Using historic data to influence real time hazardous operations

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Accidents and unplanned events continue to cause harm across all industrial sectors. In particular, the same outcomes and causes are observed time and time again across a range of operating environments. So-called 'recurring incidents' are a challenge in many of the hazardous industries despite much existing knowledge of the causes, mechanisms and consequences of workplace accidents.

A major opportunity exists to use our current understanding of people and technology to put existing incident databases to work in pursuit of reducing recurring events as well as improving efficiency and effectiveness of plant operation.

Background

Over the last century the industrial world has changed significantly.

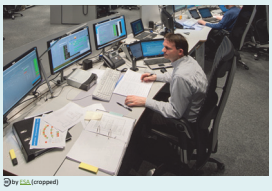
Workers are tasked with precisely managing facilities and equipment that has a complexity and efficiency that could barely have been imagined 100 years ago.

In the last 100 years we have learnt a lot about how accidents occur.

An enormous amount of knowledge exists in corporate databases that contain records of tens of thousands of accidents.

Existing knowledge is not being fully utilised in the form of tools to empower workers to detect and avoid known incidents.

To fully capitalise on this data, we firstly need to better understand how works interact with different information sources



1900-1940	1950	1960	1970	1980	1990	2000	2010	Now	Future

Eras of Industrial Control (Hassall, 2015)

Localised, direct control	Centralised control	Remote, collaborative control

Ages of Safety (Hale & Hovden, 1998; Glendon et. al., 2006; Borys et.al., 2009; Nicholson & Faulkner, 2016)

Technical age	Human factors age	Management systems age	Adaptive age	Data centric age
Integration age				

Key Questions

As an exploratory starting point, two key questions have been posed:

1. What types of decisions do different workers make and what approach do they take?
2. How do information needs change in different circumstances?

Method

Online and paper-based surveys were used to gather data from frontline and other workers.

183 participants took part in the survey with a 75% completion rate. Most participants were from the oil and gas sector (N = 174) from either the Middle East (N = 117) or Oceania/Australia (N = 43).

Participants were divided into 4 groups based on their job:

Frontline	Frontline support	Business support	Leadership
• Well operator • Head console operator • I&E Technician • Maintaining refinery instruments	• Corrosion Engineer • Technical support • Senior process engineer	• Training coordinator • Senior Chemist • Engineer handling small projects	• Manager of operators • General manger • Commissioning superintendent

Results

Frontline (N = 50)

- Follows procedures
- Perceives most decisions as high impact

Information sources	Routine decisions	High-impact decisions
My own knowledge	1st	2nd
Info. provided to me	2nd	1st
Info. I seek out	4th	4th
Knowledge of others	3rd	3rd

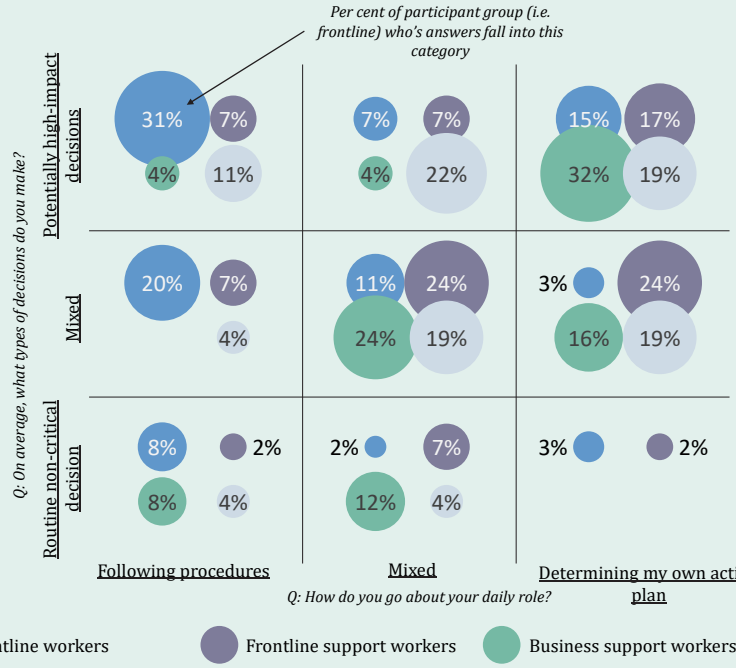
Scores are based on weighted averages of responses to forced ranking question asking about preferred information

Business Support (N = 24)

- Tends to determine own action plan
- Mixture of different decision types

Information sources	Routine decisions	High-impact decisions
My own knowledge	1st	2nd
Info. provided to me	2nd	1st
Info. I seek out	3rd	3rd
Knowledge of others	4th	4th

Scores are based weighted averages of responses to forced ranking question asking about preferred information



Frontline Support (N = 35)

- Tends to determine own action plan
- Perceives most decisions as routine

Information sources	Routine decisions	High-impact decisions
My own knowledge	1st	1st
Info. provided to me	2nd	2nd
Info. I seek out	3rd	3rd
Knowledge of others	4th	3rd

Scores are based on weighted averages of responses to forced ranking question asking about preferred information

Leadership (N = 26)

- Tends to determine own action plan
- Sees most decisions potentially high-impact

Information sources	Routine decisions	High-impact decisions
My own knowledge	1st	2nd
Info. provided to me	2nd	1st
Info. I seek out	3rd	4th
Knowledge of others	3rd	3rd

Scores are based on weighted averages of responses to forced ranking question asking about preferred information

Frontline workers | Frontline support workers | Business support workers | Leadership

Discussion

Frontline workers appear to be unique

In terms of the types decisions being made and the general mode of work, frontline workers appear to predominantly follow procedures and engage in high-risk decision making.

This pattern is to be expected as frontline workers are typically trained to follow procedures in most circumstances (normal operations through to emergence situations)

Frontline workers are the closest in proximity and time to process hazards and can influence them directly. It makes sense that they have a unique set of needs to manage these risks.

There is diversity within populations

Within populations there is a range of approaches to the way individuals work (e.g. procedure vs. self planning) and decision making (i.e. routine vs. critical decisions).

The variation is evident in the spread of responses for both questions although there is some clustering in each of the populations.

Answers to other survey questions (not included here) also showed significant spread highlighting how individual needs can vary markedly from the population average.

Information needs change based on context

Between routine, non-critical decisions and high-impact decisions the preferred information source varied in three out of four of the surveyed populations.

In general, individual knowledge (e.g. on the job experience) drives routine decision making but individuals defer to provided information (e.g. procedures) for high-impact decisions.

1. Understand the needs of workers → 2. Analysis of incident databases → 3. Understand links between worker needs to known incident patterns → 4. Tools to link operational activity to incident patterns → 5. Workers are better able to detect and avoid known incidents