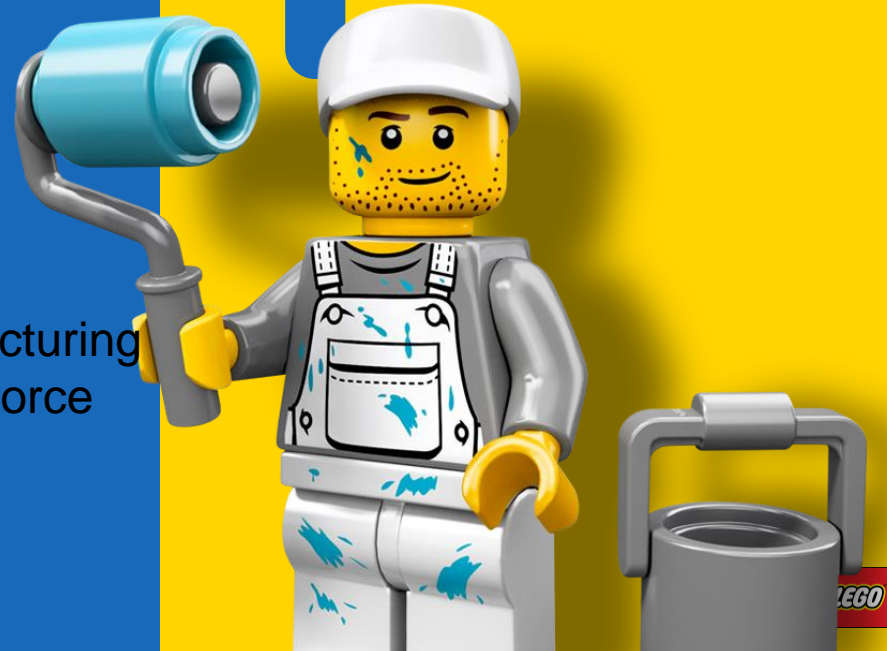




by Jesper Toubol,
VP LEGO Operations

The LEGO Group

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



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.



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



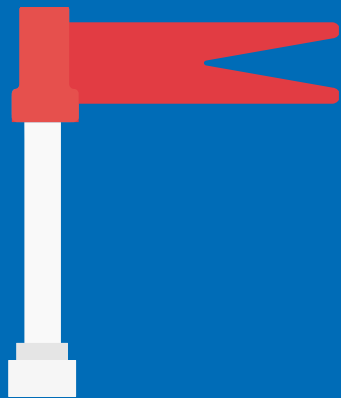
27,300+
colleagues



Top 100
influential
companies

Source: TIME 2021





What we
stand for

Children
are our role
models

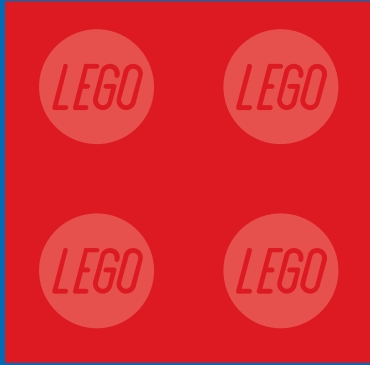


Did you
know?

6 bricks



= 915 million
combinations



Our strategic priorities

Investing

for long-term growth

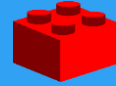


Innovating Play

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.





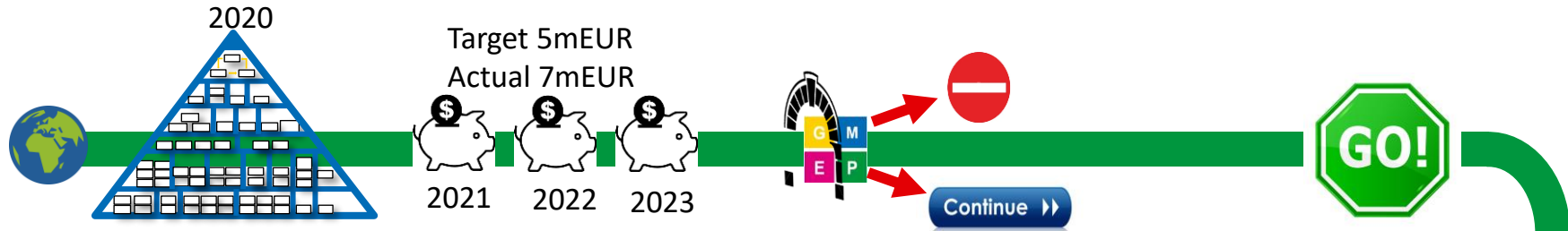
GMEP

Global Maintenance Efficiency Program

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

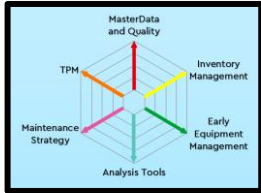
G M
E P

LEGO GMEP (Before- Now – Future)



GMEP NEW Focus 2024

Assessment



Early Equip. Management



Employee Efficiency / Std. Time



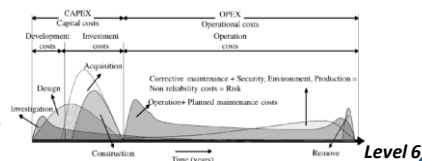
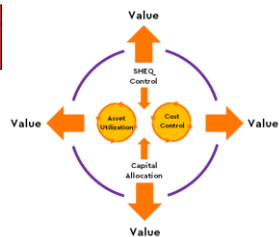
Opportunities



Network Group Focus
Super Goals



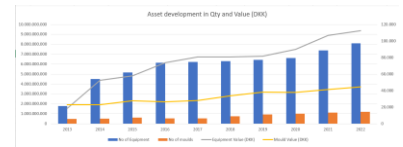
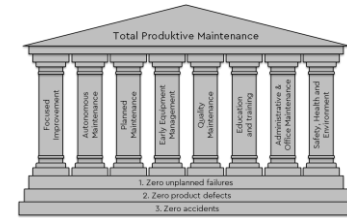
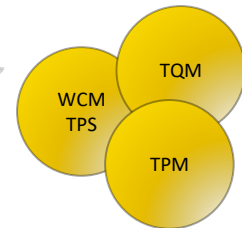
From Project to Partner
2024 – 2027
Additional 5mEUR saving
Sustain 8mEUR
New structure on Org.



Level 6



Reengineering in Reliability



PPP target for 2023

Americas	Asia	EMEA	Global Total
Manufacturing	2.2	2.2	2.2
2.6	2.2	2.2	2.2
87%	87%	87%	87%

PPP target for 2024

Americas	Asia	EMEA	Global Total
Manufacturing	2.2	2.2	2.2
2.7	2.2	2.2	2.2
87%	87%	87%	87%

Local split based on maintenance budget and wages cost index

	LCM	JIA	HSN	WV	SL	Total
Budget 2023	27.47	13.15	10.55	13.15	17%	100.00
Per target	-0.38	-0.38	-1.52	-0.35		-2.63
Budget 2024	27.48	13.15	10.55	13.15	17%	100.00
Per target	-0.80	-0.38	-0.35	-0.35		-2.28
Budget 2025	27.48	13.15	10.55	13.15	17%	100.00
Per target	-0.82	-0.38	-0.35	-0.35		-2.90
Budget 2026	27.48	13.15	10.55	13.15	17%	100.00
Per target	-0.82	-0.38	-0.35	-0.35		-2.90
Budget 2027	27.48	13.15	10.55	13.15	17%	100.00
Per target	-0.82	-0.38	-0.35	-0.35		-2.90
Total	-1.77	-0.85	-2.55	-1.51	-1.37	-8.05

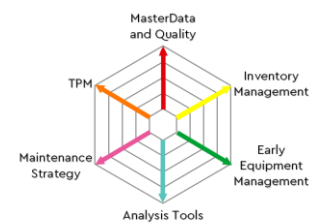
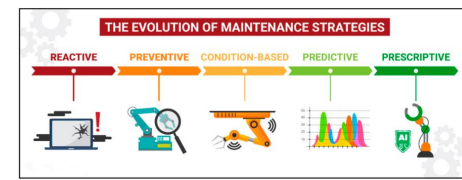
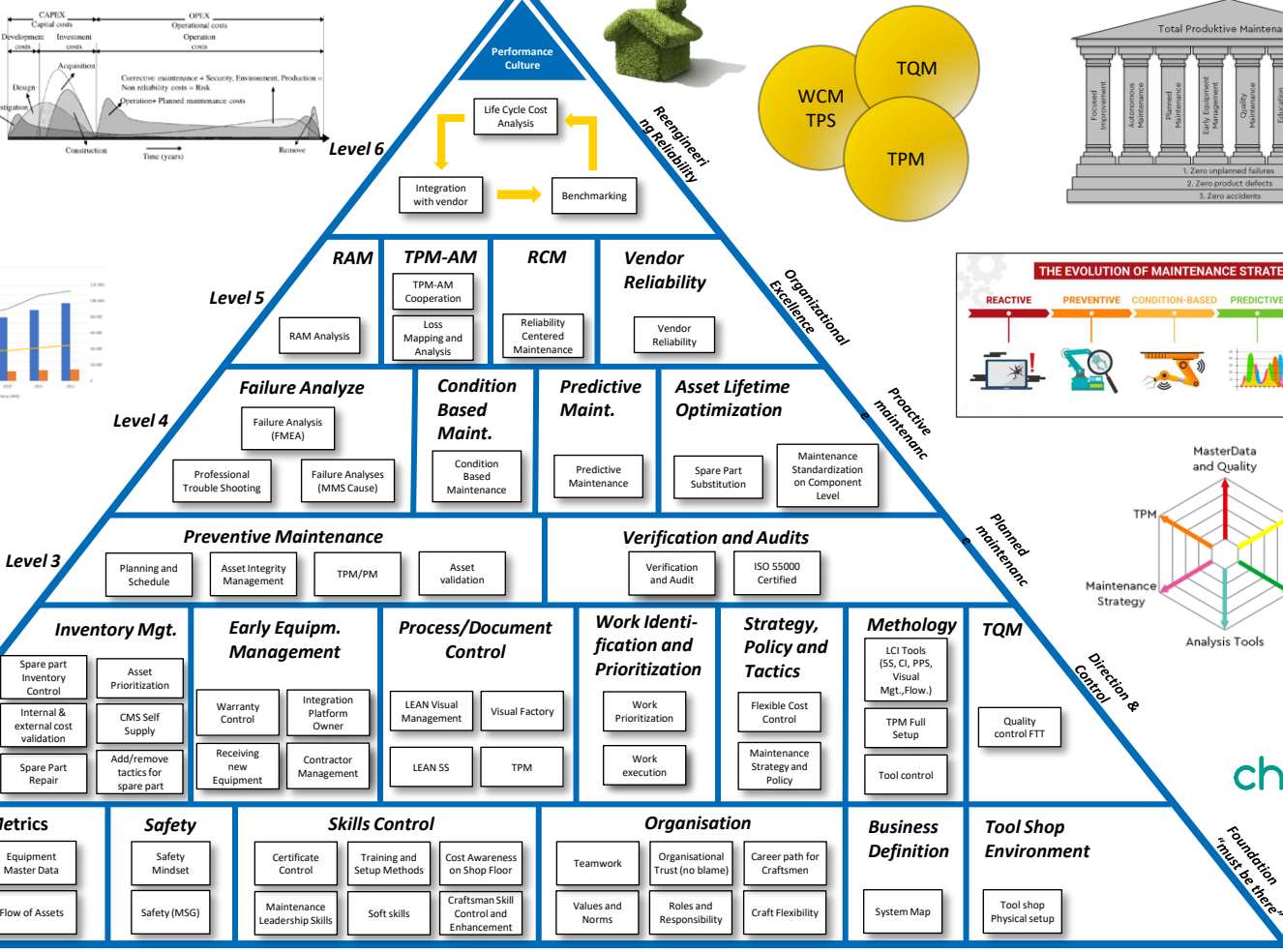


Level 2



Level 1

Sparepart production

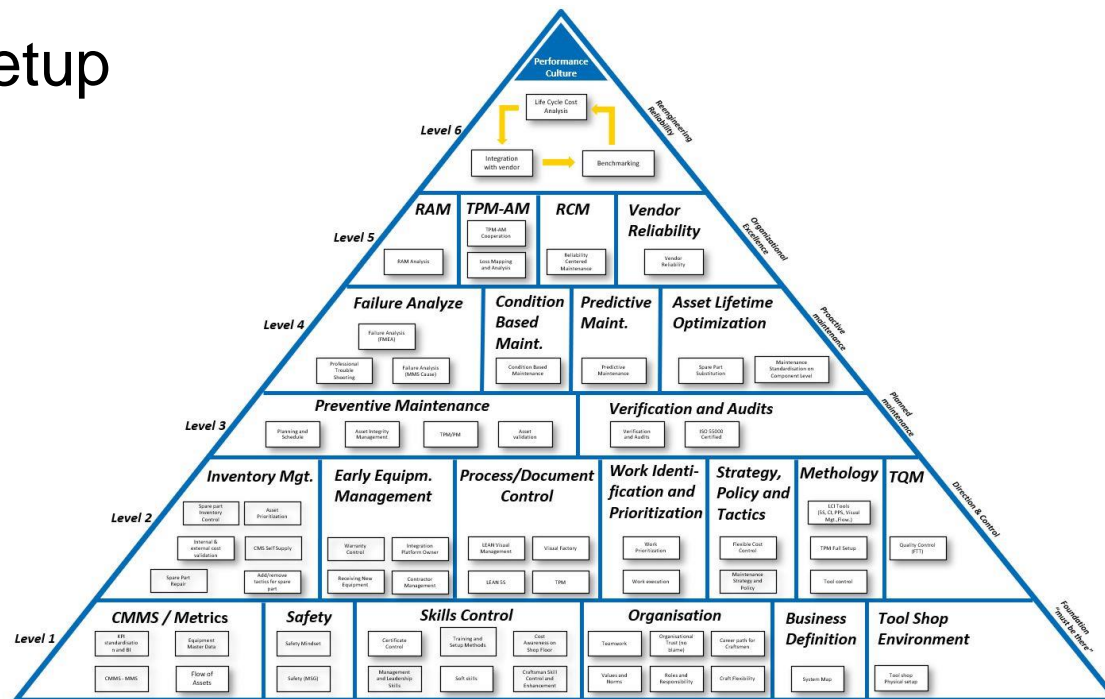


champ

Foundation "must be there"



GMEP Setup



Technology Streams

- Packaging
- Processing
- HBWH
- Mould
- Machine

Arears

- 5 sites
- 21 departments

People

- 53 people leaders
- 1462 FTE
- 5 GMEP team

Numbers

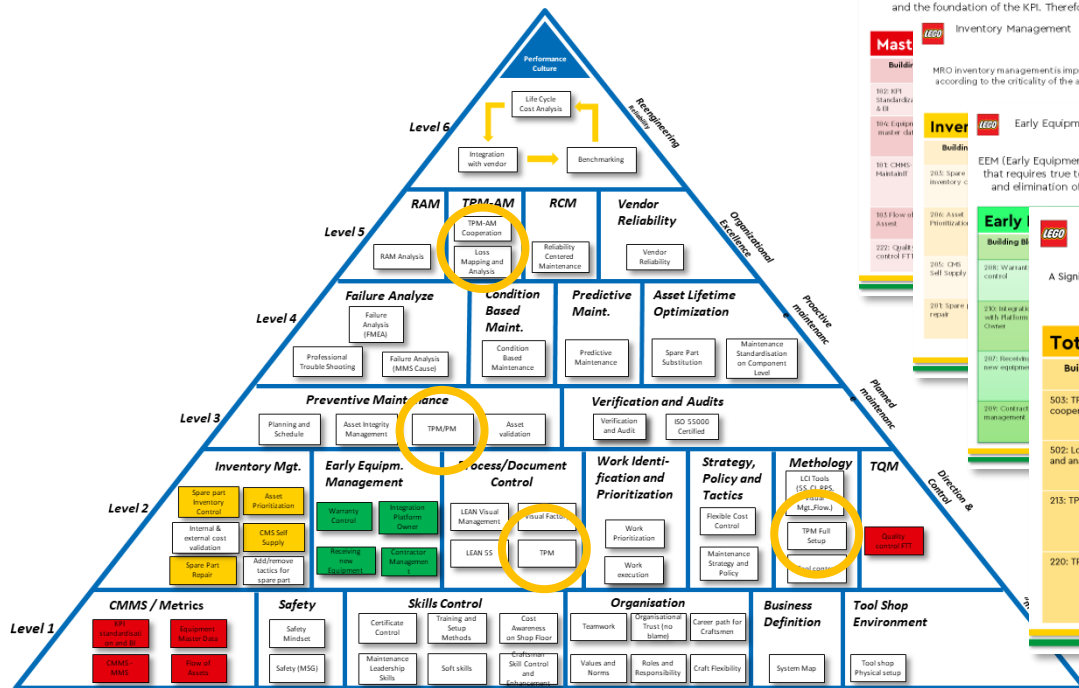
- Budget 70 mEUR

GMEP

- 2024 - 2027
- Align maintenance



Assessment 2024



Master Data and Quality

Master data are part of the foundation upon which we base decisions (short term/long term). One of the main sources to our decision data is coming from CMMS. CMMS input generate the foundation for the calculation of EAR and the foundation of the KPI. Therefore, we must care of our master data due to lack of data integrity increase the

Inventory Management

MRO inventory management is important to ensure the ability to react on breakdowns. To achieve this, it requires managing the inventory stock according to the criticality of the asset. Critical spare part (A) must be maintained different compared to Low important spare parts (D). CMMS is an active player in maintaining the asset and produce critical spare parts.

Early Equipment Management

EEM (Early Equipment Management) is a three-way partnership between (Procurement, Platform owner and Maintenance) that requires true teamwork with the aim of improving project and design management through the early identification and elimination of hidden losses such as poor maintainability, operability and reliability plus the essential safety, and sustainability.

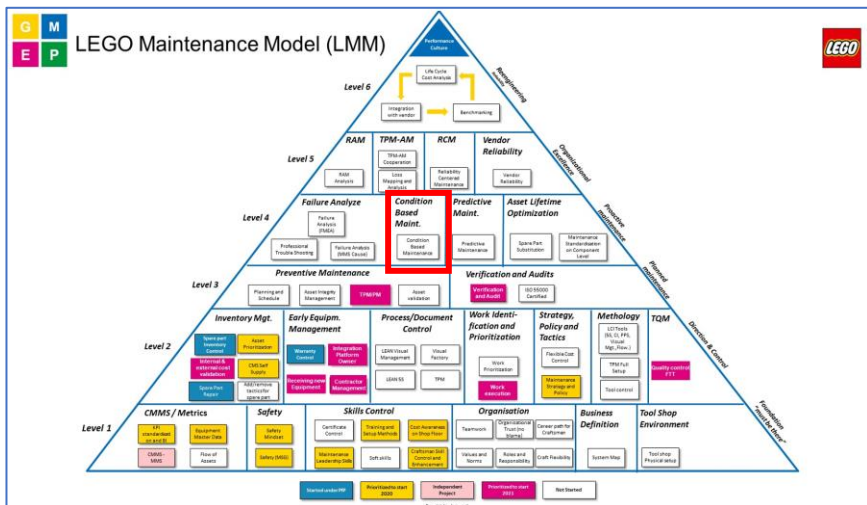
TPM, Total Productive Maintenance

A Significant parameter in manufacturing a product is to have all your Asset running when you want it to run and delivering good Quality FT. TPM is the strategy to involve the whole organization to understand how they can support production to have an efficient operation.

LEGO Maintenance Model are covering all of the 8 pillars in TPM. This assessment focus on TPM-Autonomous maintenance, Loss mapping.

Total Productive Maintenance (TPM)

Building Block	Description	Why
503: TPM-AM cooperation	Autonomous Maintenance put simply is the restoration and prevention of accelerated deterioration and has a major positive effect on OEE. It is a step-by-step improvement process rather than a production team taking on maintenance tasks.	Machine operators has good knowledge about the machine, and they can take on minor maintenance tasks which will free up Maintenance to do more proactive jobs. But all tasks need to be controlled and trained by Maintenance. Will improve the MTBF and free up time to PM in Maintenance.
502: Loss mapping and analysis	A Loss Map for a maintenance area is to cover all flows of asset in repair, preventive activities (during production stop), movement of resources and waiting time and converts this into solid improvement opportunities by visualising loss sizes.	As we normally operate 24/7 360, it is different people looking after the machines. And repeated failures can be undiscovered for a long time. But by using simple tools, we can quickly see trends and repeated problems. Asking production operators to record or mark POF will help maintenance a lot.
213: TPM	Total Productive Maintenance, or TPM, is a lean maintenance strategy that aims for zero breakdowns, zero defects and zero work accidents. TPM: Key processes are in the LPP, Documentation requirements, so we can pass an Audit, calibration procedures, Legal control of equipment and tools.	The overall purpose of TPM is to improve overall equipment effectiveness (OEE). A characteristic of TPM is the concept of shared ownership of the working environment.
220: TPM Full set up	All maintenance managers need to be aware of the Total Productive Maintenance (TPM) principals as the LEGO Maintenance Model is also highly inspired by the TPM model. The 8 pillars of TPM (Autonomous Maintenance, Planned Maintenance, Quality Maintenance, Focused Improvements, Early Asset Maintenance, Education & Training, Health, Safety & Environment, TPM in Administration).	Why are we so keen on TPM? TPM is a worldwide known maintenance strategy closely associated with the LEAN Mindset. The TPM philosophy is like an umbrella for any Operations OEE. Everyone in Operations needs to understand and support the Operations TPM mindset.



Condition Based
Maintenance on
Moulds



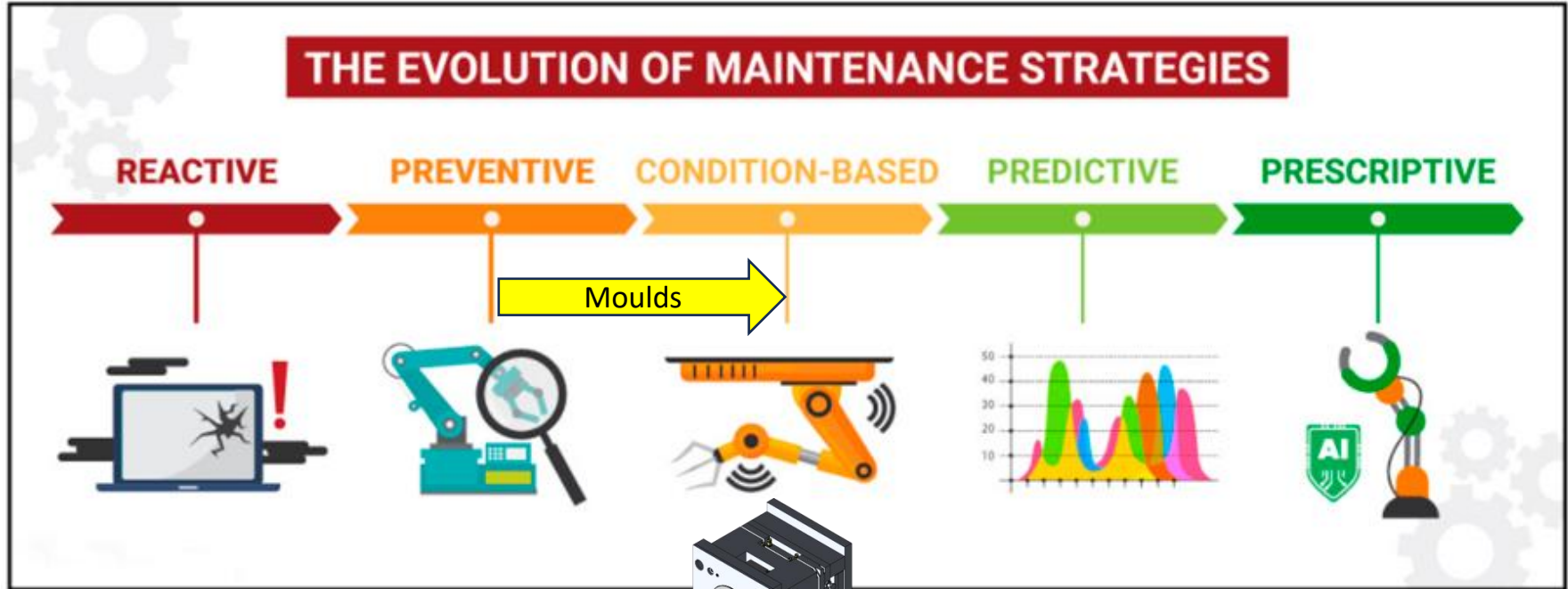
Lifetime on Moulds
(Depreciation cost)



Comments:

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

Maintenance Strategy for a Mould ?



Purpose:

Eliminate over-Maintaining. Only actions accord to need.

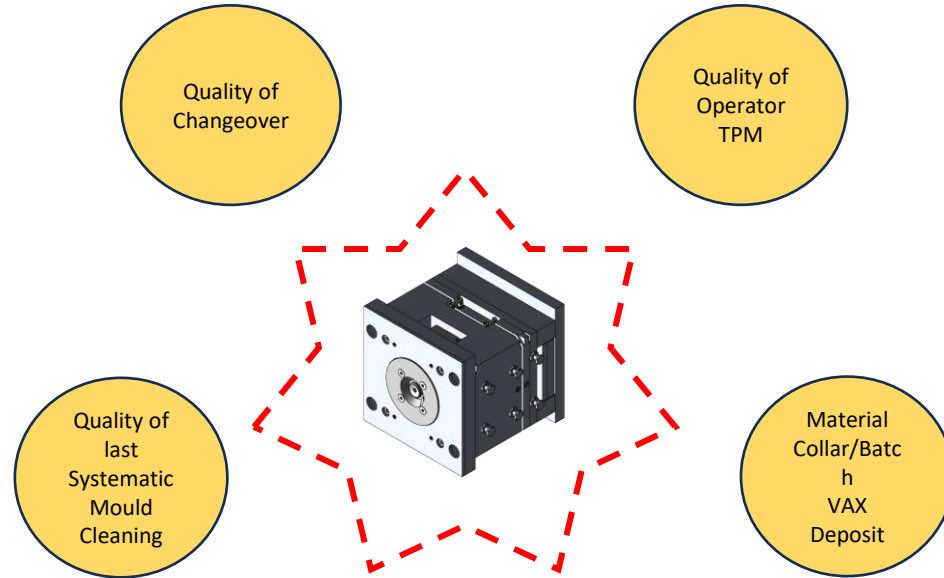
Prolong mould lifetime. Less touch/assembly/de-assembly increase life.


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






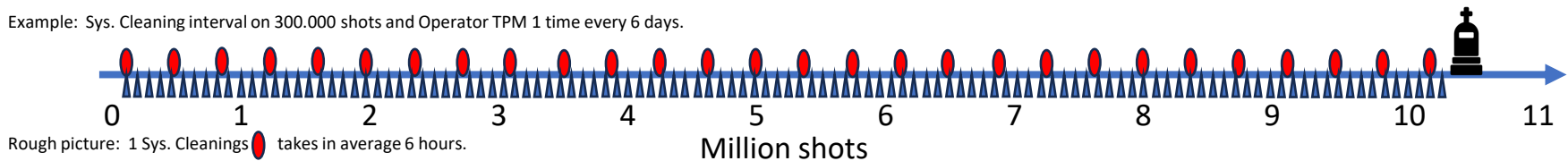
What Influence the need for preventive Maintenance on Moulds.



 Systematic Cleaning.

 Operator TPM.

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

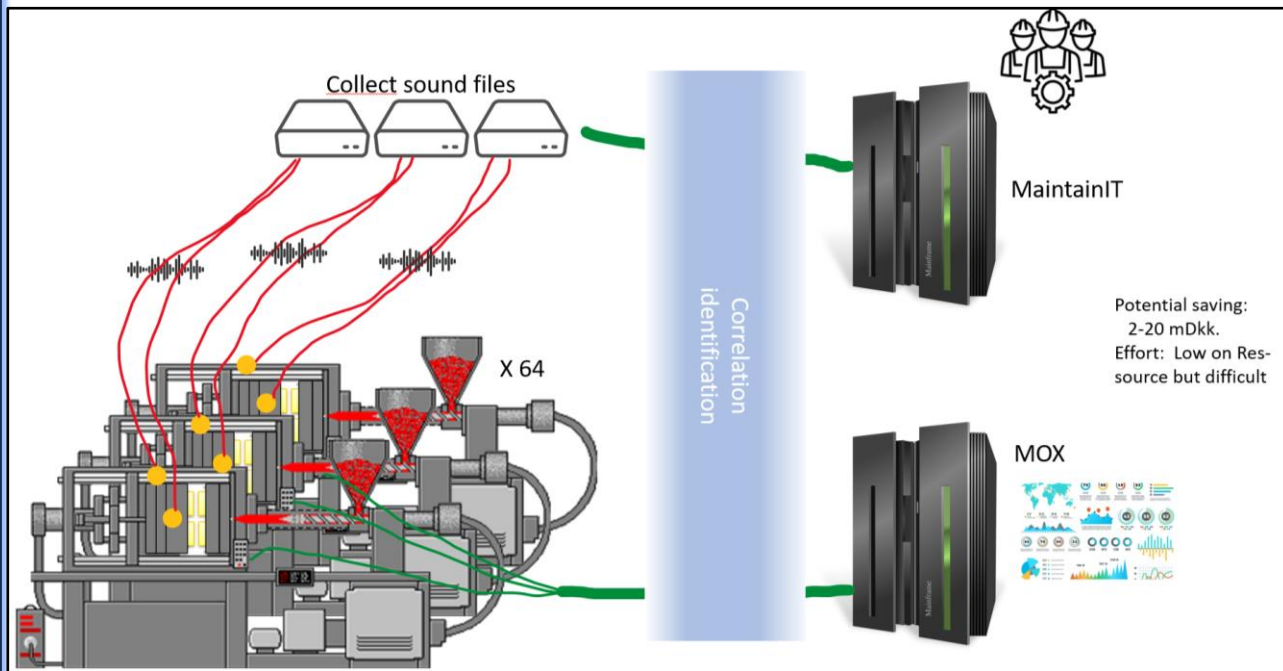




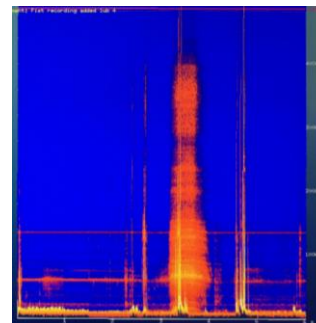
Maintenance Strategy for a Mould ?

How:

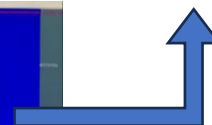
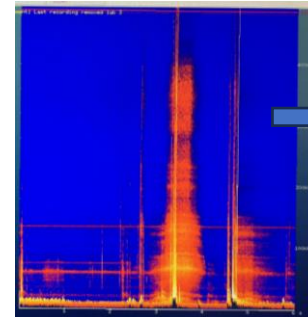
With use of Acoustic sensors, we can see when lubrication is low and learn what to search for in Moulding Machine data. Find the trigger to indicate need for Operator TPM and Systematic Cleaning.



Lubricated mould



Removed Lubrication



Mould Lifetime variables.

Design



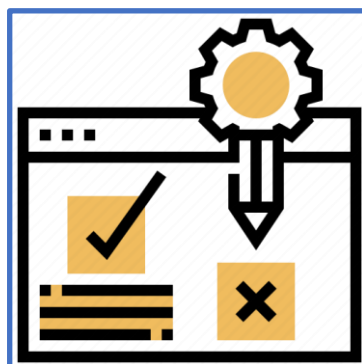
- Construction
- Self destruction in process. (Open/Close/De-mould, etc.)
- Steel choice on wear and tear parts
- Mould Qualification (Realistic qualification. Ex. Test in more collars.

Handling



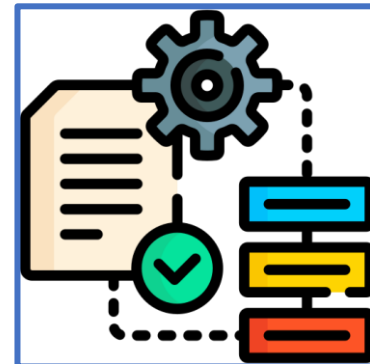
- Assembly and De-assembly
- Washings process.
- Handling of parts.
- Operator TPM
- Conservation in Transition
- Storage (Humidity / Temp)

Base condition



- Setup of the Mould
- Material type / collar.

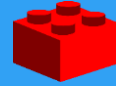
Process



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





What is a
**digital
product?**

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.

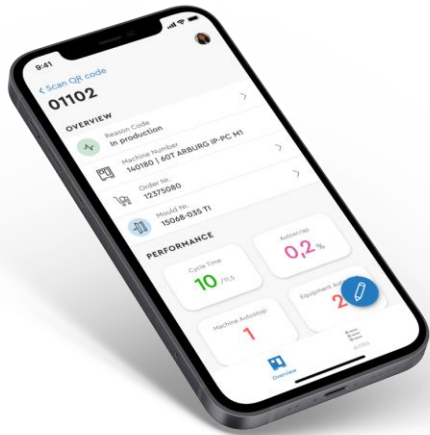
Guided by the
needs of the
Consumer,
Shopper, Partner &
Colleague

Always evolving

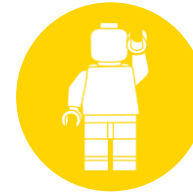
Owned by a
dedicated business
and technology
team



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



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)

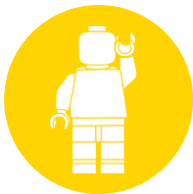
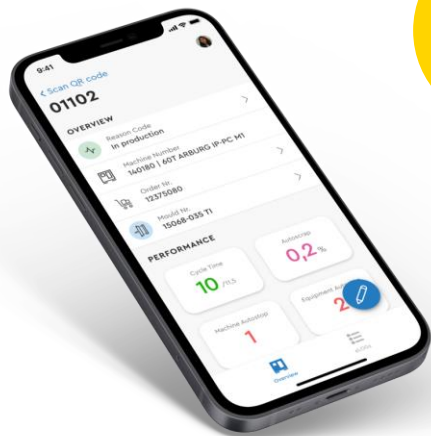
Safety updates on a frequent basis (iOS updates)

LEGO knowledge of iOS and less Android knowledge

We were first movers with smartphones in production 2019



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 activities 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

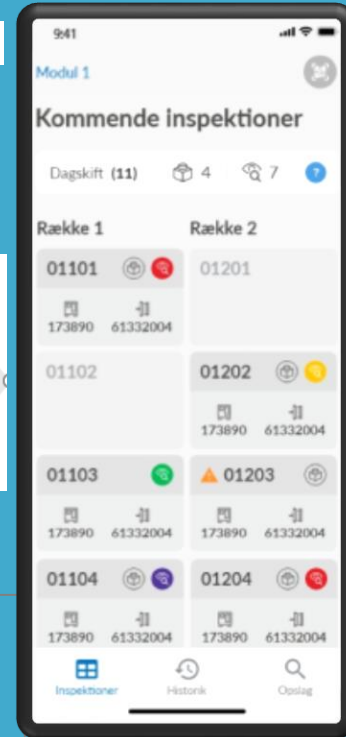
Energy efficiency: Adjust machine processes to “sleep” mode when not in used. Advise operator to reach same output but consider use of less energy (electricity)

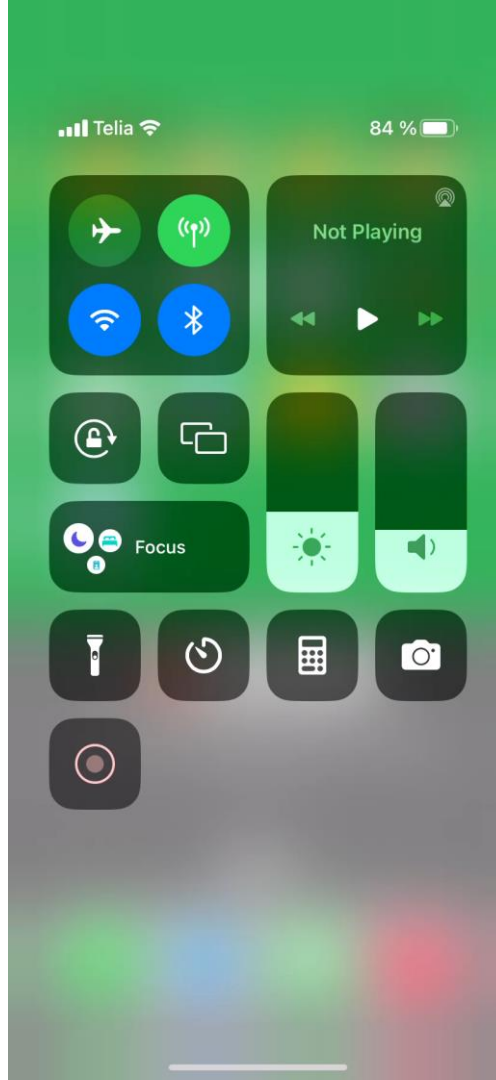
DVI history and vers. 1.0

DVI

- Differentiated Visual Inspection – quality by operators managed by algorithms

DVI from a
“historical”
point of view



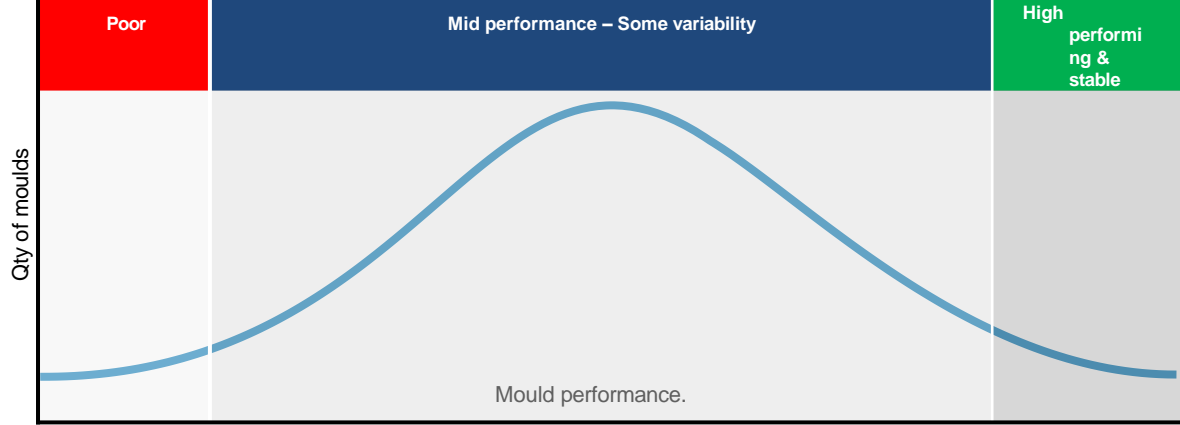




lmac

Leading Manufacturing,
Accelerating Change.

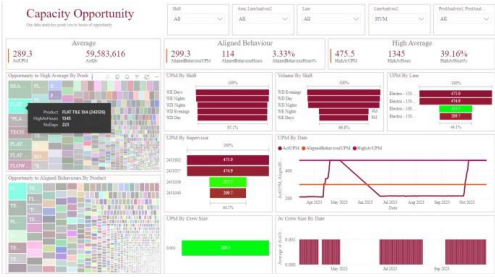
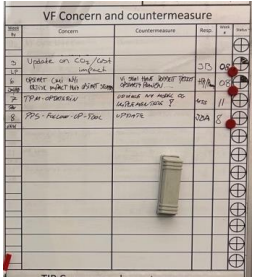
Predictive analytics dashboard providing insights into the 3 potential focus areas below.



Problem solving

Identify and reduce variation

Optimise



Action and improve

Predictive – Feed into planning

Plan. Deploy. Scale

Phased objectives

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

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

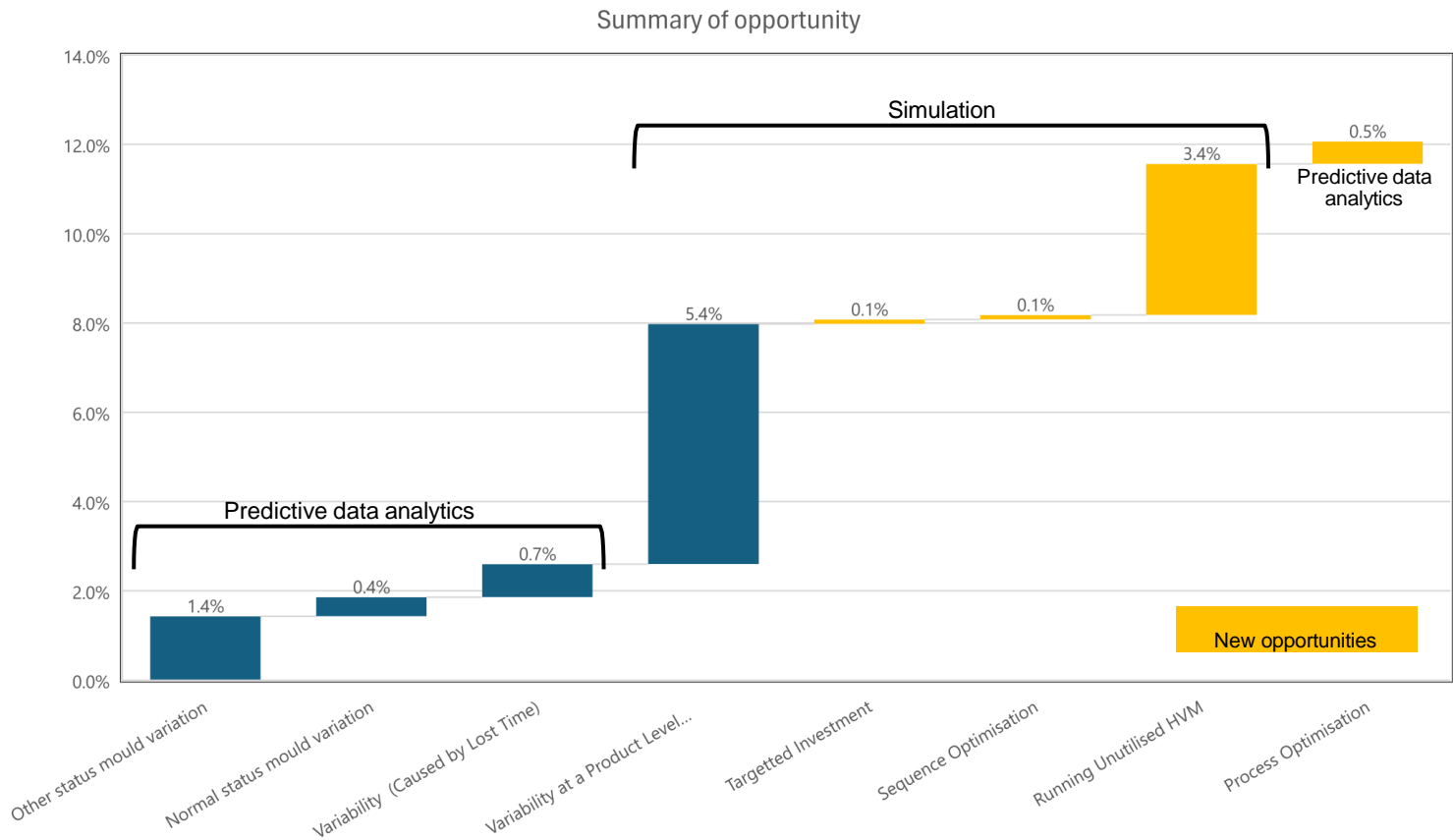
Is there logic to proceed?

Predictive data analytics

Simulation



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.

THANK YOU

