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# Managing Safety and Operations: The Effect of Joint Management System Practices on Safety and Operational Outcomes

Lynda Robson, Emile Tompa, Anna Sarnocinska-Hart, Robert Klassen, Anton Shevchenko, Sharvani Sharma, Sheilah Hogg-Johnson, Benjamin Amick, David Johnston, Anthony Veltri, Mark Pagell

November 8, 2016

# Associated publications

**Tompa E, Robson L, Sarnocinska-Hart A,** Klassen R, Shevchenko A, Sharma S, **Hogg-Johnson S, Amick BC,** Johnston DA, Veltri A, **Pagell M***. Managing safety and operations: the effect of joint management system practices on safety and operational outcomes. *Journal of Occupational and Environmental Medicine* 2016;58(3):e80-e89.

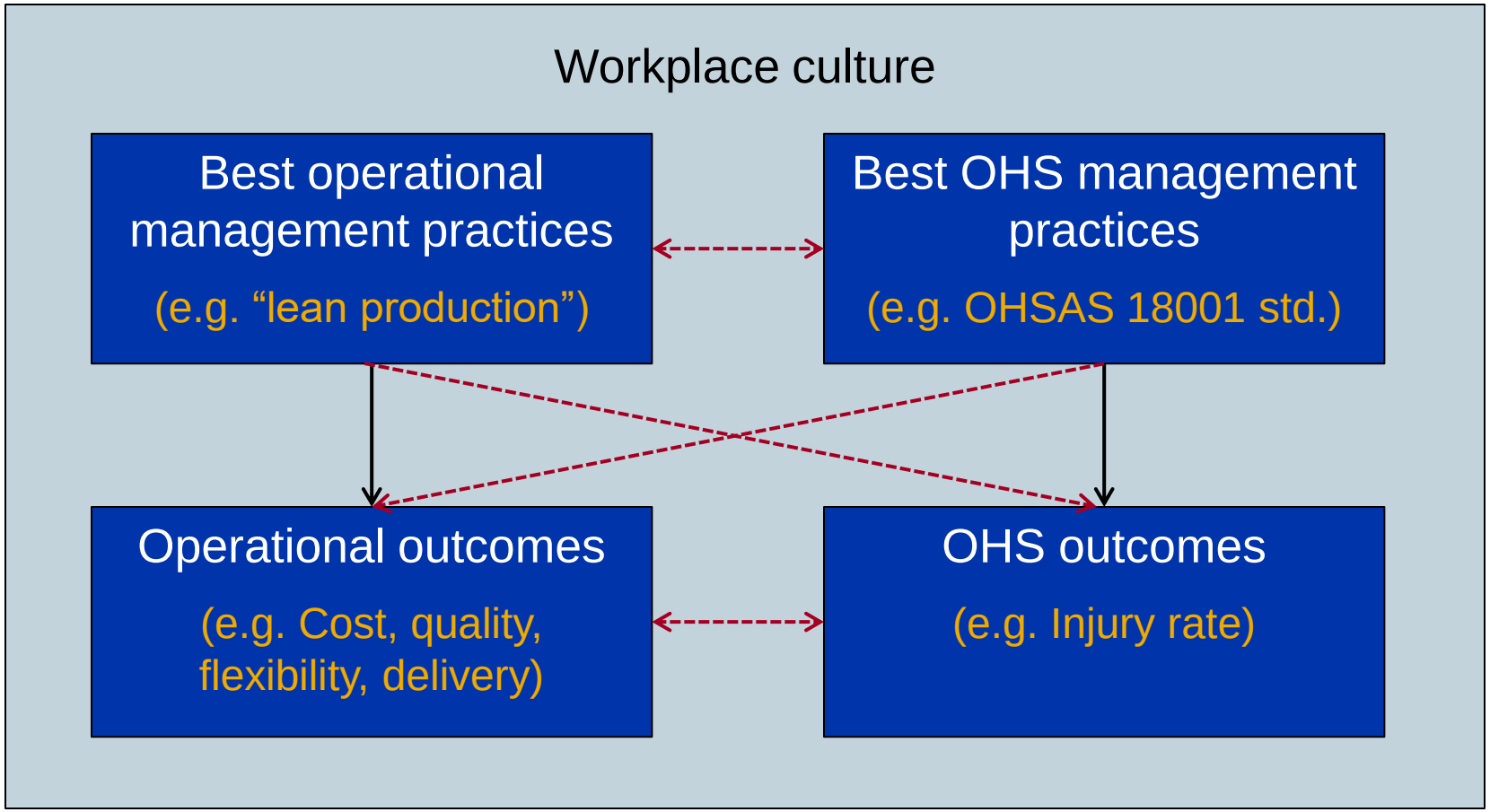
**Pagell M***, Klassen R, Johnston D, Shevchenko A, Sharma S. Are safety and operational effectiveness contradictory requirements: the roles of routines and relational coordination. *Journal of Operations Management* 2015;36:1-14.

** Mark Pagell, PhD, Chair Global Leadership, Professor Sustainable Supply Chain Management, University College Dublin, Ireland – Principal Investigator*

# Outline

- Background
- Phase 1 - qualitative – multiple case study
- Phase 2 - quantitative – survey-based
- Takeaway messages

# Sphere of interest and conceptual framework



# How is goal achievement in safety related to goal achievement in operations?

- Synergy?
- Trade-off?
- Complementarity?

# Complementarity/synergy argument

- Apparent overlap / similarity in operational and OHS best practices
  - e.g., preventive maintenance, employee involvement
- Trend of integration of management systems for quality and OHS, e.g. ISO 9001, OHSAS 18001 (Sampaio et al. 2012)
- Reviews of OHS and ergonomic intervention research show benefits to organizational outcomes (Tompa et al. 2009, Neumann & Dul 2010)

# Trade-off argument

- Managerial attention is finite (March 1994, Ocasio 1997)
- Safety climate research assumes "...rules and procedures associated with safety compete with those associated with other domains (e.g. safety versus productivity...)" (Zohar 2010)
- "Lean" interventions have been associated with poorer OHS outcomes (Landsbergis et al. 1999; Hasle 2014)

# "Lean production"

- "An integrated set of activities designed to achieve high-volume production using minimal inventories of raw materials, work-in-process, and finished goods" (manufacturing)

- Consists of four management practice bundles:
  - Just-in-time production
  - Total preventive maintenance
  - Total quality management
  - Human resource management (high involvement)

*Operations Management for Competitive Advantage, 11th ed (2006)*
*Shaw & Ward (2003) J Operations Mgmt*

# Phase 1 study: multiple case qualitative study

- 10 Ontario worksites
  - Varied manufacturing (n = 8) and distributing (n = 2)
  - Size (80 to 900 employees)
  - Unionized and non-unionized

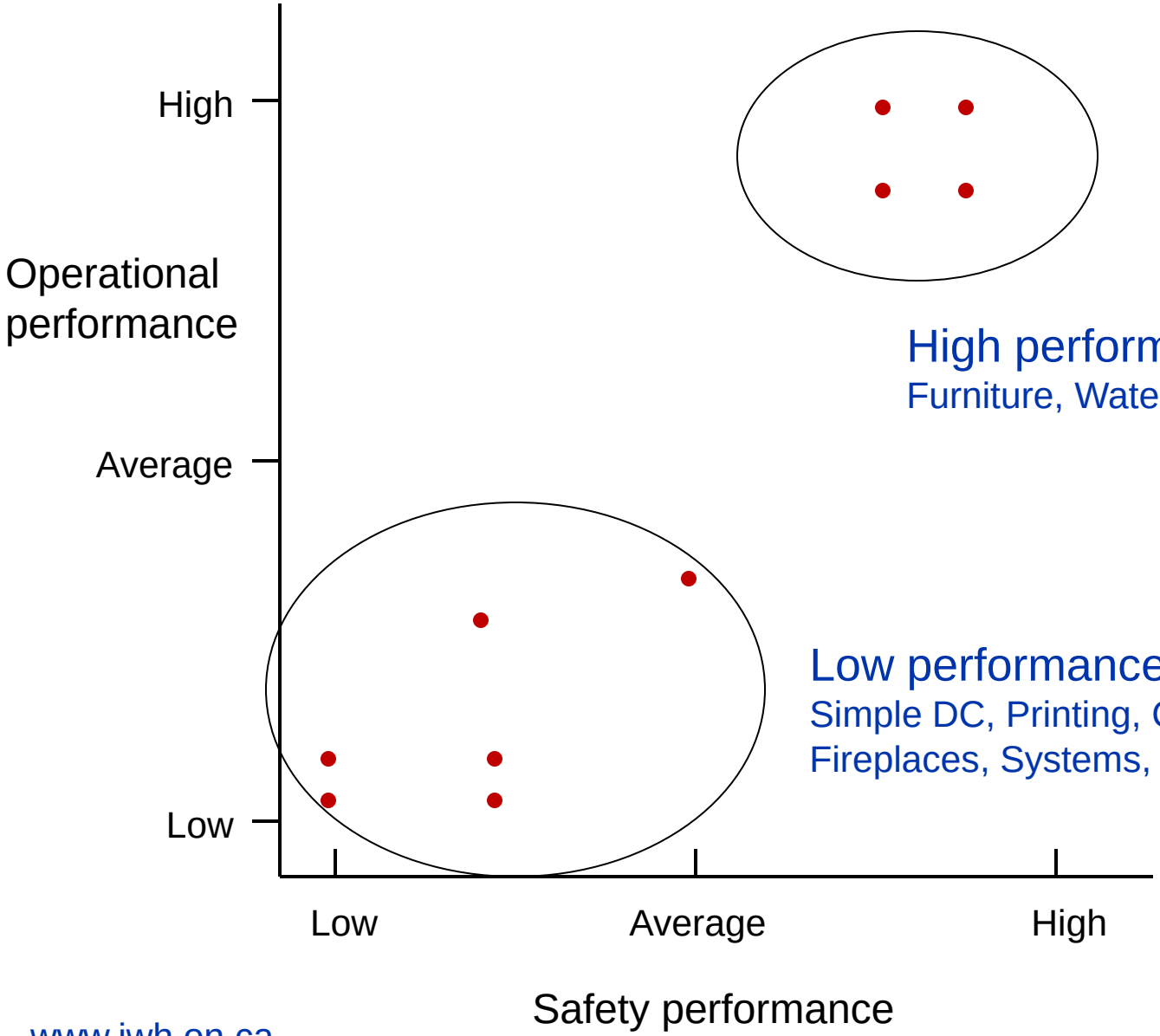
Veltri A, Pagell M, Johnston D, Tompa E, Robson L, Amick III BC, Hogg-Johnson S, Macdonald S. Understanding safety in the context of business operations: an exploratory study using case studies. *Safety Science* 2013;55:119-134.

Pagell M, Johnston D, Veltri A, Klassen R, Biehl M. Is safe production an oxymoron? *Production and Operations Management* 2014;23:1161-75.

# Data collection

| Concept | Method |
|---|---|
| Management practices – safety and operations | • Interviews, 4-5 managers (and union rep where applicable) |
| Operational outcomes | • Self-report scale, operational manager |
| Safety outcomes | • WSIB injury claims relative to sector<br>• Safety climate, worker-assessed |

# Two groups of firms emerged from case study analysis




**High performance cluster**
Furniture, Water, Plastics , Metals

**Low performance cluster**
Simple DC, Printing, Complex DC, Fireplaces, Systems, Smelter

# **High** performance cluster

| **Culture:**<br>**Supportive to ops & safety** | |
|---|---|
| • Committed to safety<br>• Disciplined – rules are followed<br>• Prevent problems<br>• Participatory | |

# **High** performance cluster

| **Culture:**<br>**Supportive to ops & safety** | **Management Practices:**<br>**Joint management system (JMS)** |
|---|---|
| • Committed to safety<br>• Disciplined – rules are followed<br>• Prevent problems<br>• Participatory | • Process-focused<br>• Safety in production (re)design<br>• Safety in operational communications<br>• Safety accountability within operations<br>• Safety in HR mgmt. of mgrs./supervisors |

** JMS = set of formal processes that allow for the shared planning, measurement, monitoring and continuous improvement of both operations and safety*

# Routes to JMS

- three cases evolved JMS via OHS management system

- one case evolved JMS via operations

# Low performance vs. high performance cluster

| | Culture | Management practices |
|---|---|---|
| **High performance cluster** | Supportive of both safety and operations | JMS present |
| | | |

# Low performance vs. high performance cluster

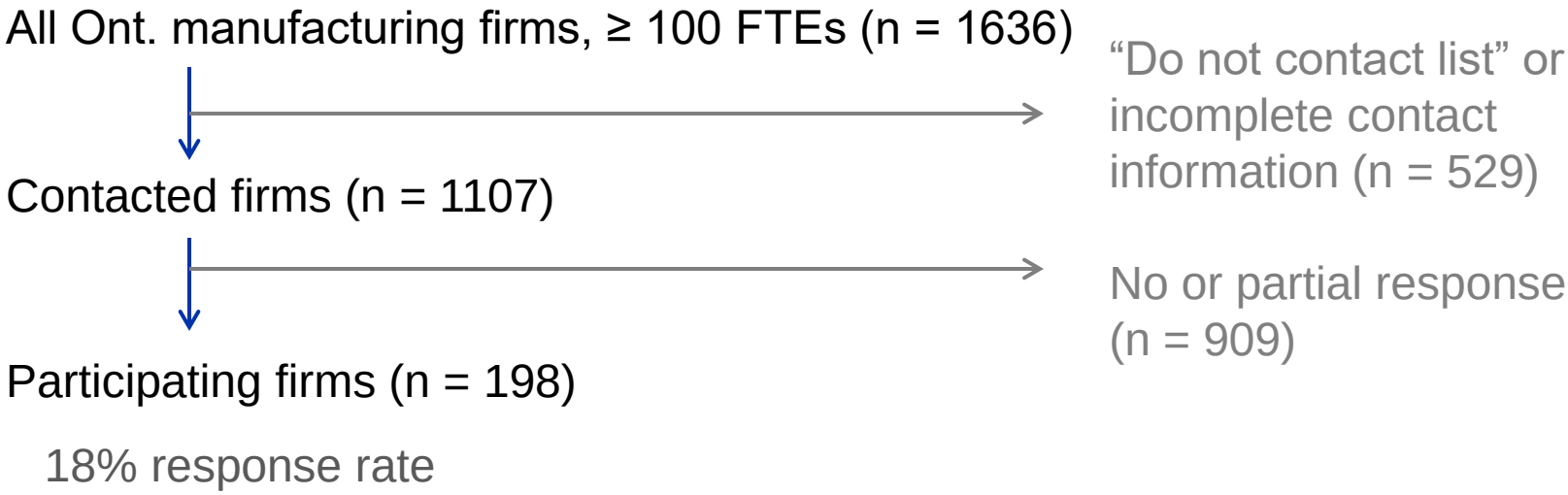
| | Culture | Management practices |
|---|---|---|
| **High performance cluster** | Supportive of both safety and operations | JMS present |
| **Low performance cluster*** | "Day-to-day" culture | JMS absent |

* Not only safety was being "traded off" in the low performance cluster, but also longer term operational outcomes

# Phase 2: Quantitative study with manufacturing firms

- Tested the positive relationship of “joint management system” (JMS) practices with operational and safety outcomes
- Cross-sectional survey linked to workers’ comp. claims data
  - Pair of survey respondents per firm
    - » Operations manager
    - » Safety manager
- Robust regression analyses:
  - JMS predictor and four operational outcomes
  - JMS predictor and six safety outcomes

# Sample selection



# Outcomes used in regression analyses

| Outcome domain | Operations | Safety |
|---|---|---|
| **Outcome measures** | • Cost<br>• Quality<br>• Delivery<br>• Flexibility | • Total (LT and NLT) claim rate<br>• No-lost-time (NLT) claim rate<br>• Lost-time (LT) claim rate<br>• MSD LT claim rate<br>• Acute trauma LT claim rate<br>• LT benefit day rate |
| **Source of data** | • Ops manager, questionnaire, 2011 | • Workers' compensation administrative files, 2010-11 |
| **Standardization** | • "compared...to... your competitors" | • Rate expressed relative to mean rate for sub-sector (z-score) |

# JMS operationalization: survey measures

| JMS Dimensions | JMS Measures |
|---|---|
| • Process focussed | • Operational processes defined<br>• Monitoring operations / safety |
| • Safety in production (re)design | • Risk identification and control |
| • Safety in operational communications | • Management safety communication frequency |
| • Safety accountability in operations | *Not available* |
| • Safety in HR mgmt. of mgrs./supervisors | *Not available* |

*Following analyses of distribution of responses, internal consistency, structural validity*

# JMS items

## Operational processes defined

- ...jobs are well defined
- ...jobs can only be done one right way *(safety mgr only)*
- ...standardized process instructions given to workers
- ...before new job started, best way to do it is defined

## Monitoring operations / safety*

- ...continuously monitor to ensure control of risks to operations/safety*
- ...continuously monitor achievement of operational/safety objectives*

## Risk identification and control

- ...system to identify risks in all jobs
- ...risks documented
- ...risks prioritized
- ...controls created for all risks

## Mgmt safety communication frequency

- ... about safety goals
- ... about plant making safety improvements
- ...about key safety priorities

** Different items for operations & safety managers*

# JMS operationalization: cluster analysis (1)

- two clusters of firms based on the **operations** managers' responses

| JMS Measures | Ops managers cluster 1 (n = 131) | Ops managers cluster 2 (n = 67) |
|---|---|---|
| • Operational processes defined | + | - |
| • Monitoring operations | + | - |
| • Risk identification and control | + | - |
| • Mgmt safety communication | + | - |

# JMS operationalization: cluster analysis (2)

- two clusters of firms based on the **safety** managers' responses

| JMS Measures | Safety managers cluster 1 (n = 127) | Safety managers cluster 2 (n = 71) |
|---|---|---|
| • Operational processes defined | + | - |
| • Monitoring safety | + | - |
| • Risk identification and control | + | - |
| • Mgmt safety communication | + | - |

# JMS operationalization: final step

- Four JMS groups based on combining results of the two cluster analyses

| JMS Measures | JMS Present (O+S+) n = 95 | | JMS Ops Emphasis (O+S-) n = 36 | | JMS Safety Emphasis (O-S+) n = 32 | | JMS Absent (O-S-) n = 35 | |
|---|---|---|---|---|---|---|---|---|
| • Operational processes defined | + | + | + | - | - | + | - | - |
| • Monitoring operations / safety | + | + | + | - | - | + | - | - |
| • Risk identification and control | + | + | + | - | - | + | - | - |
| • Mgmt safety communication freq. | + | + | + | - | - | + | - | - |

O = operations mgr; S = safety manager

# JMS operationalization: final step

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| JMS Measures | JMS Present (O+S+) n = 95 | | JMS Ops Emphasis (O+S-) n = 36 | | JMS Safety Emphasis (O-S+) n = 32 | | JMS Absent (O-S-) n = 35 | |
|---|---|---|---|---|---|---|---|---|
| • Operational processes defined | + | + | + | - | - | + | - | - |
| • Monitoring operations / safety | + | + | + | - | - | + | - | - |
| • Risk identification and control | + | + | + | - | - | + | - | - |
| • Mgmt safety communication freq. | + | + | + | - | - | + | - | - |

O = operations mgr; S = safety manager

# Regression results for models with operational outcomes: standardized coefficients

| | Cost | Quality | Delivery | Flexibility |
|---|---|---|---|---|
| JMS present O+S+ (ref) | 0.000 | 0.000 | 0.000 | 0.000 |
| JMS absent O-S- | -0.136 | -0.426** | -0.661*** | -0.356* |
| $R^2$ | 0.039 | 0.139 | 0.207 | 0.156 |

Models also include control variables (FTEs, % temp workers, % overtime, complexity, munificence, dynamism), as well as dummy variables for remaining two JMS groups.

* p < 0.1, ** p < 0.05, *** p < 0.01

# Regression results for models with 2010-11 claims outcomes: standardized coefficients

| | Total Claim Rate | No-lost-time Claim Rate | Lost-time (LT) Claim Rate | LT Acute Trauma Claim Rate | LT MSD Claim Rate | LT Benefit Day Rate |
|---|---|---|---|---|---|---|
| JMS present O+S+ (ref) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| JMS absent O-S- | 0.238** | 0.261** | 0.213 | 0.152 | 0.173 | 0.156* |
| $R^2$ | 0.430 | 0.407 | 0.229 | 0.183 | 0.089 | 0.062 |

Models also include control variables (FTEs, % temp workers, % overtime, complexity, munificence, dynamism, past claims performance 2008-9), as well as dummy variables for remaining two JMS groups.

* $p < 0.1$, ** $p < 0.05$

# Limitations in Study 2

- Limited sample size ➔ low precision in models
- Limited generalizability: only manufacturing, ≥100 FTE
- Some dimensions of JMS unmeasured in survey study:
  - Safety accountability in operations
  - Safety in HR management (e.g. job promotion)
- Only manager respondents
- Operational outcomes based on self-report
- Safety outcomes based on claims data
- Cross-sectional design

# Takeaway messages from the two studies

- No evidence that the achievement of operational and safety goals necessitate tradeoffs at the plant level
- Safety and operational success are associated with “joint management system” practices
- “Joint management system” practices involve the integration of safety into operational practices and good management of operational processes

# Acknowledgements


- Project supported by Workplace Safety & Insurance Board of Ontario Research Advisory Committee Grant

- IWH operates with the support of the Province of Ontario

- The views expressed in this document are those of the authors and do not necessarily reflect those of the Province of Ontario

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# Questions?

# Other note about JMS: drawn from earlier qualitative study

- Three  of four JMS-present workplaces arrived at JMS by first adopting an OHSMS, and then extending practices to operations

- Fourth by including safety as paramount metric of operational effectiveness in lean production system

# Regression results for models with operational outcomes

| | Cost | Quality | Delivery | Flexibility |
|---|---|---|---|---|
| JMS present O+S+ (ref) | 0.000 | 0.000 | 0.000 | 0.000 |
| JMS ops emphasis O+S- | 0.068 | 0.072 | -0.167 | 0.009 |
| JMS safety emphasis O-S+ | -0.358 | -0.493** | -0.677*** | -0.512 |
| JMS absent O-S- | -0.136 | -0.426** | -0.661*** | -0.356* |
| $R^2$ | 0.039 | 0.139 | 0.207 | 0.156 |

Models also include the following control variables: FTEs, % temp workers, % overtime, complexity, munificence, dynamism

* p < 0.1, ** p < 0.05, *** p < 0.01

# Regression results for models with 2010-11 claims outcomes (1)

| | Lost-time (LT) Claim Rate | LT Benefit Day Claim Rate | LT MSD Claim Rate | LT Acute Trauma Claim Rate |
|---|---|---|---|---|
| JMS present O+S+ (ref) | 0.000 | 0.000 | 0.000 | 0.000 |
| JMS ops emphasis O+S- | 0.277** | 0.161** | 0.140 | 0.295** |
| JMS safety emphasis O-S+ | -0.055 | -0.063 | -0.058 | 0.001 |
| JMS absent O-S- | 0.213 | 0.156*** | 0.173 | 0.152 |
| $R^2$ | 0.229 | 0.062 | 0.089 | 0.183 |

Models also include the following control variables: FTEs, % temp workers, % overtime, complexity, munificence, dynamism, past claims performance 2008-9

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

# Regression results for models with 2010-11 claims outcomes (2)

| | Total Claim Rate | No-lost-time Claim Rate |
|---|---|---|
| JMS present O+S+ (ref) | 0.000 | 0.000 |
| JMS ops emphasis O+S- | 0.045 | 0.168 |
| JMS safety emphasis O-S+ | 0.151 | 0.238** |
| JMS absent O-S- | 0.238** | 0.261** |
| $R^2$ | 0.430 | 0.407 |

← ??

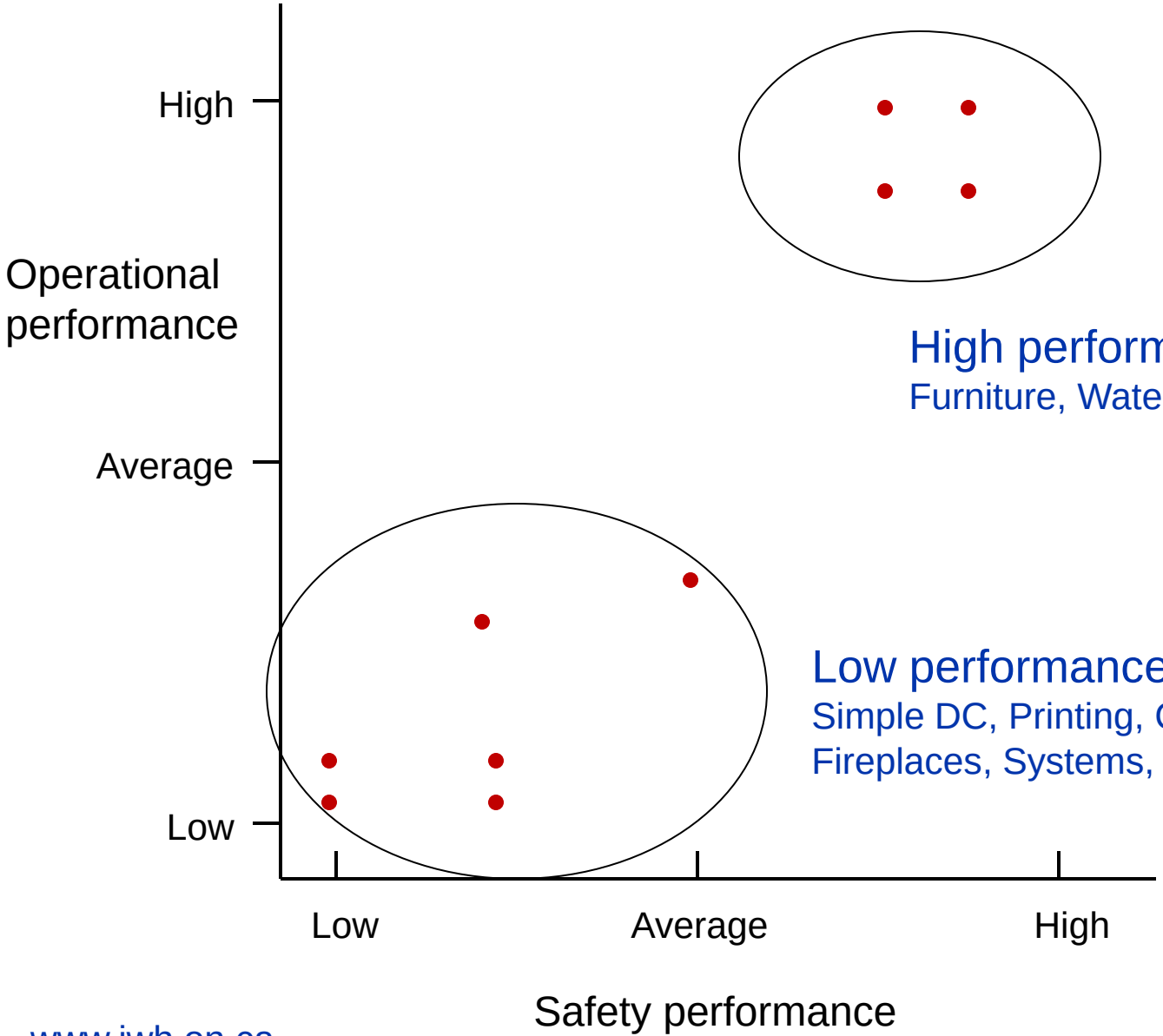
Models also include the following control variables: FTEs, % temp workers, % overtime, complexity, munificence, dynamism, past claims performance 2008-9

* p < 0.1, ** p < 0.05, *** p < 0.01

# **Low** performance cluster

| **Culture:** “Day-to-day” | **Practices:** Lacking JMS |
|---|---|
| • Not committed to safety<br>• Less disciplined w rules<br>• React to problems<br>• Less/not participatory | • Safety practices managed separately from operations; ineffective<br>• Operational practices focused on short-term priorities |

# Pattern supportive of complementarity/synergy not tradeoff

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