APOLLO TYRES LTD

AI @ Apollo Tyres R&D Europe

Sep 2021

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Future Proofing R&D

From Analogue to Digital

1. **Automotive Industry is going through dramatic changes**
2. **Car world is shifting into a digitalization approach**
3. **Tires as integral part should not be left behind**

WHAT

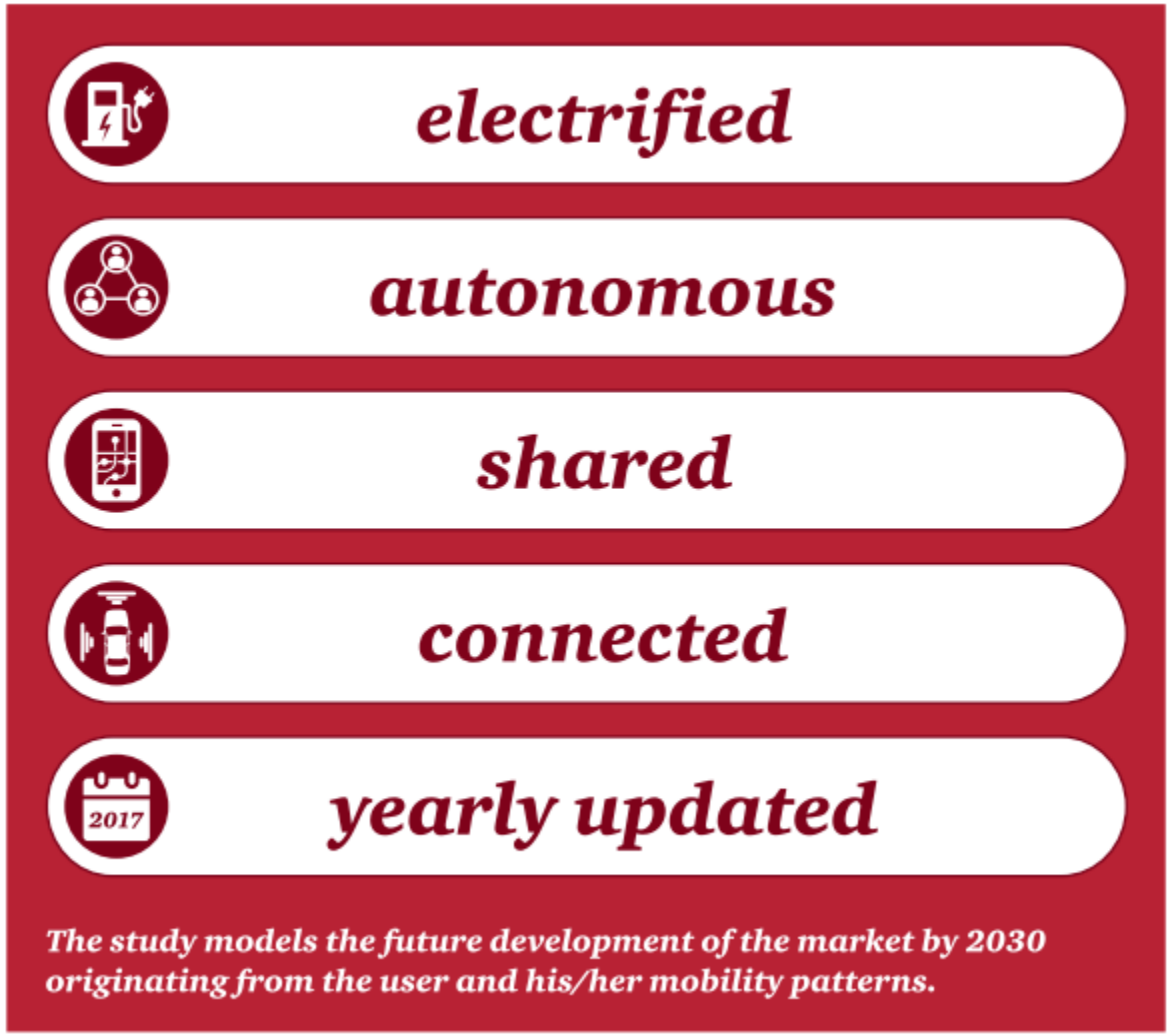
Advanced data analytics will be an additional tool next to the tools we already have.
It can help us to find correlations in huge amounts of data which are too big for a person to handle.

WHY

Improve efficiency and development time for new (tyre) specifications & technologies by use of advanced data analytics:

- Predict compound properties based on raw material properties.
- Predict tyre performance based on BOM and material properties.
- Optimize specifications for production.
- And many more.

Five trends transforming the Automotive Industry*:



*www.pwc.com/auto

Vision

R&D Priorities

1) Global LIMS
   - New end to end management system for all labs (indoor & Outdoor) + Tyre specification.

2) Artificial intelligence activities to be started in parallel
   - What are the data to be collected
   - Projects to be activated for proof of concept

Project references:

EU – Daniel Pugliese
APMEA – Pradeep Kumar

1 Step

Data Lake Generation

*A data lake is **a storage repository that holds a vast amount of raw data in its native format until it is needed**. While a hierarchical data warehouse stores data in files or folders, a data lake uses a flat architecture to store data*

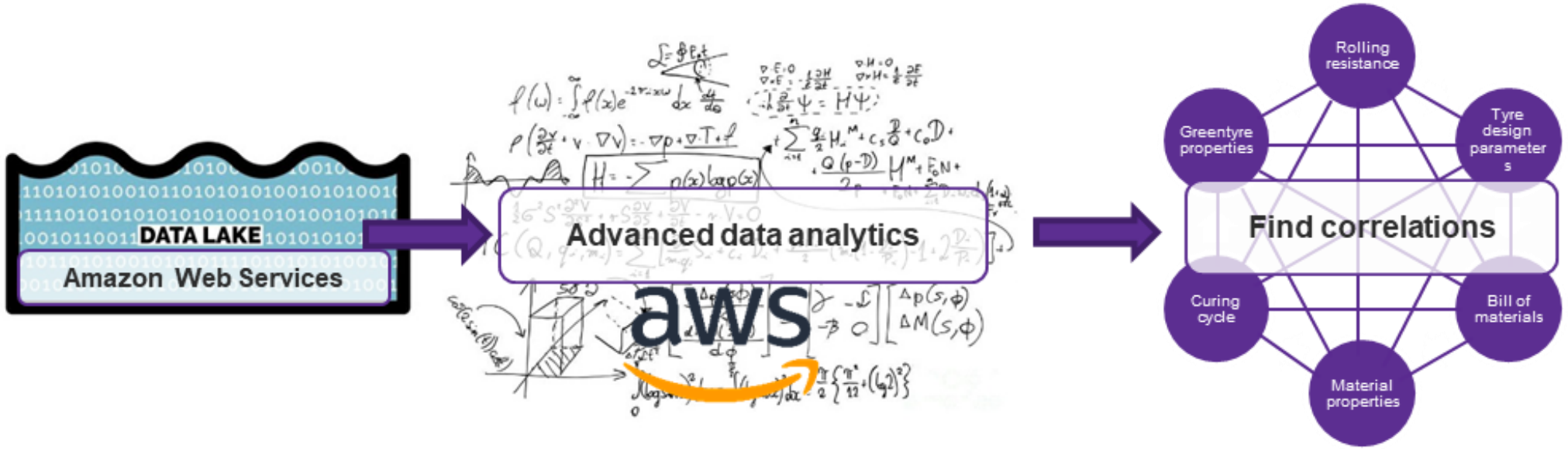
- Lab data (UNILAB)
- Material data
- Tyre specification data (INTERSPEC)
- Tread design data
- Indoor / outdoor test data (UNILAB)
- Building machine data (VMI Machines)
- Curing data
- Uniformity data
- And more?

Data ready to be transformed and applied to each use case

EU – Unified LIMS Database
APMEA – Several data base available but separated (Identify potential data)

2nd Step – Project Activation

From Data Lake to Correlations….



2 projects to activate:

1. Tyre dimensions Prediction – predict SW and OD inside strict OEM tolerances
2. High Speed Prediction – First Time Right

Running Project:

- Virtual compounding with advanced data analytics done by SIMREKA

AI in R&D Europe – Projects to activate

High Speed and Tyre dimensions Prediction

Boundary conditions:

1. Start simple
2. Amount of Data
3. Quality of Data
4. Usefulness for Core Business

	Tyre Dimensions	High Speed T729 Test (ref. ECE-R30, R54)
Goal	Predict cured tyre Section Width (SW) and Overall Diameter (OD)	Predict High (HS) Speed Performance
Focus area	Data extraction and algorithm application	Data mining, Cleaning and Transformation (Continuation and extension of previous assignment)
Input	Tyre Design and Construction (limit) parameters Tyre OD and SW measurements	Tire Design and Construction parameters HS Performance measurements
Sources of Data	Amazon Web Services aws	or On-Premise Databases
Benefits	a) Freedom to operate and design (using all constructions) b) No need for Dedicated OEM moulds c) Costs of Additional moulds	NPD/SE: first time right

AI in R&D Europe

Projects overview

1st Phase: Start with projects based on R&D data
2nd Phase: Support and make use of Manufacturing Data (TBD after Phase 1 is finalized)

Phase	What	Who	Data Source
On-going	**FAIR Data repository for Explainable AI:** Data repository generation for Data Lake creation	PDEng Student from Twente University	LIMS (Athena and Unilab)
	Virtual Compounding Started in material team	R&D EU Materials with SIMREKA	LIMS (Athena and Unilab)
1st Phase	**High Speed Prediction**	R&D EU Product/Pre-Dev with MSc Student from Utrecht University	LIMS (Athena and Unilab)
	Tyre dimensions Prediction	R&D EU Product/Pre-Dev with MSc Student from Twente University	LIMS (Athena and Unilab)
2nd Phase	TBD	TBD	Manufacturing Mixing cloud data
	TBD	TBD	Tire Building Machines cloud data (VMI)
	TBD	TBD	Sensors' Data (2 Wheel Tires)

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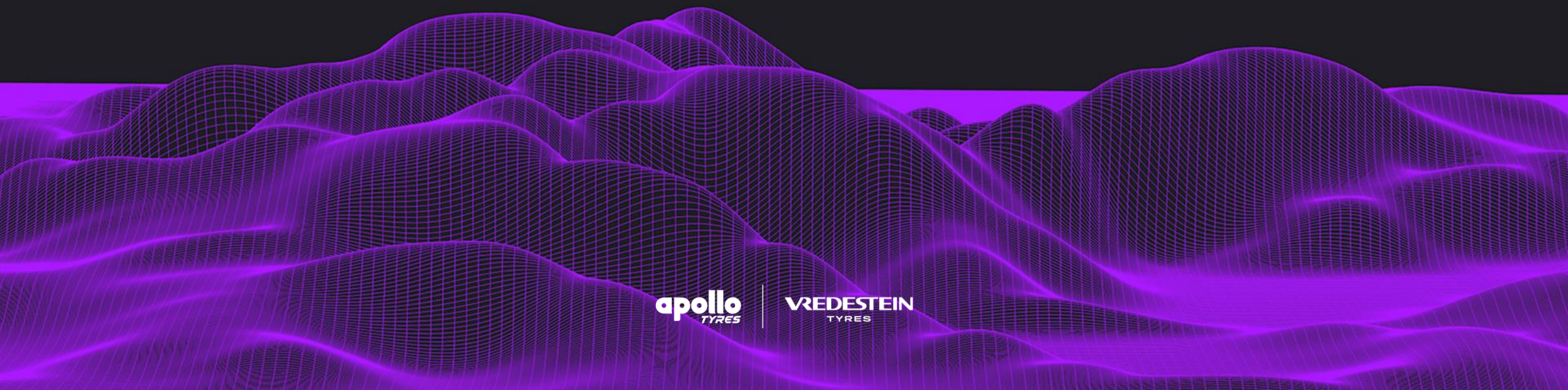
Thank you



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