Studying the recovery actions of Apollo 13, US Airways 1549 and San José Mine accidents with FRAM – discovering the human competencies behind system resilience.

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Electrical and Occupational Safety Engineer (UFRJ)
Electronics and Operations Technician (CEFET-RJ)

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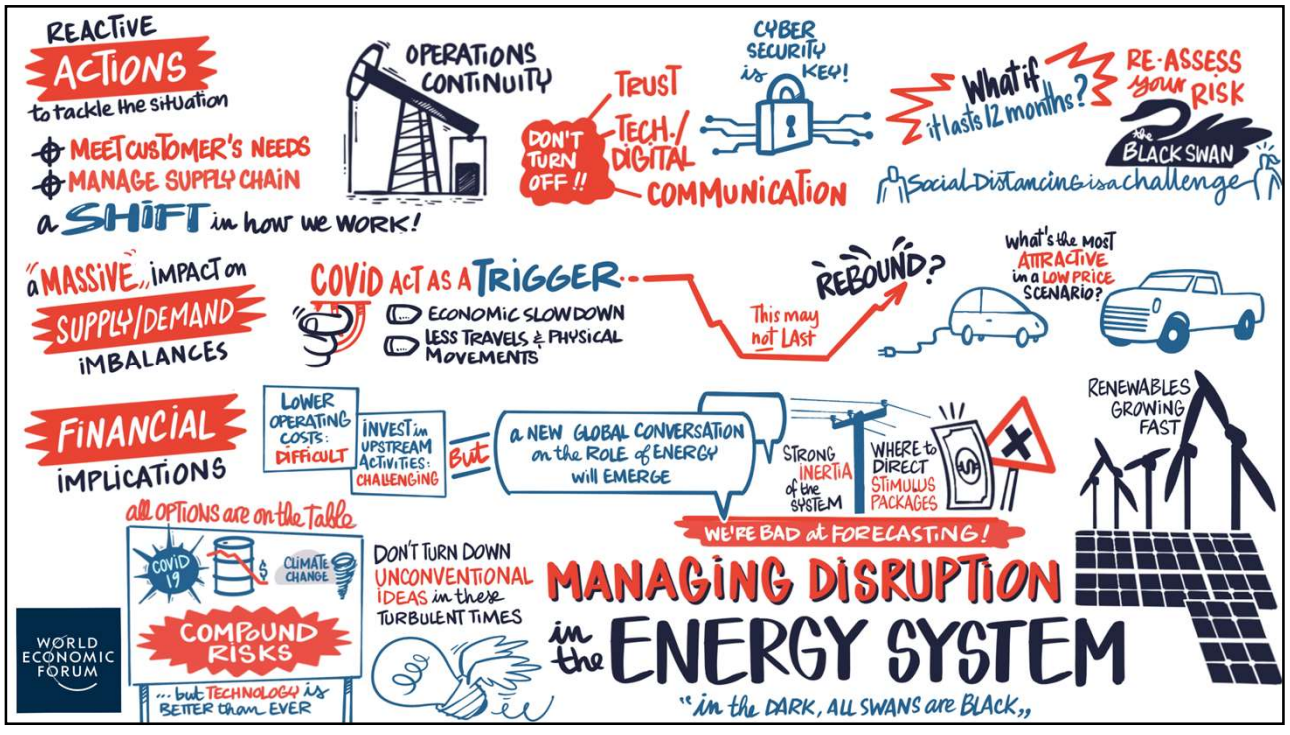

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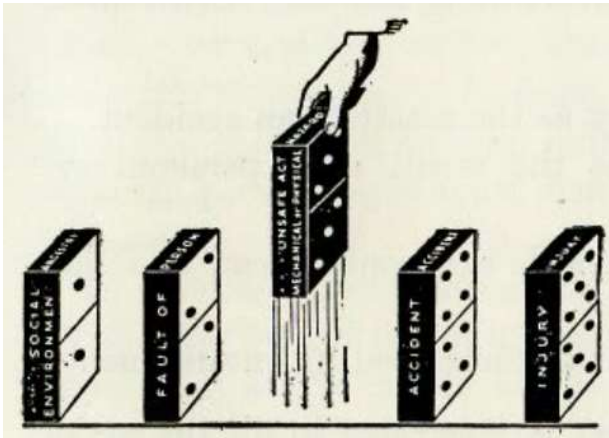

FIG. 4. The unsafe act and mechanical hazard constitute the central factor in the accident sequence.

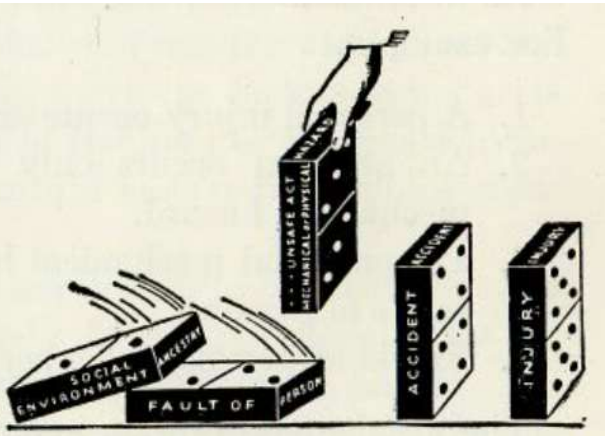

FIG. 5. The removal of the central factor makes the action of preceding factors ineffective.

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Fonte: https://www.sciencemuseumgroup.org.uk/blog/eastlondonandford/

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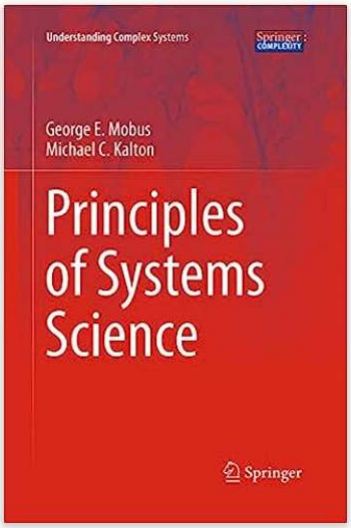

"…there are still systems and processes being developed with their epistemological base in the production line of the 1st Industrial Revolution, perpetuating a mistaken understanding of the complex reality of 21st century workplaces."

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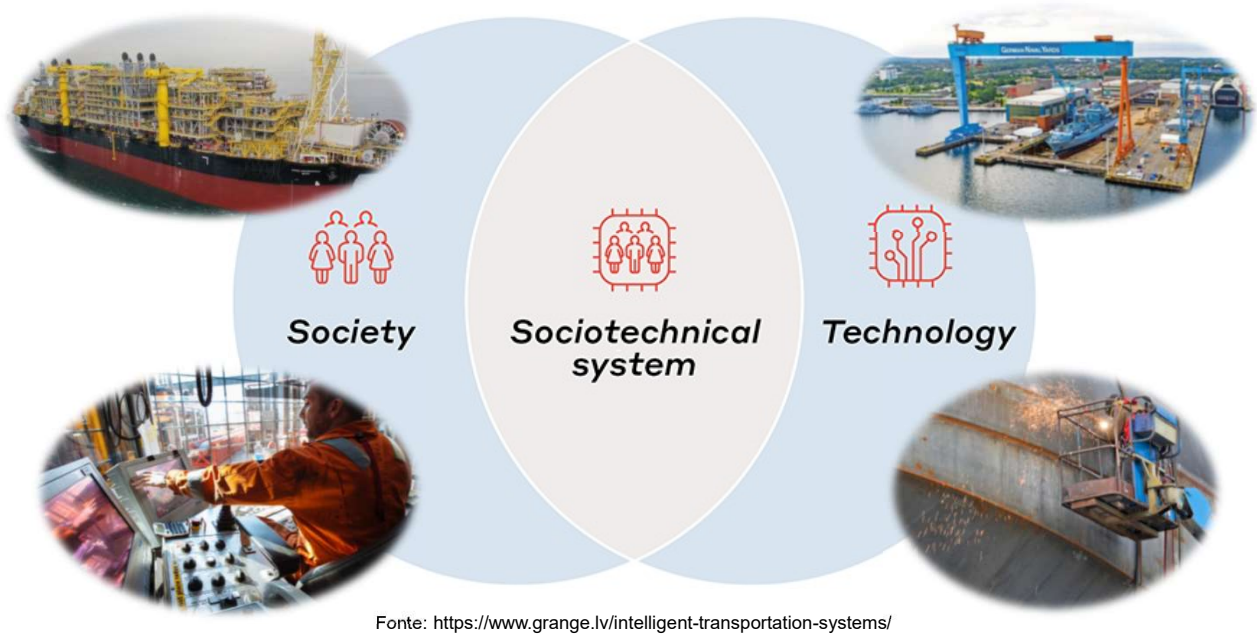

Fonte: https://www.grange.lv/intelligent-transportation-systems/

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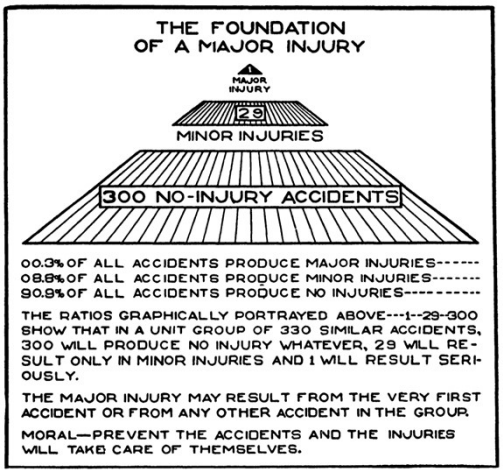

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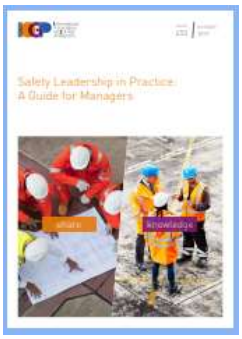

IOGP Report 453
Safety Leadership in Practice

To help us, we can be clear about how we think about human factors:

- People interact with each other, plants and processes as part of a complex system. Human beings are essential in maintaining our barriers and safeguards. They can, and often do, "save the day".
- We understand and accept that people will make mistakes, but these are typically due to underlying conditions and systems. People's actions are rarely malicious and usually make sense to them at the time. Since human error will never be eliminated entirely, we try to make sure that our most critical tasks and barriers are resistant to error.
- Understanding how mistakes happen can help us prevent or cope with them. We use what we learn to design plants, tools and activities to reduce mistakes and better manage risk.
- Finally, we know that leaders help shape the conditions that influence what people do. It matters how leaders respond when things go wrong."

From IOGP Report 453 - *Safety Leadership in Practice: A Guide for managers*

What the experts say about "80% human error"

When the 80 percent human error is broken down further, it reveals that the majority of errors associated with events come from latent organisational weaknesses (mostly the result of human and organisation actions in the past) whereas about 30 percent are caused by the individual worker who last touched the equipment or process.

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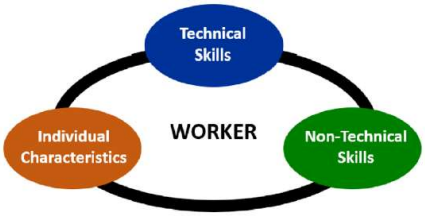
Environment Systems and Decisions
https://doi.org/10.1007/s10669-022-09884-w

Check for updates

Analyzing non-technical skills in the sharp end of facilities/utilities operations in onshore and offshore O&G process plants

Josué França[1] · Antônio Oliveira[2] · Luciana Silva[3] · Pär Karlsson[1]



environment into meaningful internal representations that can be used to guide behaviour and assess risks (Carter et al., 2019). This human intrinsic neurobiological characteristic allows the situation awareness of the surroundings, as much as the risk perceptions of situations, places and interactions (Balcetis & Lassiter, 2010). Therefore, comparing written information with visual information, visual perception is the first step that precedes individual and collective answers for all external stimulus received, seeming reasonably to use this as an efficient way to promote safety.

enables an integration between productivity and safety in the entire system, which ultimately characterizes its resilience. Therefore, these human adaptive variabilities resulting from their competences are not a problem of the system, but a solution response to the demands of the dynamic and complex functioning of the entire sociotechnical system.

Author contributions JF and AO wrote the main manuscript text, supported by Luciana Silva and supervised by PK. JF and LS selected and prepared the tables and figures of the manuscript. PK proofread the text. All authors reviewed the manuscript.

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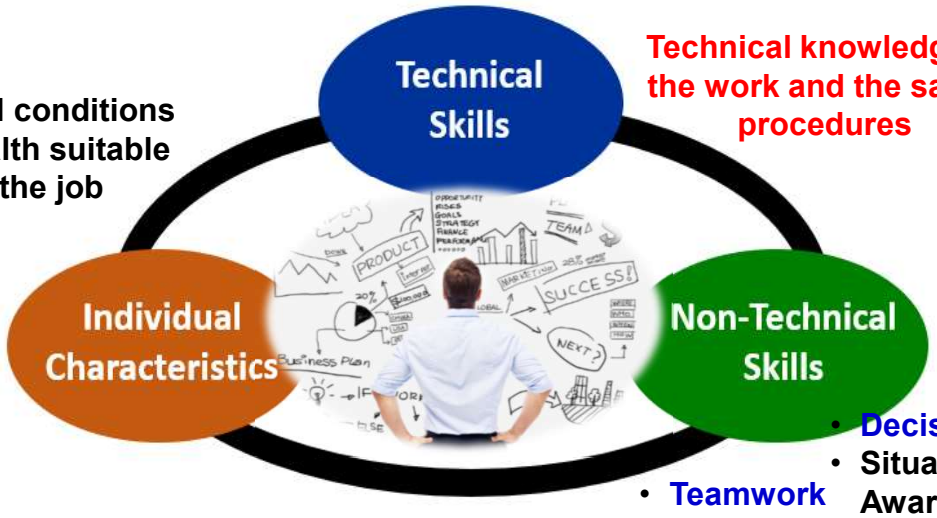
Physical conditions and health suitable for the job



Technical knowledge of the work and the safety procedures

- **Decision-Making**
- Situation Awareness
- **Teamwork**
- **Leadership**
- Communication

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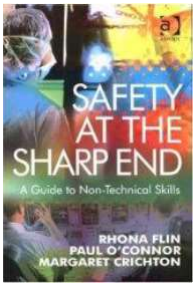
Non-Technical Skills are the cognitive and social skills that complement technical skills and contribute to safe and efficient task performance.
Rhona Flin (2008)

Of these NTS, five are highlighted:

- **Situation Awareness**
- **Decision-Making**
- **Teamwork**
- **Leadership**
- **Communication**



International Association of Oil & Gas Producers

NTS not only complement a worker's technical skills: they are part of the job itself and cannot be "removed" from the equation!

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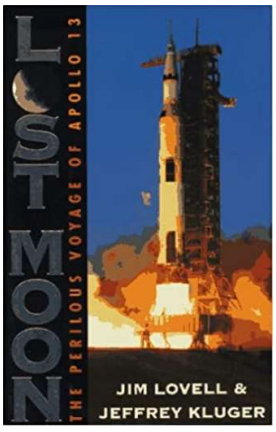
TEAMWORK

The ability to work effectively and interdependently in groups of two or more to achieve a common goal.



More than 400,000 Km away from Earth!!

"We at the capsule, and them, in the Mission Control, we were just one team at that time." *Jim Lovell*

02 07 55 19	LMP	Okay, Houston - -
02 07 55 20	CDR	I believe we've had a problem here.
02 07 55 28	CC	This is Houston. Say again, please.
02 07 55 35	CDR	Houston, we've had a problem. We've had a MAIN B BUS UNDERVOLT.
02 07 55 42	CC	Roger. MAIN B UNDERVOLT.
02 07 55 58	CC	Okay, stand by, 13. We're looking at it.

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https://apollo11space.com/flight-director-gene-kranz-it-was-go-or-no-go/

Gene Kranz
NASA Chief Flight Director
Apollo and Gemini Programs

LEADERSHIP

"It isn't equipment that wins the battles; **it is the quality and the determination of the people** fighting for a cause in which they believe."

"Everything I've ever thought about doing has been, in some sense, **about helping people**."

https://edition.cnn.com/2020/10/13/asia/jacinda-ardern-fast-facts/index.html

Jacinda Ardern
Prime Minister of New Zealand

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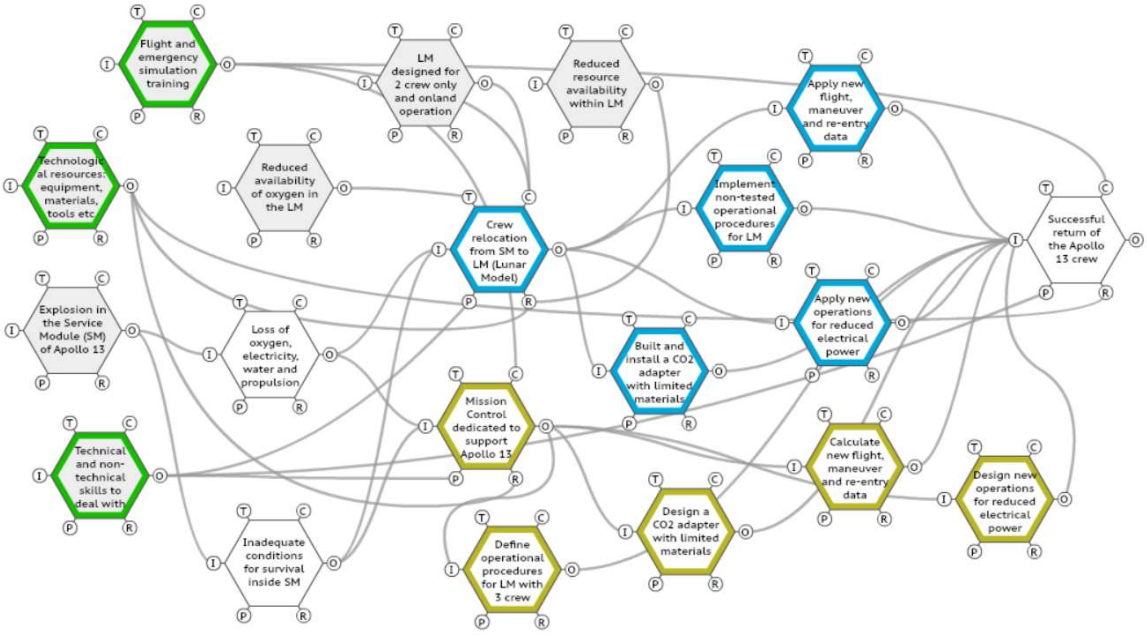

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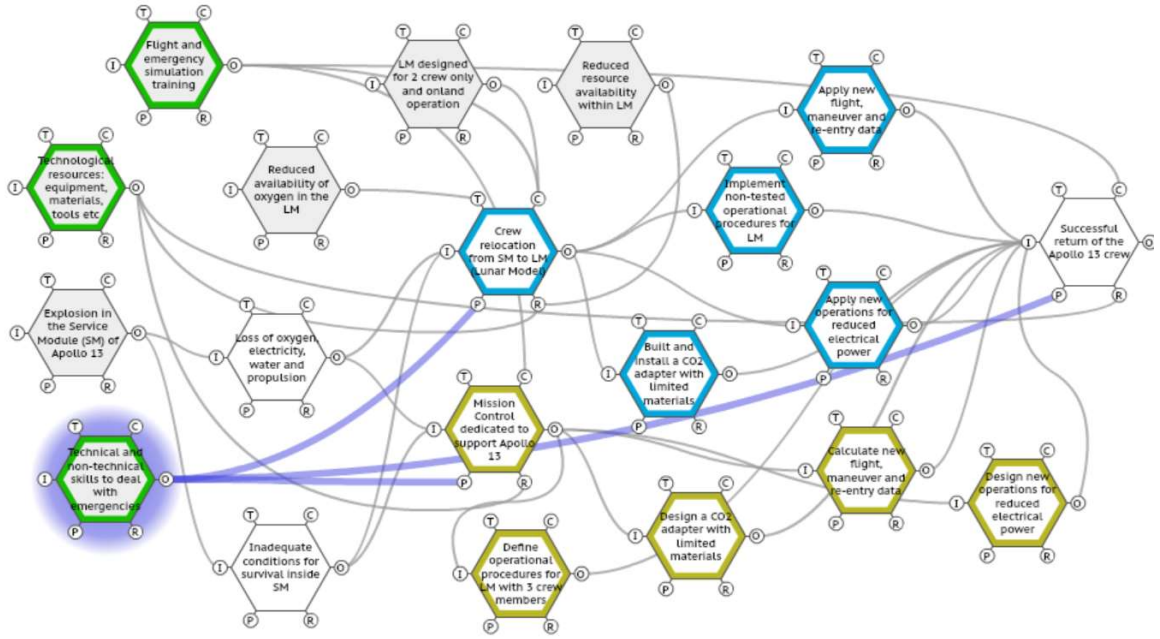

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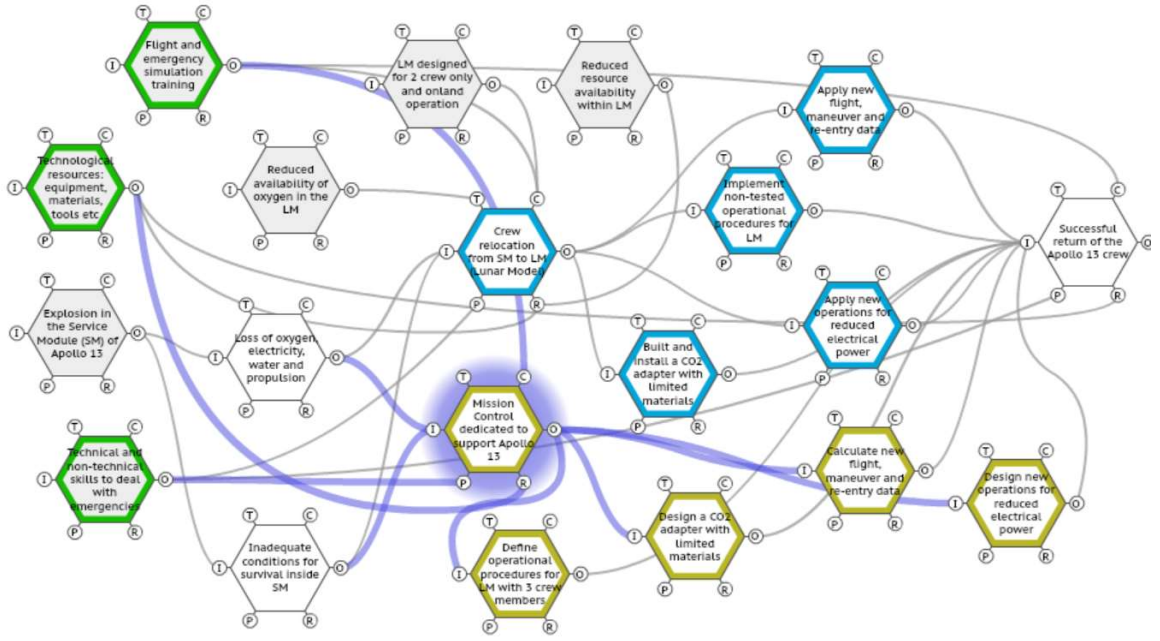

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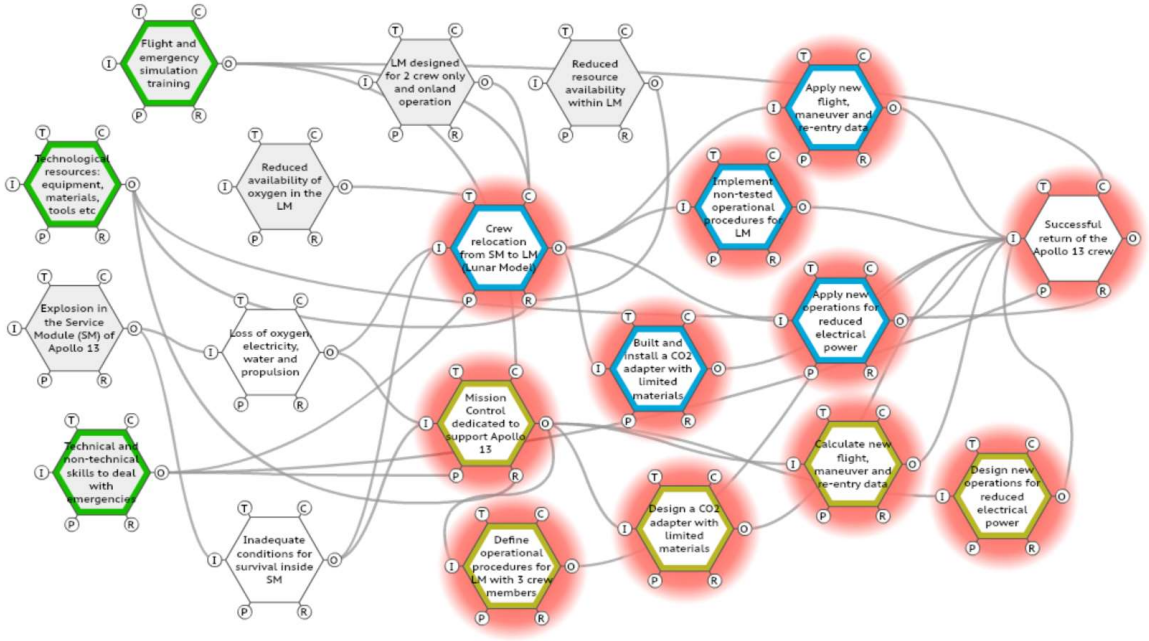

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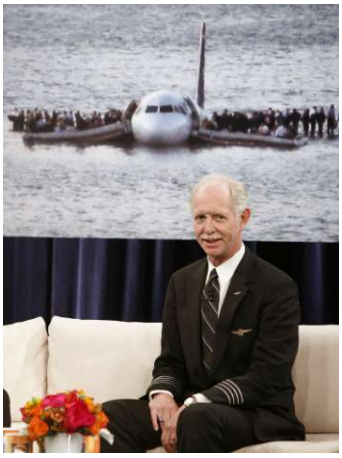
DECISION-MAKING

The ability to make a judgment or choose an appropriate option to meet the needs of an assessed or anticipated situation, as well as unforeseen ones.



"From everything I saw, knew, and felt, my decision had been made: LaGuardia was out. Wishing or hoping otherwise wasn't going to help."
Captain Sully

"Not every situation can be foreseen or anticipated. There isn't a checklist for everything."
Captain Sully

"The natural human resilience is what brought us here as a Society, and it will continue to keep us prepared for the most diverse situations." *Prof. Josué França*

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"It is the first time in U.S. aviation history that we interview the pilot and the copilot after a plane crash." *FAA Investigator*

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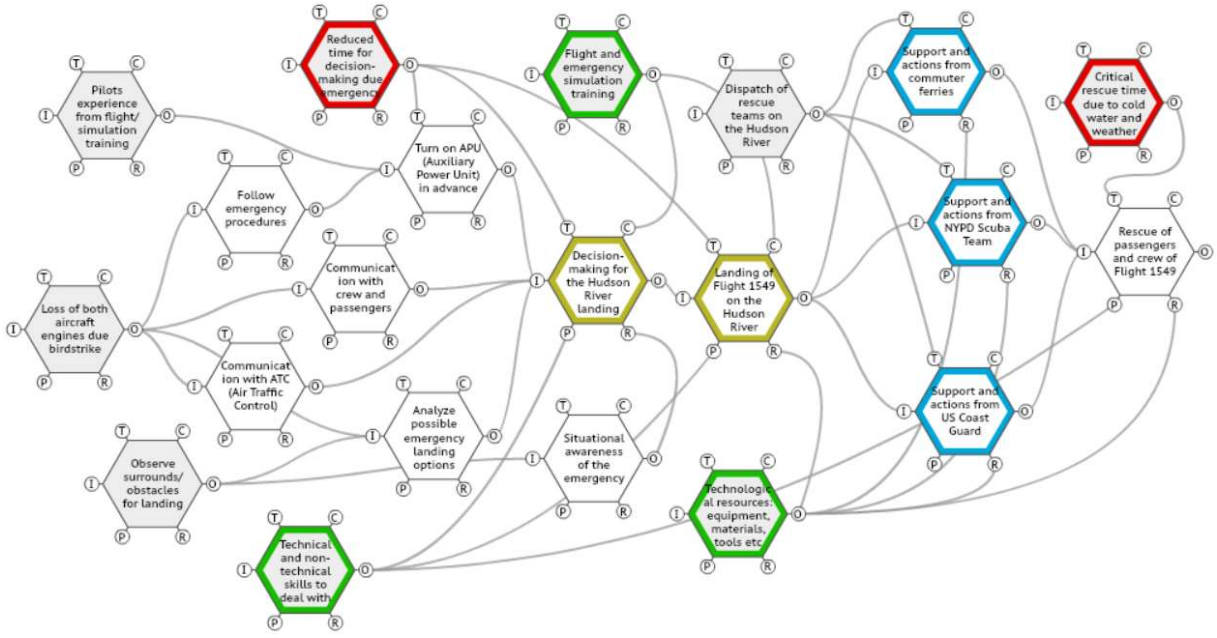

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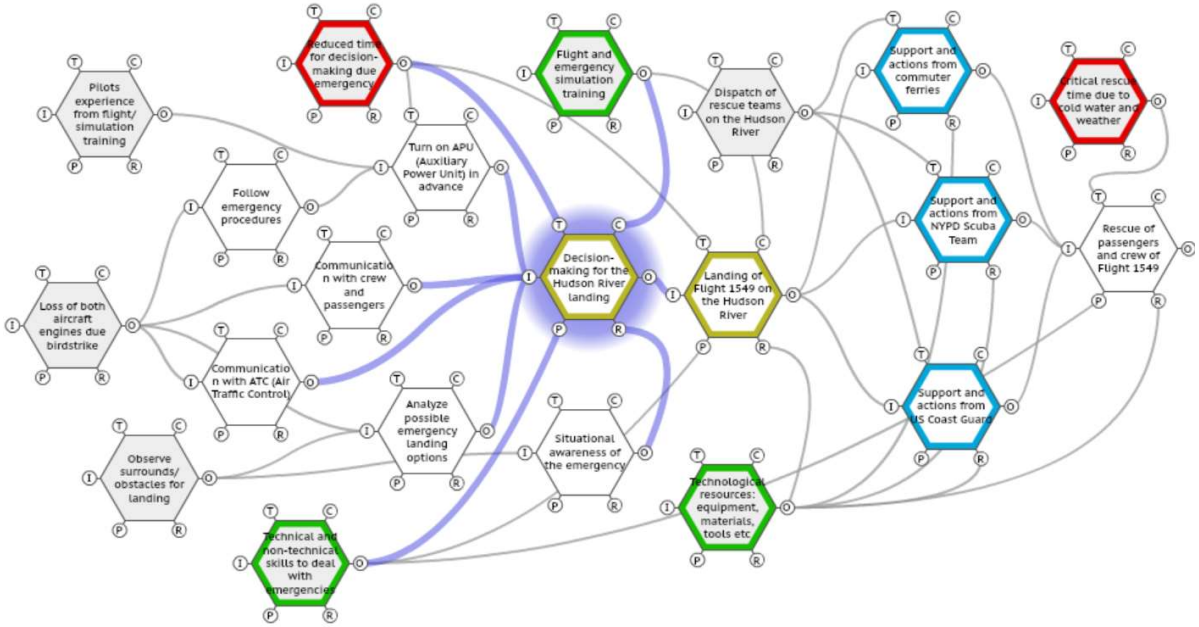

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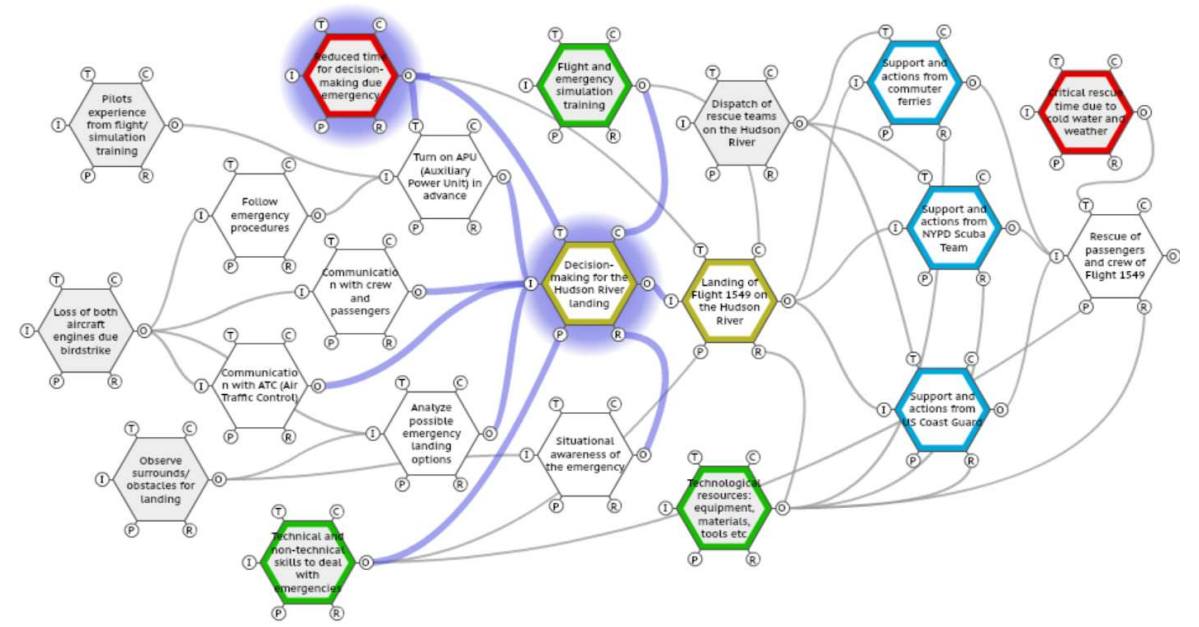

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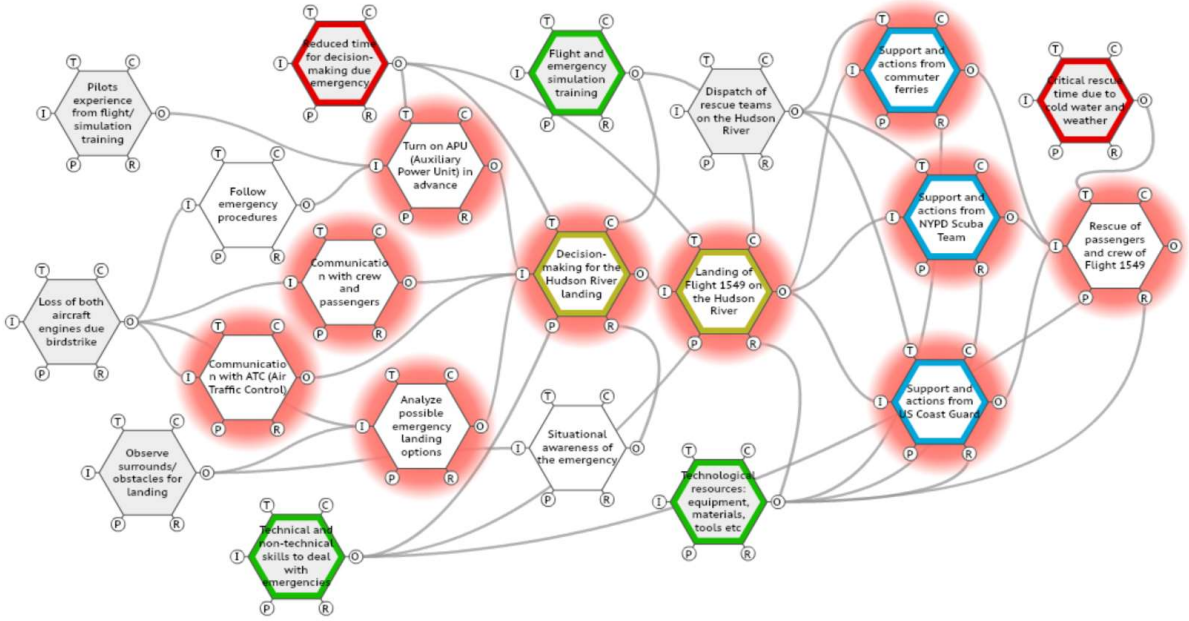

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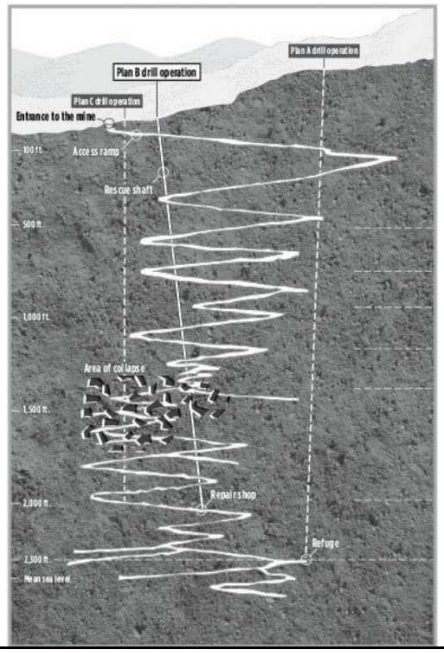

The 2010 Copiapó mining accident began on 5 August 2010, with a cave-in at the San José copper-gold mine, located in the Atacama Desert.

Thirty-three men were trapped 700 meters (2,300 ft) underground and 5 kilometers (3 mi) from the mine's entrance.

They were rescued after 69 days.

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Three separate drilling rig teams and the US space agency – NASA, helped by a dozen corporations from around the world cooperated in completing the rescue.

On 13 October 2010, “los 33” were winched to the surface one at a time, in a specially built capsule, called Fenix.

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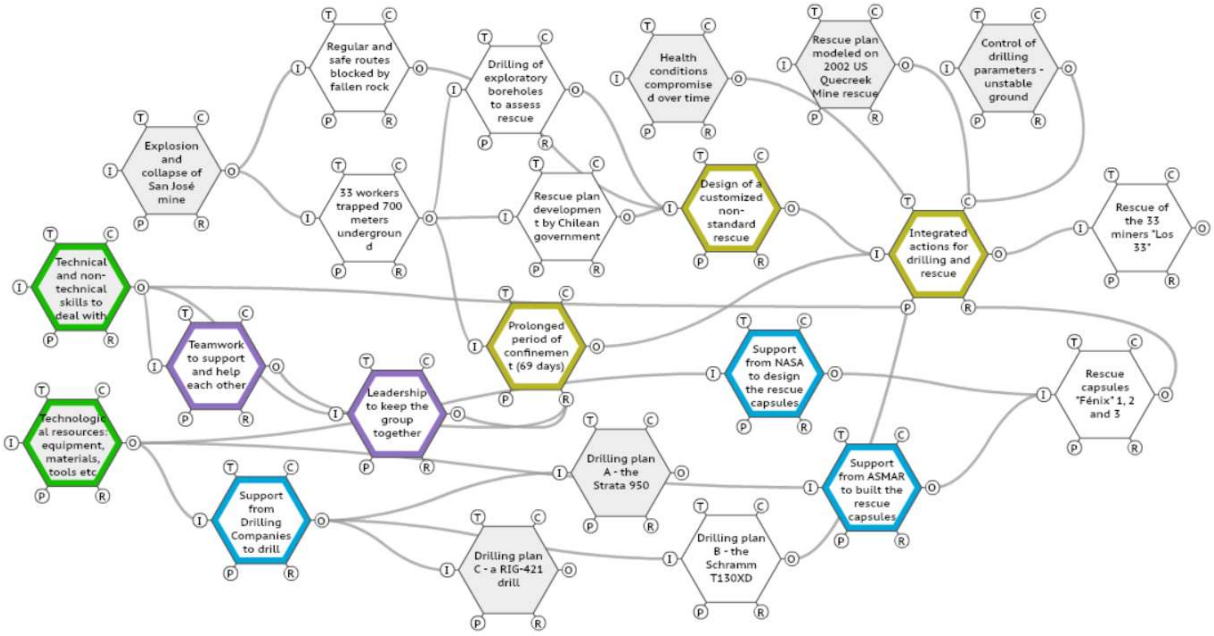

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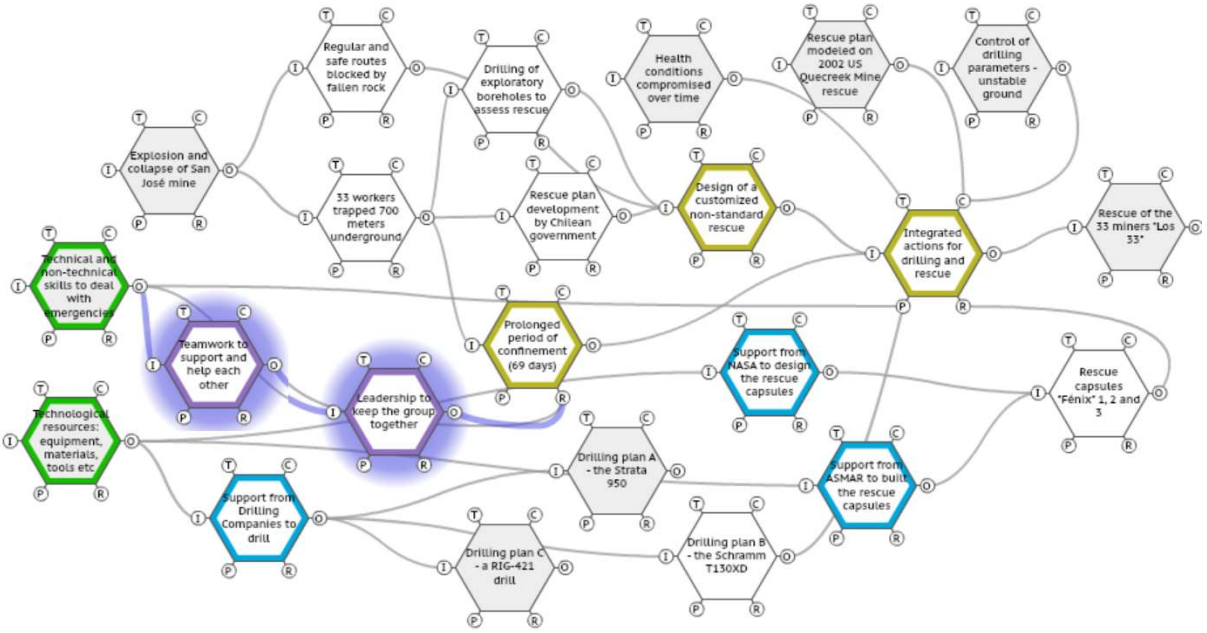

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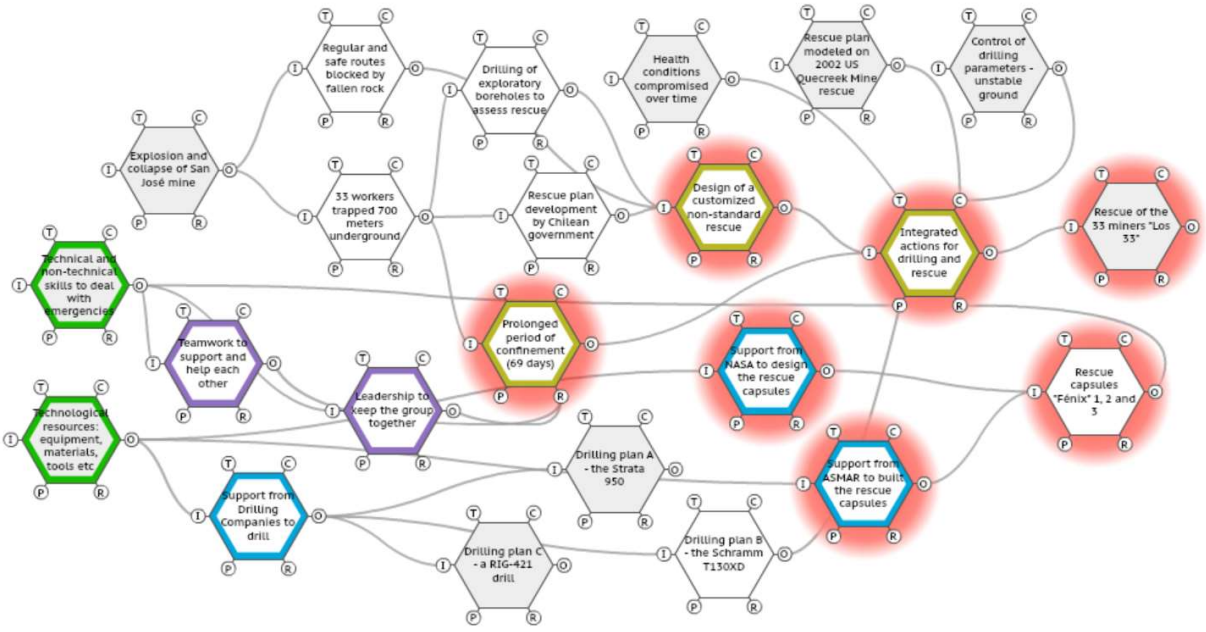

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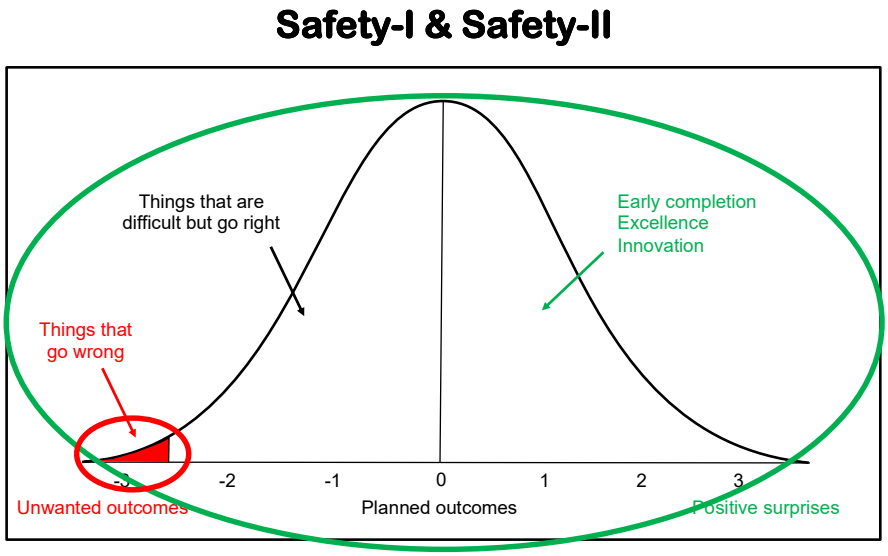

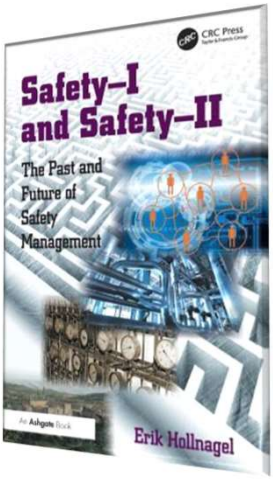

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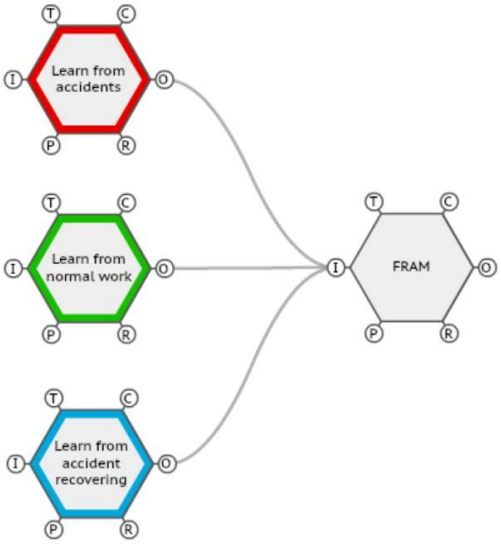

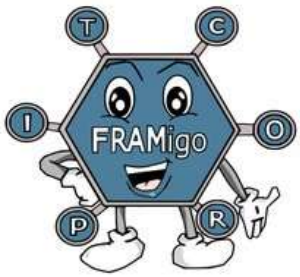

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More than ever before in history, individuals can now band together to solve grand challenges. We face enormous problems, but we 'as individuals' have enormous power to solve them.

Peter H. Diamandis

Since the beginning of the Modern Era, the O&G Industry has been the driving force of all technological evolution of Humanity.

Daniel Yergin, The New Map

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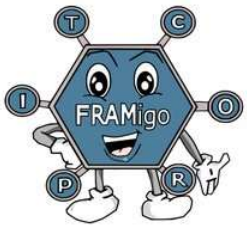

YouTube ***"Professor Josué E. Maia Franca"***

https://www.youtube.com/c/ProfessorJosu%C3%A9EMaiaFranca/videos

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Obrigado!

Tack så mycket!

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