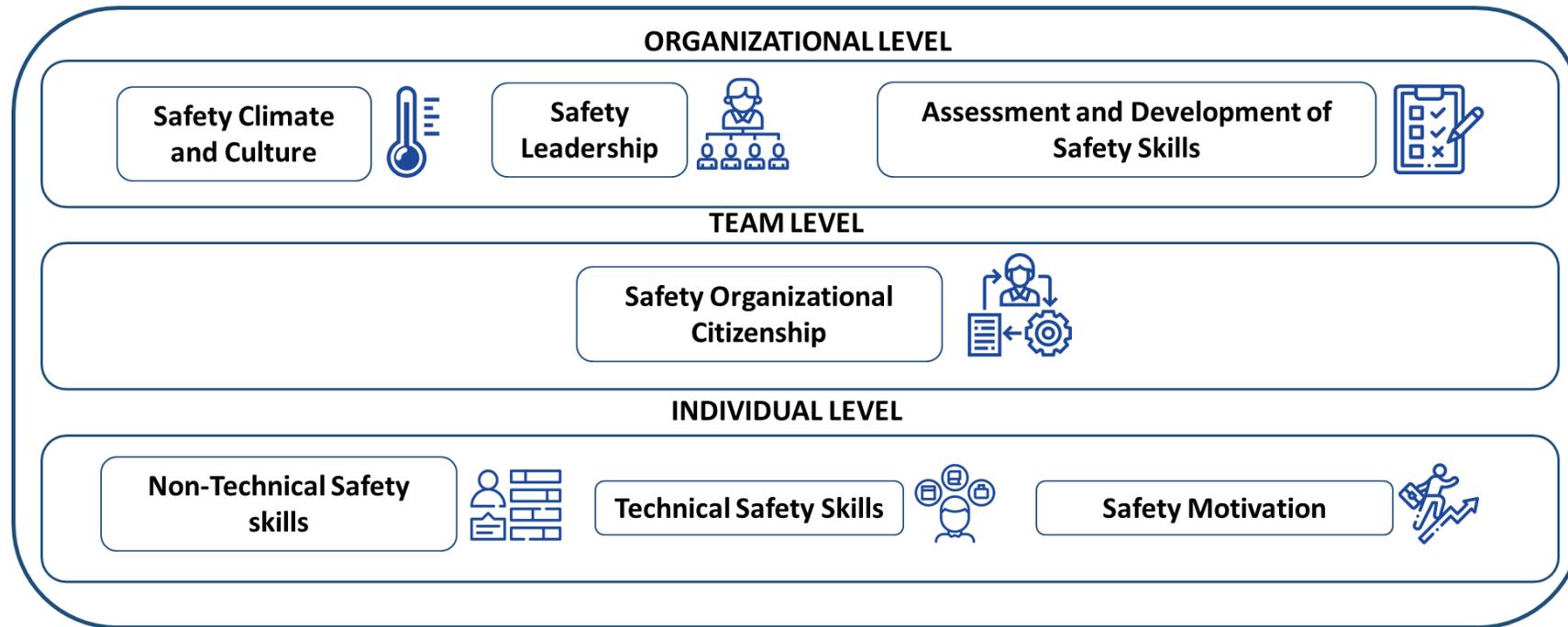
Proximal Barriers act within the dynamics of safety outcomes in a direct manner

This type of barrier refers to **the set of worker behaviors** (at individual and team level) **that promote safe performance**



Distal Barriers

Distal Barriers refer to the set of **procedures, standards and indications** adopted by the organization related to safety issues and centered on human factors and the set of **behaviors, attitudes and skills** related to safety possessed by the operators.



Assessing PSFs and Human Barriers

Direct observation: of operators in their daily routine, as they perform their work activities, from when they enter the operating area to when they complete their task

- Focus on observable behaviours: how workers interact with each other, which instruments they use, how they use them, and the context in which they are operating

Interviews:

- In preparation for observation: interview higher-level figures such as supervisors, managers, or principals.
- Following observation: schedule One-to-One interviews with personnel involved in operations

Consultation of official documents (optional): such as documents outlining procedures, work permits, contracts with outside firms



Cultural values

Journal of Occupational and Organizational Psychology (2015)
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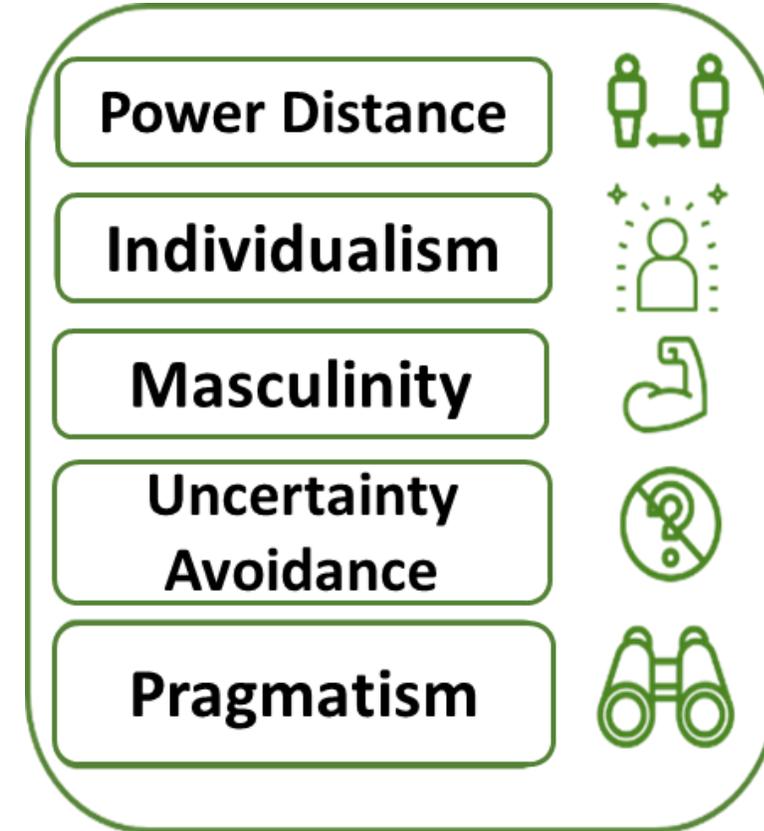
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The relationship between national culture and safety culture: Implications for international safety culture assessments

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Hypotheses/Research Questions	Support?	Findings
1 – 3 Cultural values most strongly associated with safety-specific situational factors, then individual safety-related states, safety behavior, and outcomes	Partially supported	Cultural values most strongly related to safety climate and safety outcomes compared to safety behavior
4 Correlations among cultural values vary for psychological, organizational/group, and national level relationships	Partially supported	Uncertainty avoidance most consistent across levels; power distance least consistent across levels
5 – 6 Individualism positively related to safety perceptions and behavior, negatively related to risks and hazards and outcomes	Not supported	Unrelated to safety climate and negatively related to most other safety constructs
7 – 8 Power distance negatively related to safety perceptions and behavior, positively related to risk and hazards and outcomes	Not supported	Unrelated/positively related to safety climate and behavior
9 – 10 Uncertainty avoidance negatively related to safety perceptions and behavior, positively related to risk and hazards and outcomes	Partially supported	Negatively related to safety climate and behavior and positively related to outcomes
11 – 12 Masculinity negatively related to safety perceptions and behavior, positively related to risk and hazards and outcomes	Partially supported	Negatively related to safety climate and behavior and positively related to outcomes; not consistent/small across levels



- Weakest part of model
- Demands of the company

Preliminary Field Tests

2 Separate tests conducted in different hubs

Two researchers + one HSE company coordinator

Model is effective in identifying safety fostering conditions as well as safety critical behaviours

Areas for improvements

Improve ways to:

- Recognise system complexity
- Develop resilience features
- Better comprehend system components interaction
- Generate meaningful suggestions to design interventions aimed at reducing disturbances and seizing opportunities to increase safety



Personal reflections and open issues

- “No view” on “Human error” and Binary view on human performance
- How to respond to request of a private company as academics
- Fostering the creation of shared mental models (in the team and the organization)
- Methodology as a guide for observing and getting to know daily operations

Thank you for your attention!

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