Tools of safety management II and Future challenges and new directions of safety management

MEC-E3004 Safety management in complex sociotechnical systems

Teemu Reiman

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1. 2.3. Introduction and the basic concepts of safety management
2. 9.3 Basic concepts: Human Factors and Safety Management (Douglas Owen)
3. 16.3 Accident models
4. 23.3 Accident case (BP Texas City refinery explosion in 2005)
   - Mid-term assignment
5. 30.3 Organizational learning

6.4 NO LECTURE

13.4 Returning the mid-term assignment

6. 13.4. Safety culture
7. 20.4. Safety leadership
8. 27.4. The basic principles of safety management
9. 4.5 Safety management systems
10. 11.5. Tools of safety management
11. **17.5 Tools of safety management II and future challenges (TIME!)**
12. 25.5 Recap and Q&A
    - Deadline for returning the paper 31.5.2023

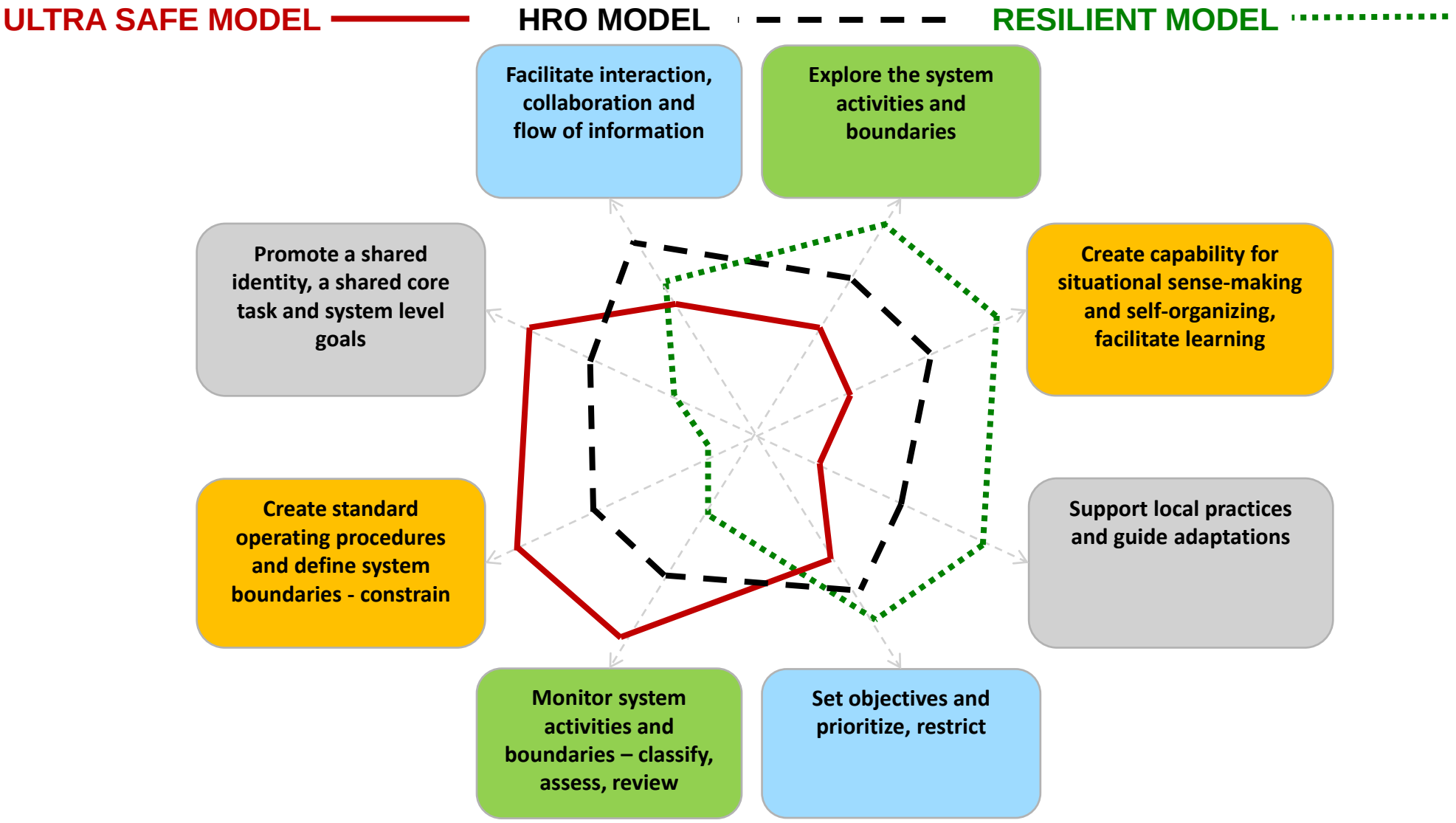
Reminders

- Read the instructions for writing the final paper from mycourses
- If you are unsure about the topic, contact the teacher: reimanteemu@gmail.com

Learning logs

- Different industries and different safety models
  - What is reality and what is wishful thinking
  - How to select the right model, or how to change the model
- Risk assessments versus risk cards, mini-risk-assessments etc on-the-job assessments
- Limits of fault trees

The three models focus on partially different principles



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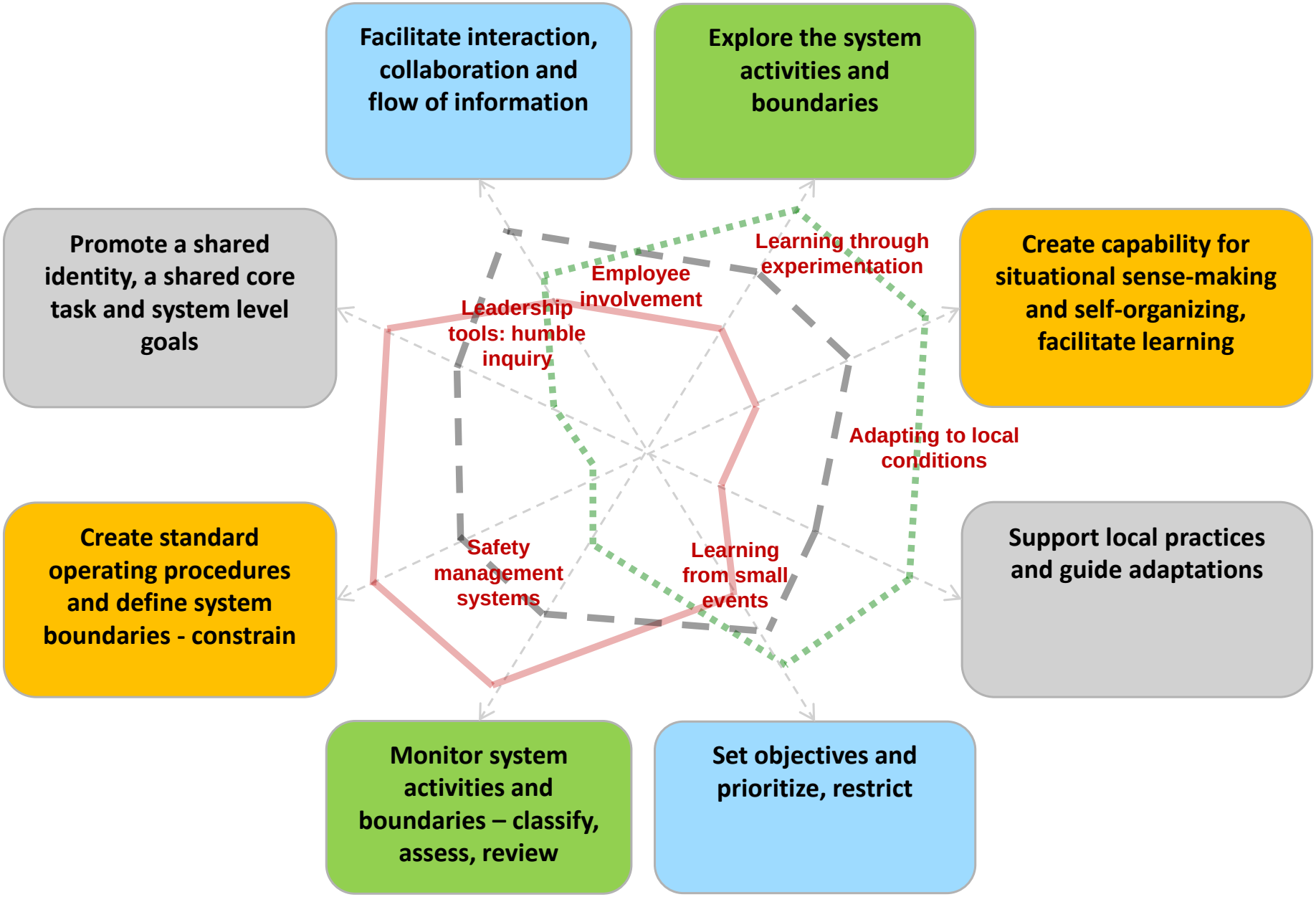

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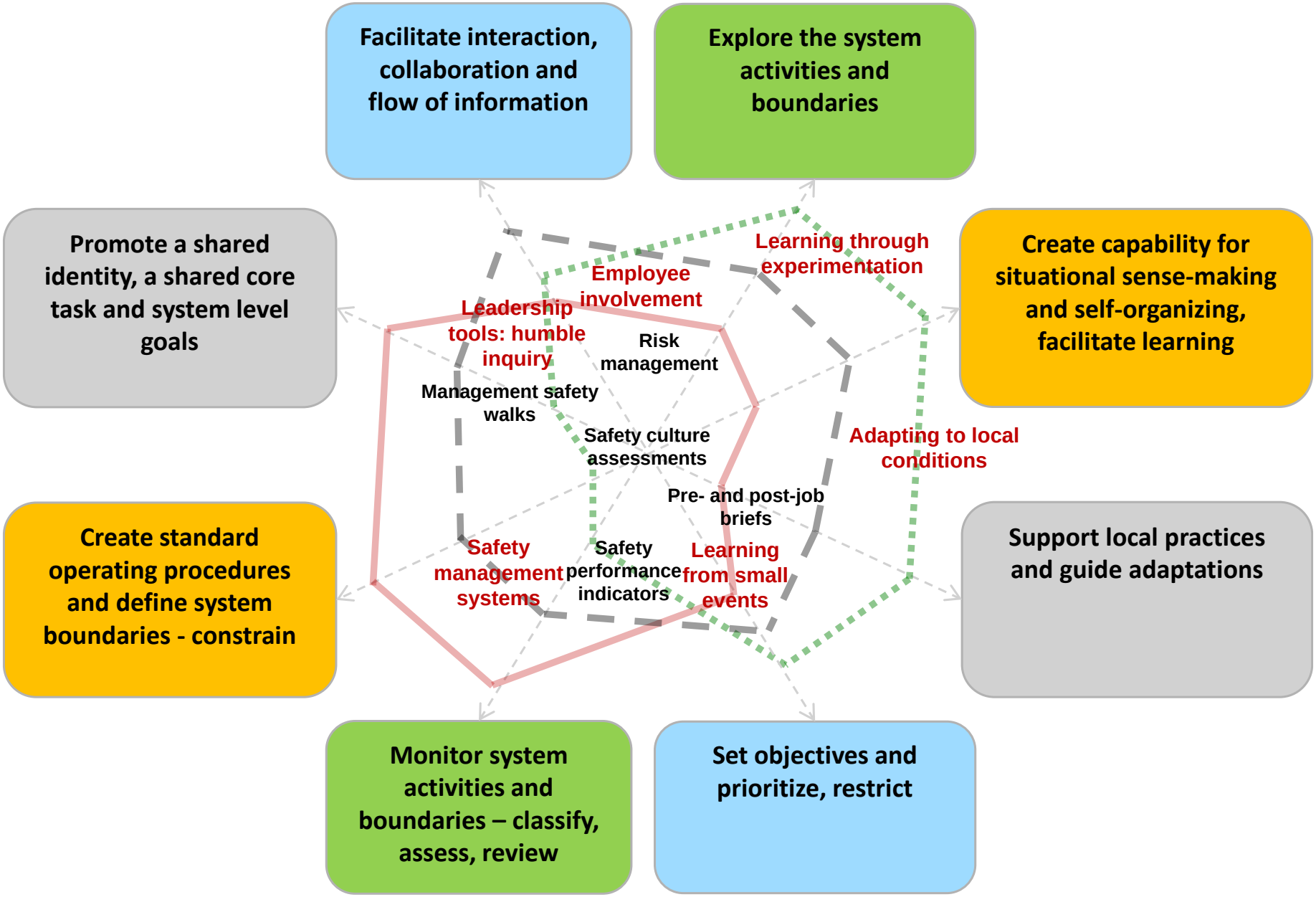
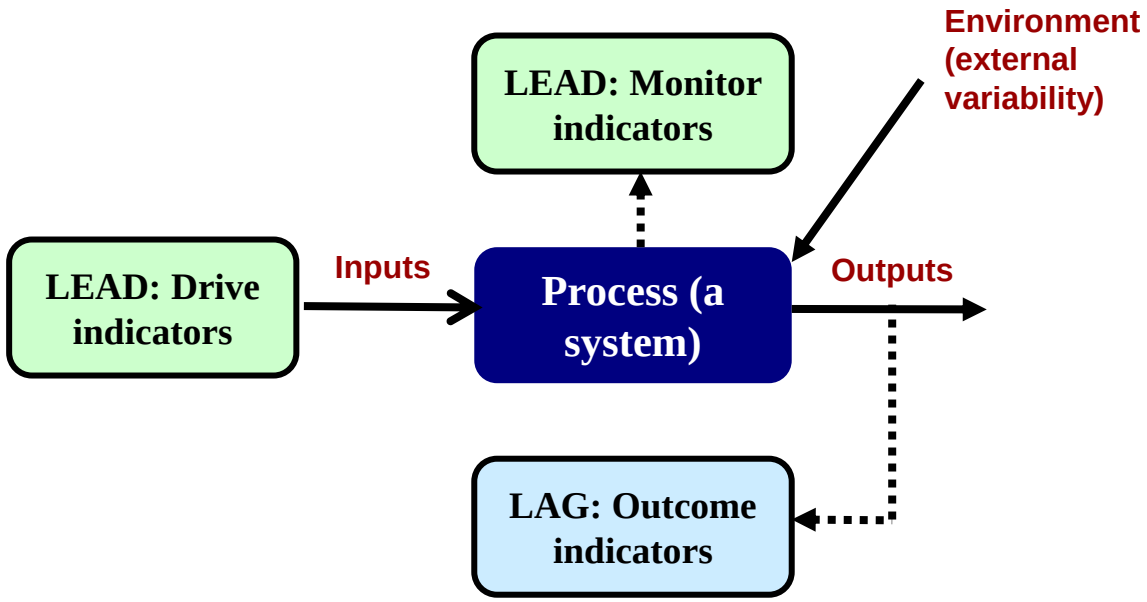


Indicators should provide information about the functioning of the sociotechnical system – in addition, indicators can measure input and direct attention (drive indicators) or tell about what has happened (outcome indicators)



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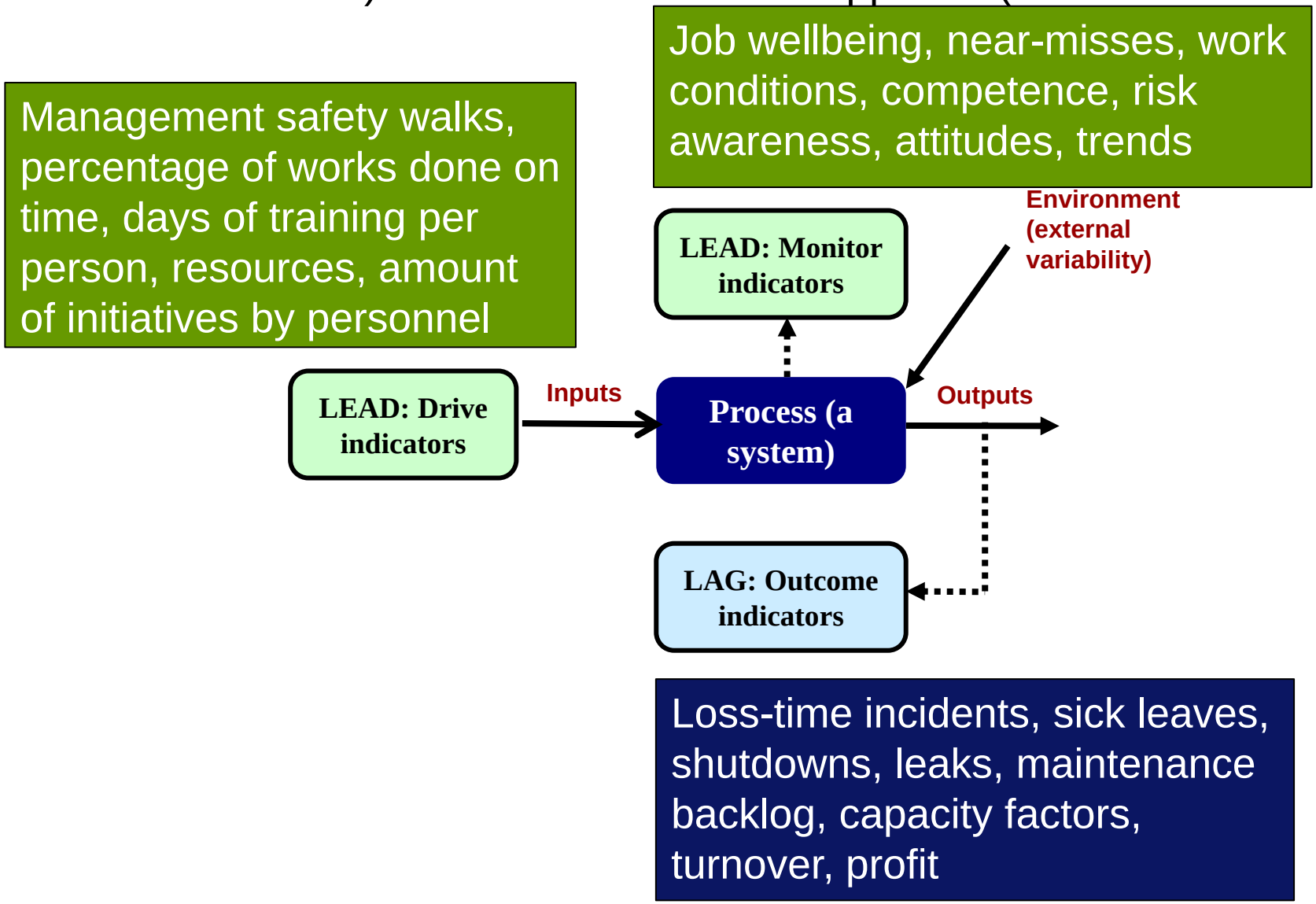


Some examples of leading indicators, provided by the Campbell Institute

Leading Indicator/description	Associated Metrics
Risk assessment *(S,O)* Identification of the tasks, hazards, and risks of a job prior to work, and the implementation of protective measures to ensure work is done safely.	Number of assessments conducted per plan
	Percent of assessments completed per plan
	Ratio between the levels of risk identified (high, medium, low)
	Scoring the steps of an operation on severity, exposure, and probability
	Number of assessments communicated
	Number of risks mitigated or controlled
	Number of assessments validated by EHS manager
	Percent of assessments reevaluated and revalidated
	Percent of routine tasks identified
	Percent of tasks identified
	Percent of risk assessments completed per schedule/plan
	Number of assessments to evaluate potential severity
Hazard identification/ recognition *(S)* Evaluations and assessments (not necessarily audits) through management and employee observations to identify potential hazards.	Number of near miss reports
	Number of unsafe observations (conditions or behaviors)
	Number of safe observations (conditions or behaviors)
	Number of unsafe observations per inspection
	Number of unsafe observations reported per employee per time period
	Number and percent of previously unknown or uncategorized hazards discovered
	Inspection count (collection of observations)
	Ratio of safe to unsafe observations
	Weighted percent safe observations (using risk matrix)
	Frequency of 100% safe
	Number of checklists filled out
	Number of comments for unsafe observations that clarified nature of the hazard
	Number of people trained in hazard identification
	Number of unsafe observations recorded by a trained person

Human performance tools

DOE (2009): Human Performance Tools

Individual

- Task preview
- Job-site review
- Questioning attitude
- Pause when unsure
- Self-checking (STAR)
- Procedure use & adherence
- Validate assumptions
- Signature
- Effective communication
- Place-keeping

Team

- Pre-job briefing
  - Technical task pre-job briefing
- Checking & verification practices
  - Peer-checking
  - Concurrent verification
  - Independent verification
  - Peer review
- Flagging
- Turnover
- Post-job review
  - Technical task post job review
- Project planning & review meeting
- Problem solving, Decision making
- Vendor oversight

Management

- Benchmarking
- Observations
- Self-assessments
- Performance indicators
- Independent oversight
- Work product review
- Event investigations
- Operating experience
- Change management
- Reporting errors and near misses
- Culpability decision tree
- Employee surveys
  - Safety climate survey
  - Job-site conditions

Hazard control: Pre-job briefings

- What are the goals of this work, why is this done?
- What are the major steps or subtasks of the job?
- Are all the workers qualified for the job, and does everyone know what they are supposed to do?
- Do we have the tools, equipment and spare parts for the job?
- What are the success criteria for this job?
- How has the job been done previously (operating experience)?
  - Are the conditions same now as previously?
- What are the risks involved? How have we prepared for them?
  - Ask “what if” questions
  - What is the worst case scenario in the work? What to do in that case?
  - How do we know that the risks have been averted?
- Do we have all the required permits and instructions?

Hazard control & continuous improvement: Post-job briefings

- Did the work go as planned? Why?
  - What hazards we identified beforehand and what we did not?
- How did we feel about the job? Why?
- Were the instructions adequate for the job? Why?
- Was the competence of the group adequate? Why?
- Were there any surprises? What? Why?
- What needs to be done differently next time?

Observations – the case of management walk-arounds

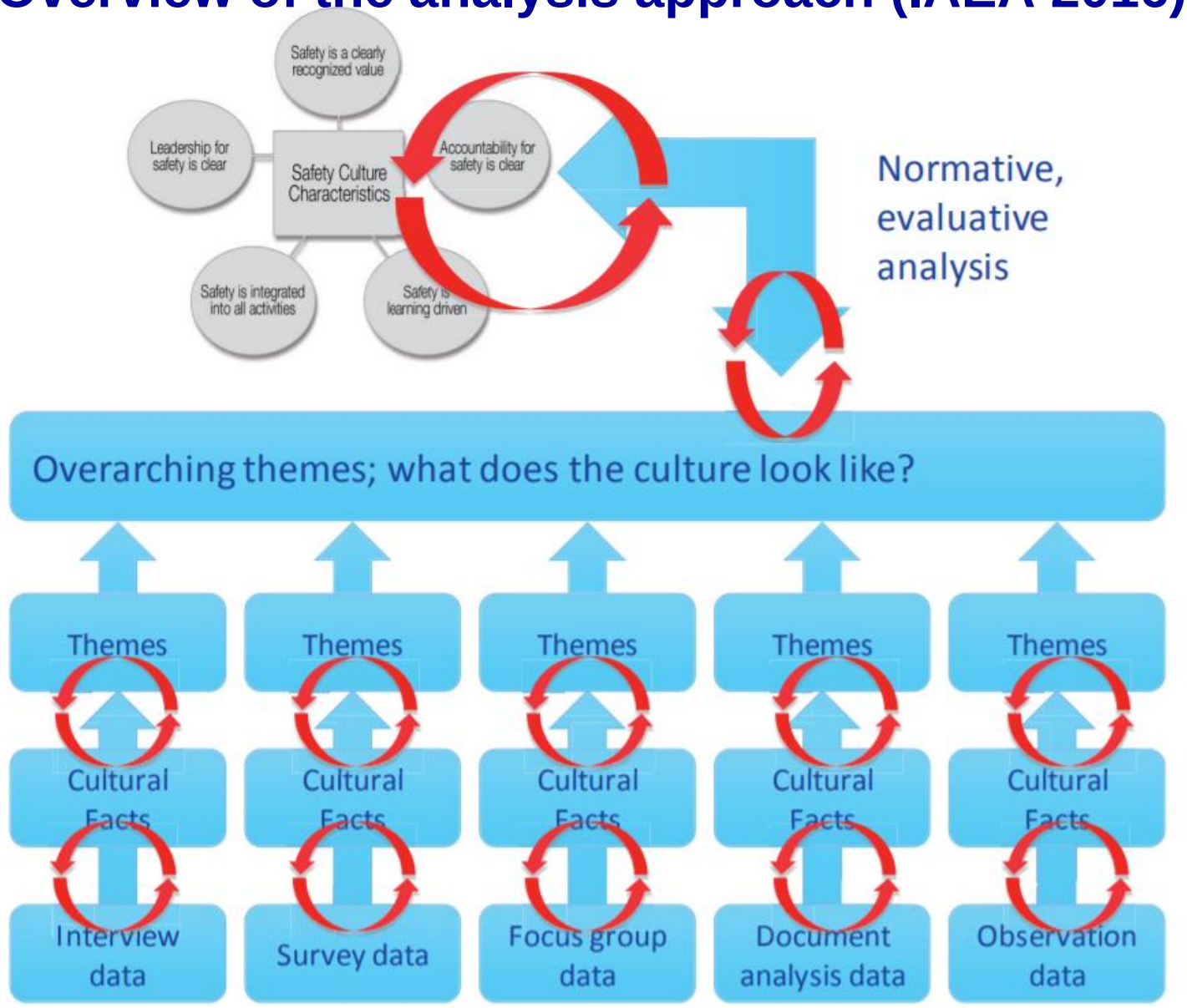
- Purpose of the management walk-arounds: to audit compliance, to listen to and learn from the “voices from the shop-floor”, or both
- Walkarounds need to be taken alone, not with a group of managers, especially if the goal is to learn about the shop floor level
- If the aim is to learn, e.g. the following questions can be used as an interview scheme (Hopkins 2012, p. 134)
  - Tell me about your job. What do you do?
  - What could go wrong? What are the greatest dangers you face?
  - Do you think we have these dangers sufficiently under control?
  - Do you think there are any safety issues here that we are not dealing with adequately?
  - Are there times when workers feel they need to take short cuts?

Safety culture assessments

Safety culture self-assessments (IAEA 2016)

- A successful SCSA is able to improve safety performance by providing a clear picture of how the organization's safety culture influences safety.
  - This involves an evaluation of the strengths and weaknesses of the safety culture by comparing what the culture is to what it should be.
  - This, in turn, allows prioritization of areas for improvement and the implementation of changes, for example, to processes, training and behaviour, as part of continuous improvement efforts.
- A self-assessment team needs to have a broad range of competencies and experience
- It is essential to use multiple methods.
  - Each method provides different information and engages the organization in a different way
  - Interviews, questionnaire, observations, document analysis, focus groups
- Management commitment and involvement are essential components of the SCSA process

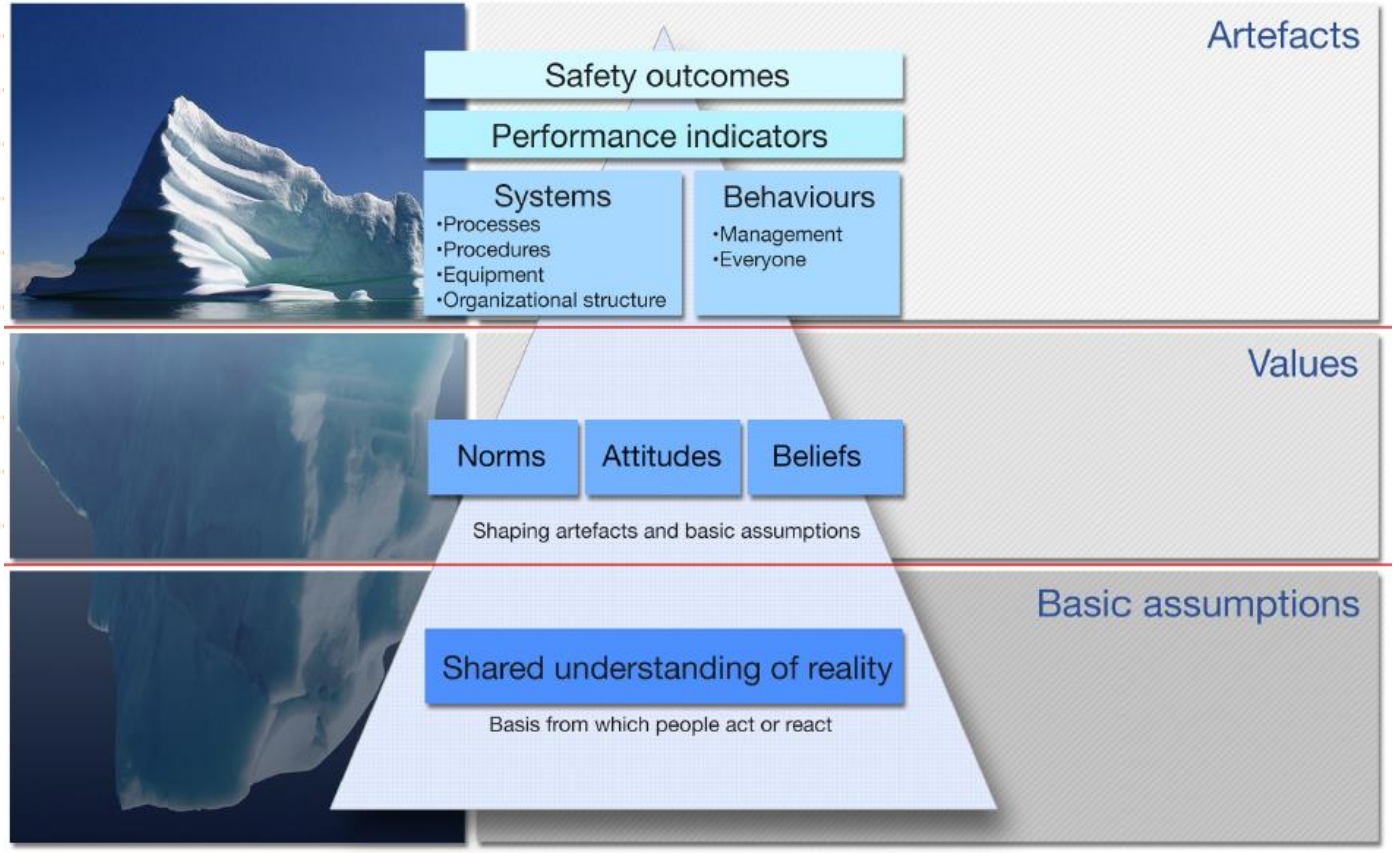
Overview of the analysis approach (IAEA 2016)



Normative analysis is carried against the safety culture traits (from IAEA harmonized safety culture model)

Safety culture traits

IR.	Individual Responsibility
QA.	Questioning Attitude
CO.	Communication
LR.	Leader Responsibility
DM.	Decision-Making
WE.	Work Environment
CL.	Continuous Learning
PI.	Problem Identification and Resolution
RC.	Raising Concerns
WP.	Work Planning



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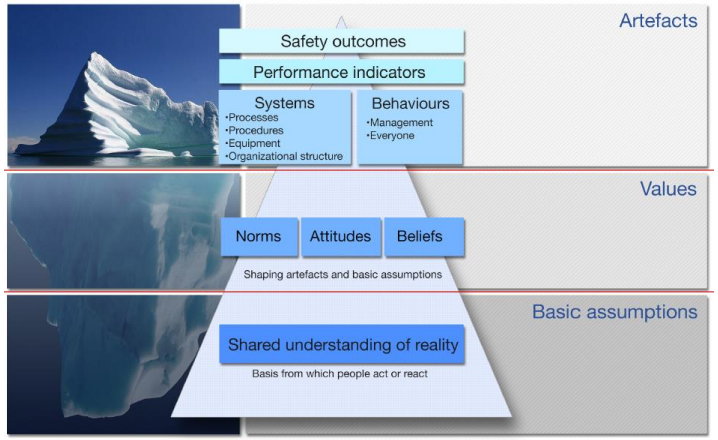

QA. Questioning Attitude

Individuals remain vigilant for assumptions, anomalies, conditions, behaviours or activities that can adversely impact safety and then appropriately voice those concerns. All employees are watchful for and avoid complacency. They recognize that minor issues may be warning signs of something more significant. Individuals are aware of conditions and alert to potential vulnerabilities and then report them.

Attributes

QA.1 Recognize Unique Risks: Individuals understand the unique risks associated with nuclear and radiation technology. They understand that the technologies are complex and may fail in unforeseen ways with significant consequences.

QA.2 Avoid Complacency: Individuals recognize and plan for the possibility of mistakes, unforeseen problems and unlikely events, even when past outcomes were successful. Individuals recognize that complacency often comes with success and continually strive to avoid it in themselves and others.

QA.3 Question Uncertainty: Individuals stop when uncertain and seek advice. The situation and risks are evaluated and managed before proceeding.

QA.4 Recognize and Question Assumptions: Individuals question assumptions and are prepared to offer different perspectives when they believe something is not correct.

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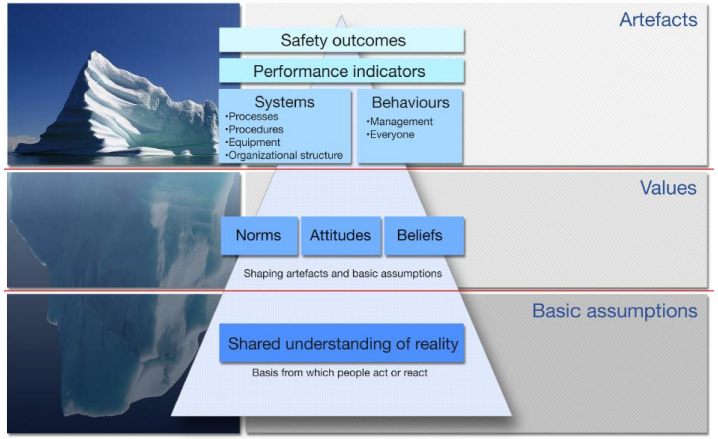

QA. Questioning Attitude

DM. Decision-Making

Decisions are systematic, rigorous, thorough, and prudent. Leaders support conservative decisions and the ability to recover quickly from unforeseen circumstances. Leaders follow the decision-making process. Responsibility for decision-making is clear.

Attributes

DM.1 Systematic Approach: Individuals use a consistent, systematic approach to evaluate relevant factors, including risk, when making decisions. Using a systemic approach, high-quality information is collected from all relevant sources.

DM.2 Conservative Approach: Individuals make prudent choices over those that are simply allowable. Actions are determined to be safe before proceeding, rather than proceeding until proven unsafe.

DM.3 Clear Responsibility: Authority and responsibility for decisions is specific and well defined.

DM.4 Resilience: Prudent decision-making is always used, but in anticipation of unforeseen situations when no procedure or plan applies, organizations develop the ability to adapt.

they believe something is not correct.

Safety culture self-assessments

- To be effective they should reach the levels of values and basic assumptions (cf. IAEA and Schein's models)
- Important to identify norms, attitudes, beliefs and basic assumptions guiding behavior
  - Not all of them can be evaluated strictly as strengths or weaknesses, but awareness is still important
- Important to identify both strengths and weaknesses, and develop corrective actions to maintain the strengths and develop the weak areas
- Additional benefit from self-assessments is that personnel learn to observe cultural issues

Future challenges of safety management

Sources of vulnerability

- Perrow (2007) identified three major sources of vulnerability in modern society which increase the consequences of future disasters
  - Concentration of energy
  - Concentration of people
  - Concentration of power

"instead of focusing on preventing disasters and coping with their aftermath – which we must continue to do – we should *reduce the size of vulnerable targets*"

Life after the pandemic

- COVID-19 has demonstrated the risks associated with concentration of people, but what happens after the pandemic?
  - Tele-work changes existing risks and creates new ones
  - Balance between interaction and collaboration that is prone to spreading the virus and physical separation that does not spread information as well as interaction
- Concentration of power is likely to continue (shared management models, software, accident models etc)
  - A potential source of common-cause failures but also possibility to agree on joint principles / legislation and share best practices
    - Some have hypothesized that the pandemic hinders globalization – if so this may have both positive and negative safety effects (e.g. long supply chains)
- Concentration of energy will take new forms as technologies develop – safer the form of energy, safer it is to concentrate
- Economic depression?
  - Probability of major accidents increases (but smaller occupational accidents may decrease if haste due to production pressure decreases)
- Technological and medical advances

Future of safety management

New hazards

- Concentration of power (including efficient distribution networks)
- Concentration of energy (bigger plants, cities, ships, trains, planes)
- Concentration of people versus separation of people by technology
- New and aging technology
- Artificial intelligence, augmented reality, remote operations
- Attention shift brought by the COVID-19 and the Russian invasion, from accidents to pandemics and from safety to security?
- Reliance on AI

New ways to fail

- Bureaucratization of safety
- Competition and 24/7 requirements for business and workers
- Shorter lifecycle expectations for products
- Long supply chains, subcontracting risk – overall risks change => on the other hand, there are signs of shortening supply chains
- Declining influence of nations (compared to global conglomerates and global interest groups)

Old failure mechanisms still exists in the new context: drift, normalization of deviance, vicious circles, structural secrecy

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