



Leadership for Process Safety

Doctoral Research Project

The paradox of safety:

Challenging the current paradigms of organization and leadership in the prevention of disasters from high hazard technologies

Sponsor:



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www.cranfield.ac.uk/som

Theoretical Background: 'Paradox of paradigms'

Traditional Paradigms

SAFETY:

Engineering; Procedures
... 'Rule-following'
... 'Work as Imagined'

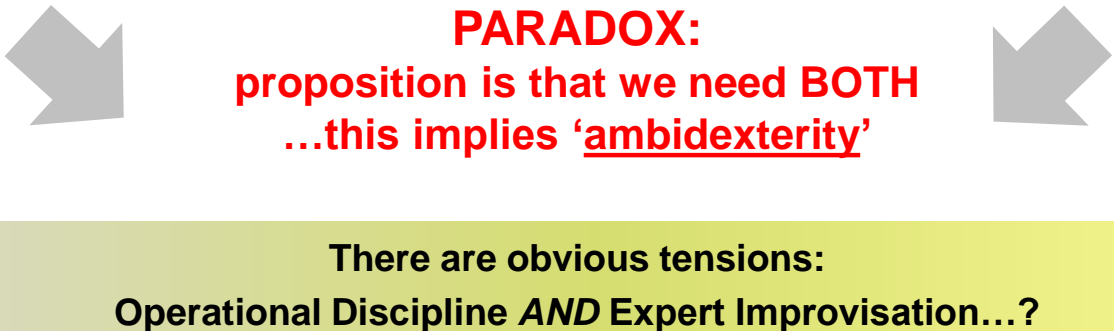
- Systems Engineering
- Operational discipline

New Paradigms

SAFETY:

'High Reliability Organizing' (HRO)
... 'System Safety' ... 'Safety II'
... 'Work as Done'

- Mindful sensemaking
- Expert improvisation



PARADOX:
proposition is that we need BOTH
...this implies 'ambidexterity'

There are obvious tensions:
Operational Discipline *AND* Expert Improvisation...?

The paradox of safety:

Challenging the current paradigms of organization and leadership
in the prevention of disasters from high hazard technologies

Improving Process Safety
...in '3's

Improving Process Safety - *in '3's*

3 Problems

3 Sets of Theories

3 Empirical Studies

3 Types of Incident

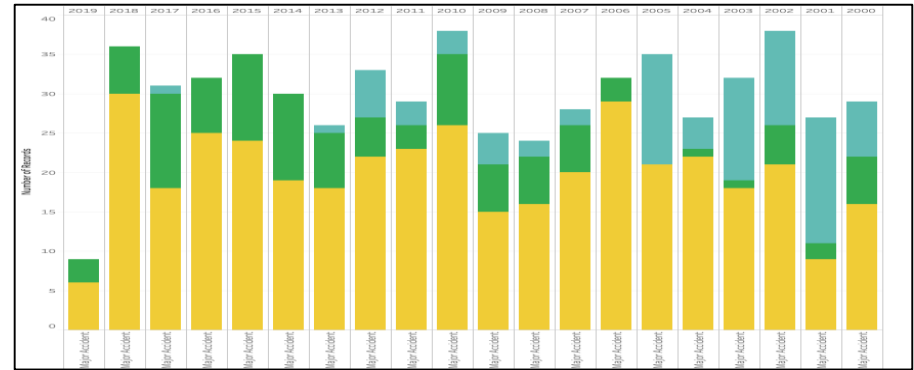
3 Fieldwork Sites

3 Main Conclusions

3 Main Implications for Practice

Why this Research? ...3 Problems

1



Major Chemical Accidents in Europe 2000 – 2019
(average 35 / year)
(from European Commission eMARS database Sep 19)

2

Many REPEAT incidents – indicating **widespread ineffective Organizational Learning**
(neither from incidents nor from normal operations)

3

Persistence in the chemical industry of the 'ADMINISTRATIVE' paradigm of 'Compliance' / 'Hierarchy' / 'Command & Control'

...despite growing research consensus of the importance of '**ADAPTIVE**' processes & practices, that require more flexible organizing and leadership: HRO / 'System Safety' / 'Safety II'



Systematic Literature Review ...3 Sets of Theories

- **Growing literature emphasising importance of ADAPTIVE practices:**

1

- High Reliability Organizing (Weick & Sutcliffe)
- System Safety (Leveson)
- Safety II (Hollnagel)

Sensemaking, mindful compliance, questioning existing processes, deference to expertise, competent improvisation...

ADAPTIVE leadership practices such as listening, reflection, dialogue, synthesizing ideas, catalysing action

ADMINISTRATIVE leadership practices such as planning, directing, monitoring, controlling

ENABLING leadership practices such as sensemaking / sensegiving; supporting formal & informal networks, creating constructive tension

3

- Organizational Learning (Argyris)
- Psychological Safety (Edmondson)

Reflective 'double-loop learning' - questioning assumptions

Climate of psychological safety: trust, low threshold for speaking up, no fear of retribution or ridicule

Research Design...3 Types of Incident

1 Actual Incident

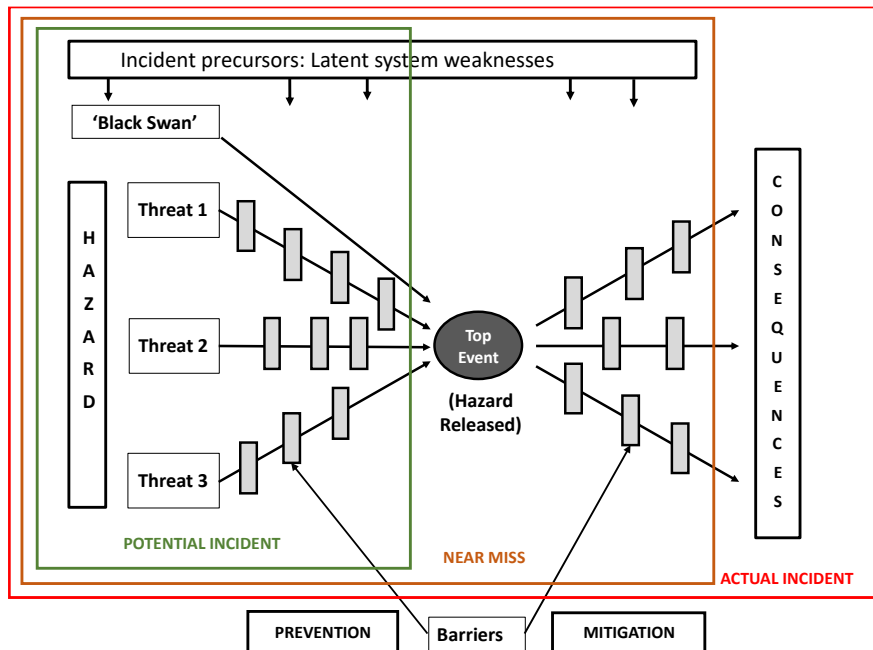
The occurrence of a 'top event' that then results in significant consequences

2 Near Miss

The occurrence of a 'top event' that DOES NOT result in significant consequences

3 Potential Incident

The detection of a system weakness before it could incubate into a release of a hazard.



	People	Environmental damage	Asset loss/Operation impact
5	Multiple fatalities	Catastrophic off-site damage	>\$10M and substantial offsite damage
4	1 or more fatalities	Significant off-site damage	\$1M - \$10M and severe impact
3	Hospitalization injury	On-site or offsite release with damage	\$100K - \$1M and significant impact
2	Lost workday injury	On-site or offsite release without damage	\$10 - \$100K and some impact
1	Recordable injury	On-site release	< \$10K and minor impact

'Significant' = 3 - 5 on this scale

Research Design...3 Empirical Studies

1

Study 1 – Repertory Grid Interviews

How do people construe the important factors for process safety?

- Analysis of 55 interviewees' **constructs**

2

Study 2 – Semi-Structured Interviews

*What kind of leadership and organizational practices are seen, and how do **leadership practices** enable **ambidexterity** in support of process safety?*

- Analysis of 73 interviews to identify **key factors**

(All the interviews were with people working at the sharp end of plant operations and maintenance:

- Operator/Technicians; Supervisors; Ops & Maintenance Managers; Contractors)

3

Study 3 – Critical Review of Accident Analysis

*How are incidents investigated and analysed, and **how could organizational learning be improved?***

- Analysis of 194 documents relating to 117 Incidents to identify **key factors**

Research Project...3 Fieldwork Sites

1

SITE A

- Large petrochemicals complex in the Middle East, in transition from project to operations
- Hierarchical, emphasising compliance
- A number of significant process safety incidents, including fatalities

2

SITE B

- Onshore oil & gas production in Asia-Pacific, rapid growth, recent major project
- Flat hierarchy, moderately open culture
- A number of significant incidents, including serious near-misses and potential incidents

3

SITE C

- Offshore oil & gas production in Europe
- Open culture, high trust and low threshold for speaking up
- No recent significant incidents; recent major award for its process safety performance

Research Project...3 Main Conclusions

1

Both ADMINISTRATIVE and ADAPTIVE practices are important for process safety, and can be mutually enabling

These paradoxically different practices can be successfully entangled by a process of '**collective competent improvisation**'.

This requires a combination of leadership practices that are **adaptive** and **enabling** as well as **administrative** - as described in theories of 'Leadership-As-Practice' and 'Complexity Leadership'. (See Process Diagram - next slide)

2

Organizational Learning is being inhibited by institutionalised highly procedural and compliance norms

This is exacerbated by over-directive leadership practices ... blame culture; over-emphasis of work pressure

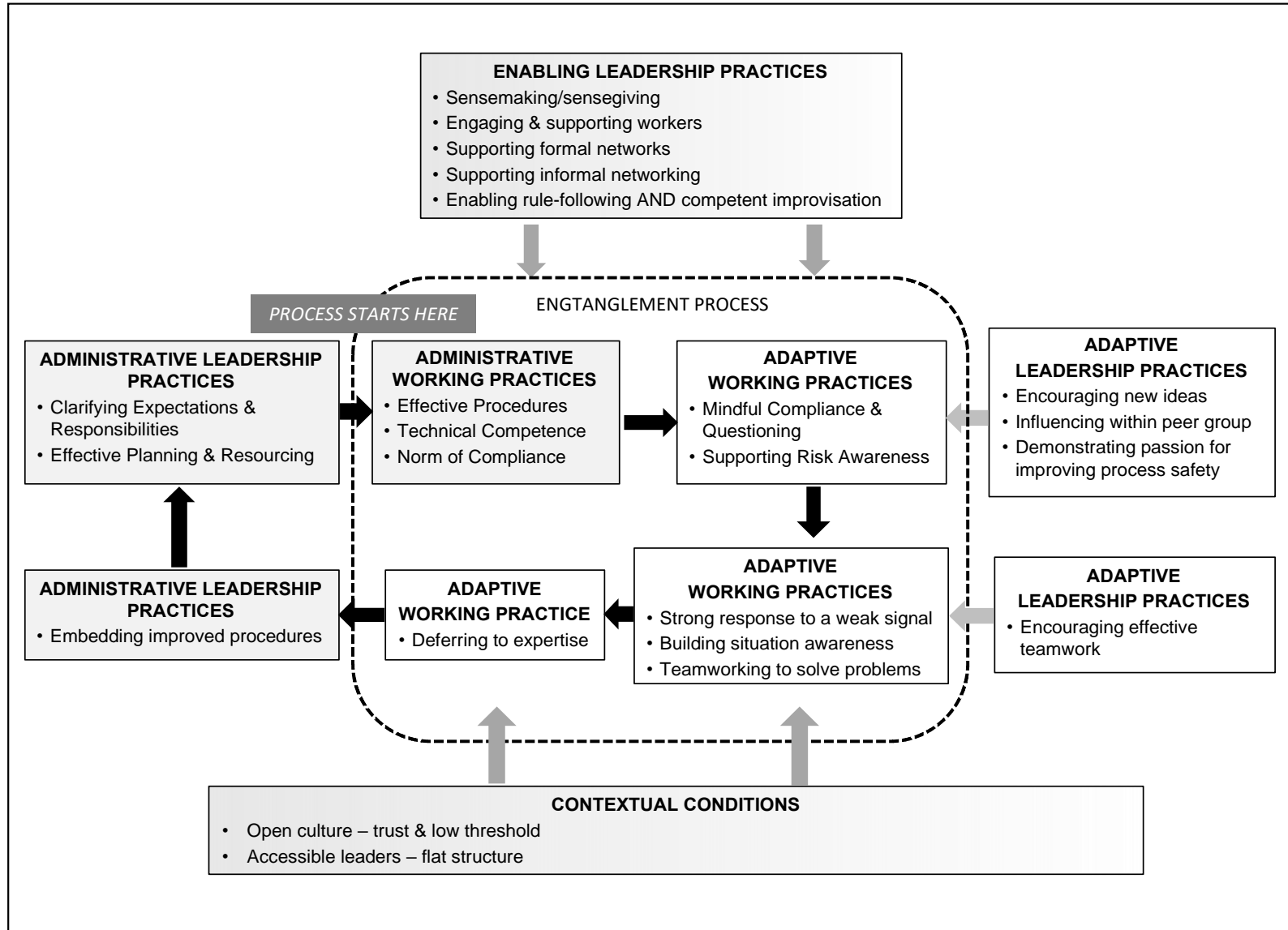
However: Effective Organizational Learning does take place in a climate of psychological safety: a mutually trusting open culture with a low threshold for speaking up, encouraged and supported by **adaptive** and **enabling** leadership practices

3

Incident investigations tend to find causal factors and make recommendations that are largely administrative in nature, overlooking adaptive aspects - limiting the potential for organizational learning.

The focus of incident investigations is largely on Actual Incidents, and to a lesser extent, Near Misses. Investigation of **Potential Incidents** provides many more opportunities for high value learning

Collective Competent Improvisation - process model



3 Main Implications for Practiceto improve organizational learning

1

- Implement a process of '**collective competent improvisation**' based on **continuous mindful sense-checking** and **questioning of existing processes and practices**.

This process emphasises the importance of adaptive working practices such as hazard detection, vigilance and early identification of potential incidents, with their high value for organizational learning.

The process is stimulated and supported by a combination of **leadership practices** - **adaptive** and **enabling** as well as **administrative** - that encourage risk management improvements, teamwork and organizational learning

2

- Create a **climate of psychological safety**

This needs a mutually trusting open culture with a low threshold for speaking up, avoiding blame and over-emphasis of work pressure

Encourage this with a focus on **adaptive** and **enabling** leadership practices

3

- Focus incident investigation and analysis on identifying **causal factors** and making **recommendations** that are **adaptive** in nature

This will stimulate **reflective organizational learning** that questions underlying assumptions

As well as Actual and Near Miss incidents, this should include **Potential Incidents**

What next?

- A new *Hearts & Minds* workshop tool, to stimulate discussion and understanding of how leadership practices influence process safety.

This will focus on:



1. **The current barriers to organizational learning:**

- Institutionalised inhibitions on speaking up
- Over-directive leadership
- Lack of 'psychological safety'

2. The paradox of needing both Adaptive and Administrative working practices, and how the paradox can be resolved by a process of '**collective competent improvisation**'

3. Leadership as formed of **Practices:**

- ideally a combination of **Administrative**, **Adaptive** and **Enabling** practices

- Paper accepted for publishing:

**Constructing safety:
Reconciling Error Prevention and Error Management
in Oil & Gas and Petrochemicals Operations**

Academy of Management Discoveries, In Press

<https://journals.aom.org/doi/abs/10.5465/amd.2019.0190>



- Research based on these findings is continuing at **Cranfield School of Management**



Research Project...3 Main Conclusions (more detail)

1

Both ADMINISTRATIVE and ADAPTIVE practices are important for process safety, and can be mutually enabling.

Mindful, questioning compliance and competent improvisation bring improvements in risk management and also create the conditions for such improvement, reinforcing both compliance and competence.

These paradoxical practices can be successfully entangled by a process of '**collective competent improvisation**' - where the competence is organizational and not just individual. When an established procedure does not fit a local unexpected situation, appropriate technical expertise is brought together to decide on the fix, which is then formally embedded as an improvement.

This requires a combination of leadership practices that are adaptive and enabling as well as administrative - as described in theories of 'Leadership-As-Practice' and 'Complexity Leadership'.

2

Incident investigations tend to find causal factors and make recommendations that are largely administrative in nature, overlooking adaptive aspects - limiting the potential for organizational learning.

Also largely overlooked is causal complexity – that is causation by particular configurations of causal factors. The method of Qualitative Comparative Analysis (QCA) offers potential for addressing this and improving understanding of and learning from complex incidents

The focus of incident investigations is largely on Actual Incidents, and to a lesser extent, Near Misses. Investigation of Potential Incidents provides many more opportunities for high value learning

3

Organizational Learning is being inhibited by the institutionalised highly procedural and compliance norms of our industries – which tend to close down discussion and work against creation of a climate of psychological safety necessary for people to speak up about concerns and question working practices.

This is exacerbated by over-directive leadership practices ... blame culture; over-emphasis of work pressure

However: **Effective Org Learning does take place** in a climate of psychological safety, created by a mutually trusting open culture with a low threshold for speaking up, and adaptive and enabling leadership practices