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BEARING RELIABILITY CONFERENCE & EXPO

Improving the diagnostic capabilities with Big Data Analytics and Prognostics

JORGE ALARCON | JESUS TERRADILLOS
IK4-TEKNIKER

lubrication management
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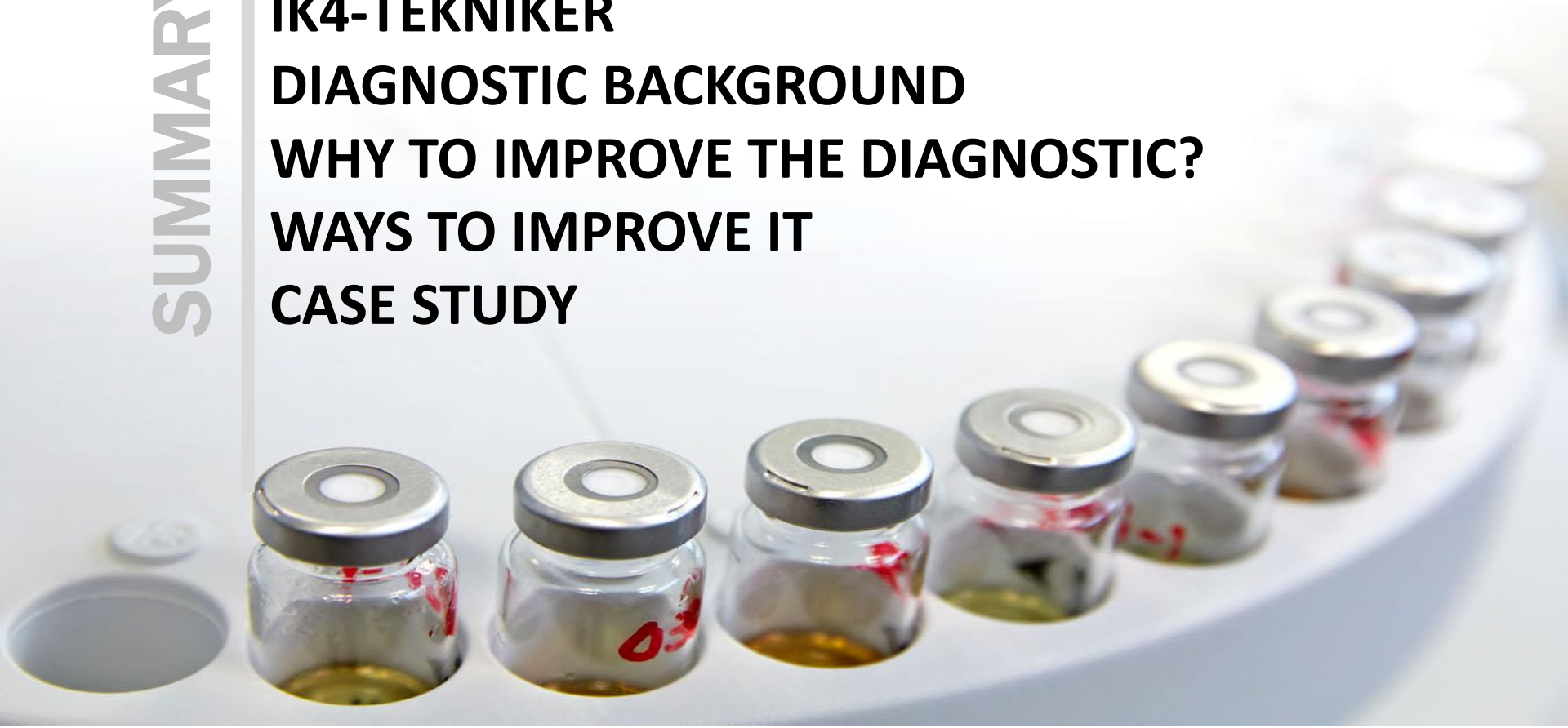
SUMMARY

IK4-TEKNIKER
DIAGNOSTIC BACKGROUND
WHY TO IMPROVE THE DIAGNOSTIC?
WAYS TO IMPROVE IT
CASE STUDY



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INDUSTRIAL MILESTONES

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Connected and Smart devices

1800

Industry 1.0
Steam-driven production

1900

Industry 2.0
Mass production supported by specialization and electricity

1970

Industry 3.0
Production automation, electronics and IT

2016

Industry 4.0
Production by cyber-physical systems

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EVOLUTION OF MANUFACTURING

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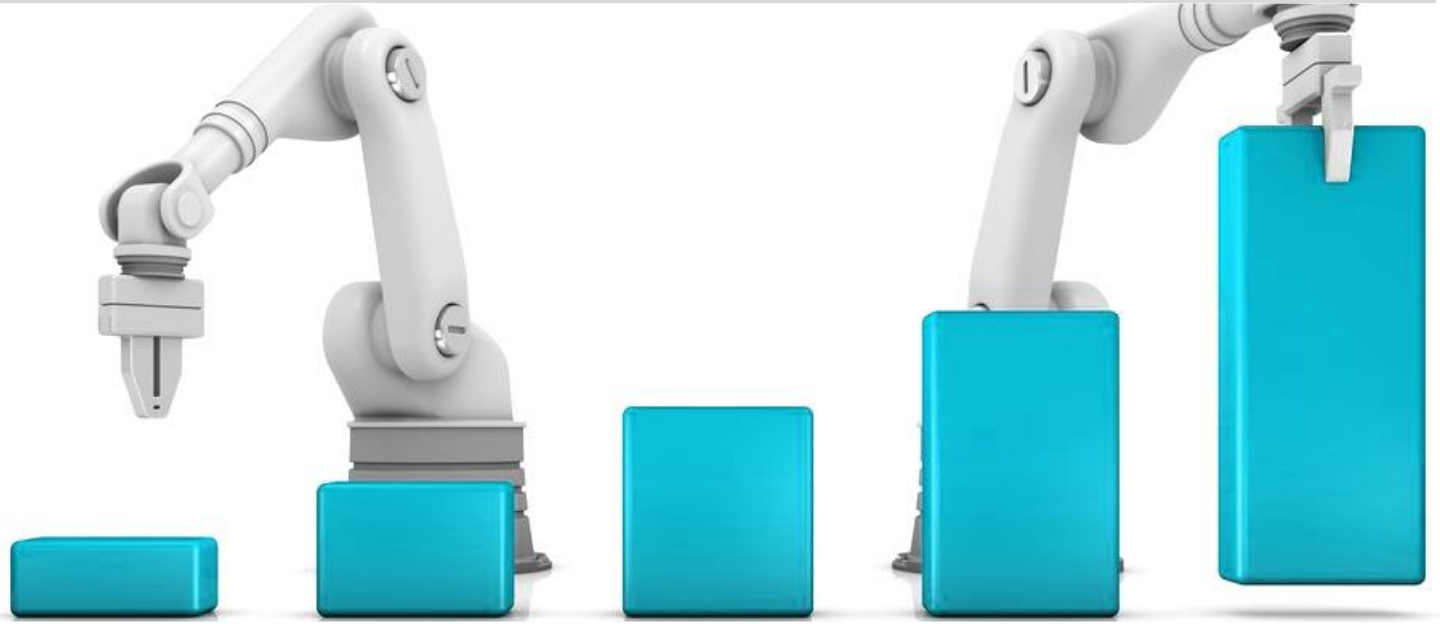
NEW DIGITAL AGE

NEW MARKET EXPECTATIONS

CHANGES IN CUSTOMER BEHAVIOR



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WE ARE MOVING TOWARDS 4TH MAINTENANCE GENERATION

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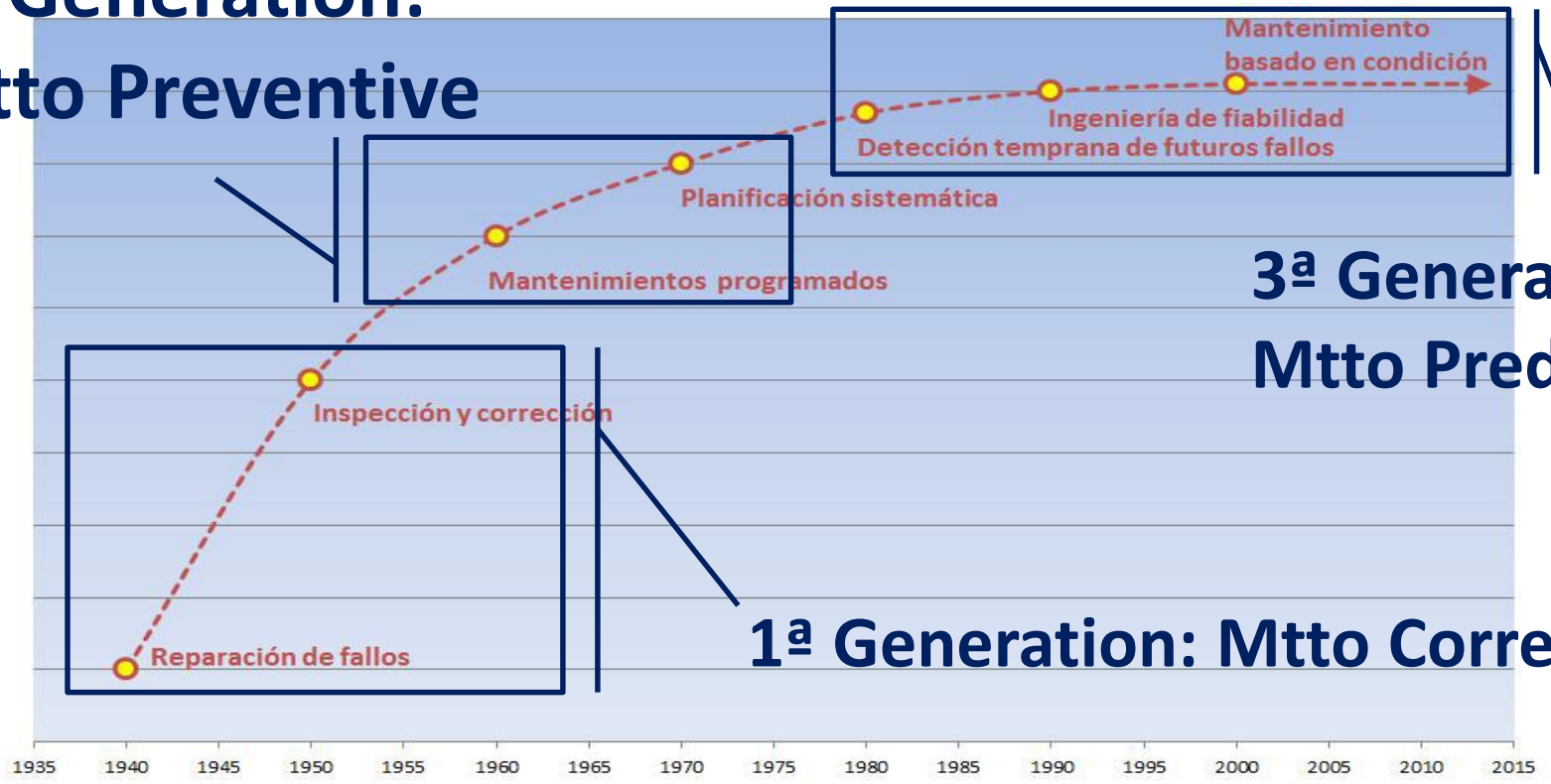
2ª Generation: Mtto Preventive



3ª Generation: Mtto Predictive

1ª Generation: Mtto Corrective

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MAINTENANCE MILESTONES

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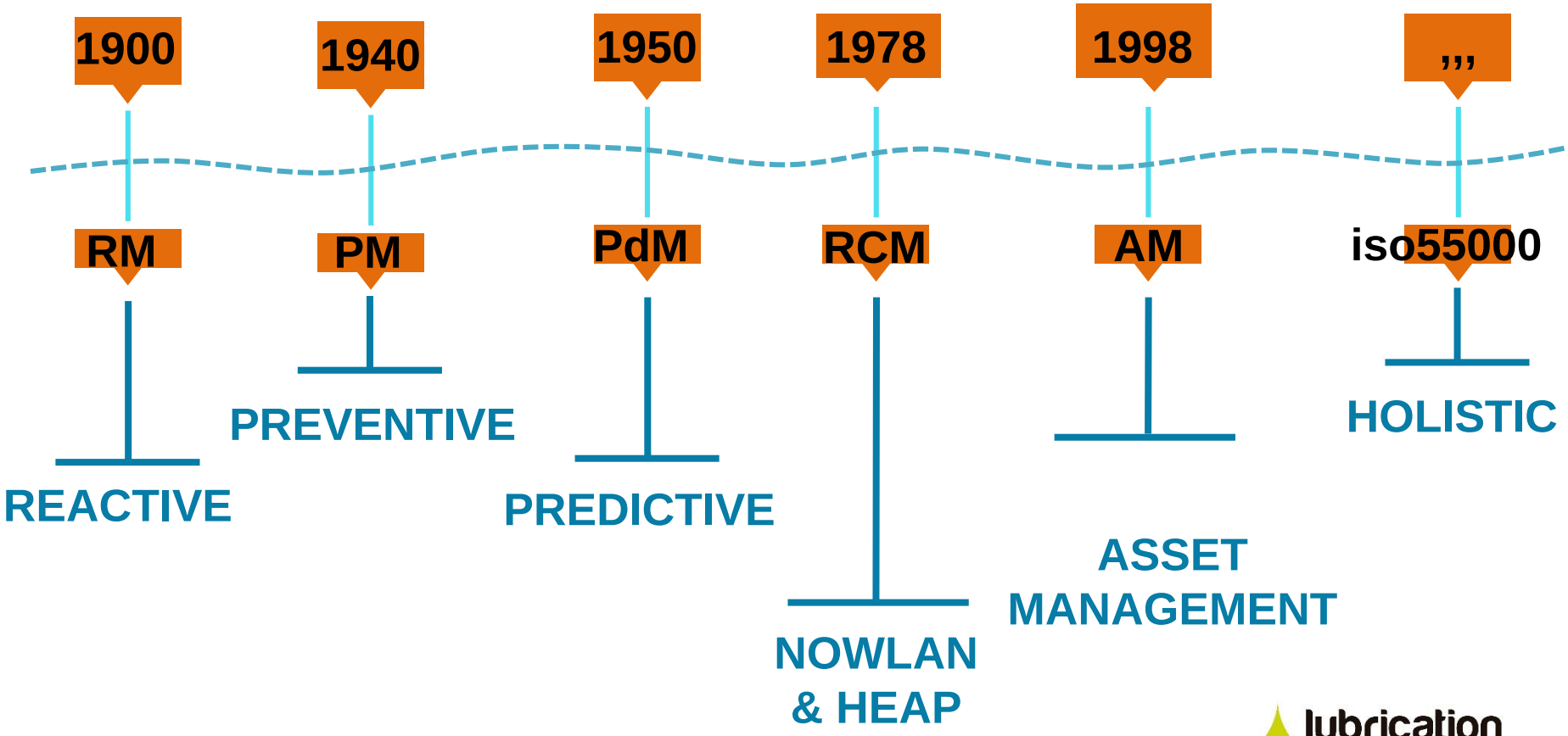

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STILL THE SAME PROBLEMS

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32%

Appropriate Lubrication processes in plant

Ref: Machinery Lubrication Reader Survey - March, 2011 (n: 347)

40%

Average time spent on corrective maintenance activities

Ref: Think Act - November 2014

WORLD CLASS < 6%

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50%
mechanical components

IS THIS A GOOD REASON TO IMPROVE DIAGNOSTIC ON MONITORED EQUIPMENT?

are replaced due to premature wear

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DATA SOURCES

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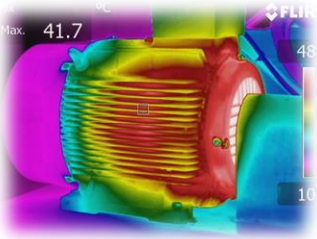
CONDITION MONITORING TOOLS

HOW
WHEN



NEW SCENARIO?

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1970´s → **COMMON DIAGNOSTIC** → 2015

GOOD
Below limits

ALERT
Slightly above limits

CRITICAL
Above limits

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WHAT IS DIAGNOSTIC?

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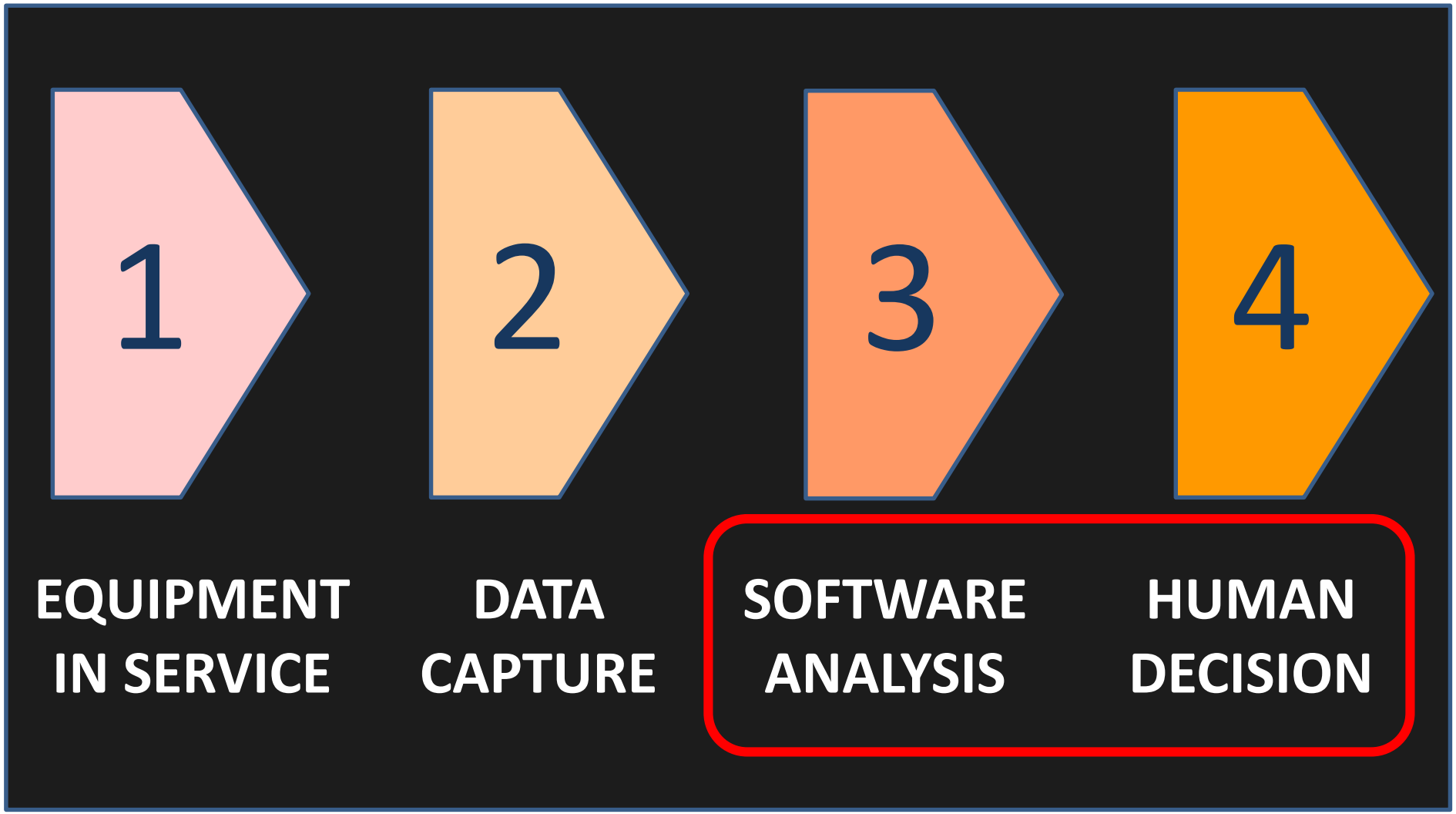

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In 20 years

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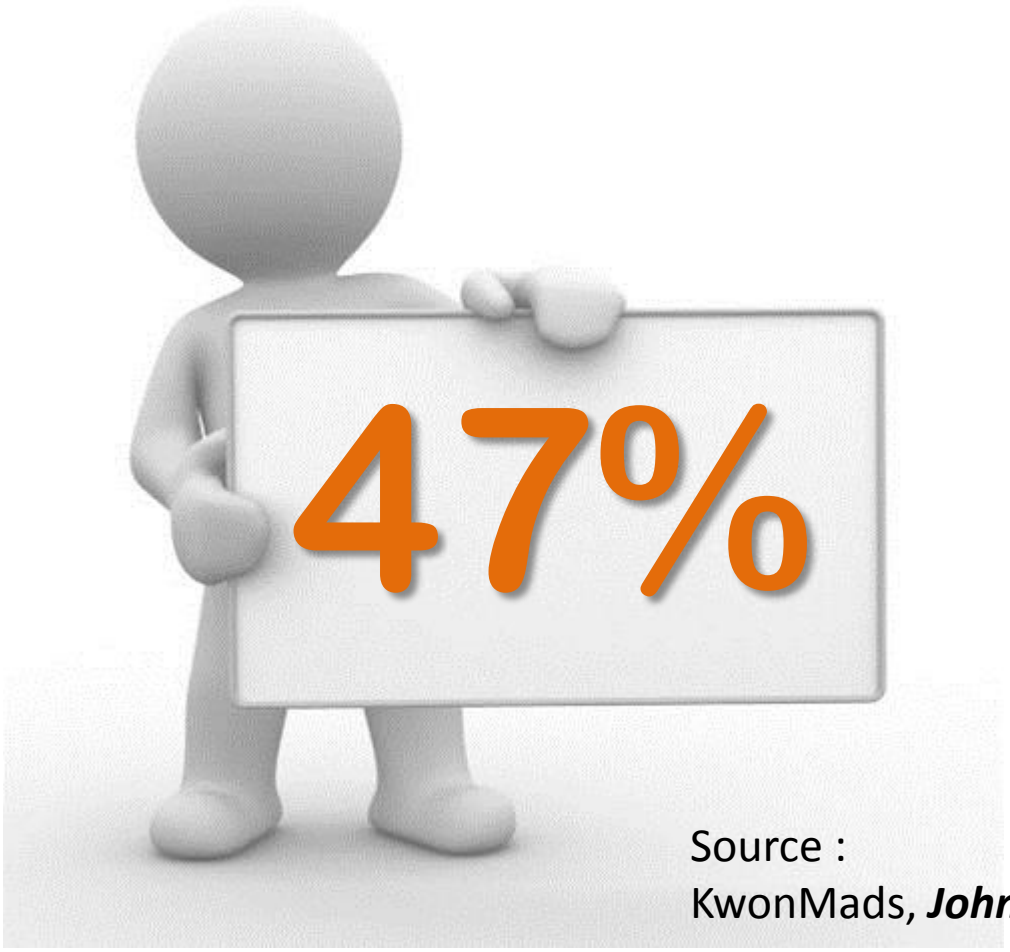
# of jobs will be automated by machines or software



Source :
KwonMads, ***John Moravec***

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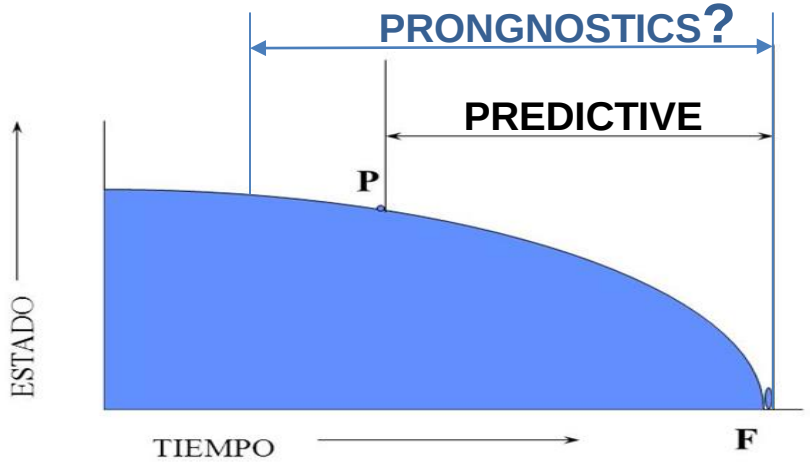
There is enough information (Big Data)

Strange but important events

Multidisciplinary team: Experts + analysts



76%

Industrial companies are **not aware** of the potential on the analysis and their data

Ref: SAS Report on Big Data 2013

WAYS TO IMPROVE IT

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COMMON DIAGNOSTIC

+

BIG DATA ANALYTICS

+

PROGNOSTICS

GOOD

ALERT

CRITICAL

BIG DATA

Is a new paradigm that represents the search for solutions to store and analyze structured and unstructured data together for an affordable and scalable data mode.

PREDICTIVE ANALYTICS

A variety of statistical techniques from modeling, machine learning, and data mining that analyze current and historical facts to make predictions about future, or otherwise unknown, events.

PROGNOSTICS

Algorithms to detect interesting patterns in data.

Statement about the way things will happen in the future

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CASE STUDY

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- Critical bearings in Plant: **320**
- Schedule Maintenance Shutdown: **4-6 months**
- 5 years of grease analysis of each bearing
- 2 different type of greases
- 3 different bearing models

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BEARING CONDITION

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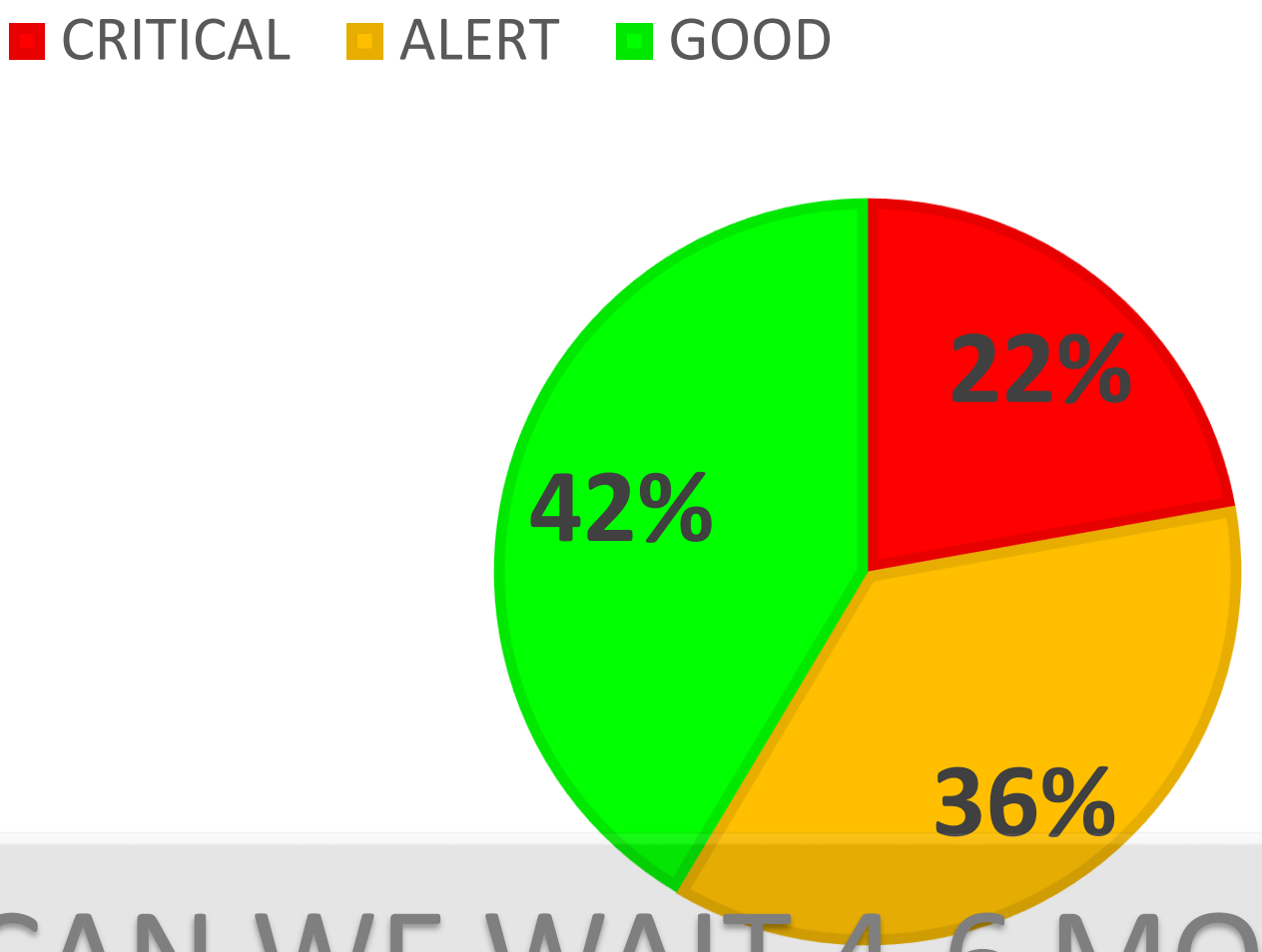

CAN WE WAIT 4-6 MONTHS?

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INFORMATION

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Critical 71: DO SOME MAINTENANCE!
Alert 115: BE AWERE OF CONDITION
Good 134: ENOUGH TIME

- 1 bearing shutdown = **1.500 € per day**
- Time to repair a bearing = **3 days**
- Potential **production** losses = 319.500 € (critical) + 517.500 € (alert)

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INFORMATION

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- Around 4.000 reports
- 3 different type of failures detected in the past

1	996566	P.E. LA FE - SAN MARTIN	05/12/2015	03/09/2015			23277 H	The oi There wear
2	1012344	P.E. ALENTISQUE	03/11/2015	03/11/2015	NULL	50815 H	50815 H	The oi contar
3	1012991	P.E. CASTELLANETA BKW	04/11/2015	04/11/2015			18648 H	The oi contar
4	1013334	P.E. FUENTE VAIN	30/10/2015	05/11/2015			46200 H	Viscos 2091.
5	1013416	P.E. SIERRA DE OLIVA	30/10/2015	06/11/2015			54916 H	The oi contar
6	1013417	P.E. SIERRA DE OLIVA	30/10/2015	06/11/2015			62054 H	The oi contar
7	1013419	P.E. SIERRA DE OLIVA	30/10/2015	06/11/2015			62054 H	Silicon in VTM
8	1013421	P.E. SIERRA DE OLIVA	30/10/2015	06/11/2015			54916 H	The oi contar
9	1013423	P.E. SIERRA DE OLIVA	30/10/2015	06/11/2015			62054	Contac
10	1013425	P.E. LEZUZA	30/10/2015	06/11/2015			35605 H	The oi contar
11	1014295	W.F. SOUDAN	10/11/2015	10/11/2015			27163 H	The oi contar
12	1014305	P.E. VIRGEN DE LA PEÑA	30/10/2015	10/11/2015			76138 H	The oi contar
13	1014312	P.E. LUCERA	10/11/2015	10/11/2015			27526 H	The oi contar
14	1014324	P.E. LUCERA	10/11/2015	10/11/2015			27526 H	The oi contar
15	1014348	P.E. FOIANO-BN EDISON	10/11/2015	10/11/2015			35781 H	The oi contar
16	1014352	P.E. FOIANO-BN EDISON	10/11/2015	10/11/2015			137483 H	The oi contar
17	1014357	P.E. GINESTRA STAR WIND	10/11/2015	10/11/2015			138897 H	The oi contar
18	1014570	P.E. JANDA III	30/10/2015	11/11/2015		26272	26272	The oi contar
19	1014571	P.E. JANDA III	30/10/2015	11/11/2015		26272	26272	The oi contar
20	1014572	P.E. EL PINO	05/11/2015	11/11/2015		80069 H	80069 H	The oi

SamplesResultsBySampleAndParame

BIG DATA ANALYTICS & OIL ANALYSIS

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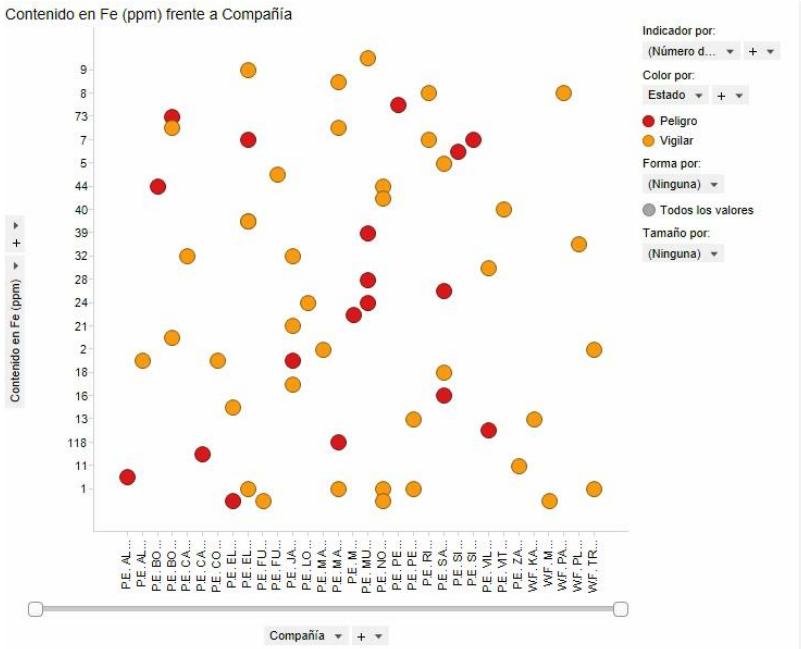

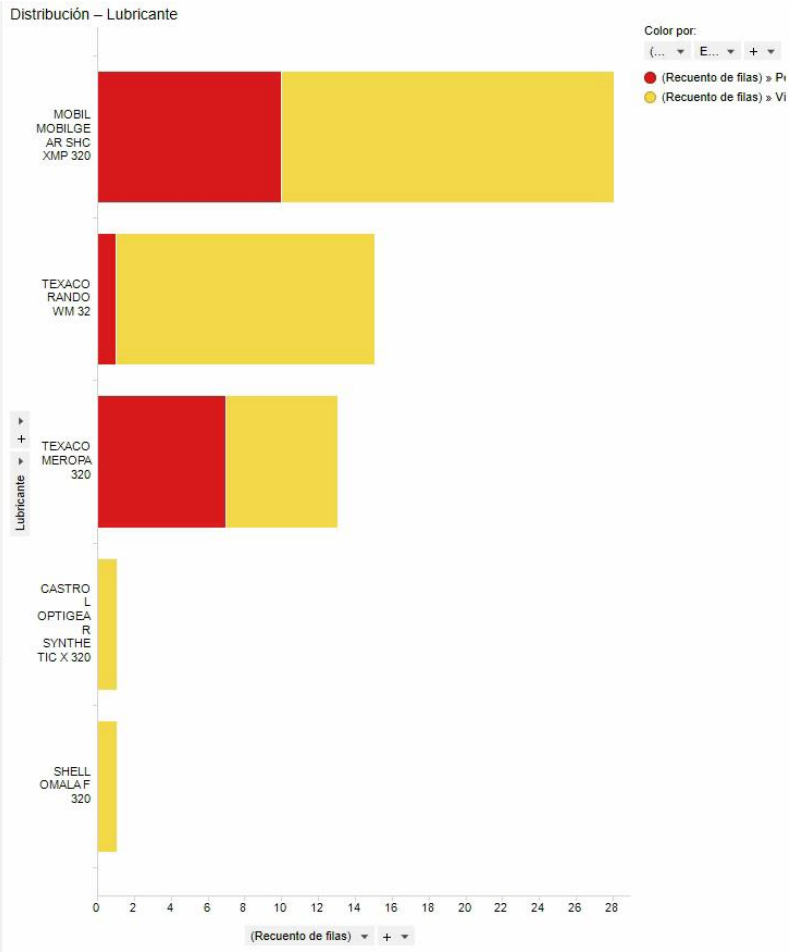

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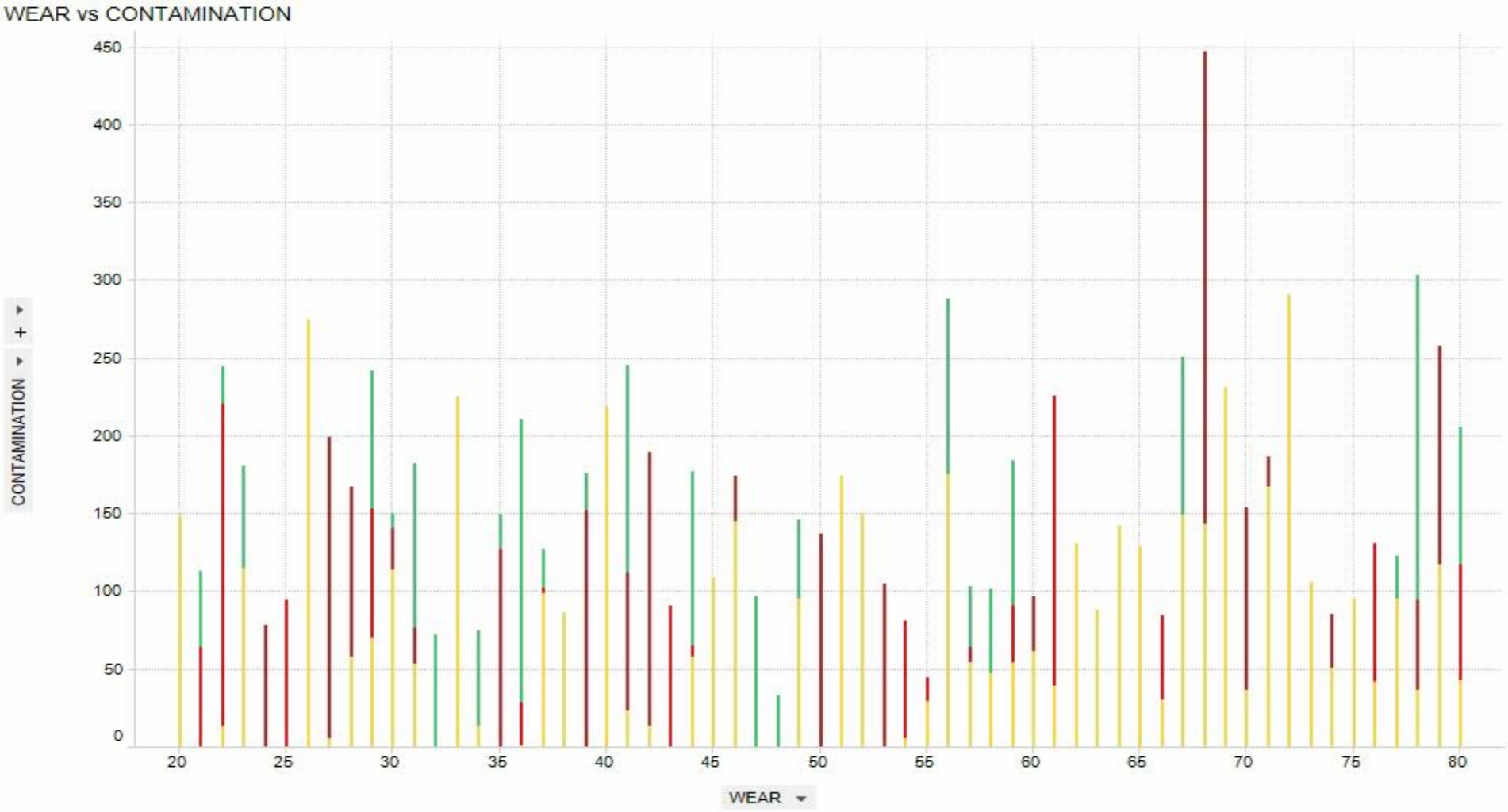
WEAR vs CONTAMINATION
CONTAMINATION
WEAR
0
50
100
150
200
250
300
350
400
450
20
25
30
35
40
45
50
55
60
65
70
75
80

HOW is going to fail?

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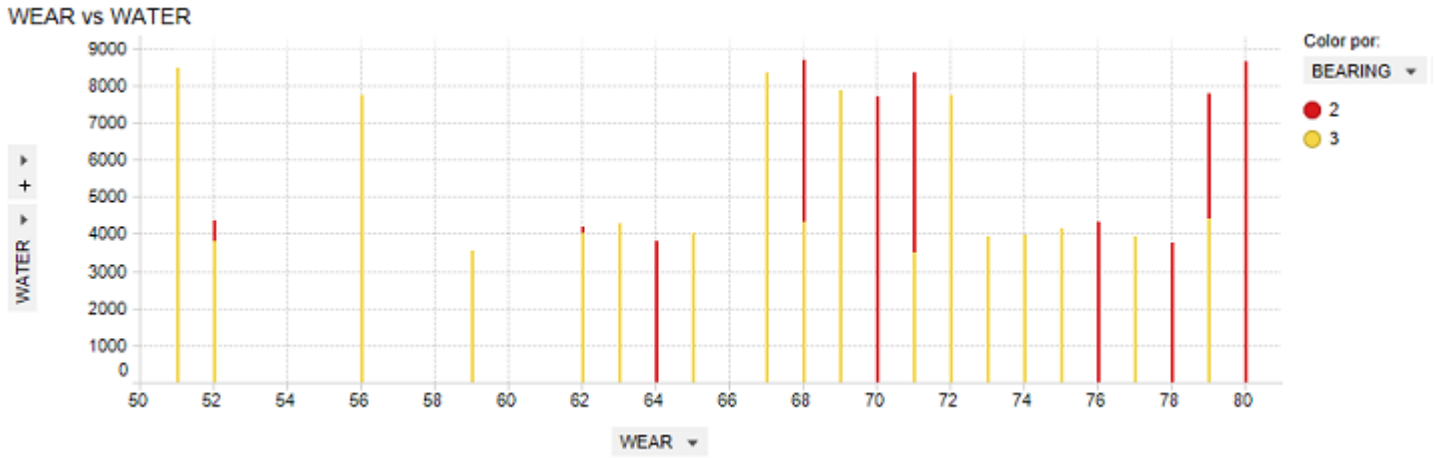
BIG DATA ANALYTICS



9 bearings of type 2 - Failure type b

17 bearings of type 3 - Failure type a

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PROGNOSTICS

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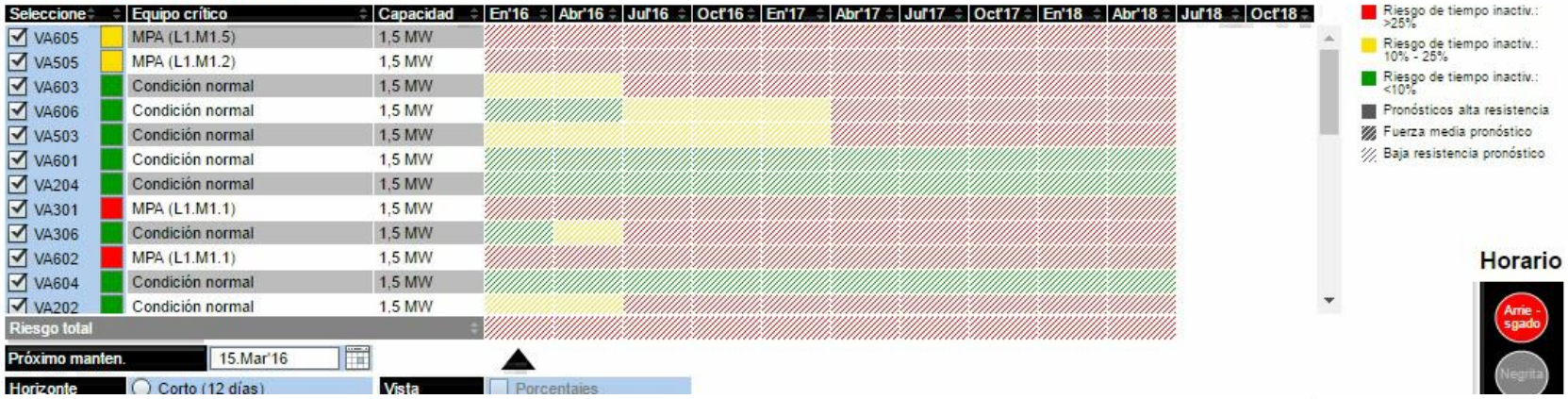
Especificación de flota

Nombre del operador	Acciona Energia
Nombre de flota	VED
Localización flota	Monte Vedadillo (Falces)
Tipo de flota	Parque Eólico
Capacidad de la flota	49,5 MW
Flota ID	VED
Unidades monitoreadas	VA

Diagnóstico de condición

Condición

Pronósticos de mal funcionamiento



Horario

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WHEN is going to fail?

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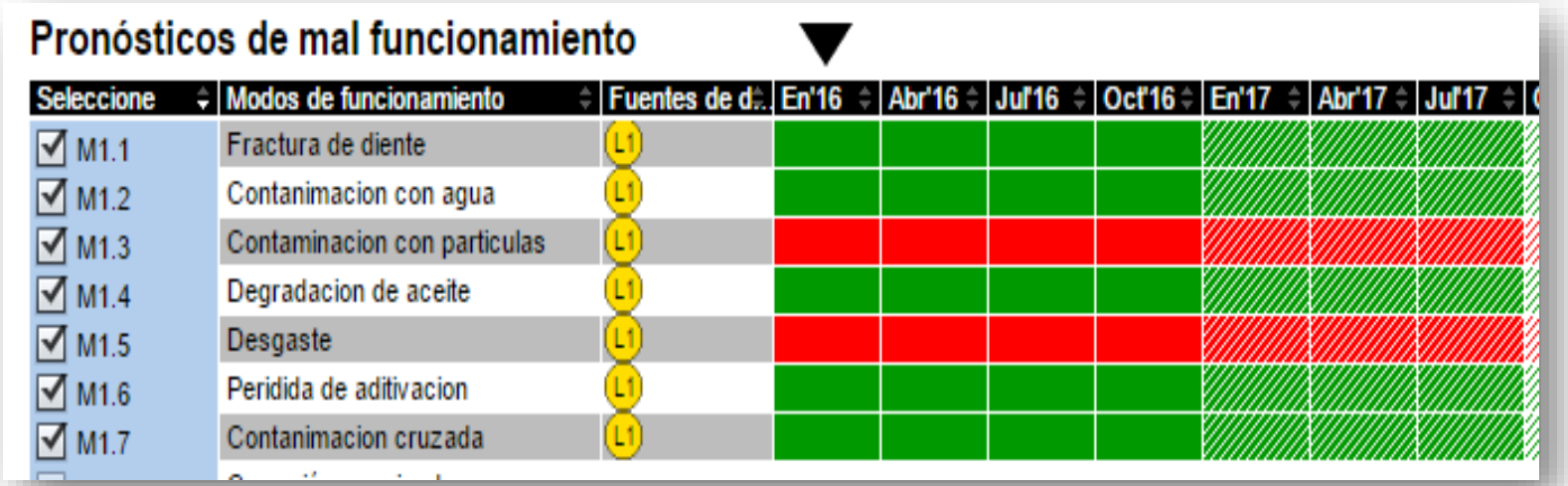
PROGNOSTICS



Pronósticos de mal funcionamiento

Seleccione	Modos de funcionamiento	Fuentes de d...	En'16	Abr'16	Jul'16	Oct'16	En'17	Abr'17	Jul'17
M1.1	Fractura de diente	L1							
M1.2	Contanimacion con agua	L1							
M1.3	Contaminacion con particulas	L1							
M1.4	Degradacion de aceite	L1							
M1.5	Desgaste	L1							
M1.6	Peridida de aditivacion	L1							
M1.7	Contanimacion cruzada	L1							

Critical 71:

31% will fail in the next 3 months

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Case Study Conclusions

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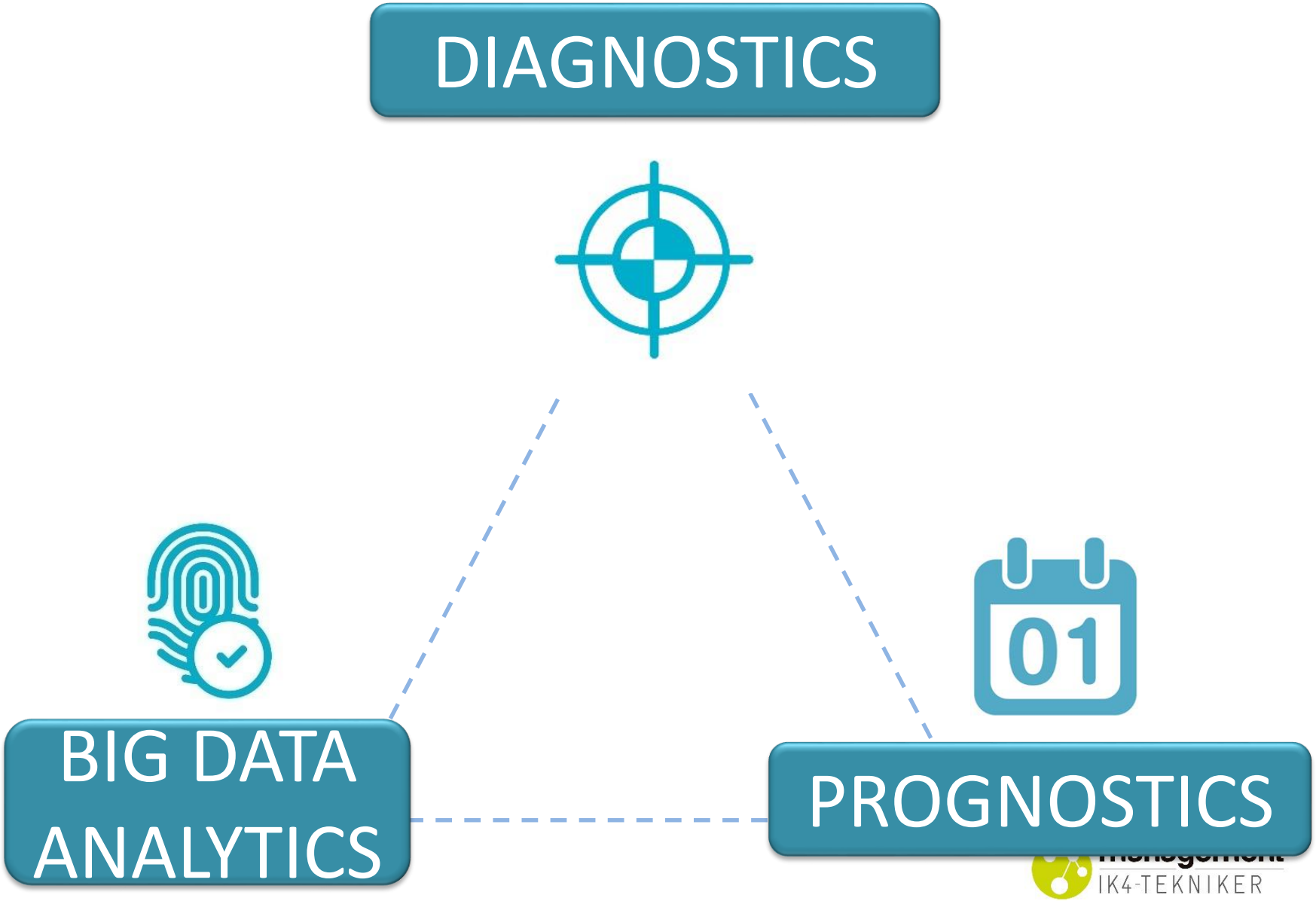

To sum up

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More Data doesn´t just let us see more

More data allow us to see **new**

More data allow us to see **better**

More data allow us to see **different**

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