BEMAS
BRIDGE TO
WORLDCLASS MAINTENANCE & ASSET MANAGEMENT

Mayor trends & Challenges in Maintenance & Asset Management

Wim Vancauwenberghe
BEMAS – Belgian Maintenance Association

Introduction

BEMAS
BRIDGE TO
WORLDCLASS MAINTENANCE & ASSET MANAGEMENT

Vision

Maintenance & Asset Management play a key role in achieving a sustainable industrial activity in Europe. Managers nowadays realise that an efficient maintenance and asset utilisation leads to increased benefits. A continuous improvement of asset utilisation and the reduction of (production) costs, results in added value for all stakeholders. As a result, maintenance and asset management are to be considered as key drivers to create competitive advantage and sustainable operation.

Mission

Help (Belgian) asset owners to increase their competence level by sharing knowledge on maintenance, production reliability & asset management, and by creating a larger awareness and appreciation for maintenance activities and the responsible maintenance & asset managers.

BEMAS

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open network not-for-profit member association

inspiration helps you to improve knowledge sharing

asset management maintenance reliability engineering

field service asset integrity energy management facility maintenance

online suppliers index lobbying training courses advice plant visits

certification promoting technical careers personal support

world class manufacturing competitiveness

Member of efnms European Federation of National Maintenance Societies vzw

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Content

- Introduction
- 3 Trends & Challenges
- 3 Innovations

The MORE4CORE - project

- MORE4CORE stands for ***M***aintenance, ***O***verhaul and ***RE***pair ***for CO***mpetitiveness of the North-West European ***RE***gion

- The MORE4CORE project aims at:
  - providing an insight at the challenges of asset owners and MRO service providers
  - developing plans for coherent policy initiatives and industrial actions

Participating partners

Project Partners:

Brabantse Ontwikkelings Maatschappij BOM

afim

efnms European Federation of National Maintenance Societies vzw

BEMAS BRIDGE TO WORLDCLASS MAINTENANCE & ASSET MANAGEMENT

voka Chamber of Commerce and Industry Antwerpen-Waasland

Dutch Institute World Class Maintenance – Maintenance Education Consortium

WVIS Wirtschaftsverband für Industrieservice e.V.

Knowledge and content partners:

Bax & Willems Consulting Venturing

mainnovation

KPMG

MORE4CORE - project

Activities

- The benchmark study & MRO market analysis
- Maintenance Skill Passport concept
- Award for HR best practice based on the magnet concept for technical talent
- Strategic research & innovation agenda
- Suppliers reference guide
- Overview of Maintenance related Regulations in DE, FR, BE & NL
- Etc …

Is Maintenance important?

- In Europe, about 6 million people work in technical maintenance

- Every year about **450 Billion Euro** is spent on maintenance of industrial technological assets, with an estimated reinvestment value of **10.000 Billion euro.** A big part of these industrial assets are based in NWE.

Benchmark study

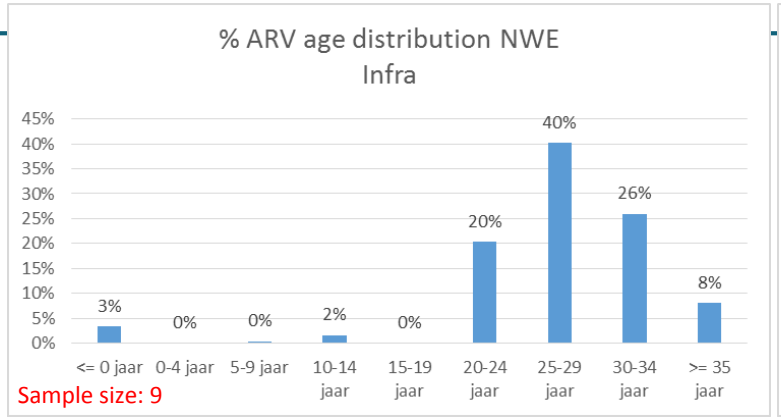
Industries involved:

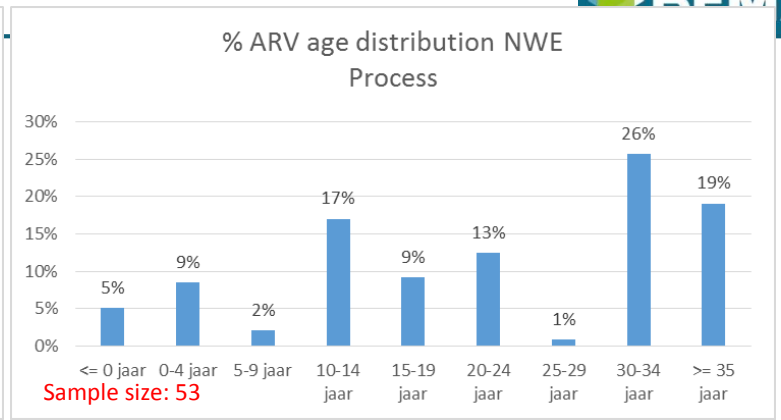
- Fleet
- Food, Beverage & Pharma
- Manufacturing
- Process industry
- Infrastructure

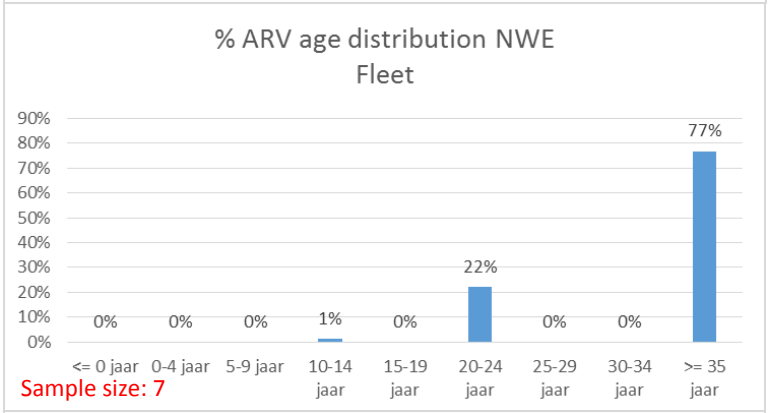
Research themes

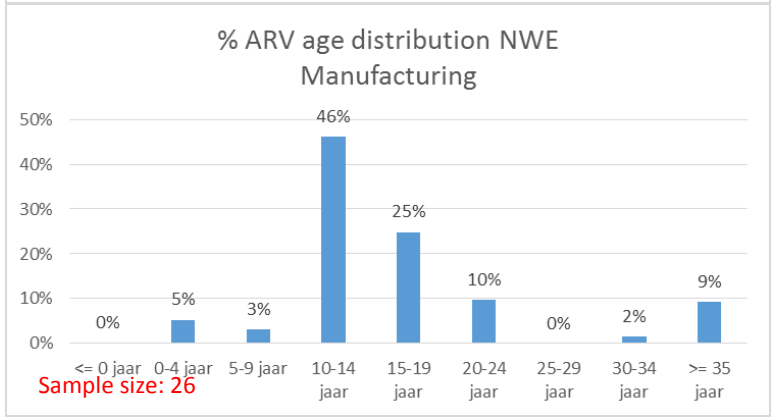
- The benchmark study collected data of +/- 200 asset intensive companies
- In order to better understand the impact of asset age and remaining asset lifetime, there is a need of clear definitions of some KI and KPI's that relate to lifetime and remaining life time of (a collection of) assets.

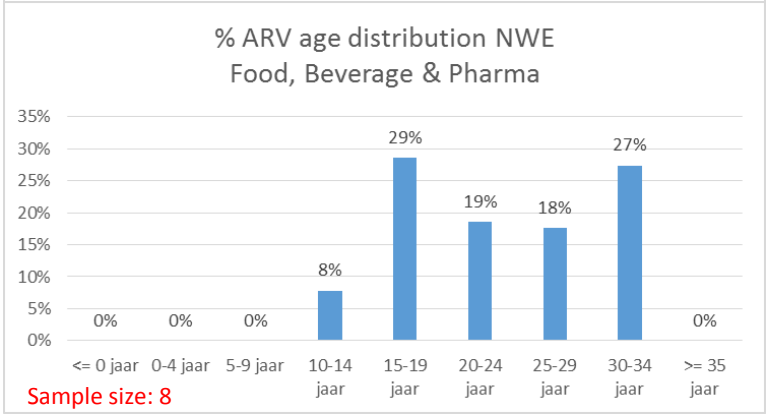
Asset Age











Preliminary results

Asset Age

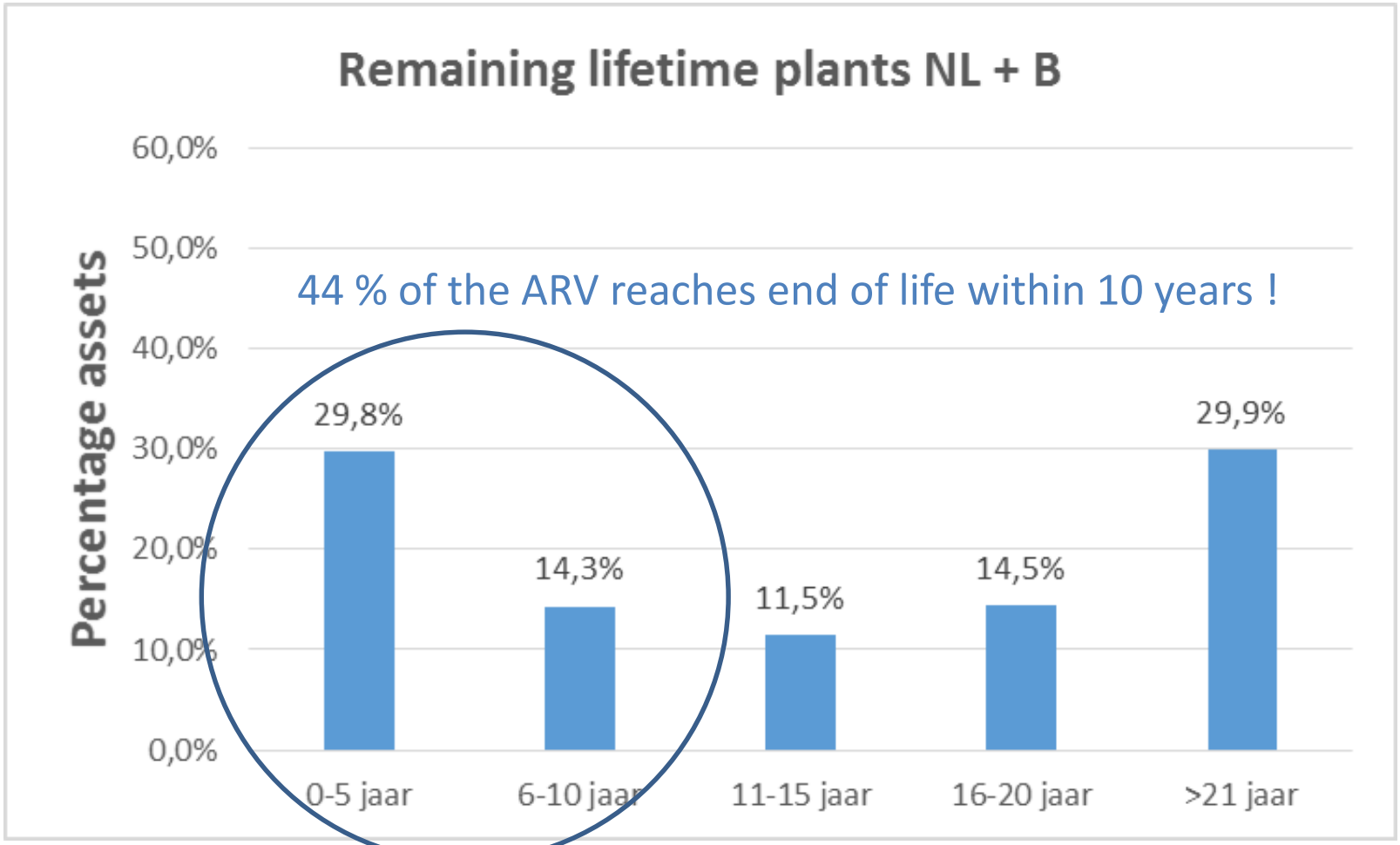
Mean Asset Age

The Mean Asset Age is quit similar in BE as in NL:

- Proces industry
  - 19 years in BE
  - 23 years in NL
- Manufacturing
  - 15 years in BE
  - 20 years in NL
- Food, Beverage & Pharma
  - 20 years in BE
  - 16 years in NL

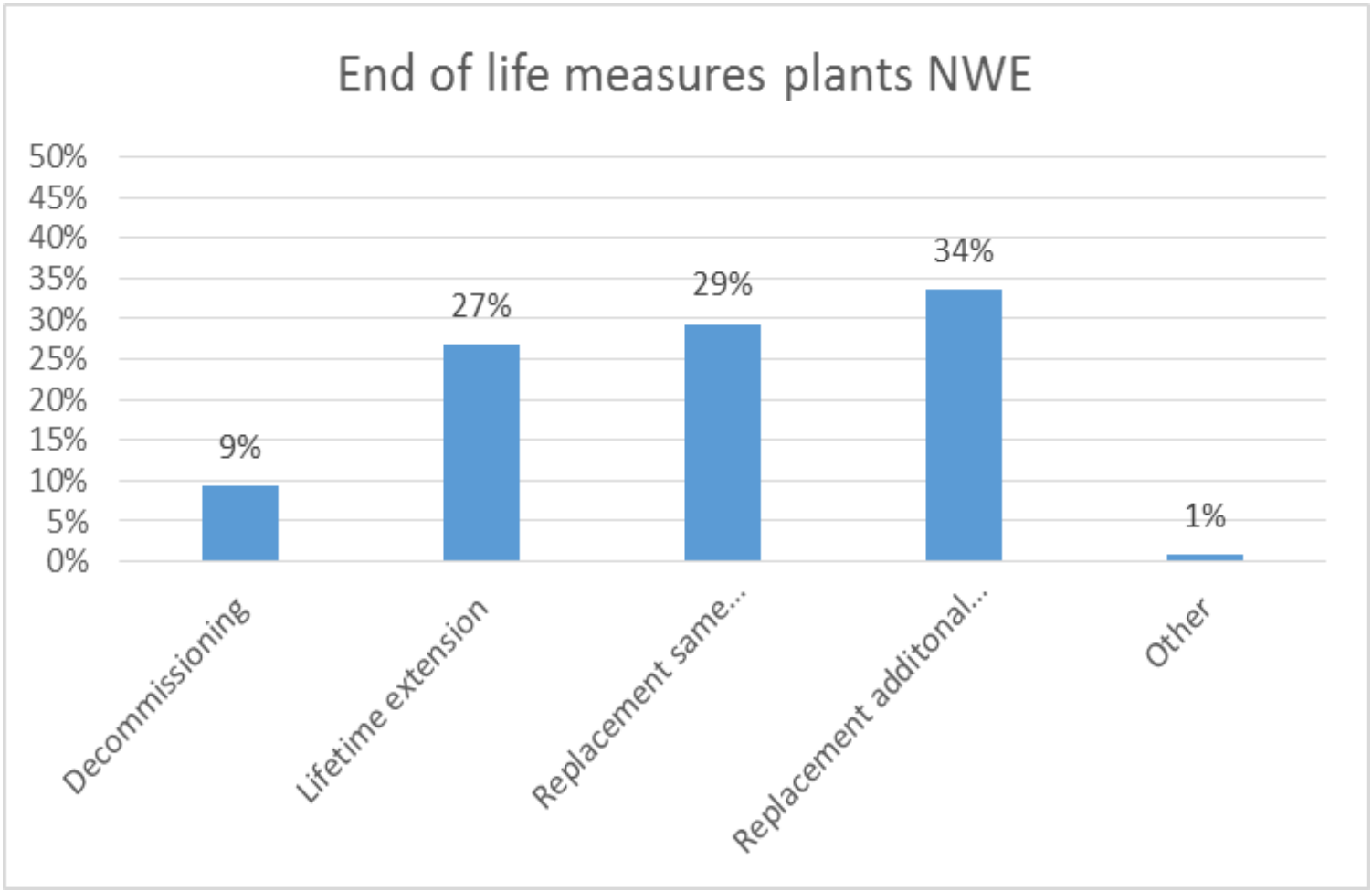
Remaining lifetime of Plants

Plants = process industry +manufacturing+food, beverage & pharma

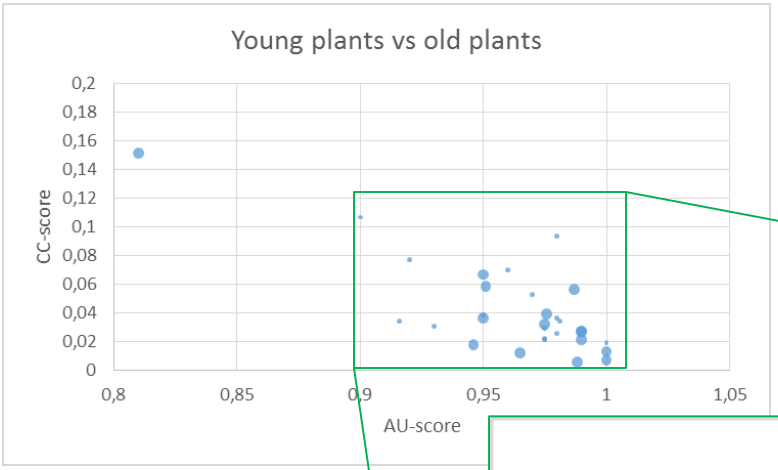


Sample size: 82

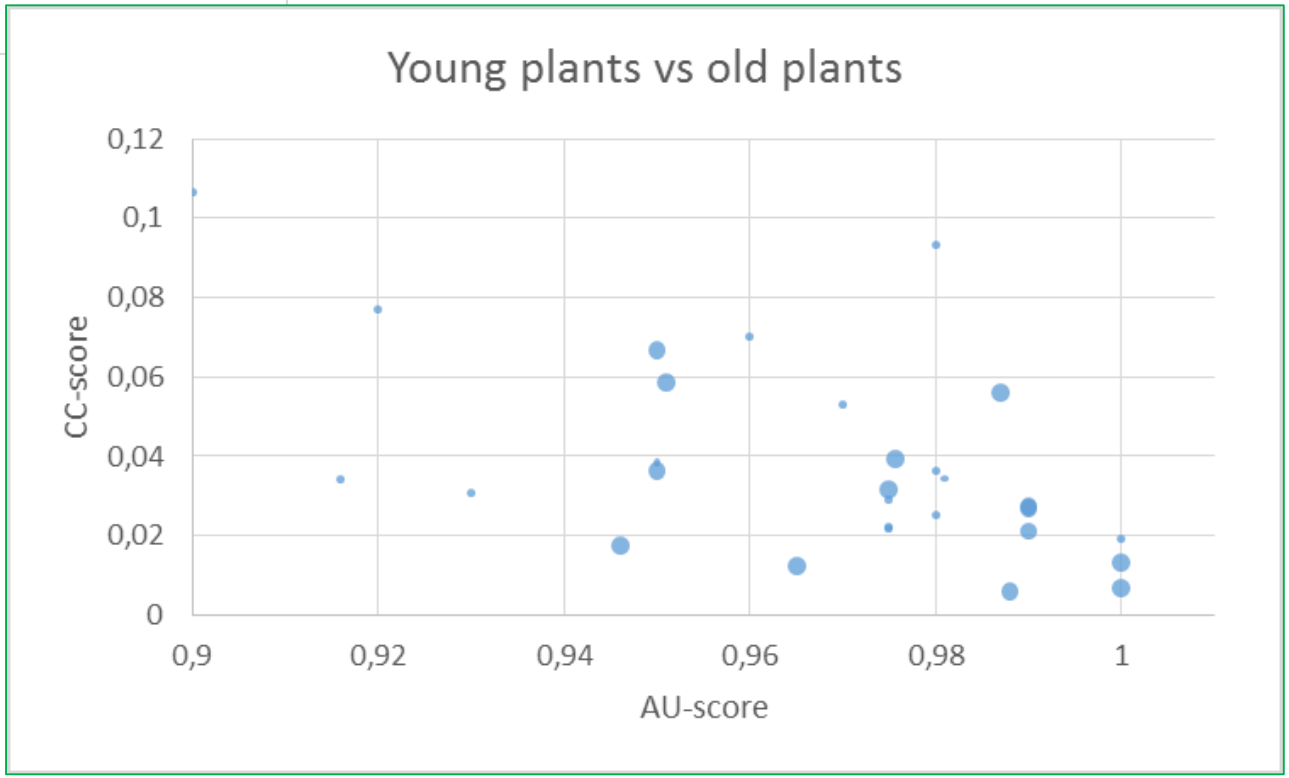
Remaining lifetime of Plants



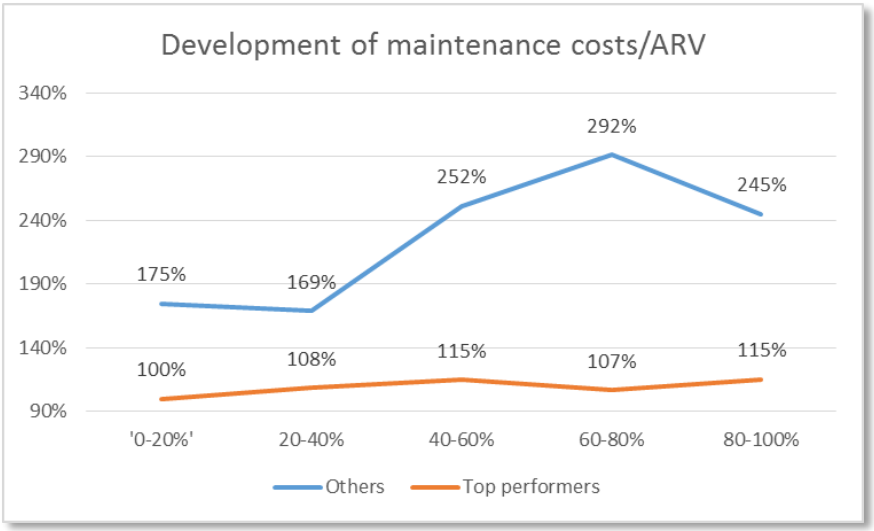
Remaining lifetime has no impact on performance…

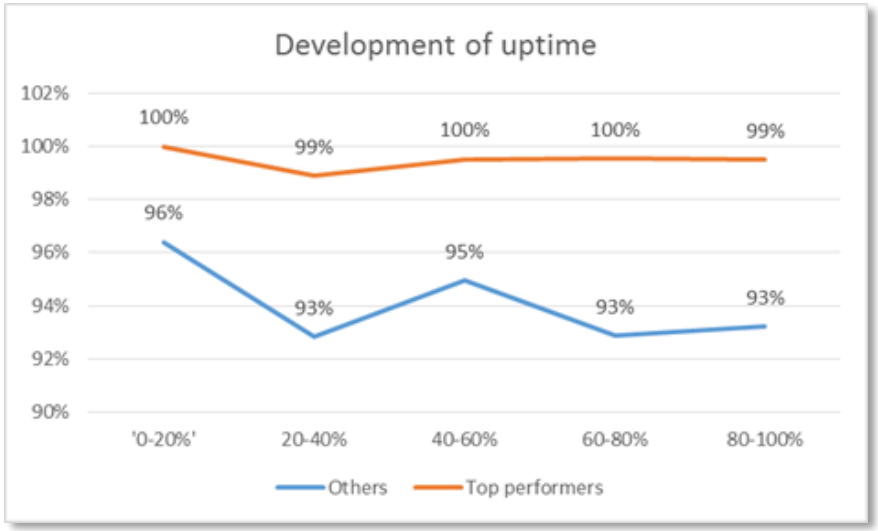


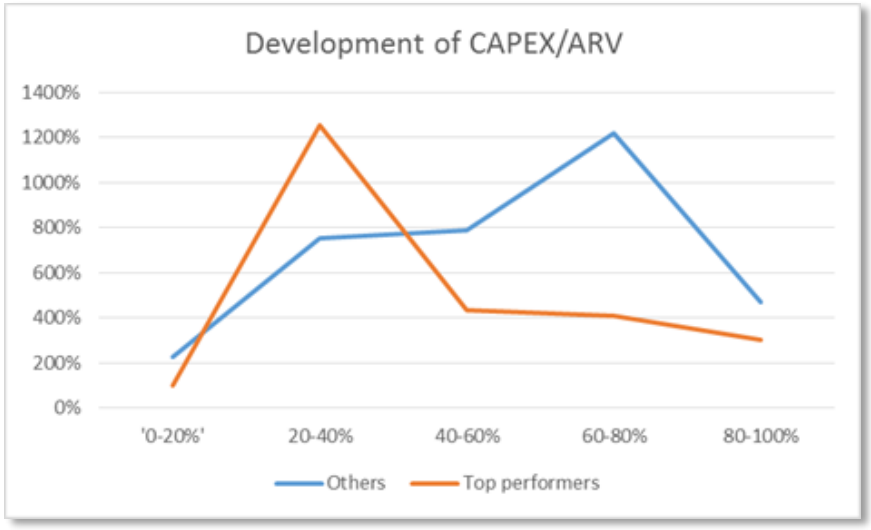
Small dot: old plant
Large dot: young plant
Category plant age: based on remaining average lifetime

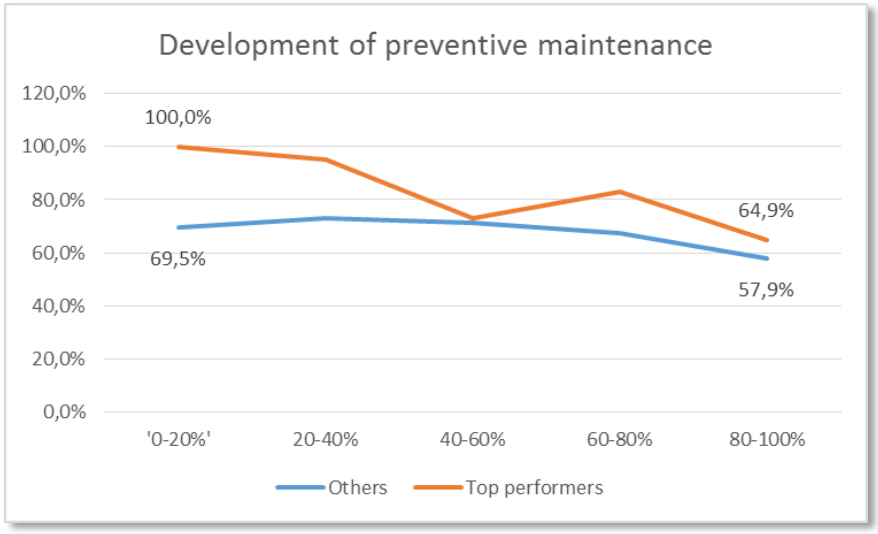


…at least for the best performers





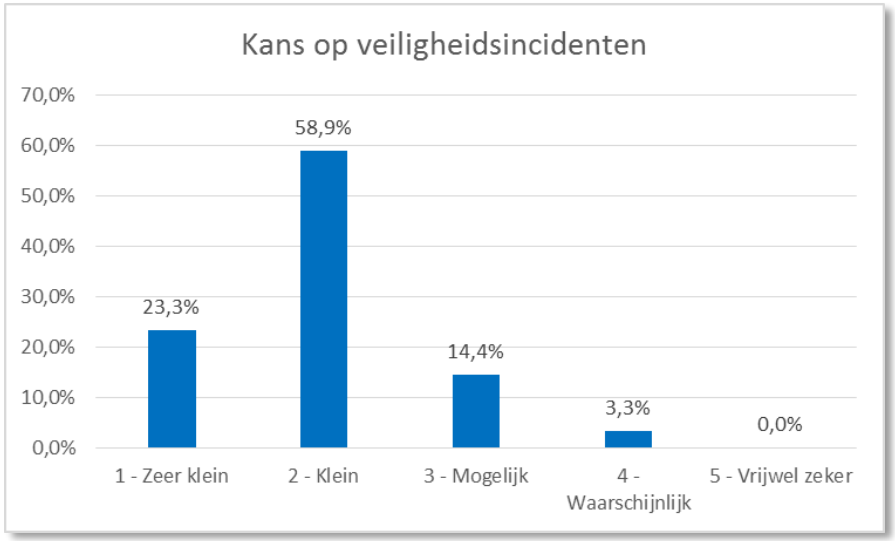




BUT …

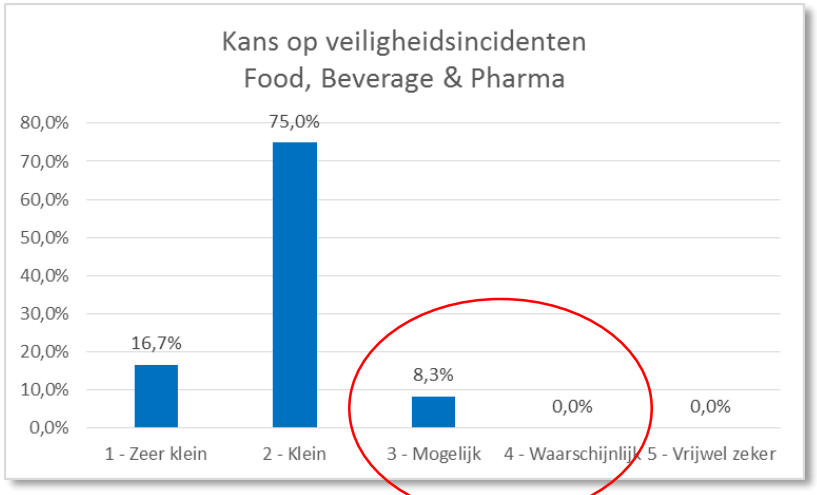
Probability of serious incidents

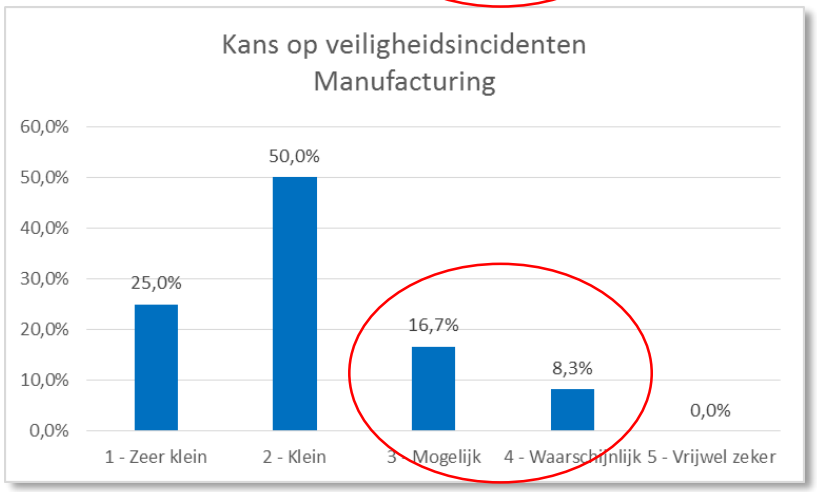
- 82% of the technical managers consider the probability small or very small
- But ... one of the five factories say there is a reasonable probability (18%) on security incidents
- In 2010, this probability was only estimated as 1 in 12 factories (8%)
- There is a clear negative trend for asset security



Sectoral differences

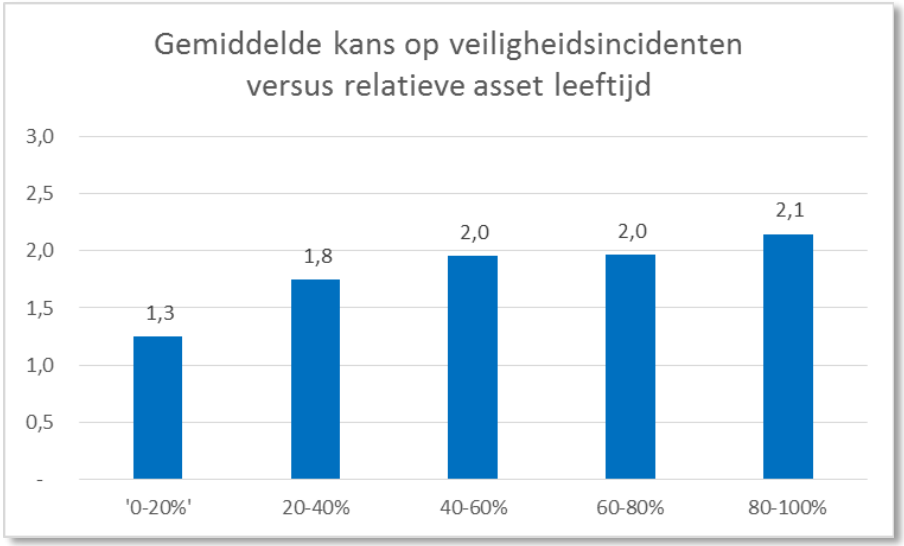
- The estimate of a reasonable probality of a safety incident changes from sector to sector
  - Food, Beverage & Pharma best result: 8%
  - Manufacturing: 25%
  - Proces Industry: 17%





Relation between asset age and safety

- At higher asset age, the risk of incidents estimated higher
- At end of life probability is 60% larger than at start life
- The increased asset age of the installed base in the market declares (partly) the negative trend



Conclusion: significant potential for increasing our industrial competitiveness

- Increase the lagger performers to Top Performer levels (75% of the asset owners)
- Increases competiveness of EUR 85 billion per year
  - Cost reduction: EUR 68 billion per year
  - Increase Uptime : EUR 17 billion per year
- EBITDA increase of 30%
- Decrease of the resonable probability on safety incidents from 18% to 7%

Cashflow

+ € 85 billion per year

EBITDA

+ 30%

Safety

Probalility: 18% → 7%

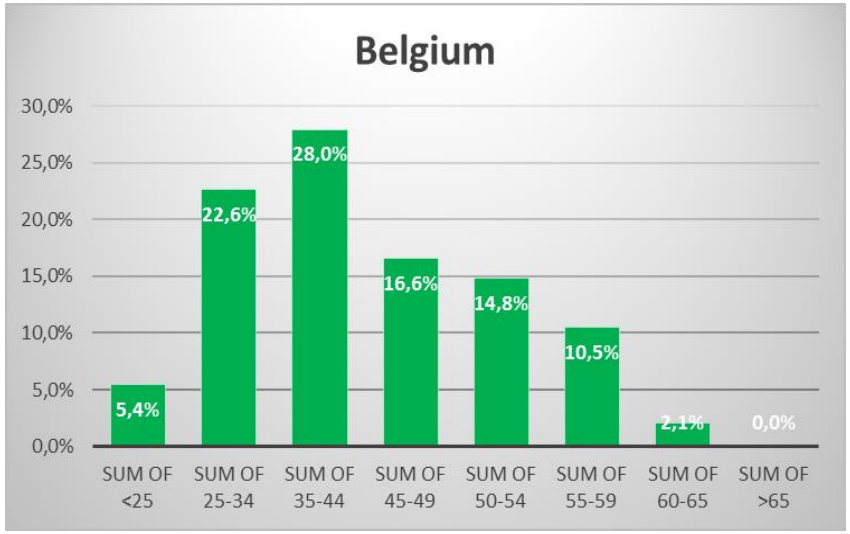
Content

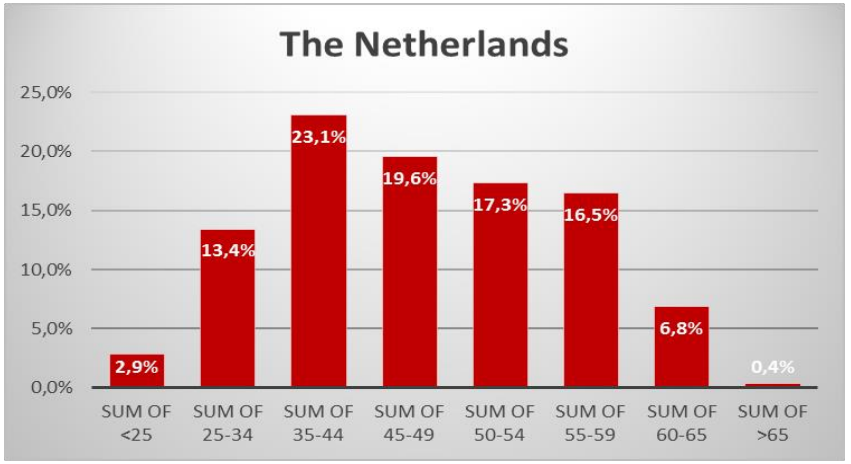
- Introduction

- 3 Trends & Challenges
  - Aging Assets
  - Aging population

- 3 Innovations

Personnel development and HR





- In Belgium about 12% will retire in the next 10 years
- In The Netherlands about 23% will retire in the next 10 years

PS: BEMAS roughly estimates the number of maintenance workers in Belgium on 65.000.

- Off course the main question is: will we be able to get new maintenance personnel started in the next 10 years and how will we avoid a major loss of knowledge & experience?

Disclaimer: all results shown are preliminary. No rights can be claimed from those results.

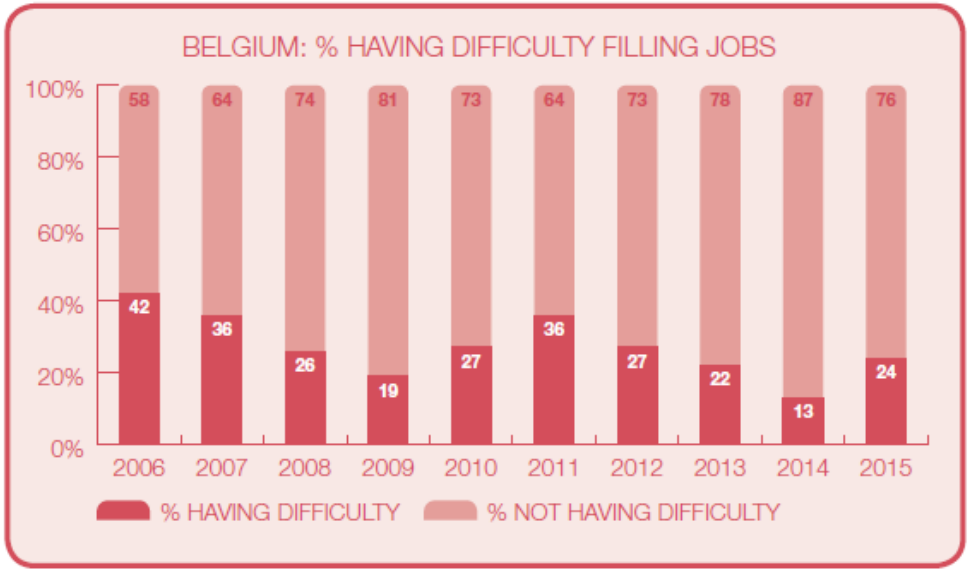
HARDEST JOBS TO FILL

For the fourth consecutive year, **SKILLED TRADES** vacancies are the hardest jobs to fill globally. **SALES REPRESENTATIVES** are in second place, followed by **ENGINEERS, TECHNICIANS AND DRIVERS.**

1. **Skilled Trade Workers** *(especially chefs/bakers/butchers, mechanics and electricians)*
2. **Sales Representative**
3. **Engineers** *(especially mechanical, electrical and civil engineers)*
4. **Technicians**
5. **Drivers** *(especially truck/lorry/heavy goods drivers, delivery/courier drivers, heavy equipment/construction drivers)*
6. **Management/Executives**
7. **Accounting & Finance Staff** *(especially book keepers, certified accountants and financial analysts)*
8. **Office Support Staff**
9. **IT Staff** *(especially developers and programmers, database administrators, and IT leaders and managers)*
10. **Production/Machine Operations**

Source: ManpowerGroup™

BRCE
BEARING RELIABILITY CONFERENCE & EXPO
BEMAS



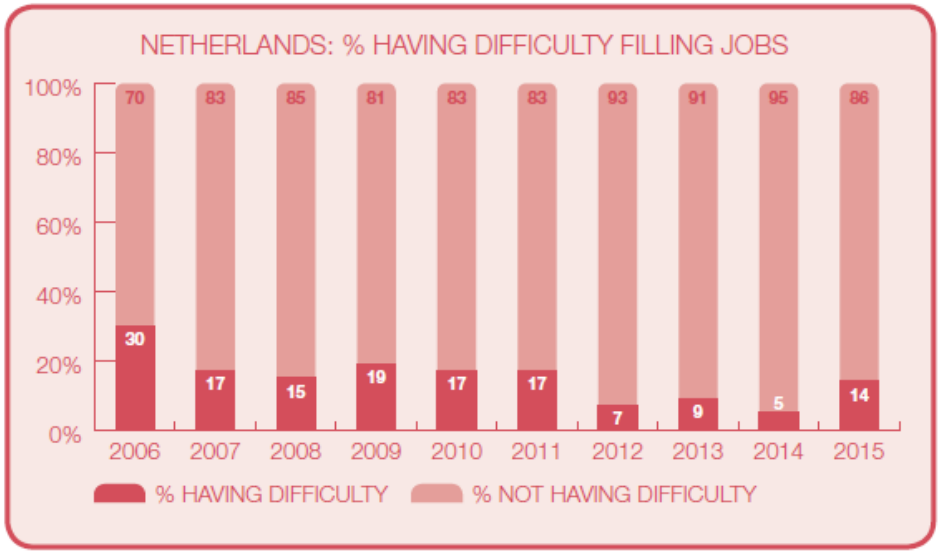
BELGIUM
TOP 10 JOBS EMPLOYERS ARE HAVING DIFFICULTY FILLING

1 | Skilled Trades
2 | Sales Representatives
3 | Technicians
4 | Accounting & Finance Staff
5 | Drivers
6 | IT Personnel
7 | Secretaries, PAs, Receptionists, Admin Asst. & Office Support Staff
8 | Engineers
9 | Project Managers
10 | Laborers

Source: ManpowerGroup™

BRCE BEARING RELIABILITY CONFERENCE & EXPO

BEMAS



GERMANY
TOP 10 JOBS EMPLOYERS ARE HAVING DIFFICULTY FILLING

1 | Skilled Trades
2 | Management / Executive (Management / Corporate)
3 | Technicians
4 | IT Personnel
5 | Engineers
6 | Accounting & Finance Staff
7 | Sales Representatives
8 | Sales Managers
9 | Drivers
10 | Doctors & other Non-Nursing Health Professionals

NETHERLANDS
TOP 10 JOBS EMPLOYERS ARE HAVING DIFFICULTY FILLING

1 | Skilled Trades
2 | Secretaries, PAs, Receptionists, Admin Asst. & Office Support Staff
3 | Technicians
4 | Doctors & other Non-Nursing Health Professionals
5 | Management / Executive (Management / Corporate)
6 | IT Personnel
7 | Laborers
8 | Customer Service Representatives & Customer Support
9 | Engineers
10 | Sales Representatives

Source: ManpowerGroup™

BRCE
BEARING RELIABILITY CONFERENCE & EXPO
BEMAS

BRAZIL
TOP 10 JOBS EMPLOYERS ARE HAVING DIFFICULTY FILLING

1 | Technicians
2 | Skilled Trades
3 | Production Operators / Machine Operators
4 | Secretaries, PAs, Receptionists, Admin Asst. & Office Support Staff
5 | Laborers
6 | Drivers
7 | Sales Representatives
8 | Engineers
9 | Accounting & Finance Staff
10 | IT Personnel

CHINA
TOP 10 JOBS EMPLOYERS ARE HAVING DIFFICULTY FILLING

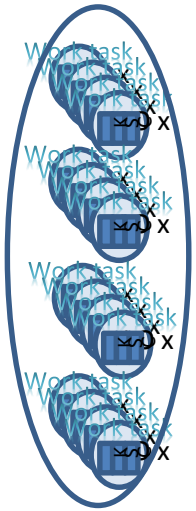
1 | Technicians
2 | Sales Representatives
3 | Sales Managers
4 | Management / Executive (Management / Corporate)
5 | Laborers
6 | Skilled Trades
7 | Engineers
8 | IT Personnel
9 | Production Operators / Machine Operators
10 | Researchers (R&D)

The big picture

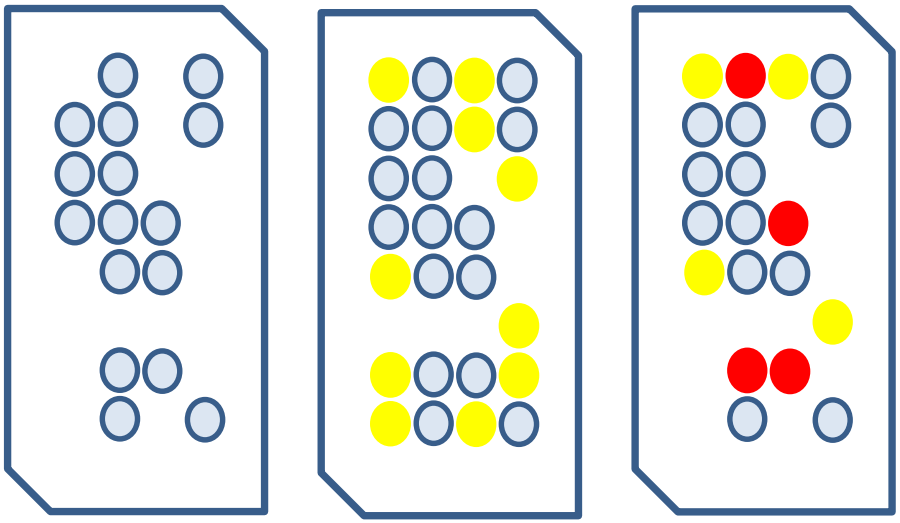
- Decreased availability of technical skilled workers
- Increased need for worker mobility
- Need for skill transparency

The European Maintenance Skill Passport

Work task
Function X



Personal
European Maintenance
Skill Passport



needed skills

not needed skills

missing skills

needed skills = personal skills	needed skills < personal skills	needed skills > personal skills
match	*overqualified*	*underqualified*

MAINTENANCE FOR COMPETITIVENESS

INTERREG IVB nwe

The European Maintenance Skill Passport

Benefits the individual worker :

1. Increased mobility: the uniform interpretation of skills

2. Transparent value of diploma in the field of maintenance

3. Possibility to continuously upgrade and validate skills and competences acquired through experience

4. increased personal safety

The European Maintenance Skill Passport

Benefits for the employers (asset owner & contractor):

1. Increased safety and reduced risks

verification if a certain employee or contracted maintenance worker has the required set of skills and competences (LO's) to execute a certain job or task.

2. Specify training needs

task based and exactly described in terms of knowledge, skills and competences.

3. Hire (foreign) maintenance workers without risks

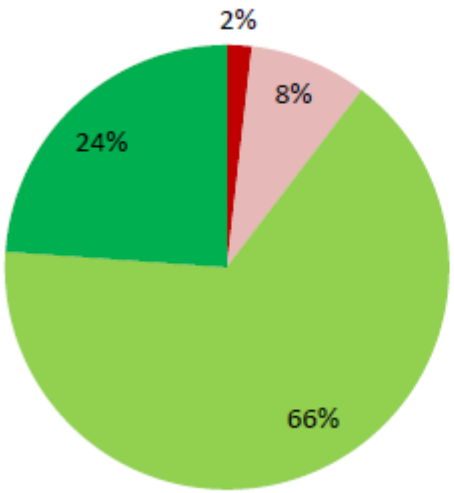
thanks to the transparency of well described and assessed LO's, the capabllities of a certain person are very clear.

BUT …

We can still learn a lot from our technicians !

Job satisfaction

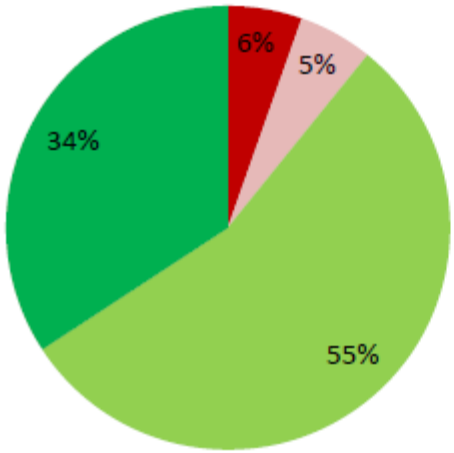
Technicians working for an asset owner



Very unsatisfied
Unsatisfied
Satisfied
Very satisfied

About 10 % is not satisfied about their current job

Technicians working for a contractor

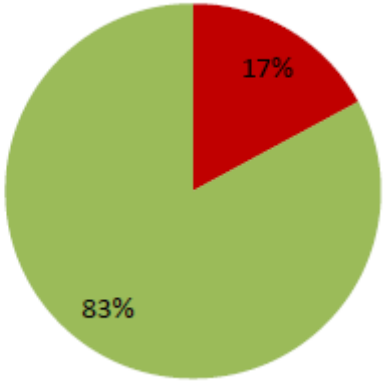


Very unsatisfied
Unsatisfied
Satisfied
Very satisfied

Results of a survey of 300+ technicians working at asset owners and maintenance contractors.

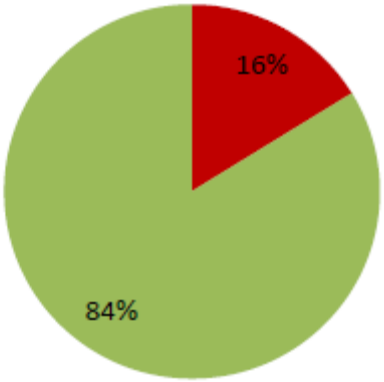
Job satisfaction

Technicians working for an asset owner



>>> 16 %-17% would leave for another job if there is an opportunity

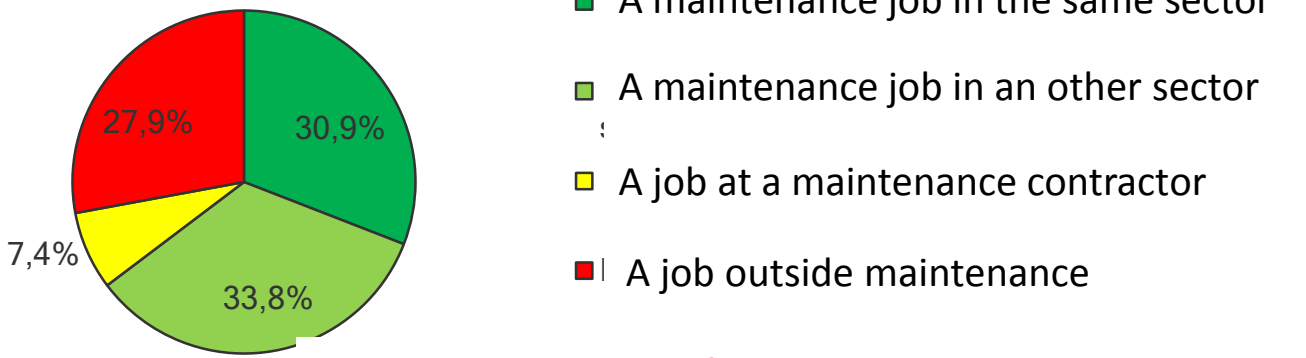
Technicians working for a contractor



Job satisfaction

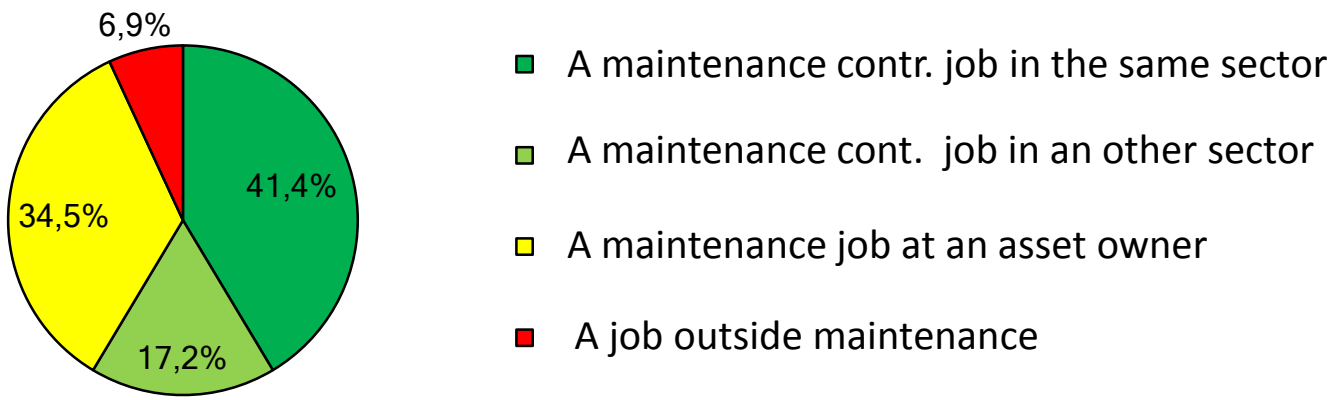
If you would change jobs, what type of job would you chose?

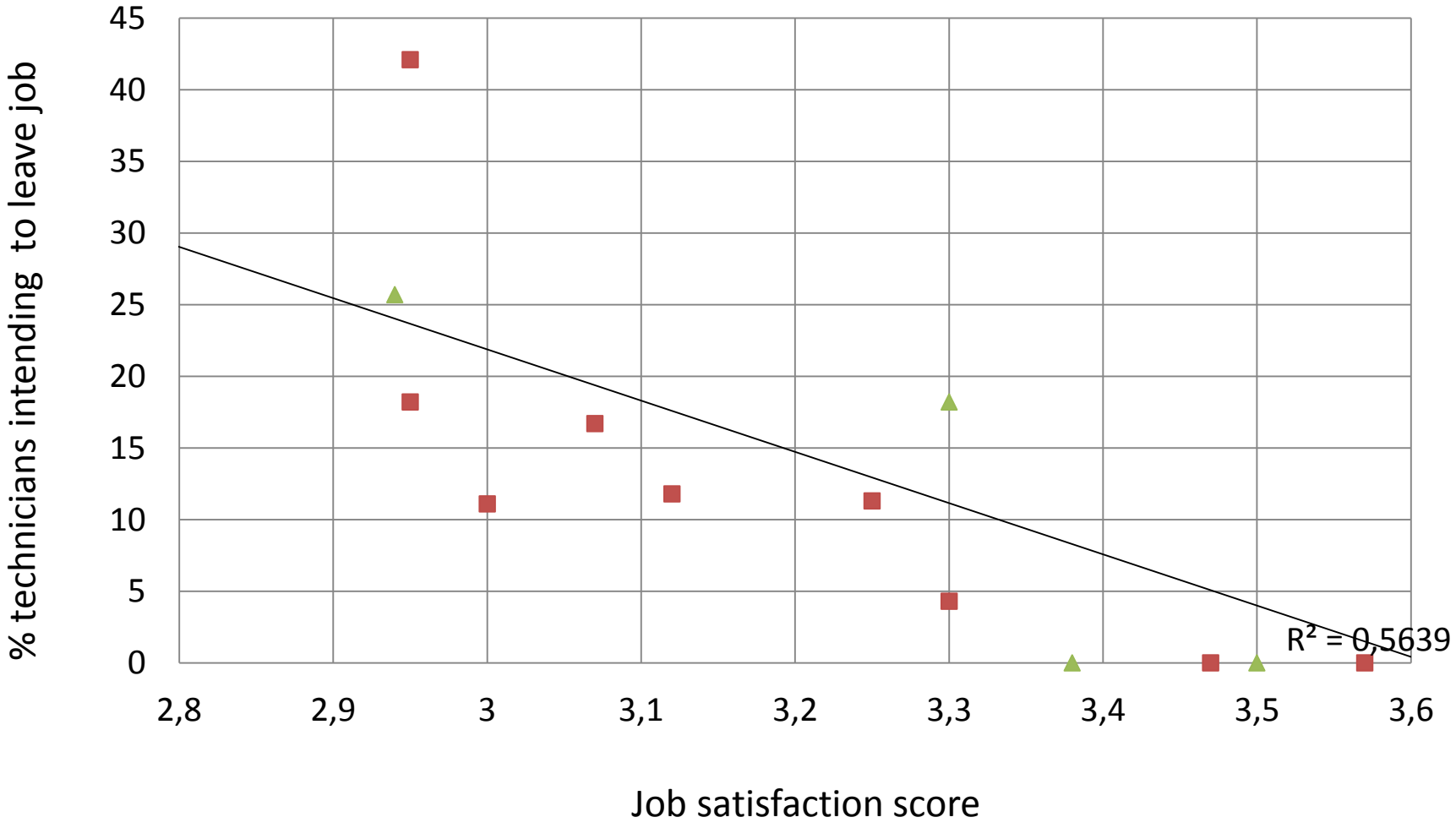
Technicians working for an asset owner



More than a quarter of the AO-techs jobchangers would leave maintenance, versus only 7% of the C-techs. But more than a third of the C-tech jobchangers would leave contractor for a job at an asset owner.

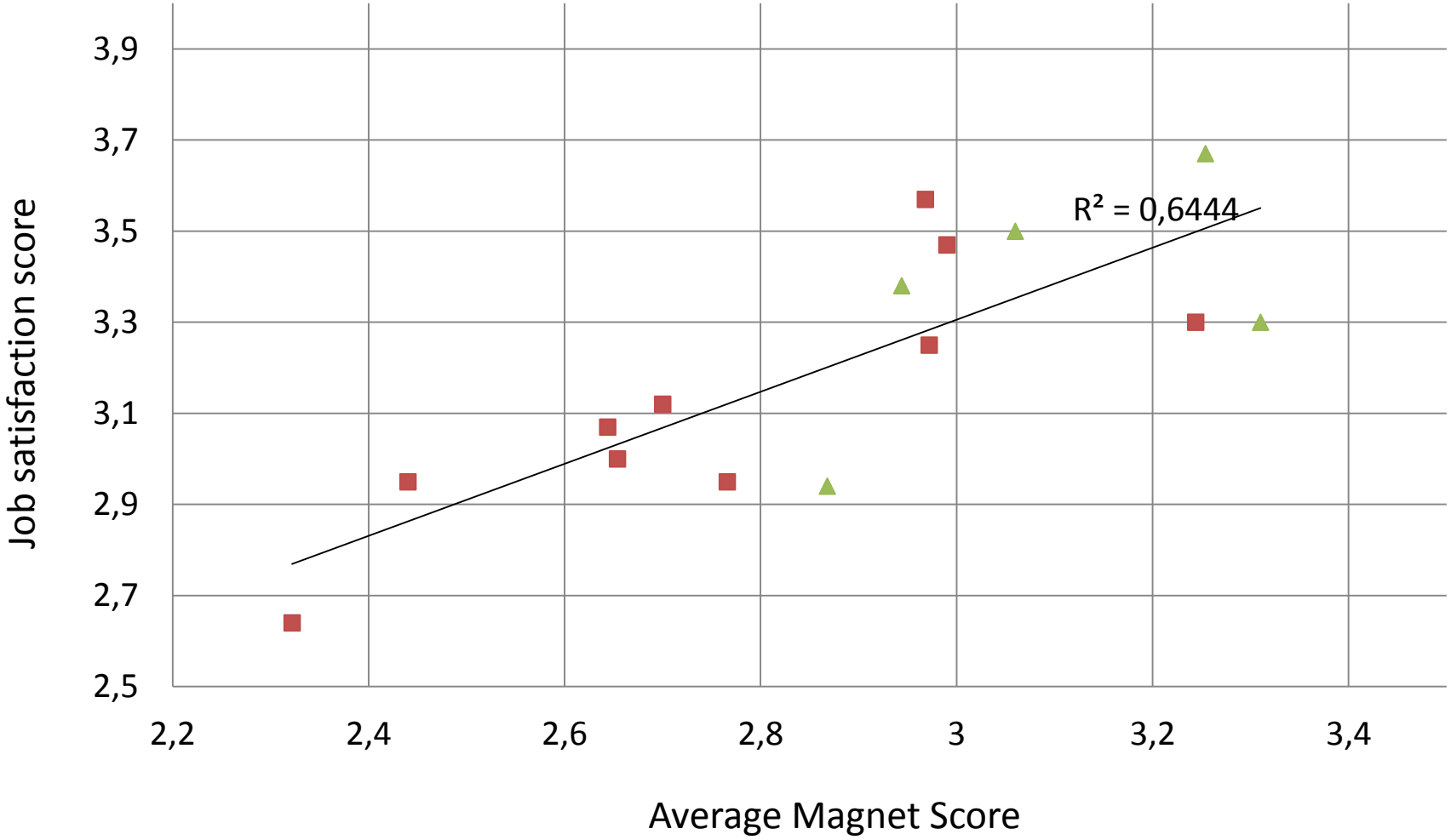
Technicians working for a contractor




% technicians intending to leave job
45
40
35
30
25
20
15
10
5
0
2,8
2,9
3
3,1
3,2
3,3
3,4
3,5
3,6
Job satisfaction score
R² = 0,5639

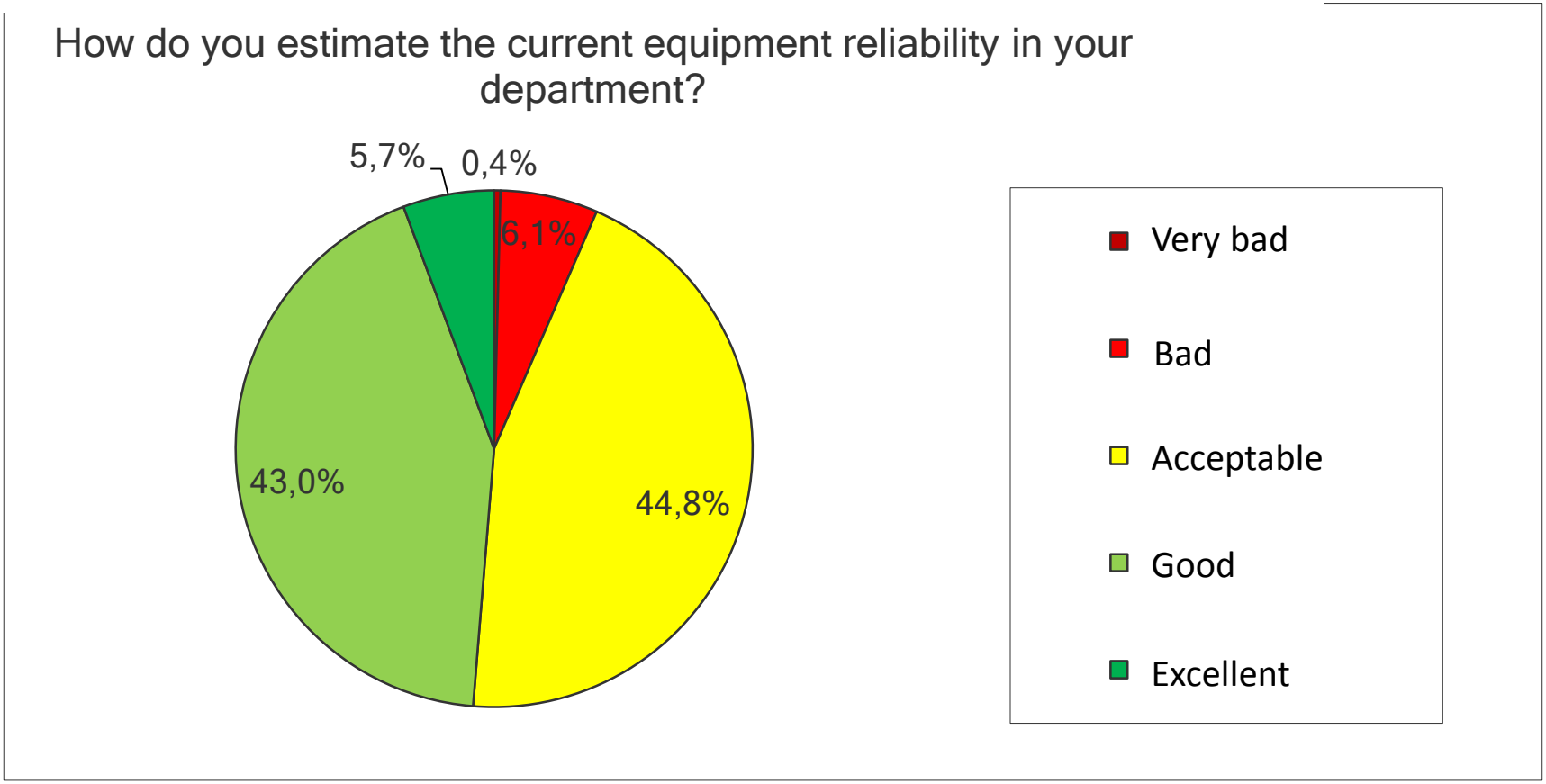
Magnet factors

Magnet factor	Technicians @ Asset owners	Technicians @ Maint.Contractors	% difference
1. The proper availability of resources, materials and tools	2,81	3,07	9%
2. The relationship between the (maintenance) technicians and operations	2,77	3,24	17%
3. Leadership, management and support of the technicians	2,83	3,06	8%
4. Management of the maintenance quality	2,85	3,11	9%
5. Bottom-up participation of the technicians in the policy	2,6	2,95	13%
Average score on magnet factors	2,77	3,09	12%
Job satisfaction score	3,13	3,36	7%
Intention to leave company %	16%	12%	-23%
Reliability Culture score	3,36	3,87	15%
Technicals stress indicator score	2,76	2,12	-23%
Psychosocial Stress indicator score	1,88	1,77	-6%


3,9
3,7
3,5
3,3
3,1
2,9
2,7
2,5
2,2
2,4
2,6
2,8
3
3,2
3,4
Job satisfaction score
Average Magnet Score
R² = 0,6444

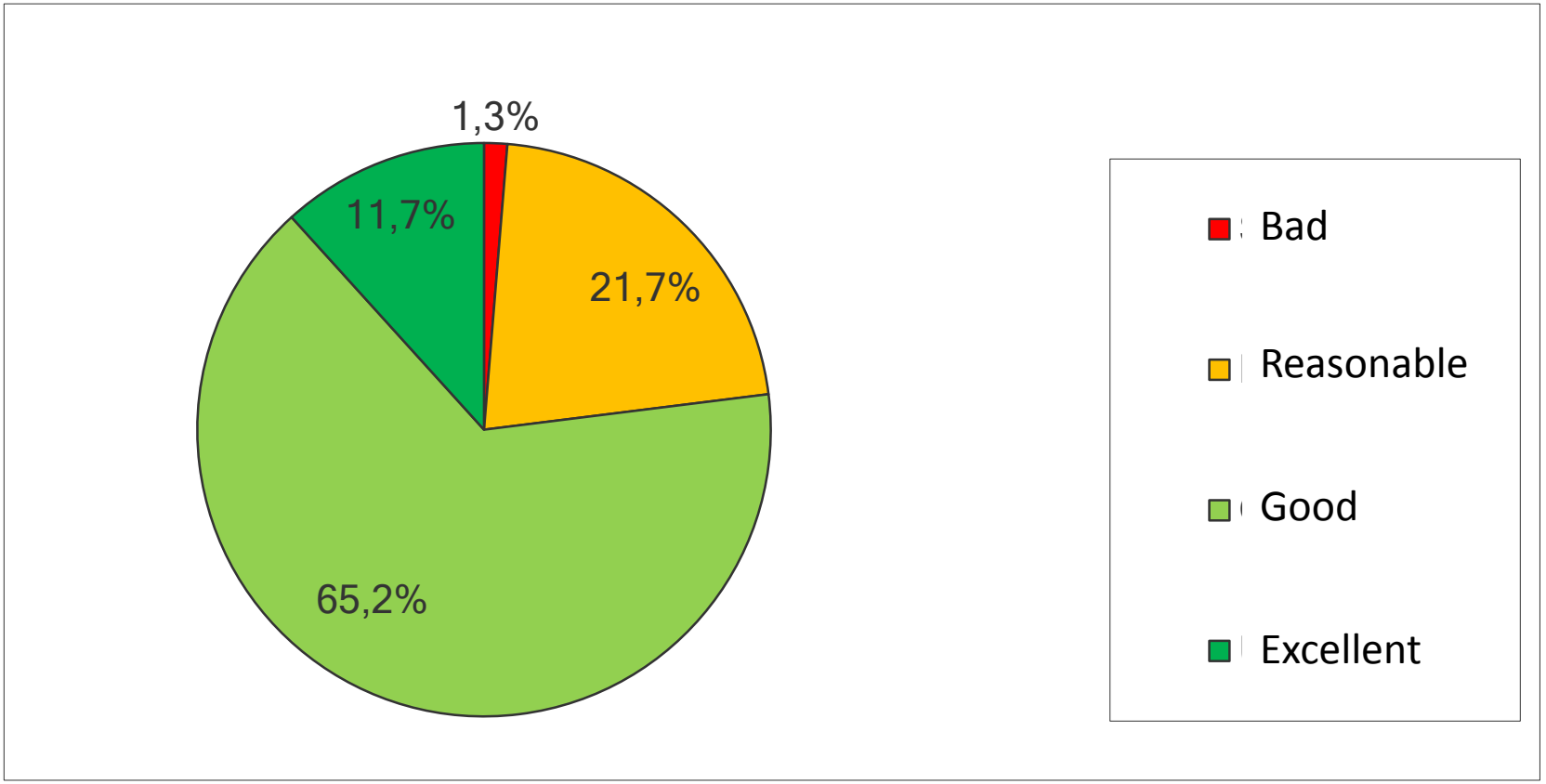
Reliability trend

- 6,5% of Technicians working for an Asset owner indicate that equipment reliability is bad.
- About 45% indicate equiment reliability as ‘acceptable’.



Reliability trend

How would you qualify the quality of the maintenance as executed in your company?



Reliability Culture

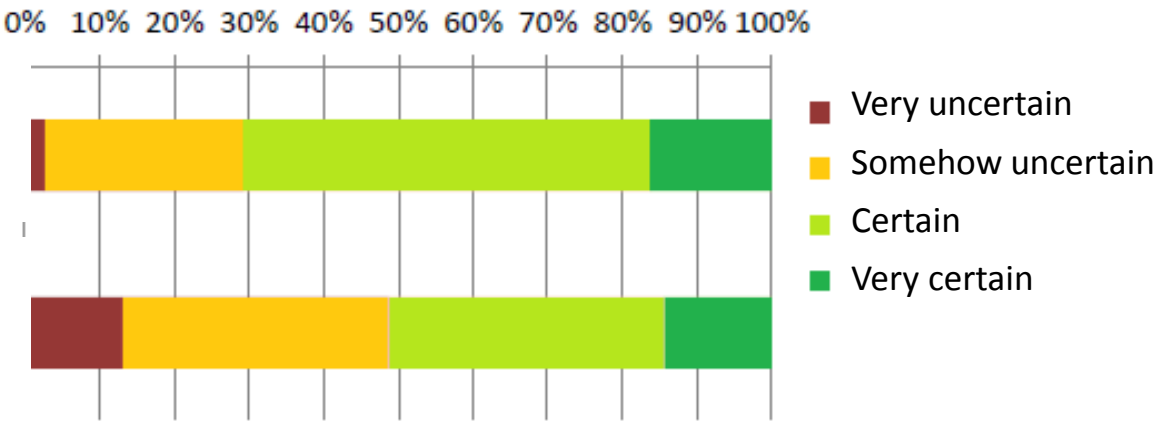
- 30% of the maintenance technicians working for an asset onwer are not certain that equipment will function reliable after a maintenance intervention.

- 50 % of the AO-techs are not certain that management will act on reported (technical) problems.

Technicians working for an asset owner

How certain are you that equipment will function reliable after a maintenance intervention ?

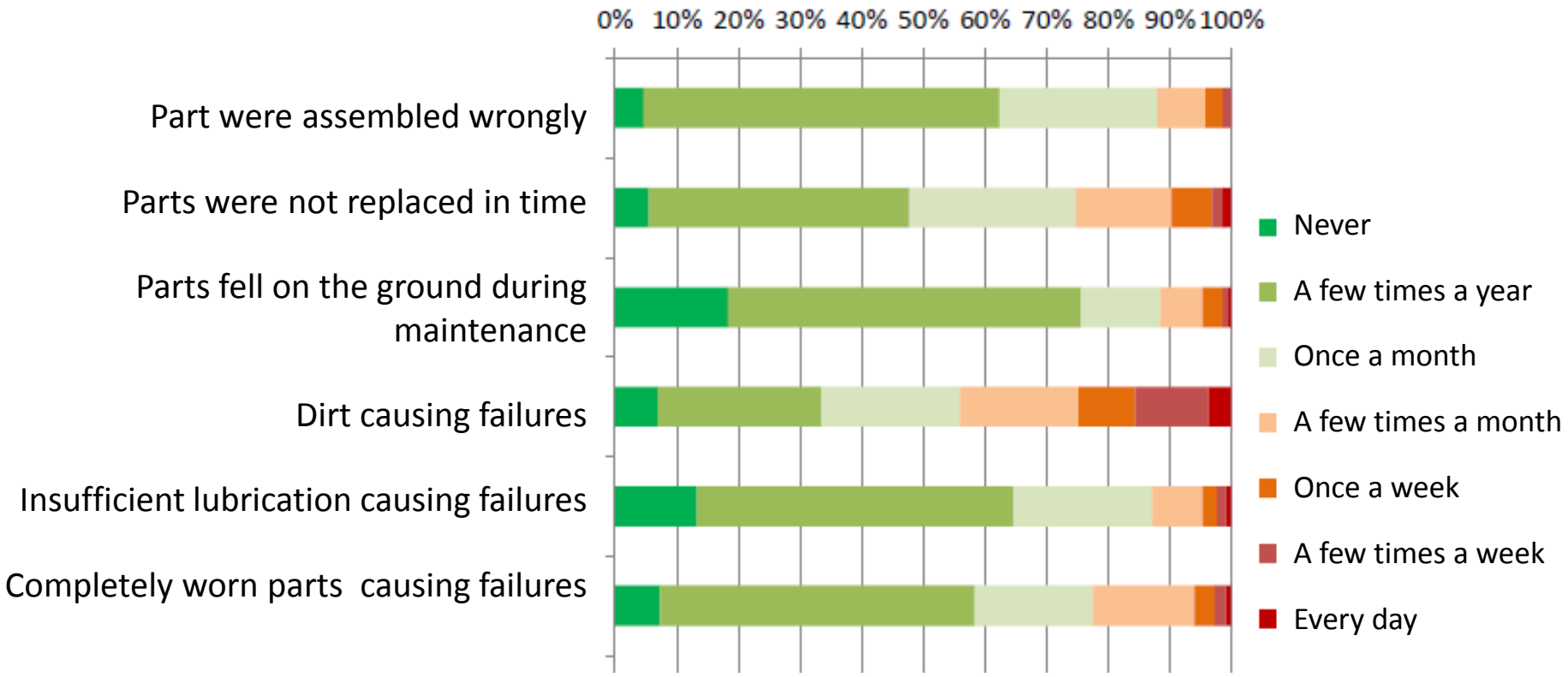
How certain are you that management will take action to solve problems you report concerning maintenance or the condition of equipment?



Reliability Culture

- Still a lot of potential to improve reliability.
- Start with tackling dirt (clean) and wear (lubrication , timely replacement, …)

Technicians working for an asset owner



Reliability Culture

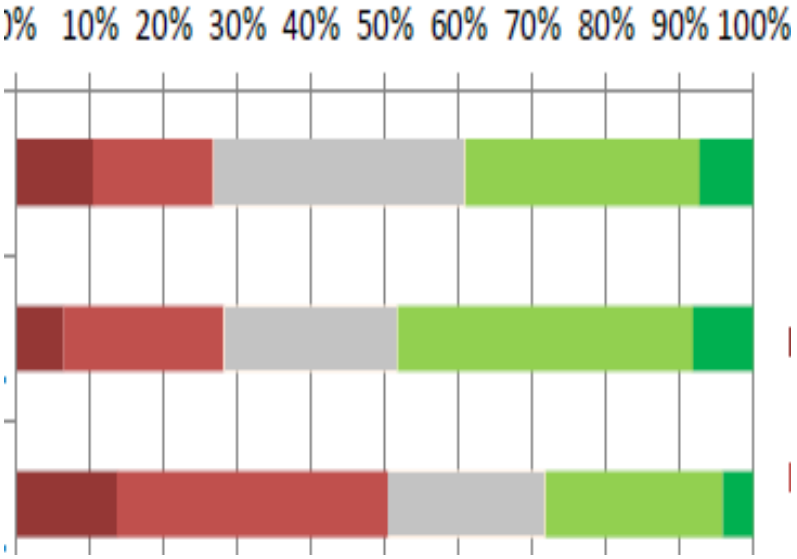
- 25% of AO-techs are afraid to admit mistakes
- 30 % indicate loss of valuable information between shifts
- 50 % indicate that there is a lach of knowledge and information on new equipment

Technicians working for an asset owner

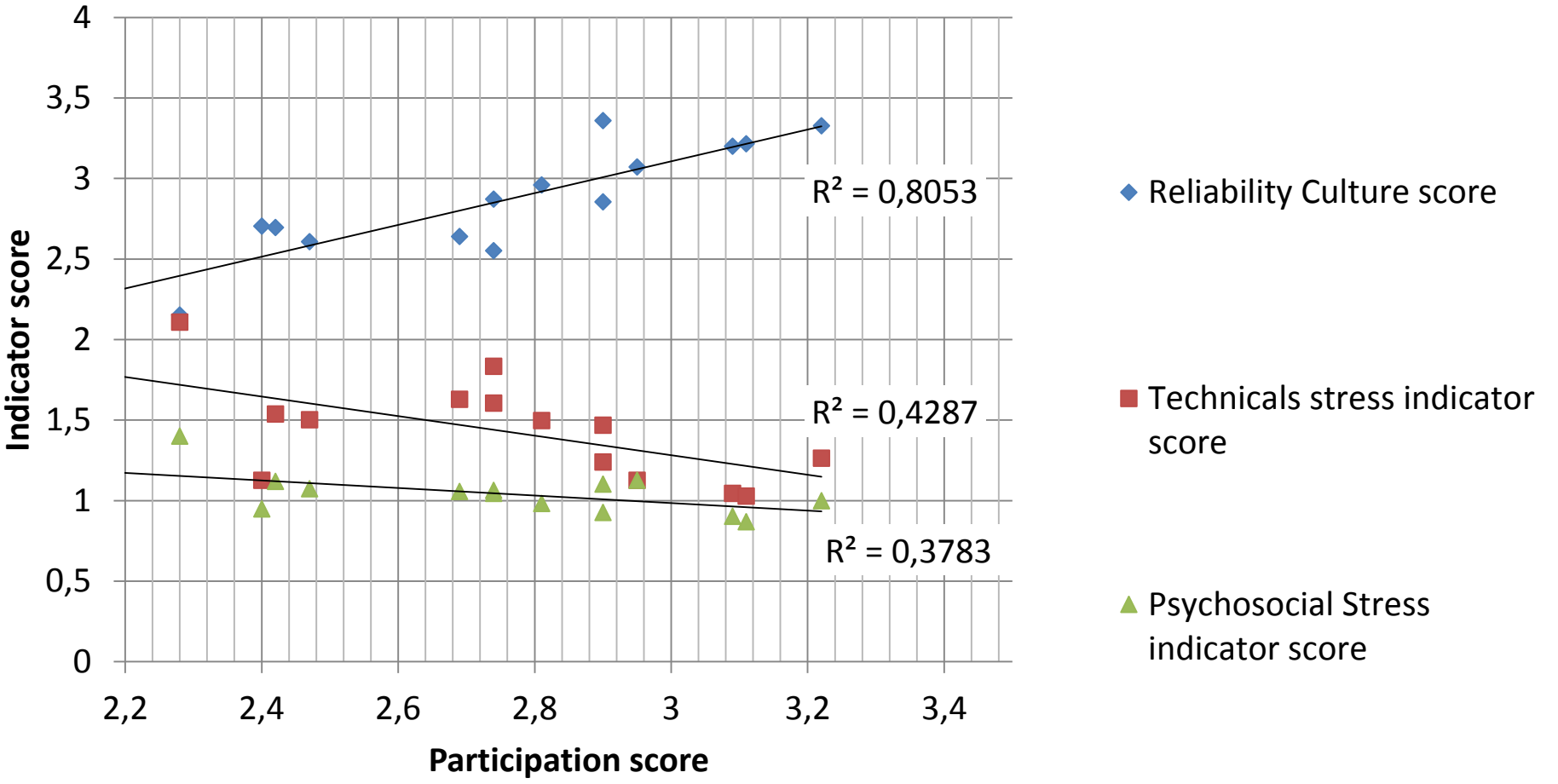
People are not afraid to admit mistakes.

There is no loss of important information regarding maintenance between shifts.

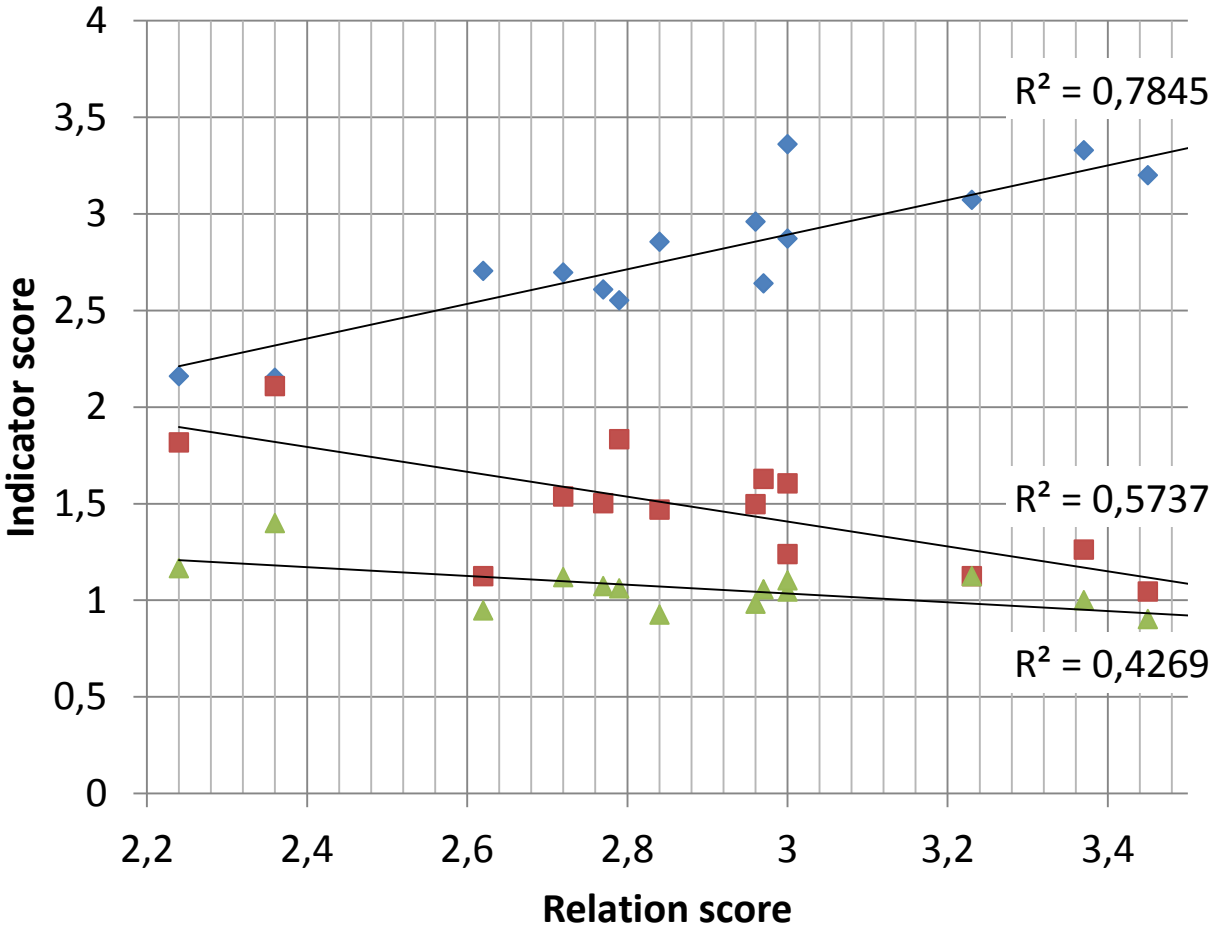
There is sufficient information and knowledge when starting up new equipment.



Impact of Bottom-up participation of the technicians in the maintenance policy



Impact of the relation between operations/production and technicians



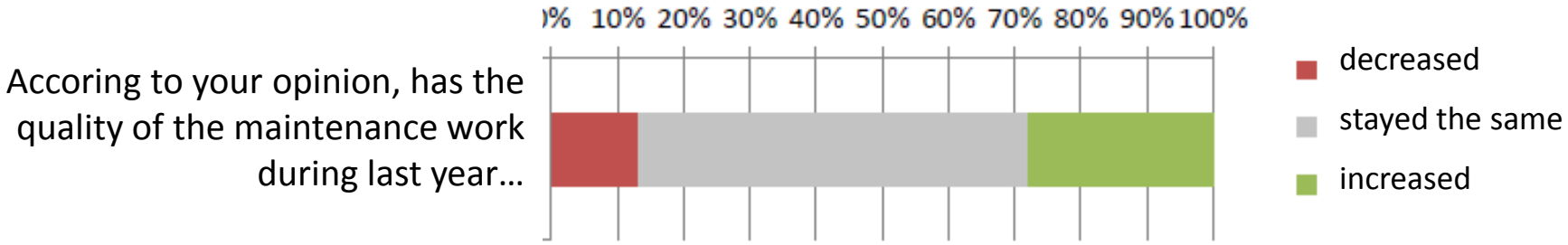
Time pressure …

Things NOT executed during the most recent shift (due to time pressure)	% of asset owner technicians
Analysis of possible root causes of a defect	32%
Planning and preparation of the work to be executed	28%
Updating technical documentation and diagrams	25%
Adequate reporting about the executed maintenance activities	23%
Preventing a potential next defect on the equipment / installation involved (eg lubrication, replacement of nearly worn-out parts, small adaptations in the PLC program)	22%
Instruction and 'education' of the operator to prevent recurrence of breakdowns / failures	22%
Removing of dirt/contamination/foul from (parts of) the equipment	19%
Consultation with the operator involved at the start of or during the maintenance activities	19%
Careful assembly (correct aligned, labeling …)	18%
A thorough inspection after completion of the work, in order to be able to start safely and without difficulties.	18%
Adequate inspection of (parts of) an equipment / installation	17%
Safe stop and lock-out/tag-out of the equipment / installations before an intervention	13%
Use of lifting equipment to lift (heavy) parts	13%

Reliability trend

- 30 % of the technicians working at an Asset owner estimate that the quality of their maintenance work has improved.
- 13% of them have the impression the quality of the maintenance work has decreased.
- This is an interesting leading indicator for future relability performance.

Technicians working for an asset owner



- 3 Trends & Challenges
  - Aging Assets
  - Aging population
  - Sustainability

Maintenance as key enabler for sustainable manufacturing & Circular economy

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- When can Maintenance have an impact on sustainability & efficient material use?
  - Making the correct choices when there is a break down:
    - Repair or Replace (eg electrical motor)
  - During operations
    - By preventing breakdowns and premature wear (reliability)
    - By minimizing energy consumption through application of best practice allignment, lubrication, etc…
  - By maximizing & extending the lifetime of the equipment
  - By maximizing input into the circular economy at end of equipment life

Maintenance as key enabler for sustainable manufacturing & Circular economy

- Challenge:
  - Maintenance helps increasing sustainability and reducing material use , but this contribution is not quantified.
  - There is no guidance or framework that can help asset owners or MRO service providers to take the most sustainable decisions regarding maintenance, neighter in the operational phase, nor in the design phase of an industrial asset.
  - There is no general agreement on how to report on the sustainability of maintenance and reliability activities
  - As a result, Sustainability optimization of maintenance processes has still to start...

Content

- Introduction

- 3 Trends & Challenges

- 3 

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1. Wearables & Smart devices

https://www.youtube.com/watch?v=2jIbhRPCJG4

1. Wearables & Smart devices

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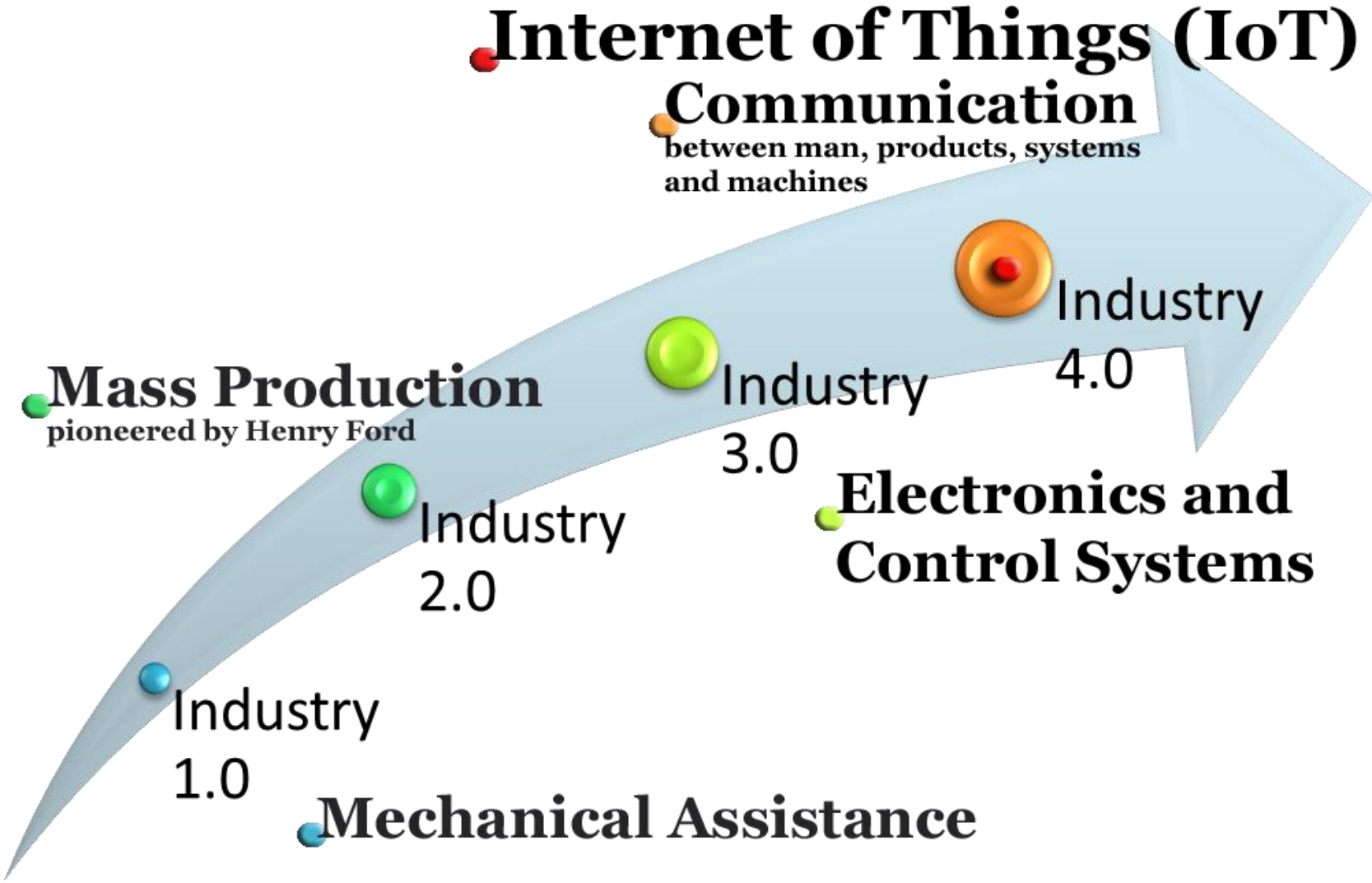
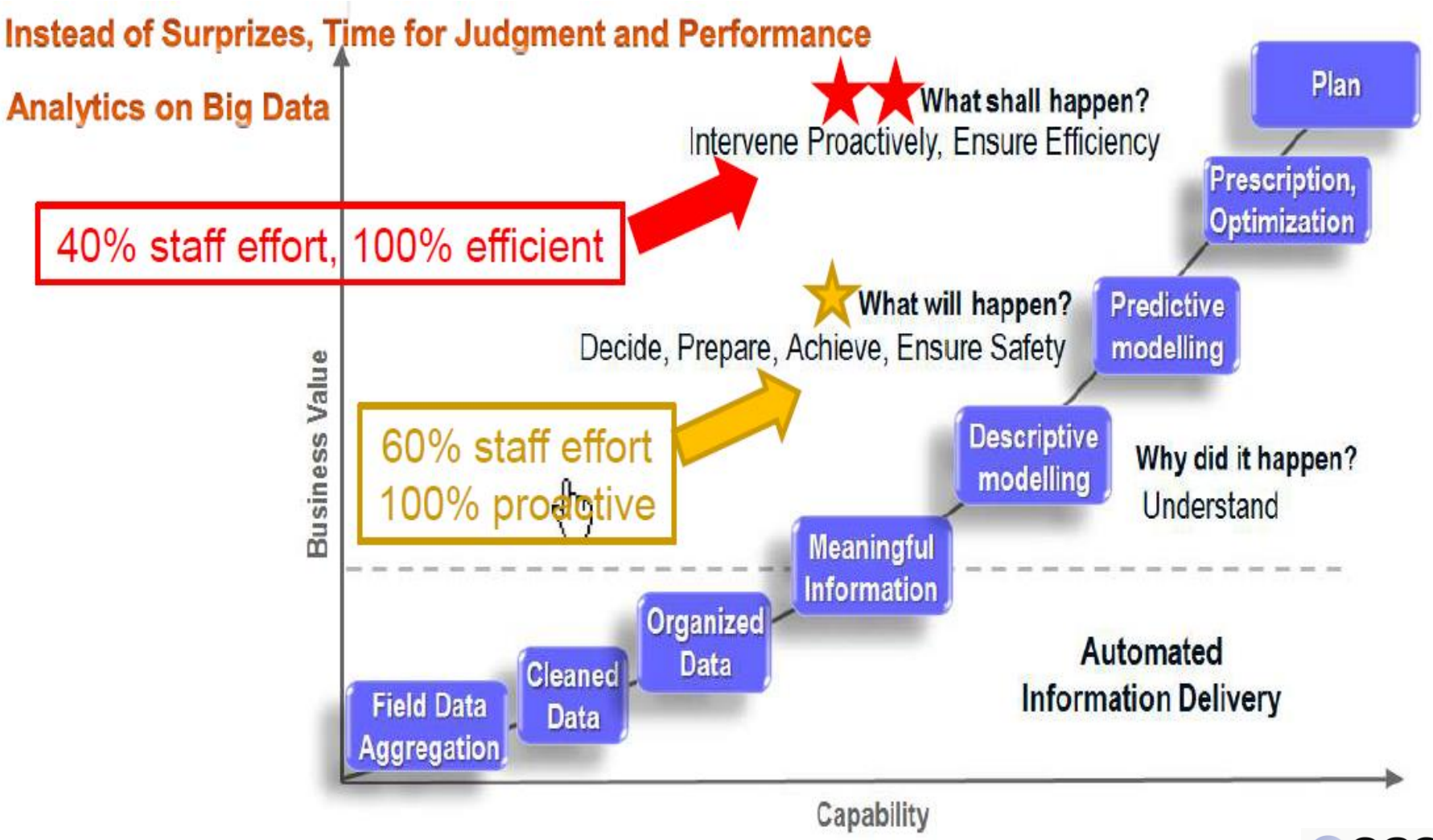
2. Big data & industry 4.0



2. Big data & industry 4.0

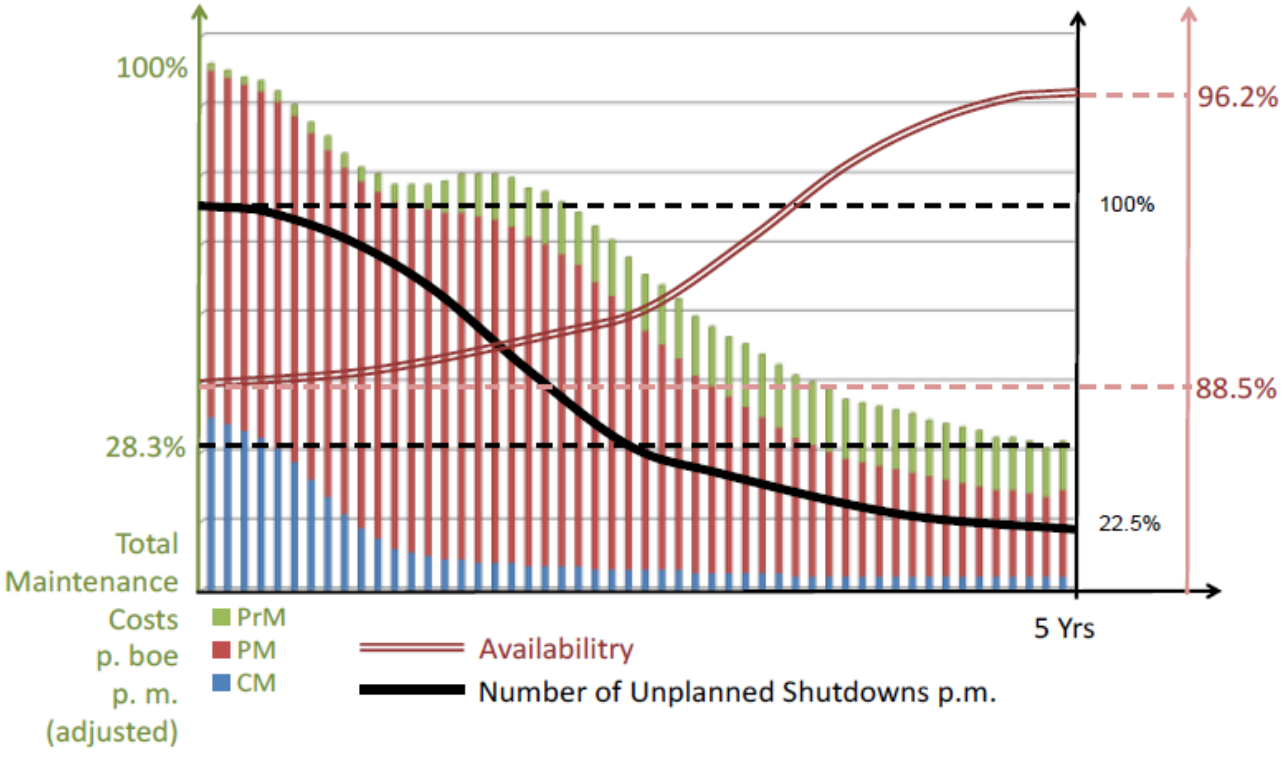


=> New definition of “predictive” maintenance

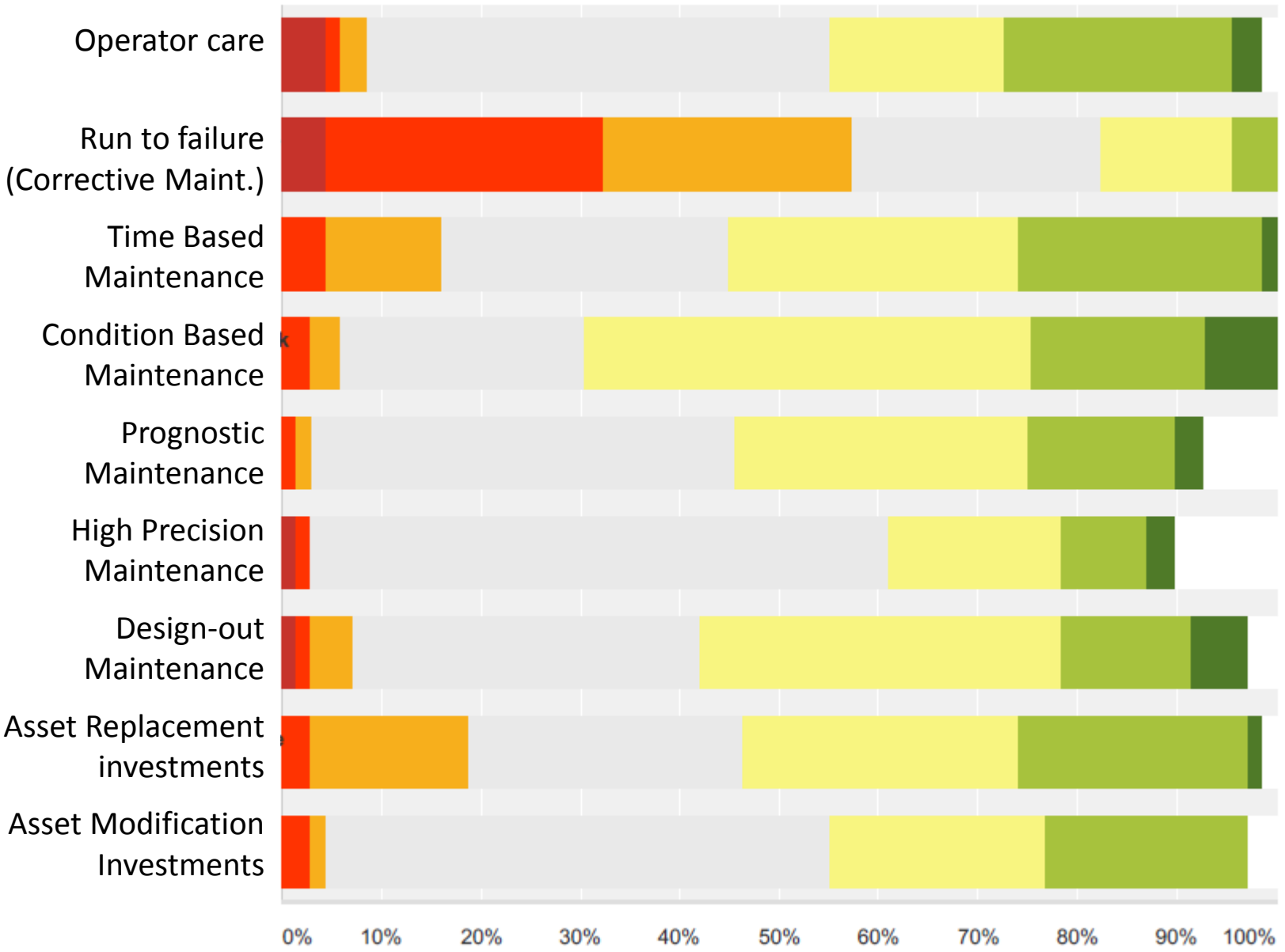
2. Big data & industry 4.0

BUSINESS IMPACT | ***SIGNIFICANT MAINTENANCE EFFORT AND COST REDUCTION***

Substantial reduction of maintenance effort while increasing the reliability and availability. The relative distribution of PrM, PM & CM explains the benefits



BEMAS Market Survey 2016



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3. Robotisation

http://www.dw.de/in-industry-40-machines-take-over-factories/a-17357299

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In Industry 4.0, machines take over factories

Networking machines in production facilities is supposed to spark the next industrial revolution. Industry 4.0, or smart factories, promises to optimize production. But how far has the new technology already come?

Industrial connectivity company Weidmüller is promoting itself as a leader in Industry 4.0

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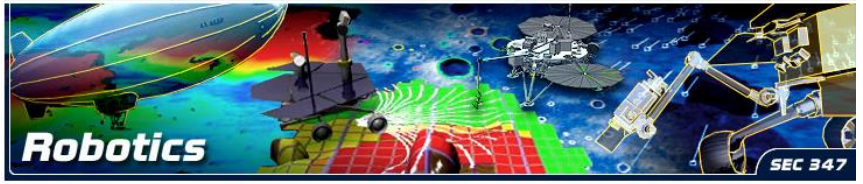

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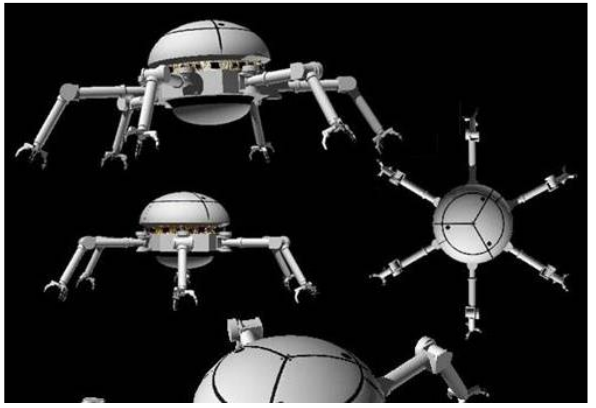
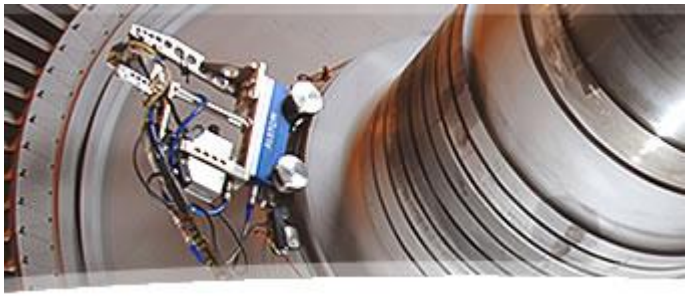
TASK PAGE | IMAGE GALLERY | VIDEO GALLERY

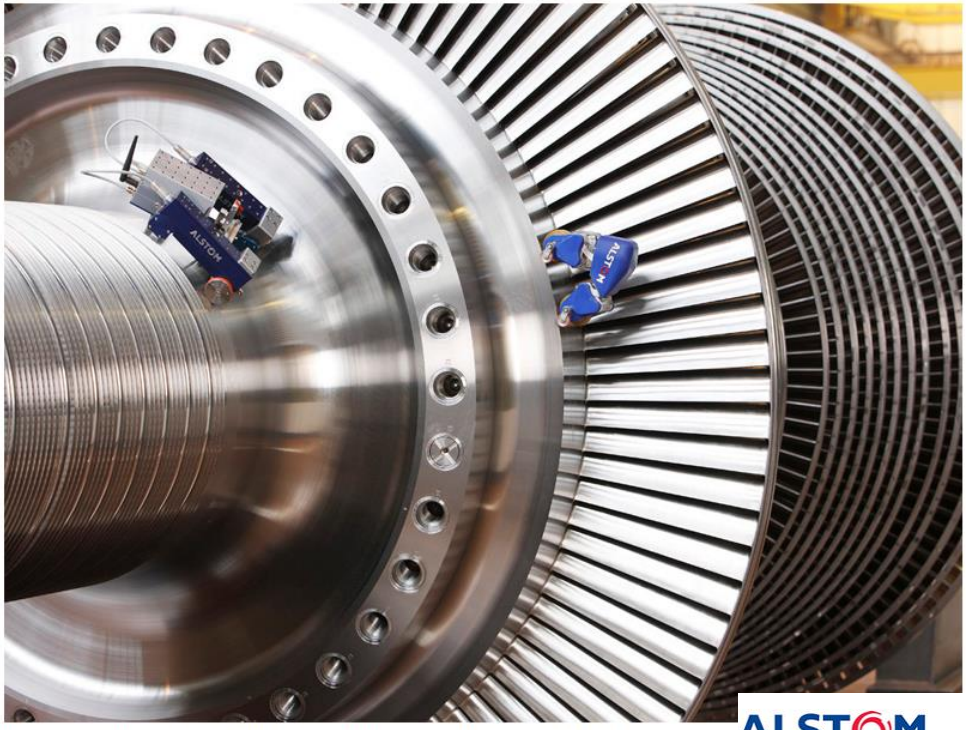
AWIMR: Autonomous Walking Inspection and Maintenance Robot



3. Robotisation

Der von der ETH Zürich entwickelte «AirGapCrawler» inspiziert die Kupferbahnen eines Generators und überprüft die Isolation. (Bild: ETH Zürich).
Image 1 of 2





Die Inspektionsroboter arbeiten bedeutend schneller als ihre menschlichen Vorbilder. Hier eine Testfahrt auf einer Dampfturbine. (Bild: Alstom Inspection Robotics)

3. Robotisation - Drones

Western Daily Press

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Airline easyJet ditches pilots for maintenance flights with drones

By Western Daily Press | Posted: May 08, 2014 By Peter Woodman

Unmanned **flying drones** are to be used by a low-fare airline to inspect its fleet of Airbus aircraft.

Budget carrier easyJet hopes to introduce the drones as early as next year following trials in the next few months.

The drones will be programmed to scan and assess the carrier's fleet of Airbus A319 and A320 planes, reporting back to engineers on any damage which may require further inspection or maintenance work.

The airline is working with the Coptercraft and Measurement Solutions companies as well as Bristol Robotics Laboratory on modifying existing technology so it can bring in the drones. Ian Davies, head of engineering at easyJet, said: "Drone technology could be used extremely effectively to help us perform aircraft checks.

http://www.westerndailypress.co.uk/Airline-easyJet-ditches-pilots-maintenance/story-21071854-detail/story.html#ixzz3UfSPIHV1

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Thank you

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