The LEGO Group

How Sustainability Drives Manufacturing Efficiency, Productivity, and Workforce Collaboration and Engagement

by Jesper Toubol,
VP LEGO Operations

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I will share…

1. Who we are
2. What's important to us
3. How we do it:
   - Use machine learning to optimize condition-based maintenance.
   - Promote data democracy on the shop floor for connected workers.
   - Focus on variances to achieve operational excellence.

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The LEGO Group at a glance

Family-owned
Danish company
founded in

The LEGO name
comes from ‘LEg GOdt’,
meaning
‘play well’

#1
Reputable
Brand

111
countries

27,300+
colleagues

Top 100
influential
companies

Source: TIME 2021

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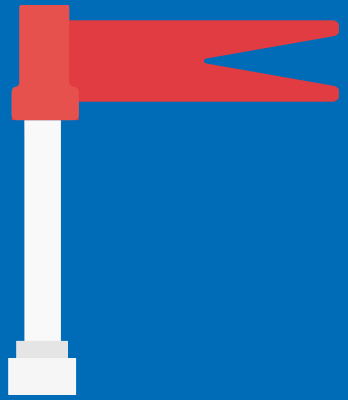

What we stand for

Children are our role models

Did you know?

6 bricks

=915 million combinations

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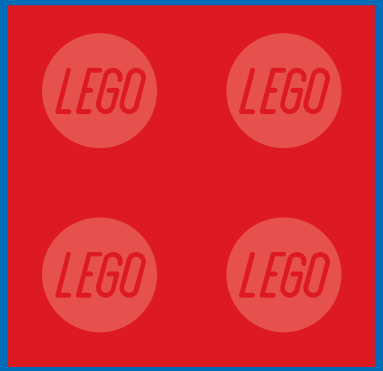

Our stategic priorities

Investing

for long-term growth

Innovating Play

Innovating Retail

Digital Transformation

Positive Environmental Impact

- Use machine learning to optimize condition-based maintenance.
- Promote data democracy on the shop floor for connected workers.
- Focus on variances to achieve operational excellence.

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GMEP

Global Maintenance Efficiency Program

Empower your operations with accessible data, fostering informed decision-making at lightning speed

G M E P

GMEP (Before- Now – Future)

2020

Target 5mEUR
Actual 7mEUR

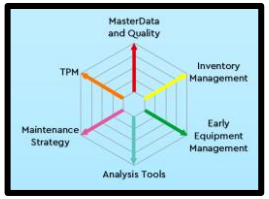
2021 2022 2023

Continue

GO!

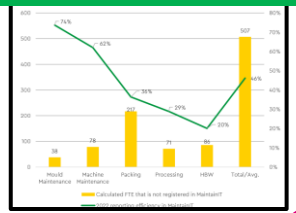
GMEP NEW Focus 2024

Assessment



Early Equip. Management

Employee Efficiency / Std. Time

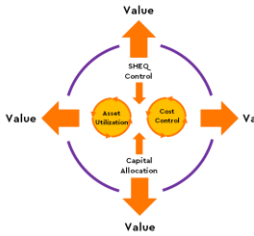


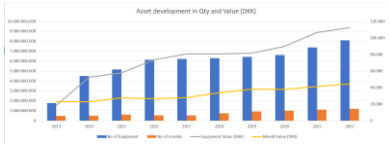
Apportunities

Network Group Focus
Super Goals

From Project to Partner
2024 – 2027
Additional 5mEUR saving
Sustain 8mEUR

New structure on Org.





PFP target for 2023

Americas Manufacturing	Asia Manufacturing	EMEA Moulding & DUPLO	EMEA Pack	Grand Total
-2,0	-1,2	-1,0	-1,2	- 8,0mDkk
32%	15%	38%	15%	100%

PFP target for 2024

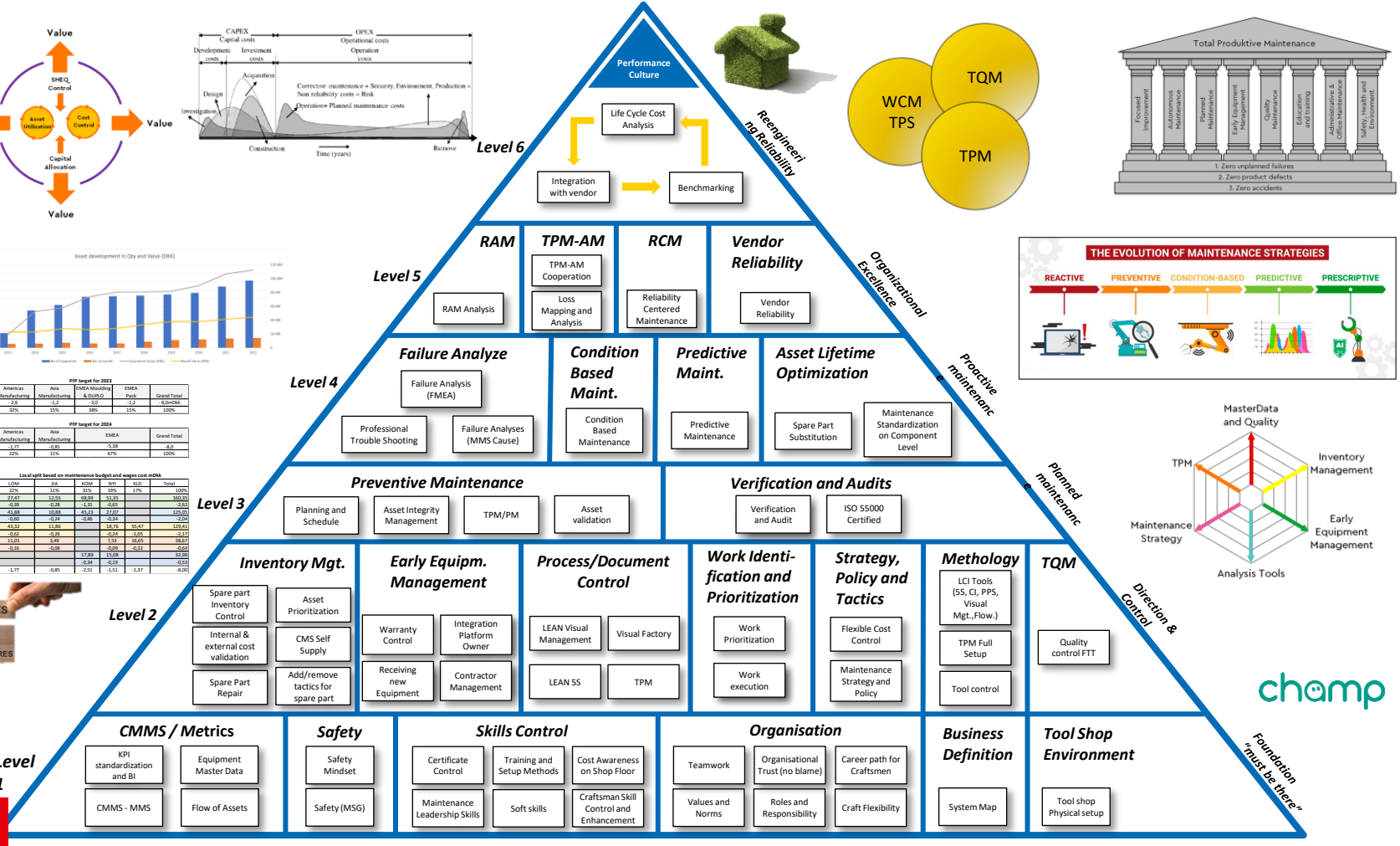
Americas Manufacturing	Asia Manufacturing	EMEA	Grand Total
-1,77	-0,85	-5,38	-8,0
22%	11%	67%	100%

Local split based on maintenance budget and wages cost mDkk

		LOM	JVA	KOM	NYI	KLD	Total
		22%	11%	31%	19%	17%	100%
Mould maintenance	Budget 2023	27,47	12,55	68,99	51,35		160,35
	PFP target	-0,39	-0,28	-1,31	-0,65		-2,62
Machine maintenance	Budget 2023	41,88	10,88	45,23	27,07		125,05
	PFP target	-0,60	-0,24	-0,86	-0,34		-2,04
Packing maint	Budget 2023	43,32	11,86		18,76	55,47	129,41
	PFP target	-0,62	-0,26		-0,24	-1,05	-2,17
Processing maint	Budget 2023	11,01	3,49		7,53	16,65	38,67
	PFP target	-0,16	-0,08		-0,09	-0,32	-0,64
HBWH maint	Budget 2023			17,89	15,08		32,96
	PFP target			-0,34	-0,19		-0,53
	Total	-1,77	-0,85	-2,51	-1,51	-1,37	-8,00

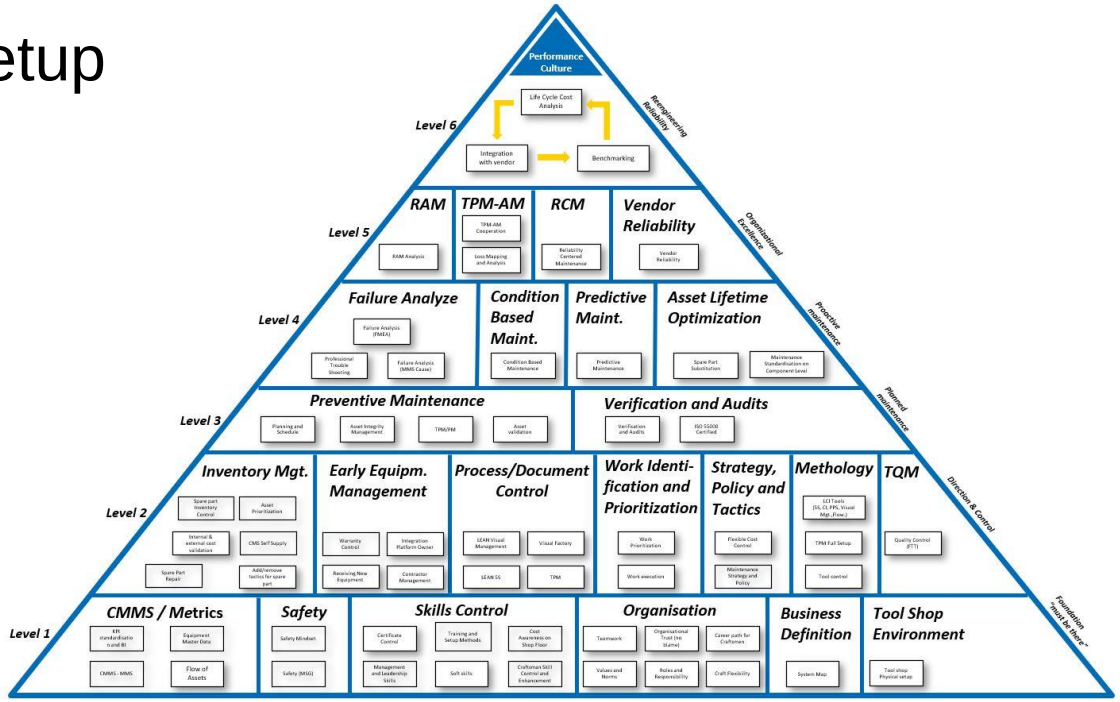
CMMS

Sparepart production



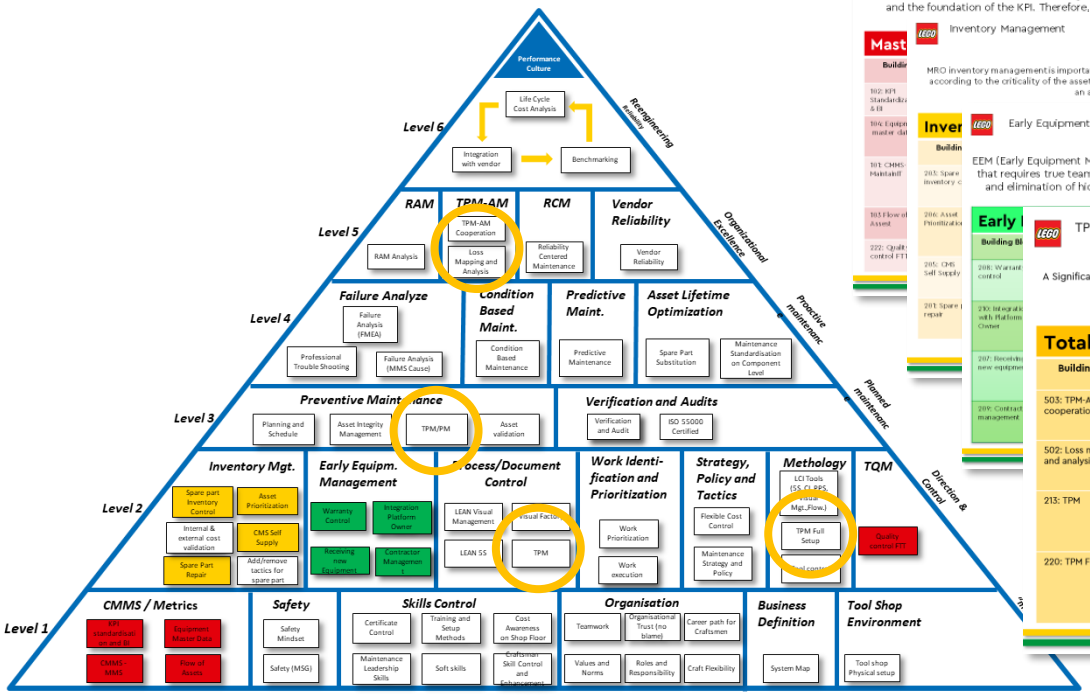
champ

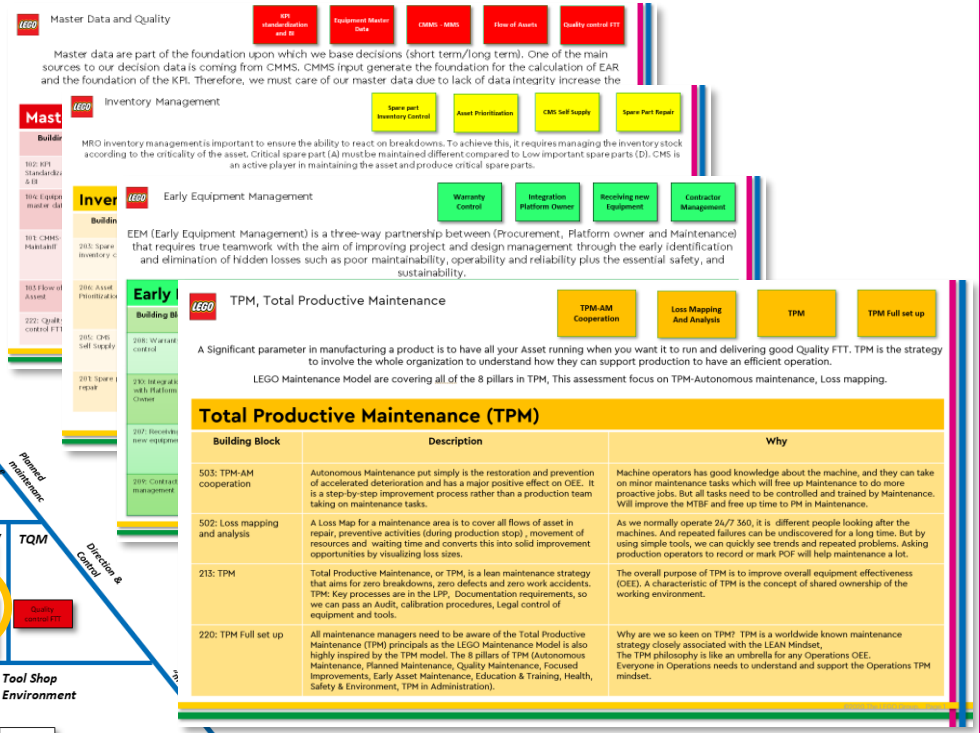
GMEP Setup



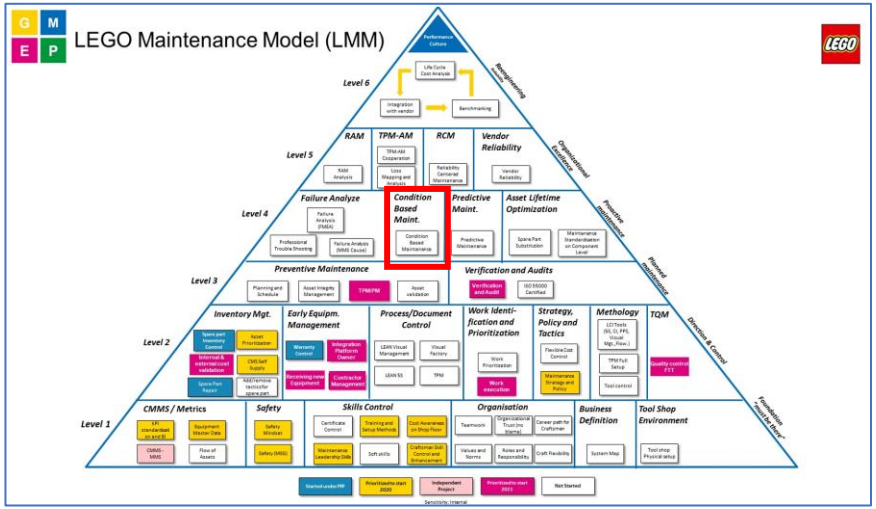
Technology Streams	Arears	People	Numbers	GMEP
• Packaging • Processing • HBWH • Mould • Machine	• 5 sites • 21 departments	• 53 people leaders • 1462 FTE • 5 GMEP team	• Budget 70 mEUR	• 2024 - 2027 • Align maintenance

Assessment 2024





Strategic Topics: GMEP Acoustic Sensors & Mould Lifetime



Condition Based Maintenance on Moulds

Lifetime on Moulds (Depreciation cost)

Comments:

- Ambition to move “Shot based Maintenance” to Condition Based Maintenance.
- Potential benefit and impact on Mould Lifetime.

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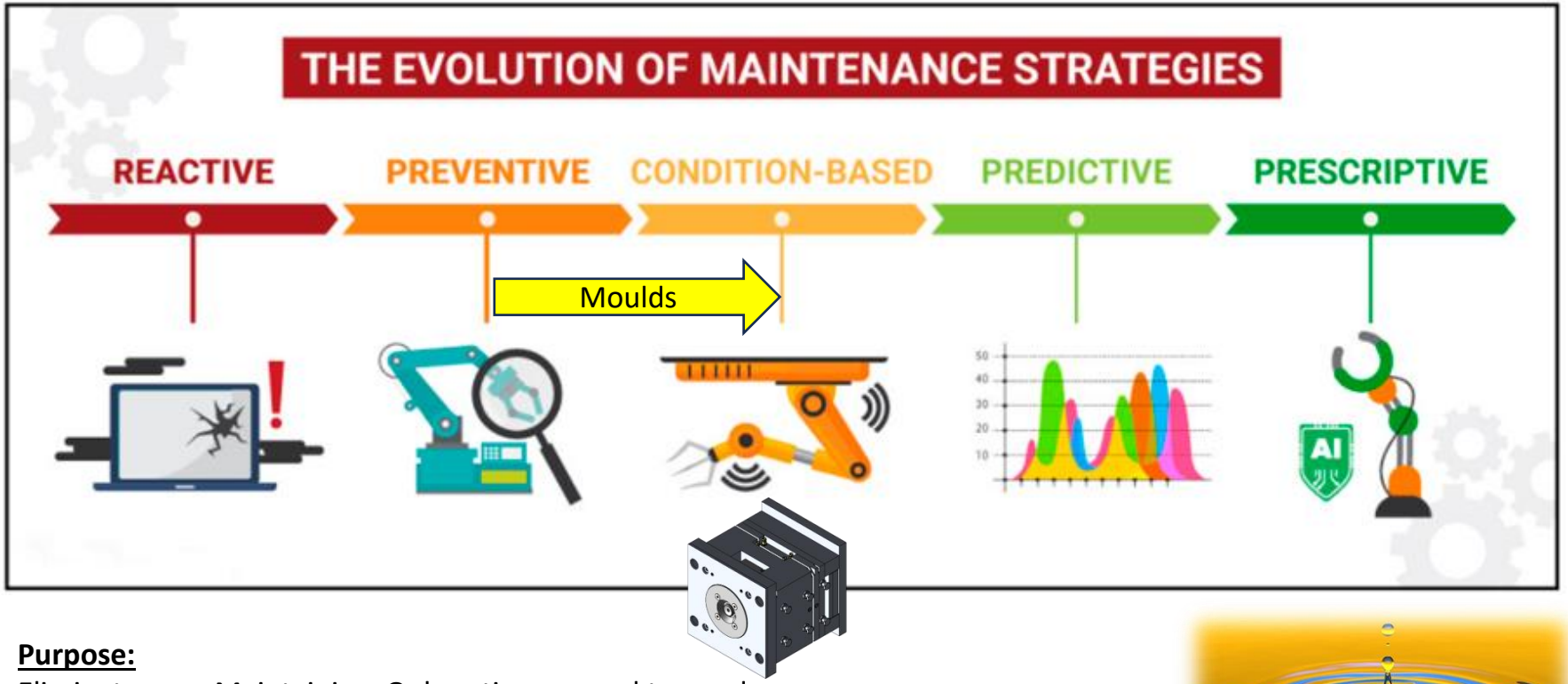
Maintenance Strategy for a Mould ?



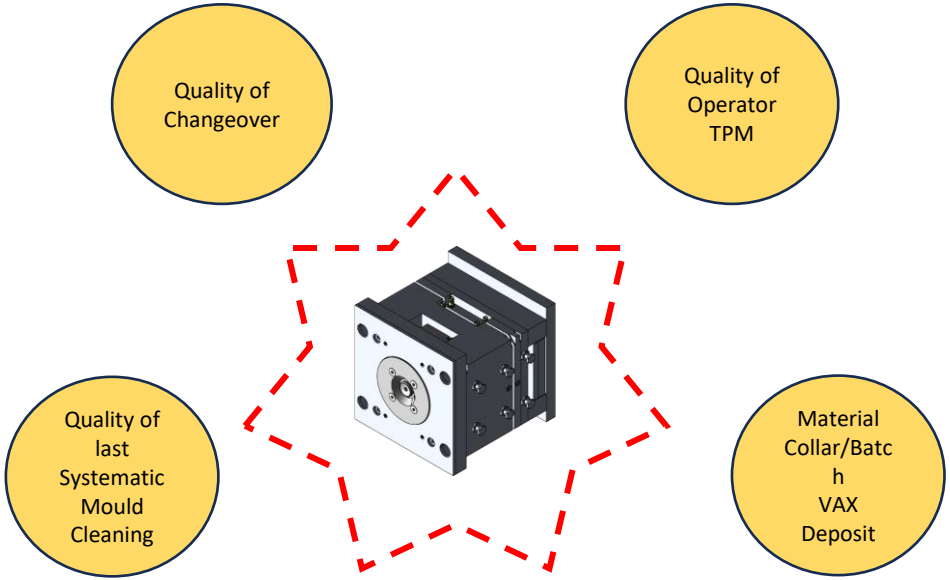
Purpose:

Eliminate over-Maintaining. Only actions accord to need.

Prolong mould lifetime. Less touch/assembly/de-assembly increase life.

Short and sweet: Save money without effect on Safety, Quality, Productivity and lifetime.

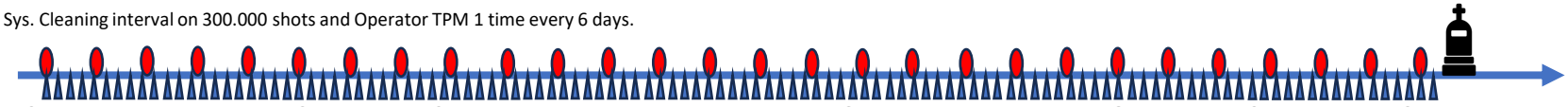
What Influence the need for preventive Maintenance on Moulds.



Systematic Cleaning.

Operator TPM.

Example: Sys. Cleaning interval on 300.000 shots and Operator TPM 1 time every 6 days.

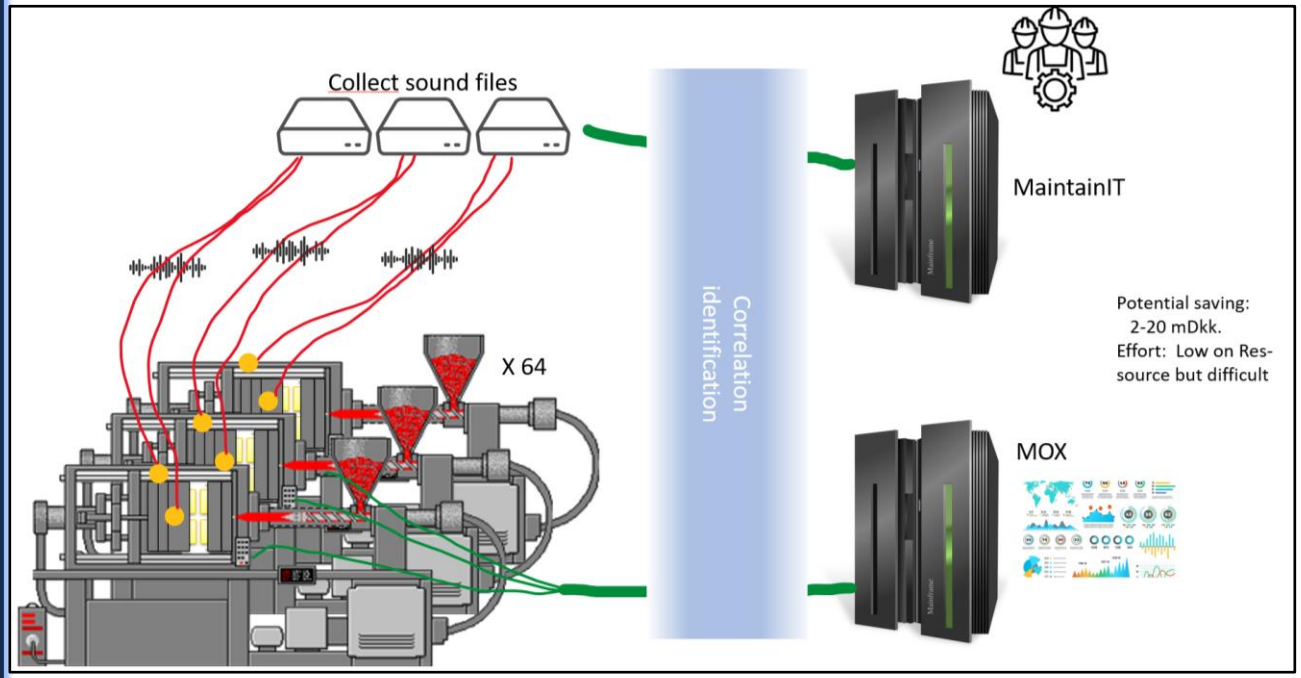


Rough picture: 1 Sys. Cleanings takes in average 6 hours.

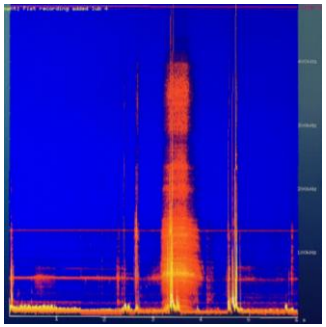
Maintenance Strategy for a Mould ?

How:

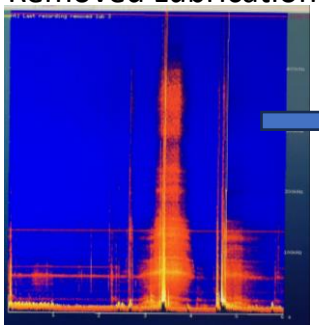
With use of Acoustic sensors, we can see when lubrication is low and learn what to search for in Moulding Machine data. Find the trigger to indicate need for Operator TPM and Systematic Cleaning.



Lubricated mould



Removed Lubrication



Mould Lifetime variables.

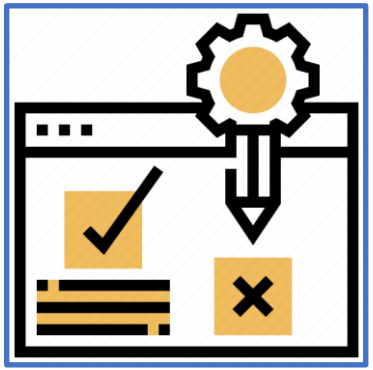
Design

- Construction
- Self destruction in process. (Open/Close/De-mould, etc.)
- Steel choice on wear and tear parts
- Mould Qualification (Realistic qualification. Ex. Test in more collars.

Handling

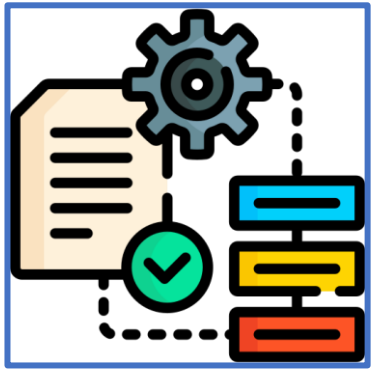
- Assembly and De-assembly
- Washings process.
- Handling of parts.
- Operator TPM
- Conservation in Transition
- Storage (Humidity / Temp)

Base condition



- Setup of the Mould
- Material type / collar.

Process



1. Worn-Out process
2. Challenge tool / rolls
3. Standard as reference

TOP Causes for actual Lifetime of a mould.

Potential cause: Investigate deeper

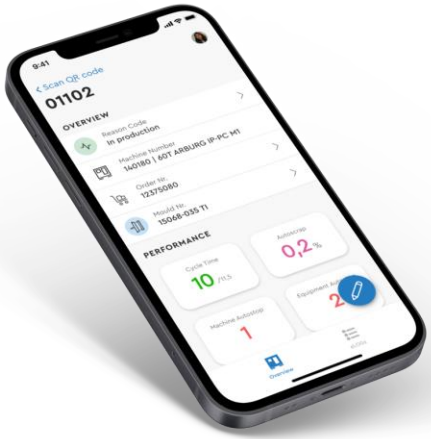
- Empower your operations with accessible data, fostering informed decision-making at lightning speed.
- Streamline processes to absorb variations, driving productivity and sustainability to new heights

Our Definition:

A digital product is like our physical products but applied to software development. It is something we create to delight our audiences and realize value.

Guided by the needs of the Consumer, Shopper, Partner & Colleague	Always evolving	Owned by a dedicated business and technology team

Ensure data democracy on the shop floor for the connected worker – The Factory device



Why Factory Device and iPhone?

How does Factory Device support productivity and energy efficiency?

Working agile – MVP and next step

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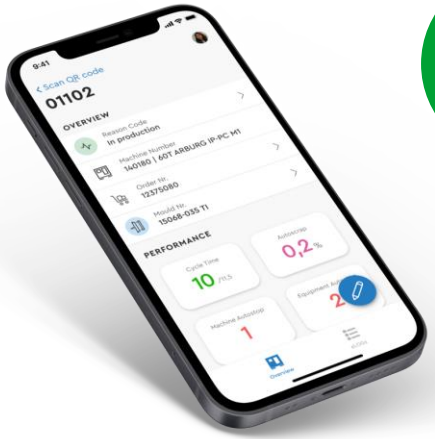
Factory device



Why Factory Device and iPhone?

We started more than 3 years ago with **one device philosophy** – meaning one device should be the tool in production / moulding supporting the digital activities. All employees on shop floor has a factory device – and they are not able to perform there job without this device.

Reason for iPhone choice:

Possible to adjust features – turn-on/off (Enterprise Device management) – e.g. No camera function – no internet function (but able to scan barcodes / QR codes

Safety updates on a frequent basis (iOS updates)

LEGO knowledge of iOS and less Android knowledge

We were first movers with smartphones in production 2019

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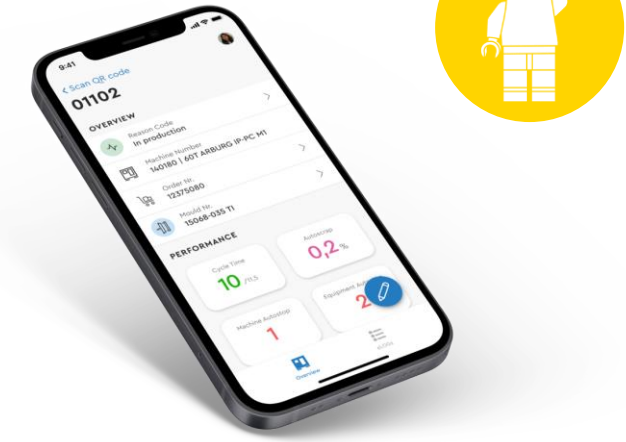
Factory device



How does Factory Device support our strategy for Efficiency and Sustainability ?

Reason-code: Supporting OEE – loss in production is categorized in order to drive either problem solving – reach the target or improvements

Logging activities: eLog – all activties are logged digitally and categorized – related to Quality, Machine, Mould, Equipment or Misc. It supports data driven problem solving or improvements

Change over (mould, color, mould/color): one app is guiding you through the change over process and mapping internal time and external time. We perform more than 106,000 change overs a year globally.

DVI: Differentiated Visual Inspection – based on date the specific mould to be inspected shows up on the factory device – and we have reduced manning perform the visual inspection by 85% - since we now look at quality performance per mould

Energy efficiency: Adjust machine processes to “sleep” mode when not in used. Advise operator to reach same output but consider use of less energy (electricity)

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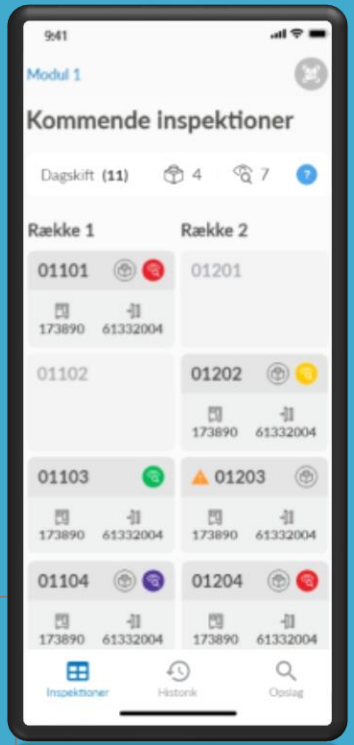
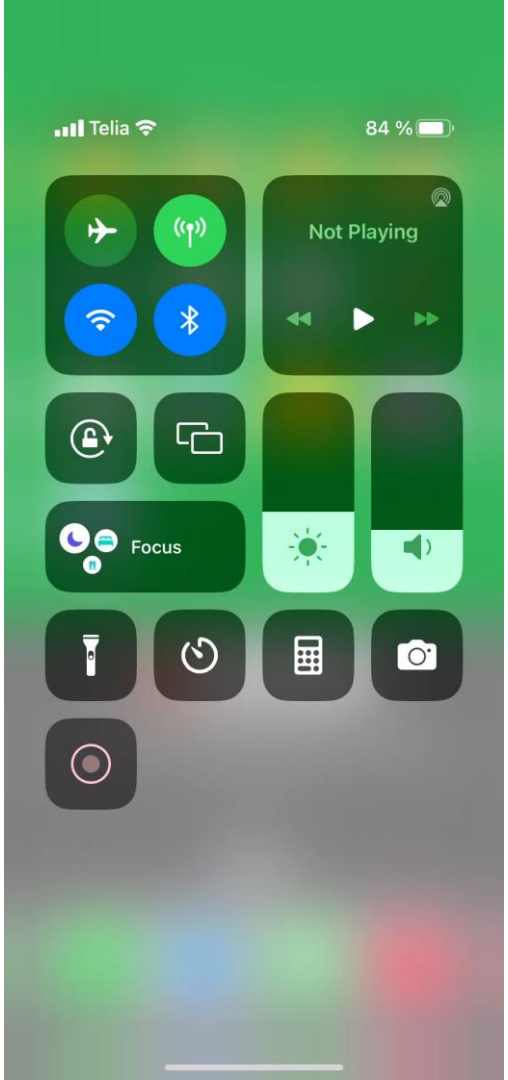
DVI history and vers. 1.0

DVI

- Differentiated Visual Inspection – quality by operators managed by algorithms

DVI from a "historical" point of view





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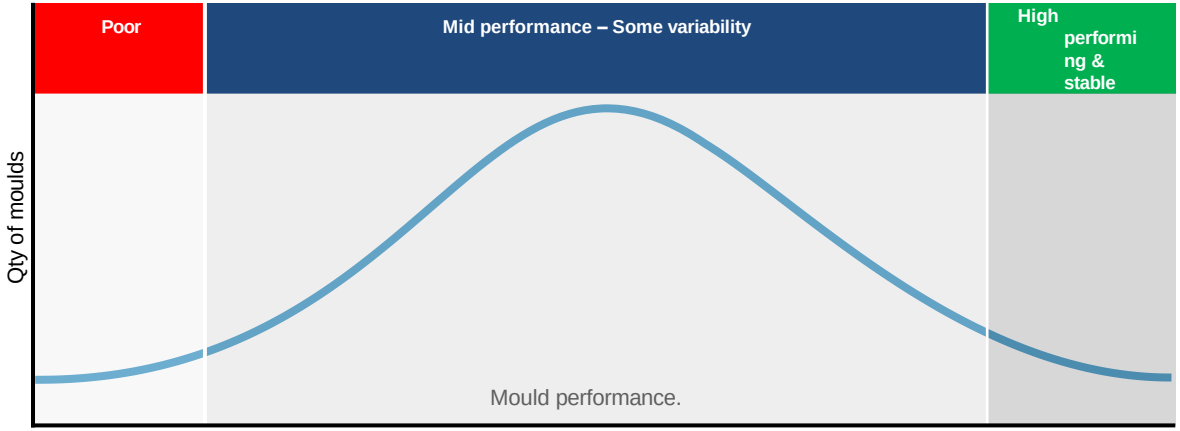
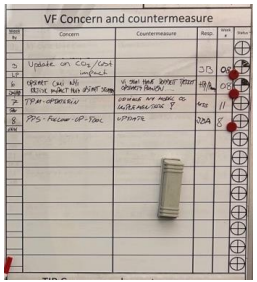
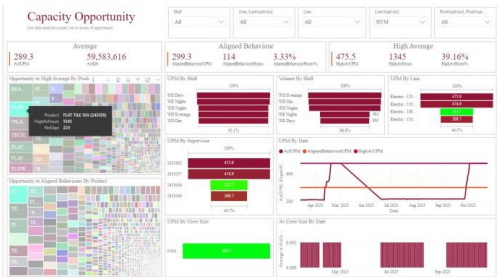
lmac
Leading Manufacturing,
Accelerating Change.

Predictive analytics dashboard providing insights into the 3 potential focus areas below.



Problem solving | **Identify and reduce variation** | **Optimise**





Plan. Deploy. Scale

Visibility and transparency

Action and improve

Predictive – Feed into planning

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Phased objectives

Plan. Deploy. Scale

Phase 1

High level review of all areas exploring where A&D principles could unlock value and estimate size of opportunity

Function	Key points
Planning & Scheduling	Not getting the full functionality out of your APS solution
Inventory management and control	Overstocked on many finished goods and components
Production	Very automated and efficient, opportunities to improve using planning and data
Machine/ Logistics maintenance	Mature practices, lack of labour scheduling and opportunity for predictive maintenance
Mould Manufacturing and support	Mature practices, lack of labour scheduling and opportunity for predictive maintenance
Moulding process engineering & education	Variety of support functions provided to the business. Need to closely align with future factory project
High bay warehouse	Very automated process, appear to be carrying additional labour on dayshift to cover non-standard activities
New technology Implementation (maturing / AM)	New product and process design. Focus will be on bringing some of the production rigour to any new processes developed
Re-grind area	Number of key waste initiatives to tackle in the factory. Progress the existing scrap recovery in Lego products
LCI / BI / Digital	Opportunity to do more targeted data analytics and support the site with the required insights
Quality & EHS	Opportunity for standard work and labour scheduling in Quality. Can some of the quality checks be automated and put in line (Colour etc) Opportunity to use H&S data to take a more predictive focus based on risk factors

Predictive data analytics

Simulation

Phase 2

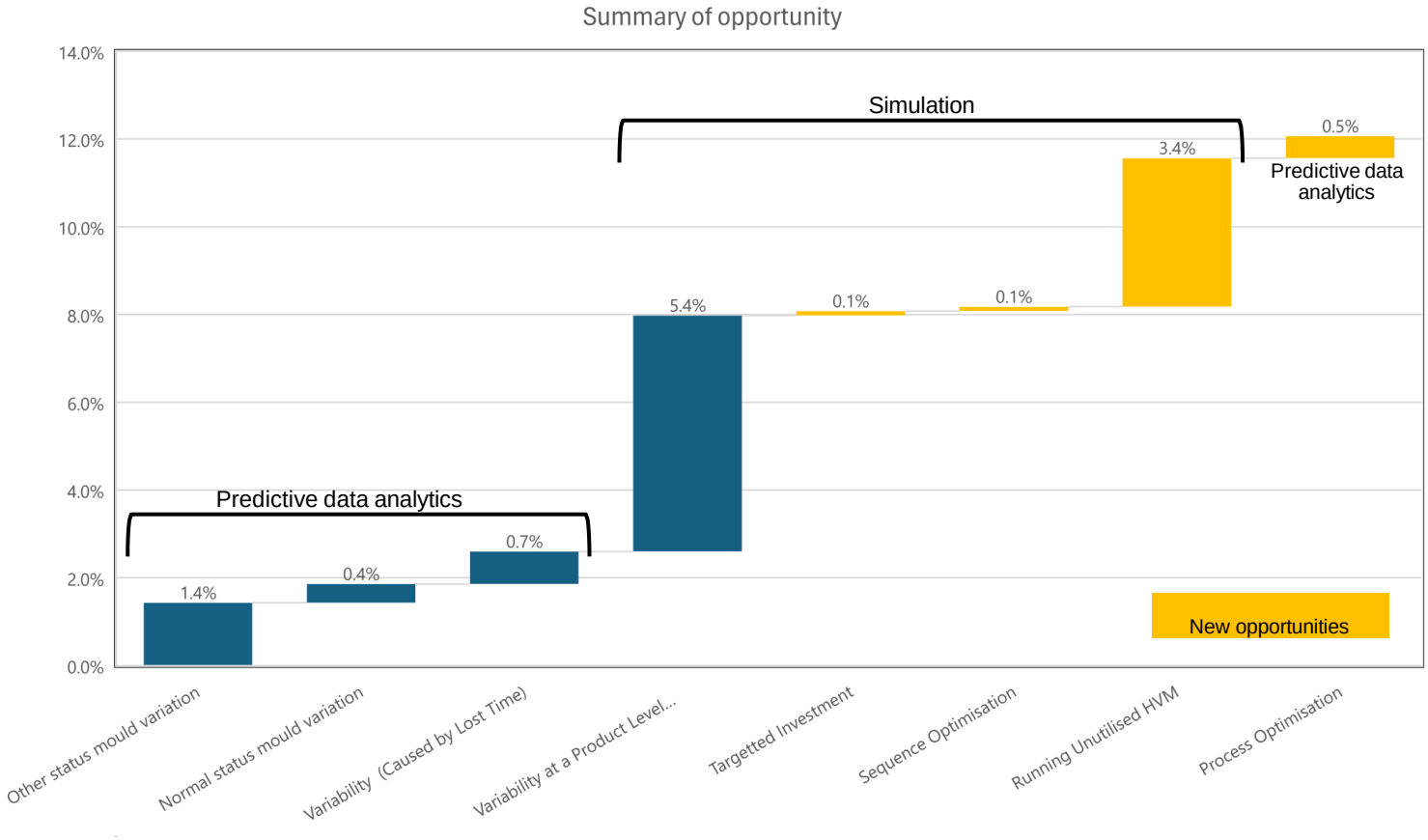
Deeper study of these focus areas

- Accurate value of the opportunity
- Complexities / processes understanding
- Input from subject matter experts to ensure the approach is logical
- Plan to achieve

Outcome

Is there logic to proceed?

We originally identified 8.83% opportunity through variation. After more detailed investigation we have summarised the opportunities as follows:



Opportunity

Identify high-volume moulds with low-quality issues and consistent output.

- **27 (2%)** moulds account for **10%** of annual production hours
- They only ever run on 1 machine
- Average auto reject rate of **0.05%**

A 5% improvement in output across these moulds = **0.5% capacity opportunity / DKK 2.1M**

Recommendation is to pick 1 example and review it with the appropriate team and understand the potential opportunity.

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