

ROTTERDAM SCHOOL OF MANAGEMENT
ERASMUS UNIVERSITY

DEPARTMENT OF TECHNOLOGY AND INNOVATION MANAGEMENT

**MAAKT DE LOGISTIEK
MANAGER HET
VERSCHIL?**



RENE DE KOSTER, SMARTPORT
SMARTPORT ONTBIJTSESSIE
DELTALINGO-DIALOG
23 MEI 2012

The business school that thinks
and lives in the future



2


Program

A. Productivity? ↑
J.A Larco, PhD thesis , 2010

B. Accidents? ↓
- JOM, 2011, with D. Stam & B. Balk
- J. de Vries (Mphil student)

C. Stockouts? ↓
S. Ockhuisen, 2012 (MSc student)


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3

**A. Can we influence worker
productivity?**

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4

**A. Can we influence worker
productivity?**

Order pick experiment

- We set order picking goals for different groups of workers
- Does this work?

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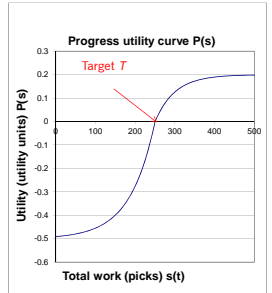


5

Theory: Prospect theory (Kahneman & Tversky 1979)

"Motivation" of working at speed $s(t)$:

1. Strictly increasing
 $P'(s(t)) \geq 0; t \in [0, D]$
2. Loss aversion
 $P(T + \delta) < P(T - \delta); \delta > 0;$
3. Diminishing sensitivity
 $P''(s(t)) > 0; s < T$
 $P''(s(t)) < 0; s > T$
4. Inflection point

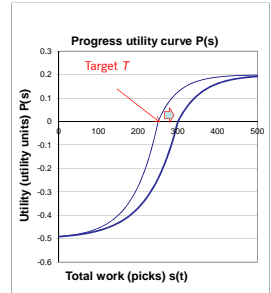


6

Theory: Prospect theory (Kahneman & Tversky 1979)

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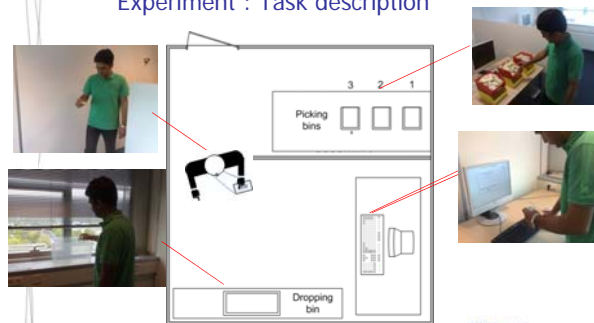


Experiment Design

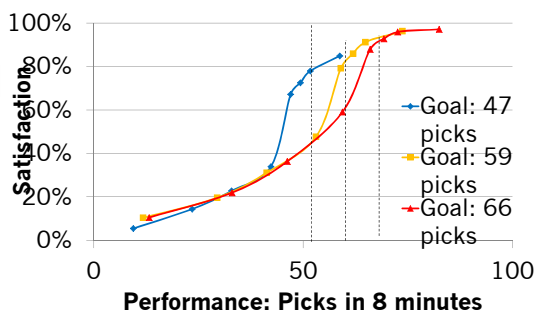
- Simple order picking task, short cycled (<10 sec)
- Learning effects controlled
- **Within subject design:** 3 randomized goal levels (10,50,90th percentile) **per** subject (n=81 subjects) + "Do your best" control (n=36 subjects)
- **Process view:** time stamps recorded
- For each goal:
 - Motivation Level measured (S-curve)
 - Subjective likelihood of success
 - Quality and fatigue



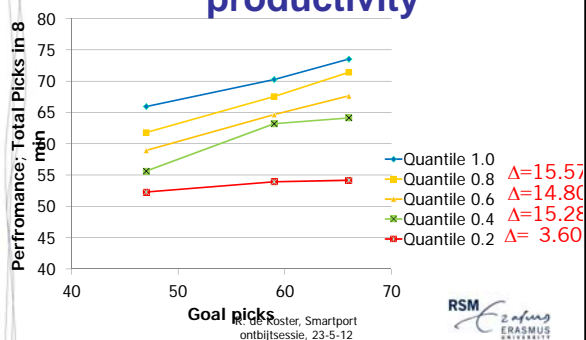
Experiment : Task description



Results 1: Evidence for prospect theory (valuation)



Results 2: Impact on worker productivity



Conclusies (deel A: productiviteit)

- Mensen ontlenen meer motivatie aan harder werken
- Ca. 80% van de mensen is in staat gem 15% productiever te werken met de juiste stimulansen
- Mits manager juiste doelen stelt



B. Accidents happen....?



1. Research Motivation

13

Netherlands:

- 2007: 219,000 work related serious injuries (Venema et al., 2009)
- Between 87-147 annual occupational deaths (2000-2007)
- Direct hospital costs: €95M, work absence: €220M (2007)
- 2008: 1,700 serious forklift related accidents in warehouses (www.logistiek.nl), 126/year permanently disabled / lethal



USA:

- 94,750 forklift-related injuries annually (NIOSH)





2. Research question

14

Employee Reckless Driving



Forklift Collision with Storage Racks

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Many accidents caused by forklifts

15

Employee Reckless Driving

Forklift Collision with Storage Racks

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2. Research question

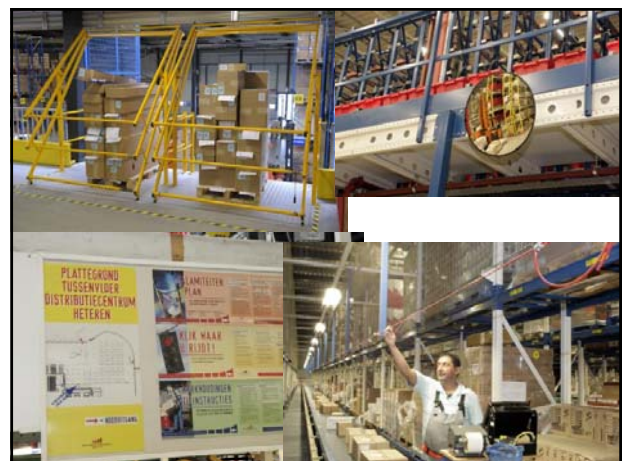
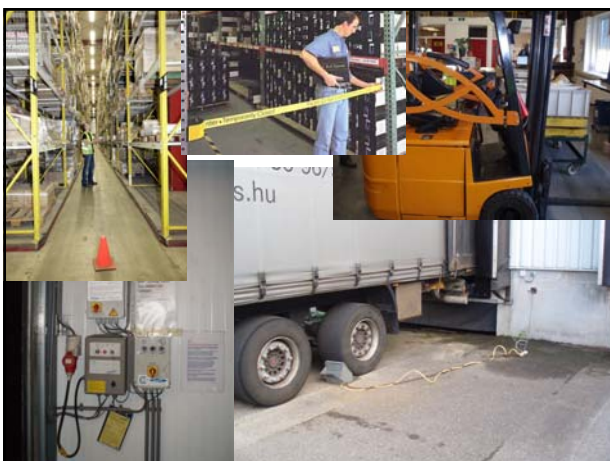
16



RQ: Which measures really help to reduce such accidents?

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Quick survey

- What is the most important determinant to reduce accidents?

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3. Two main theories

- NAT, Normal Accident Theory (Perrow, 1984): accidents arise from systems and are unavoidable in complex, tightly coupled systems
- HROT, High Reliability Organizational Theory (La Porte, 1996; Roberts, 1990): highly-reliable organizations exist, even with complex, tightly coupled processes, thanks to specific systems and processes. Management practices are the key drivers

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In warehouses: which theory is more valid?

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In warehouses: which theory is more valid?

In line with HROT we conjecture Hazard Reducing Systems (HRS) may impact accidents in warehouses

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Conceptual model

Safety performance
(accidents)

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Conceptual model

Safety consciousness

→ H2 →

Safety performance
(accidents)

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Conceptual model

Safety transformational leadership

→ H3 →

Safety consciousness

→ H2 →

Safety performance
(accidents)

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Conceptual model

Hazard reducing systems

→ H4 →

Safety transformational leadership

→ H3 →

Safety consciousness

→ H2 →

Safety performance
(accidents)

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29

Conceptual model

Hazard reducing systems

→ H4 →

Safety transformational leadership

→ H3 →

Safety consciousness

→ H2 →

Safety performance
(accidents)

Lack of accident registration

→ H1 →

Safety transformational leadership

→ H3 →

Safety consciousness

→ H2 →

Safety performance
(accidents)

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30

Conceptual model

Hazard reducing systems

→ H4 →

Safety transformational leadership

→ H3 →

Safety consciousness

→ H2 →

Safety performance
(accidents)

Lack of accident registration

→ H5 →

Safety transformational leadership

→ H3 →

Safety consciousness

→ H2 →

Safety performance
(accidents)


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31

4. Method: Data collection

- 1,708 companies selected from a list of 6,000 warehouses of BMWT; size >5 direct warehouse fte, non-dangerous goods
- 1,466 listings correct (i.e. a warehouse)
- 90 respondents (6.1%), 78 useable

14 companies visited in person
78 manager questionnaires
1,033 worker questionnaires

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Construct operationalization: SP

SP (safety performance); measured by its inverse: the number of accidents

- 4 accident categories:
 - 1- Occupational accidents resulting in injury, but not leading to absence, 2- Occupational accidents resulting in injury and a minimal absence of 1 day, 3- Occupational accidents resulting in hospital admission after a visit to the emergency department of a hospital, 4- Fatal occupational accidents.
- Nr of accidents per fte per category during 3.5 years (2006-2009)

Extra variable: LAR (Lack of Accident Registration)


All accident data verified with data of Ministry of SZW

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Construct operationalization: HRS


HRS (Hazard Reducing Systems); based on safety handbook of BMWT, VeLA and ministry of Social Affairs (BMWT, 2005), containing 300 potential measures in warehouses, in 4 categories: human factors, equipment factors, organizational factors and environmental factors.

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HRS

<p>Human factors (HF)</p> <ul style="list-style-type: none"> • Job training • Competencies • Knowledge/Experience • etc 	<p>Equipment factors (EF)</p> <ul style="list-style-type: none"> • Certification of equipment • Maintenance of equipment • Use and goodness of fit • Ergonomics of equipment use • etc
<p>Organizational Factors (OF)</p> <ul style="list-style-type: none"> • General safety procedures • Specific safety procedures • Safety training • Safety monitoring and feedback • Work pressure • etc 	<p>Environmental factors (ENV)</p> <ul style="list-style-type: none"> • Flow separation • Storage separation • Waste removal & handling, active cleaning • (day)Light (ergonomics) • Personal Protective equipment • Noise (ergonomics) • Floor quality • Air quality/ active ventilation • Safety signs/ indicators, and equipment • Security and theft prevention • Fire prevention/ escapes • etc

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HRS

Measure: 69 HRS-related items measured on a five-point scale (totally disagree-totally agree; plus one "not applicable" category)

Exploratory Principal Factor analysis:


- 1: Safe traffic measures ('Traffic')
- 2: Safety training ('Training')
- 3: Cleanliness, tidiness, hazard procedures ('Hygiene')
- 4: Safe storage, parking, and security ('Storage')

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SSTL, SC

Safety-specific transformational leadership	Safety consciousness
<p>A. Idealized Influence</p> <ol style="list-style-type: none"> 1. My manager shows determination to maintain a safe work environment 2. My manager behaves in a way that displays commitment to a safe workplace <p>B. Inspirational motivation</p> <ol style="list-style-type: none"> 3. My manager talks about his/her values and beliefs of the importance of safety 4. My manager provides continuous encouragement to do our jobs safely <p>C. Intellectual Stimulation</p> <ol style="list-style-type: none"> 5. My manager suggests new ways of doing our jobs more safely 6. My manager encourages me to express my ideas and opinions about safety at work <p>D. Individualized Consideration</p> <ol style="list-style-type: none"> 7. My manager spends time showing me the safest way to do things at work 8. My manager listens to my concerns about safety on the job <p>E. Contingent Reward</p> <ol style="list-style-type: none"> 9. My manager makes sure that we receive appropriate rewards for achieving safety targets on the job 10. My manager expresses satisfaction when I and my colleagues perform our jobs safely. 	<ol style="list-style-type: none"> 1. I know what protective equipment and/or clothing is required by my job 2. I am well aware of the safety risks involved in my job 3. I know where the fire extinguishers are located in my workplace 4. I know what equipment is safe to use for my particular job(s) 5. I know how to inform management about any potential hazards I notice on the job 6. I know what procedures to follow if injured on my shift 7. I would know what to do if an emergency occurred on my shift (e.g., fire) <p>Based on Barling et al. 2002 & Kelloway et al. 2006. In turn based on the MLO of Bass & Avolio, 1990</p>

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SSTL, SC

- All questions measured on 5–point scale (disagree strongly-agree strongly)
- Average score over all employees per item
- Average over all items

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LAR

Lack of Accident Registration (LAR)

Added also category 1 accidents: 'Near accidents'

Scale 0 to 5

0: all types of accidents are registered
 1: all but category 1 accidents are registered
 2: all but category 1+2 accidents are registered
 :
 5: no accidents are registered

Higher score = less inclusive accident registration system

38

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5. Analyses – hypotheses testing

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Improved model

Path diagram showing relationships between variables:

- Traffic to Safety performance (accidents): ns
- Hygiene to Safety performance (accidents): ns
- Training to Safety performance (accidents): ns
- Storage to Safety performance (accidents): ns
- Storage to Safety consciousness: .26* H5
- Lack of accident registration to Safety consciousness: -.33**
- Safety consciousness to Safety transformation at leadership: .67** H3
- Safety transformation at leadership to Safety performance (accidents): -.29* H1
- Lack of accident registration to Safety performance (accidents): .29*
- Storage to Safety performance (accidents): -.21† H4
- Safety consciousness to Safety performance (accidents): ns H2

Improvement: $\chi^2(1) = 6.02, p = .01$

- $\chi^2(5) = 2.98, p = .70$
- CFI = 1.00, GFI = .99
- SRMR = 0.03

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But what is the real impact of safety leadership?

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Effect on accidents?

20% companies with lowest SSTL-score on average have:

- 115% more minor, and
- 88% more medium, and
- 135% more serious accidents per employee, than the top 20% companies with highest SSTL score

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Which "character" properties should the successful manager have?

'Regulatory focus'
determines motivation and behavior in the decision making process wrt goals attainment

Two types:

- Promotion oriented (go for positive outcomes; associated with growth, advancement, accomplishment)
- Prevention oriented (avoid negative outcomes; associated with protection, safety, responsibility)

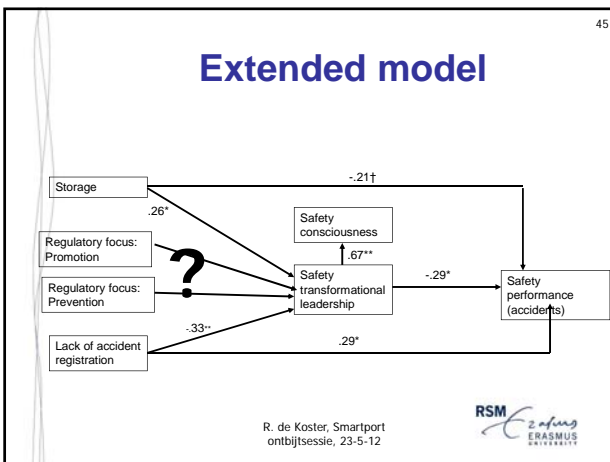
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Which trait should the manager possess to minimize accidents?

1. He/she should be promotion focused
2. He/she should be prevention focused
3. He/she should be both
4. Neither promotion nor prevention focused

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46

Conclusions (part B: safety)

- A manager's focus on safety helps reducing accidents substantially!
- Safety is not expensive!
- Important antecedents of SP: accident registration, safety-specific storage procedures,
- but.....
- HRS, (L)AR are not sufficient
- Prevention oriented managers have fewer accidents than promotion oriented managers

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C. What determines store stockouts?

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48

C. What determines store stockouts?

- Systems (Point-of-sales systems, demand forecasting, replenishment systemens, repl. frequency,...)?
- Product type?
- Something different?

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49

C. Study of 206 stores belonging to 1 store chain

- Same products
- Same procedures:
 - Procedures for counting
 - Handling stock differences
 - Fallback code procedure
- Same systems
 - PoS
 - Forecasting
 - Replenishment systems
 - Replenishment frequency
- 2 countries : B, NL

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50

Model

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51

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52

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53

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Model

	Top 20		Bottom 20		Test Statistics	
	Mean	SD	Mean	SD	t	p
Prevention focus	4.95	0.0319	3.52	0.1693	37.255	0.000**
Known shrinkage						
Fallback code						
Inventory corrections						
OSA						

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55

Model

	Top 20		Bottom 20		Test Statistics	
	Mean	SD	Mean	SD	t	p
Prevention focus	4.95	0.0319	3.52	0.1693	37.255	0.000**
Known shrinkage	9.42	5.7413	19.79	12.945	-3.274	0.002**
Fallback code						
Inventory corrections						
OSA						

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56

Model

	Top 20		Bottom 20		Test Statistics	
	Mean	SD	Mean	SD	t	p
Prevention focus	4.95	0.0319	3.52	0.1693	37.255	0.000**
Known shrinkage	9.42	5.7413	19.79	12.945	-3.274	0.002**
Fallback code	5.59	8.9561	6.11	11.968	-0.157	0.876
Inventory corrections						
OSA						

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57

Model

	Top 20		Bottom 20		Test Statistics	
	Mean	SD	Mean	SD	t	p
Prevention focus	4.95	0.0319	3.52	0.1693	37.255	0.000**
Known shrinkage	9.42	5.7413	19.79	12.945	-3.274	0.002**
Fallback code	5.59	8.9561	6.11	11.968	-0.157	0.876
Inventory corrections	0.2869	0.1018	0.1981	0.1423	2.270	0.030*
OSA						

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58

Model

	Top 20		Bottom 20		Test Statistics	
	Mean	SD	Mean	SD	t	p
Prevention focus	4.95	0.0319	3.52	0.1693	37.255	0.000**
Known shrinkage	9.42	5.7413	19.79	12.945	-3.274	0.002**
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Inventory corrections	0.2869	0.1018	0.1981	0.1423	2.270	0.030*
OSA	0.9842	0.0100	0.9662	0.0191	3.354	0.002**

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- 59
- ### Conclusions
- Not only systems are important for performance
 - **Manager is crucial for performance**
 - Prevention-oriented managers have better performance (safety, stockouts,...) than promotion oriented managers
 - Leadership can be trained
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- 60
- ### Follow up research projects
- Impact of manager's environmental consciousness on warehouse emissions (CO2) (S. Ullsperger)
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