

Future Challenges of the Lubricants Industry

FUCHS Capital Market Day 2018
18 June 2018 | Dr. Lutz Lindemann, CTO

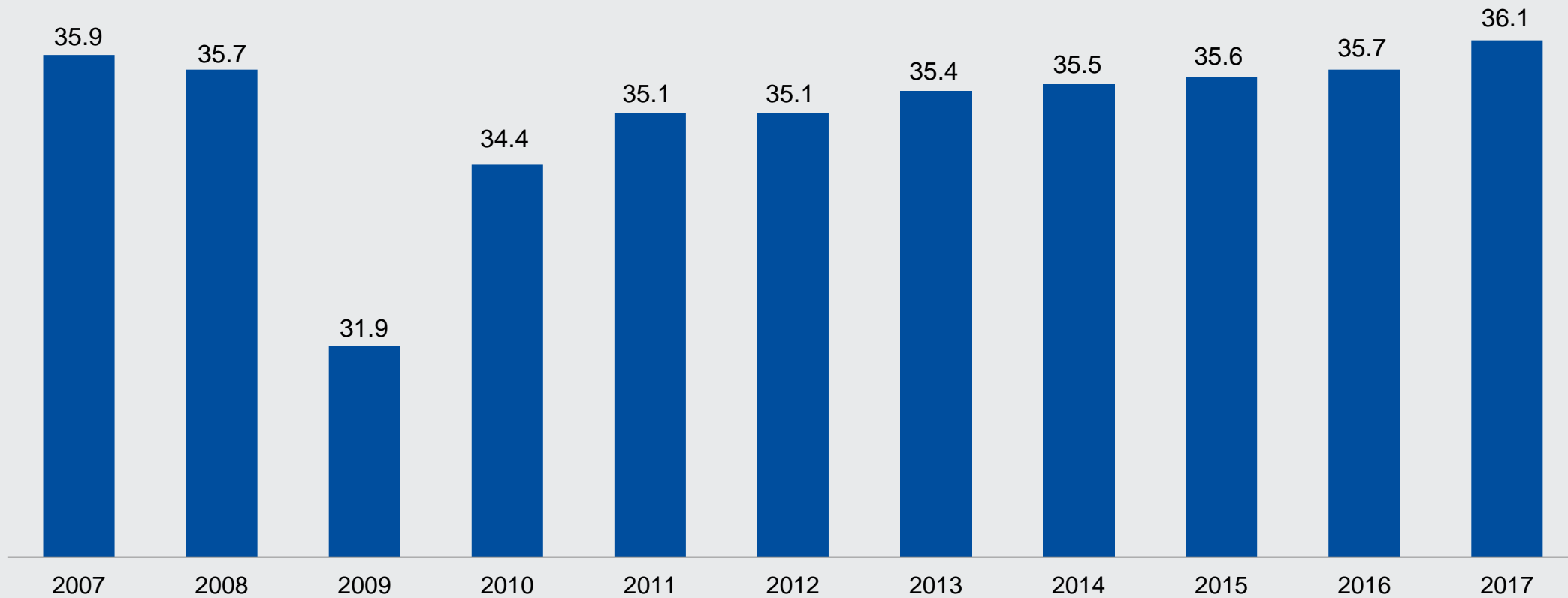


01 Markets



Markets

Development Global Lubricants Demand (million tons)*



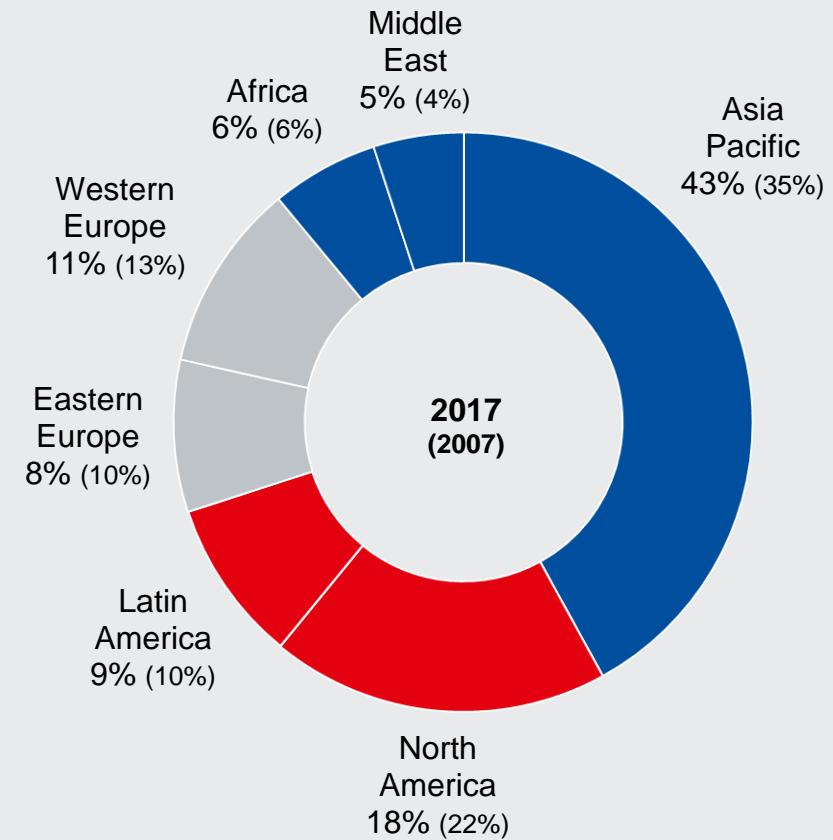
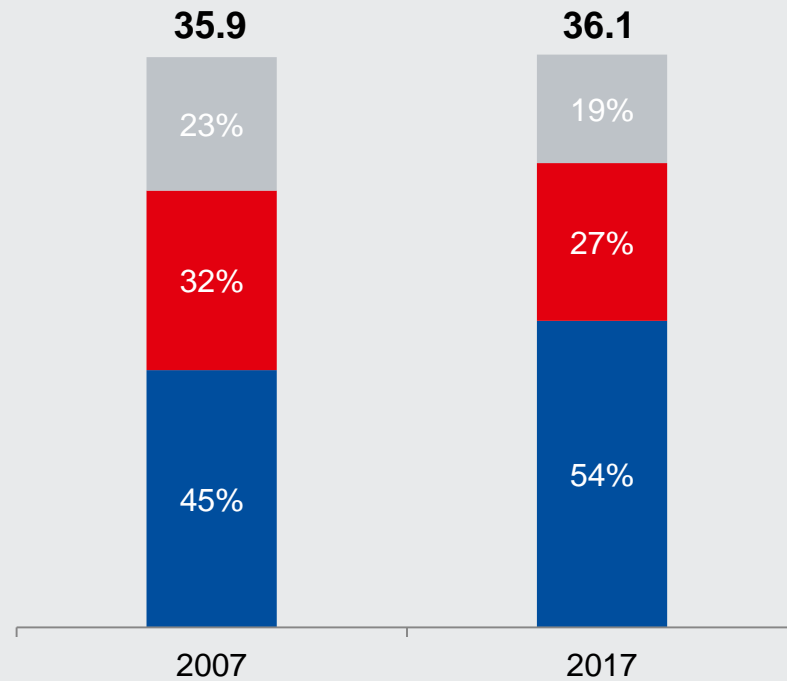
*Without Marine Oils

Markets

Development Regional Lubricants Breakdown

Demand (Million Tons)*

■ Asia-Pacific & MEA ■ Americas ■ Europe



*Without Marine Oils

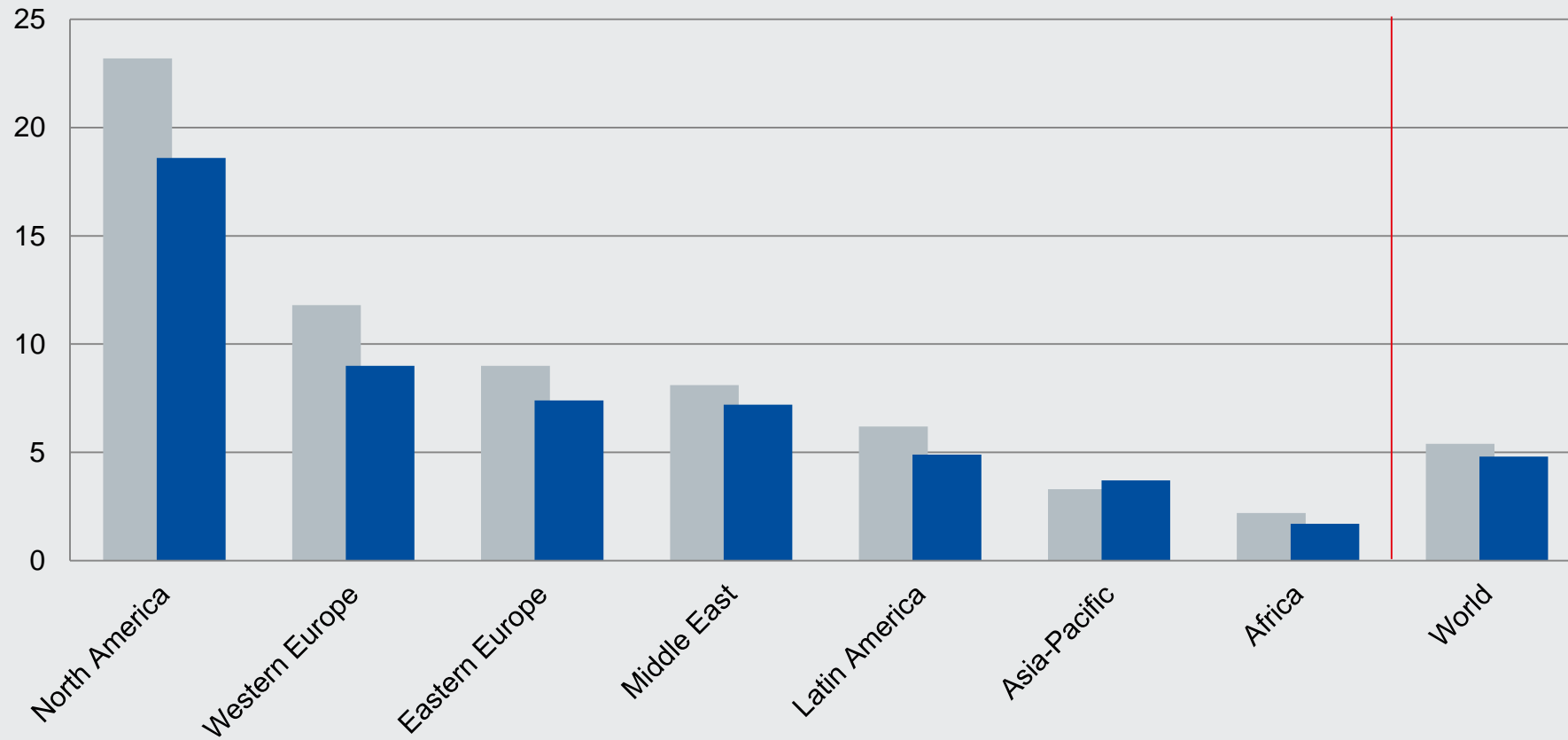
Markets

Development Regional Lubricants Demand

	2017 : 2016 *Variance (%)
North America	-0.1
Latin America	-2.0
Western Europe	1.4
Eastern Europe	0.5
Middle East	-0.3
Africa	-3.0
Asia-Pacific	2.8
World	1.0

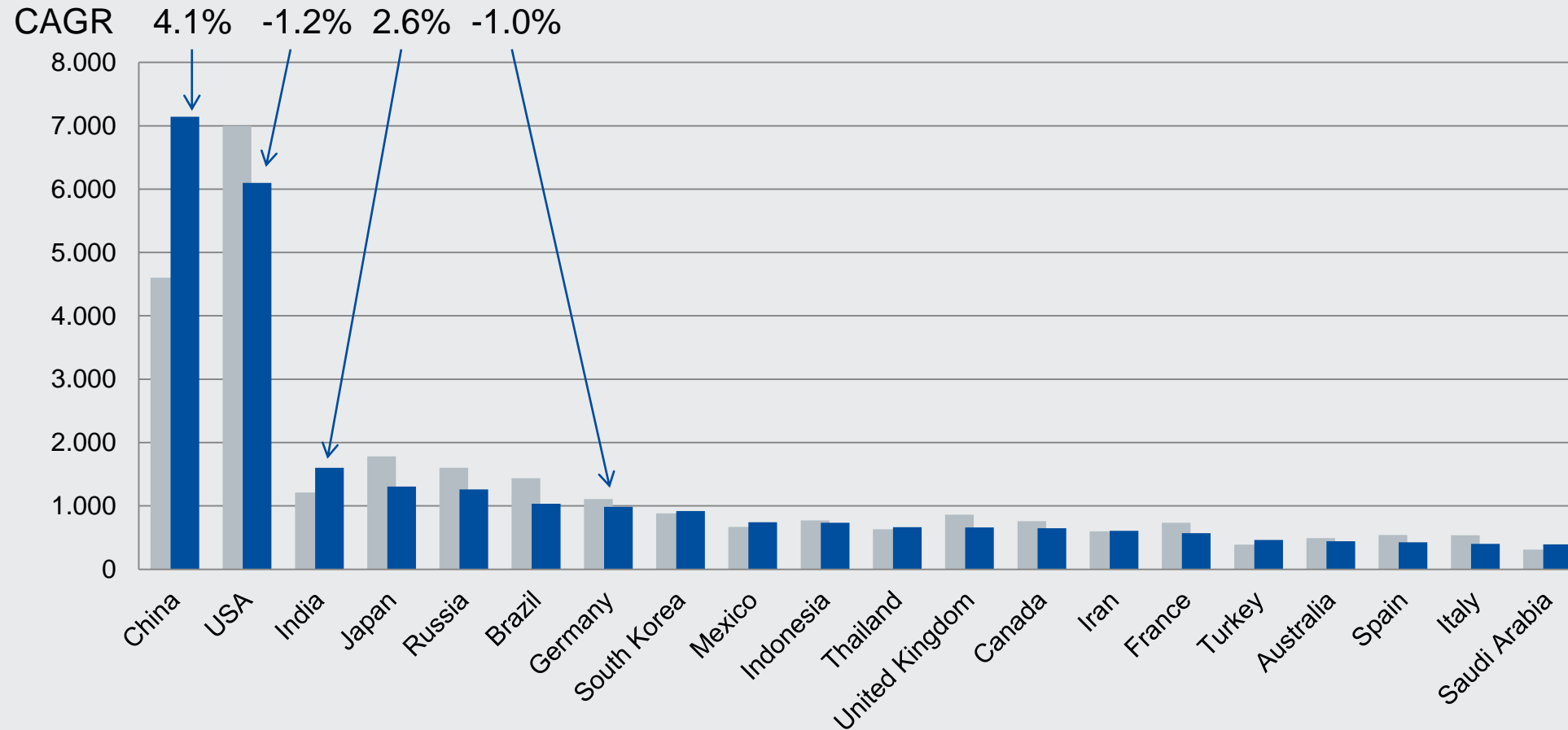
Markets

Regional Per-Capita Lubricants Demand (kg)



Markets

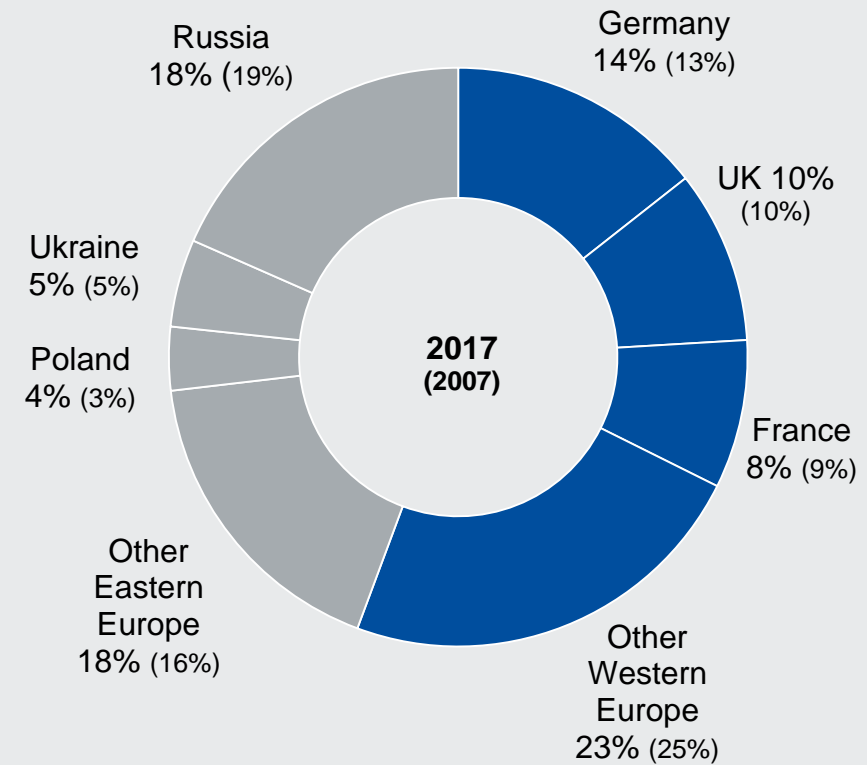
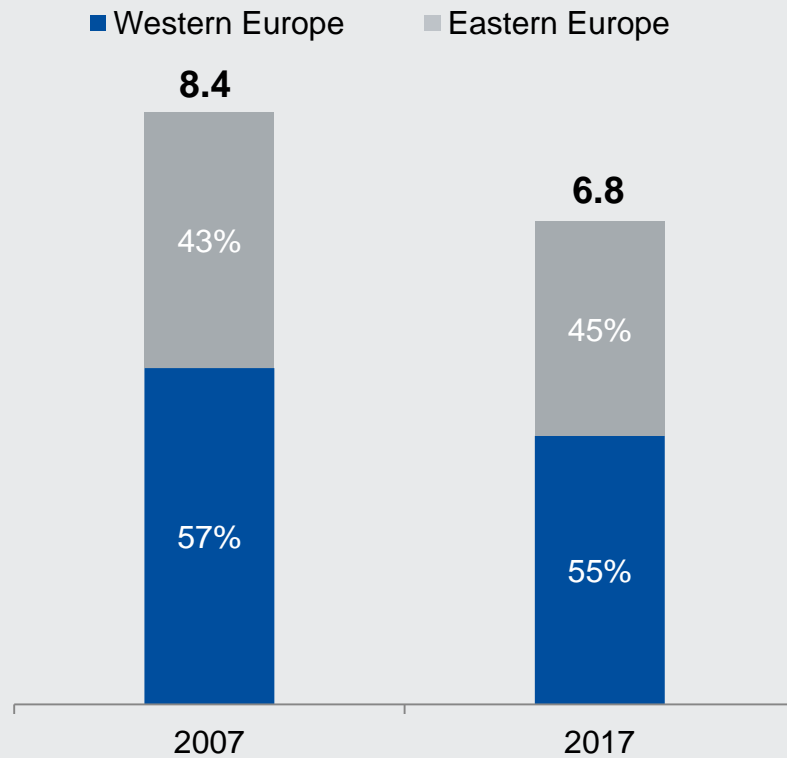
Ranking Top 20 Lubricants Countries (KT)



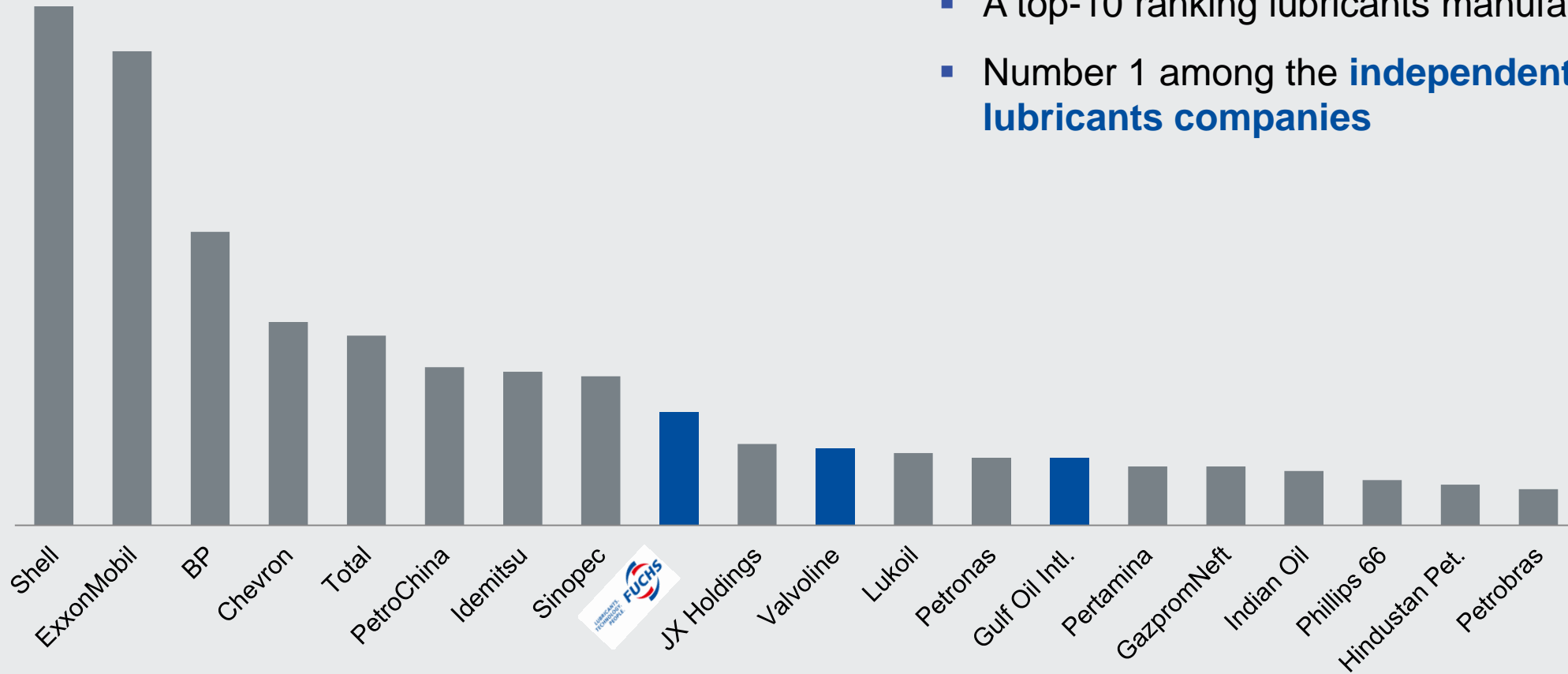
Markets

Development European Lubricants Breakdown

Demand (Million Tons)*



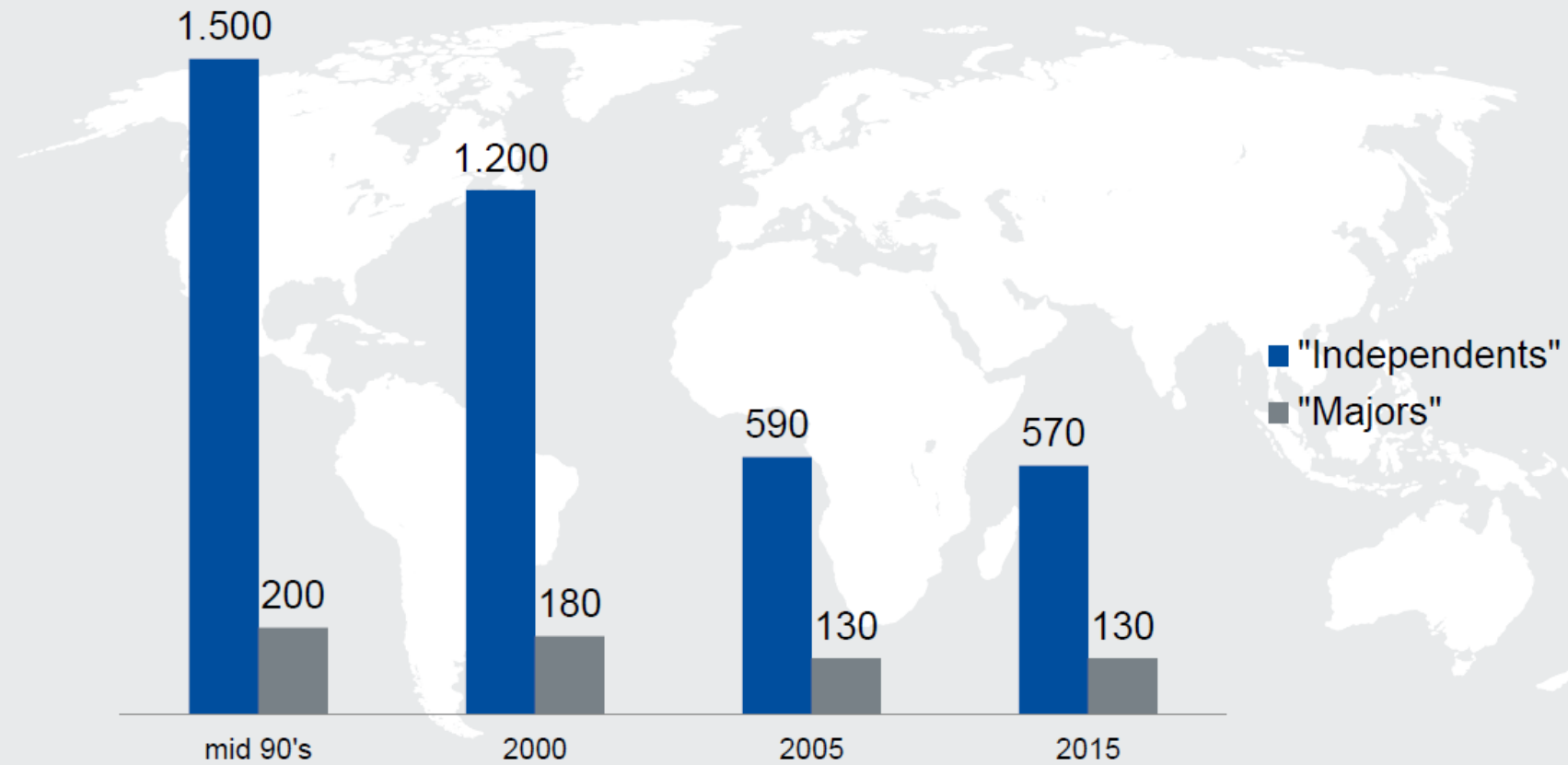
Top 20 lubricants manufacturers



- A top-10 ranking lubricants manufacturer
- Number 1 among the **independent lubricants companies**

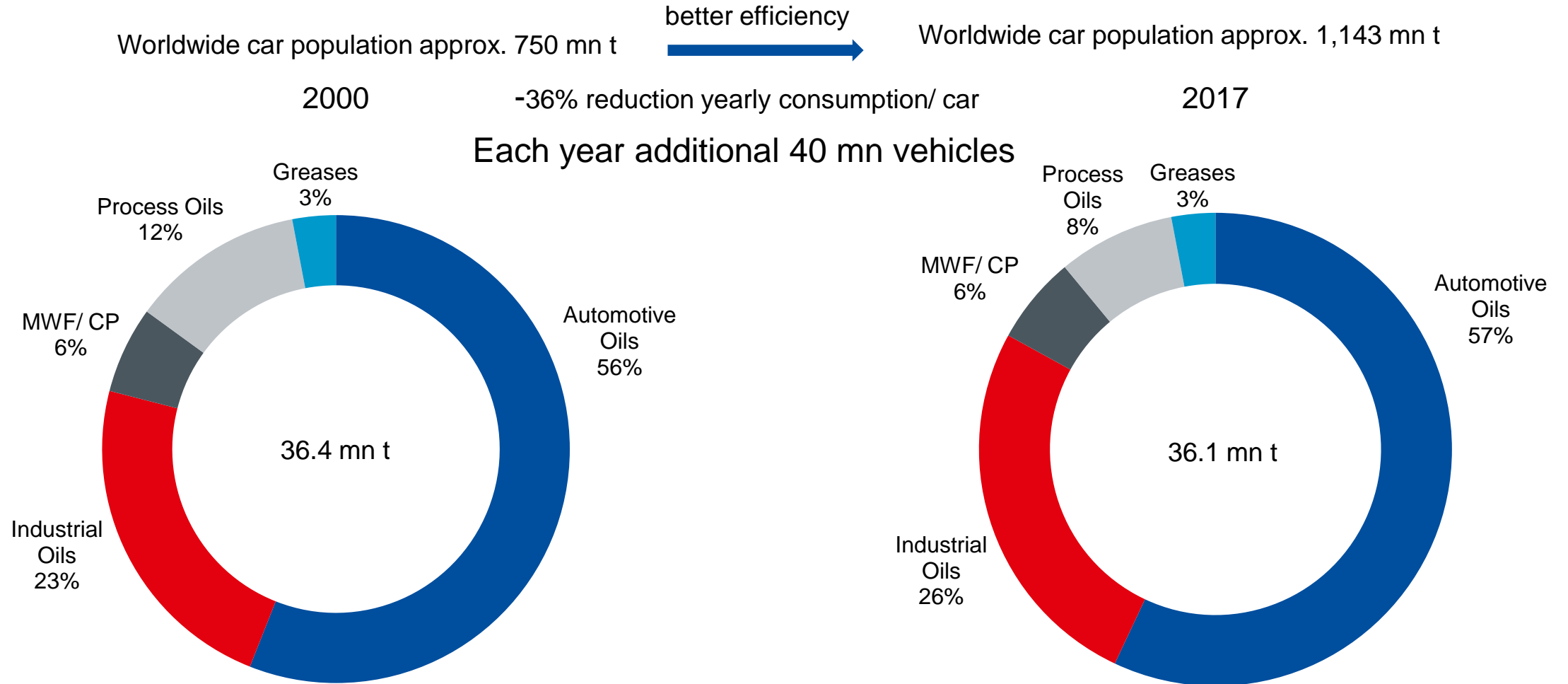
Global Lubricants Market

Global Industry Structure

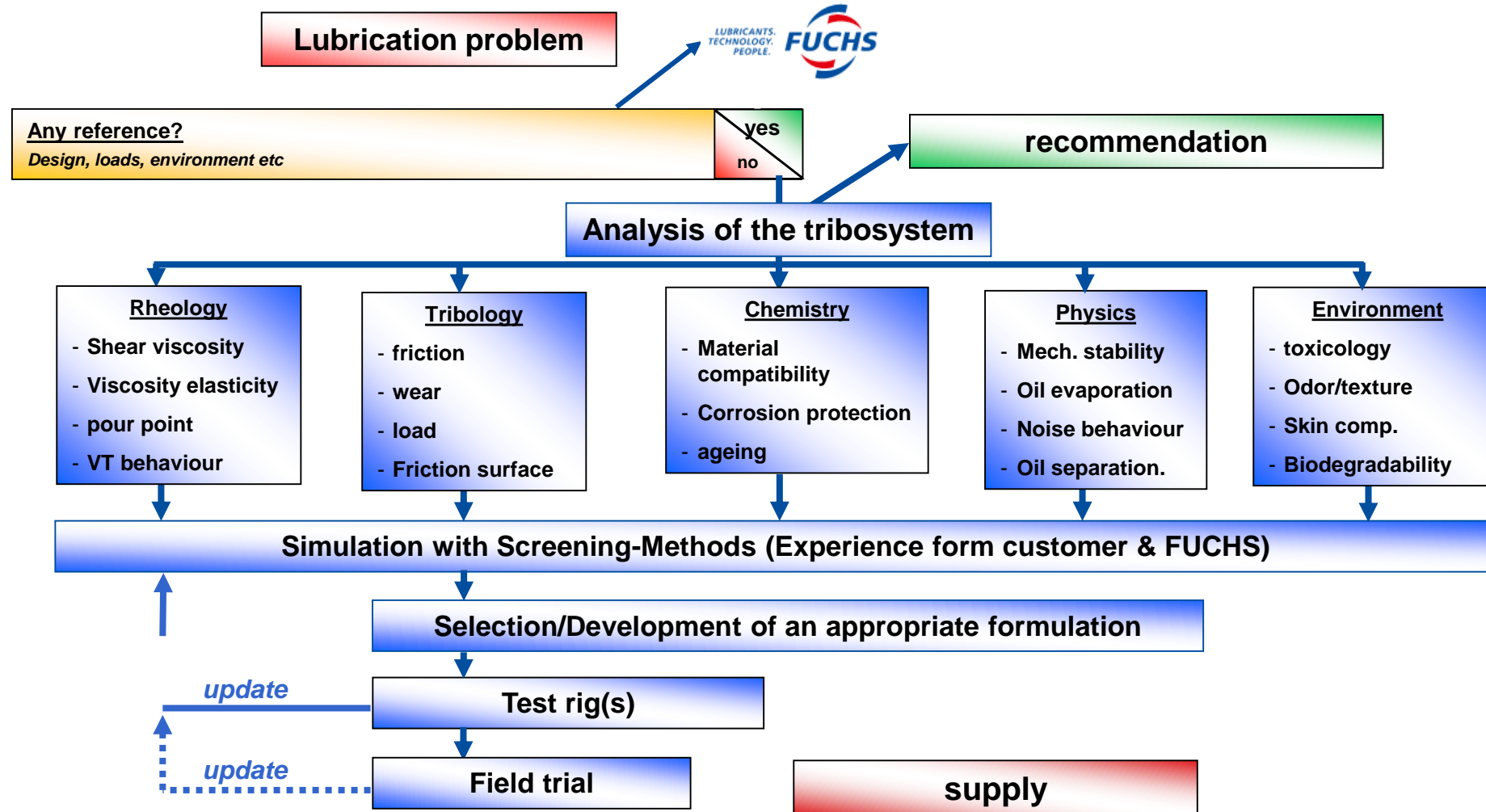


Product Split

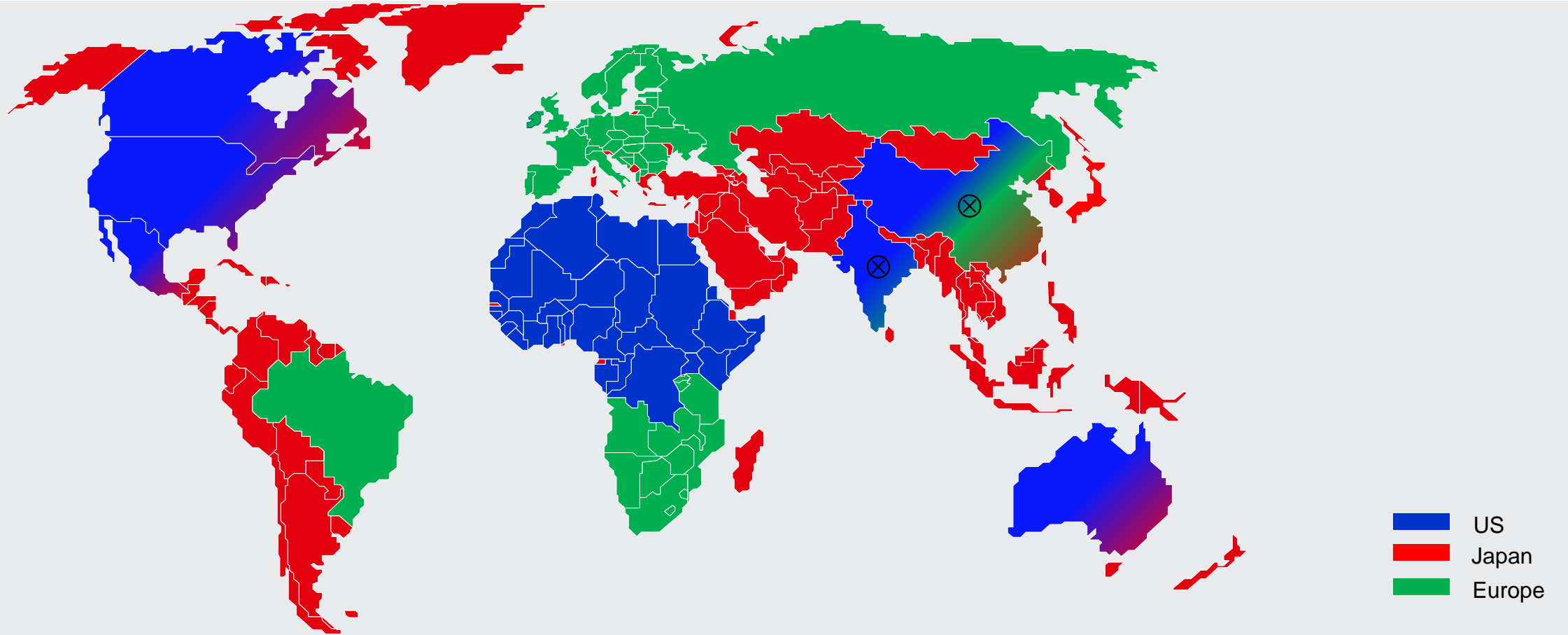
Global Lubricants Market



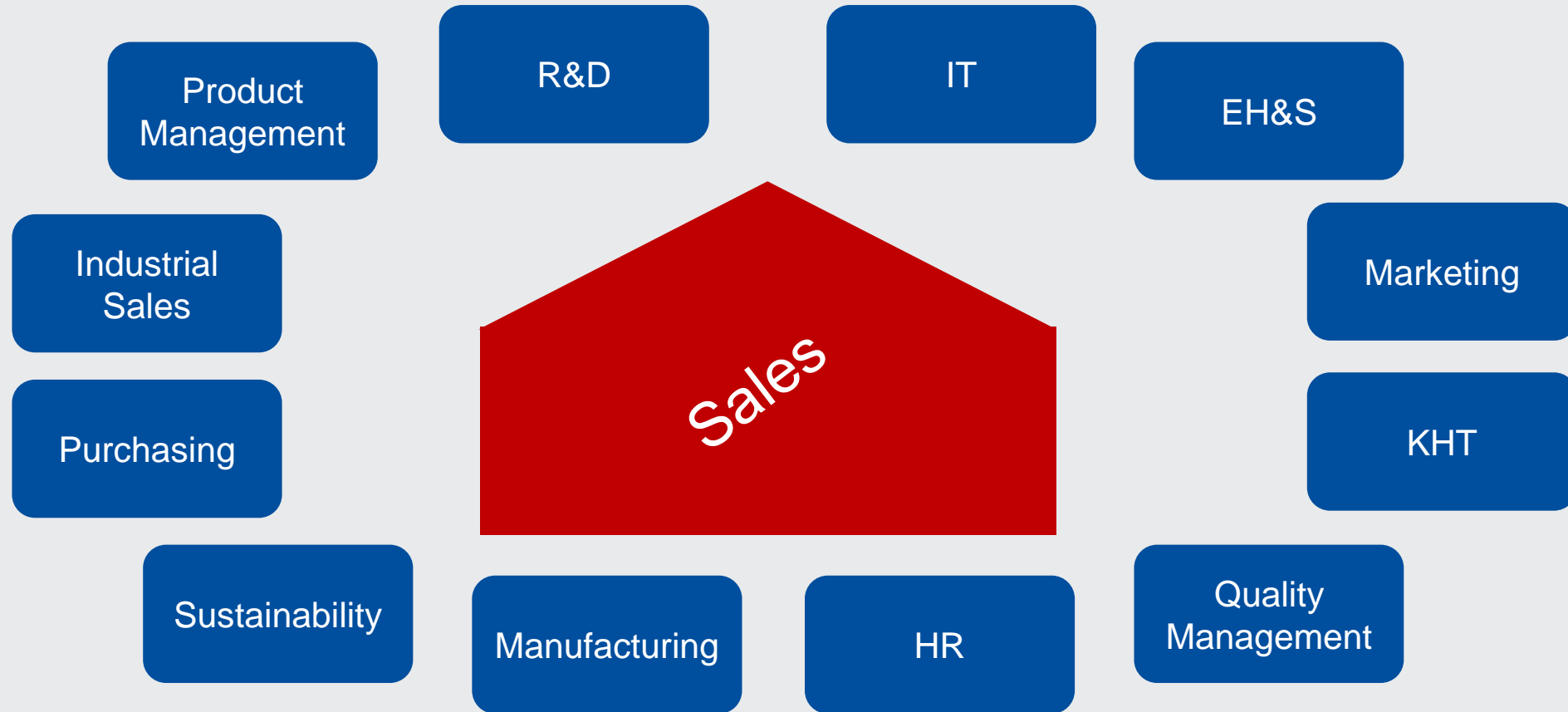
Analysis of Tribosystem – the way



Technology Regions



Organizational Structure



Organisational concept – Globalisation and Networking

Matrix structure with global Key Working Groups (16 + 3)



02 Challenges and Market Impact



Future Trends – 3.5 disruptions at a time

Digitalization

- **Simulation/ Modelling**
- **Sensor Techniques**
- **Big data**
- **Business Models**

3D printing

- Aerospace Industry
- Car manufacturing
- Medical engineering
- Steel Industry

Sustainability

- Raw materials availability
- New sources and synthesis paths
- Independence of mineral oil
- Reduction of CO2-foot print
- Environmental acceptable

E-Mobility

- **Impact on the industrial and automotive application**
- **New requirements for lubricants, e.g. temperature, materials, conductivity**
- **Autonomous Driving**

Future Trends – 3.5 disruptions at a time

Digitalization

- **Simulation/Modelling**
- **Sensor Techniques**
- **Big data**
- **Business Models**

- **China**
- **USA**
- **Europe?**

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- **China**
- **Germany?**

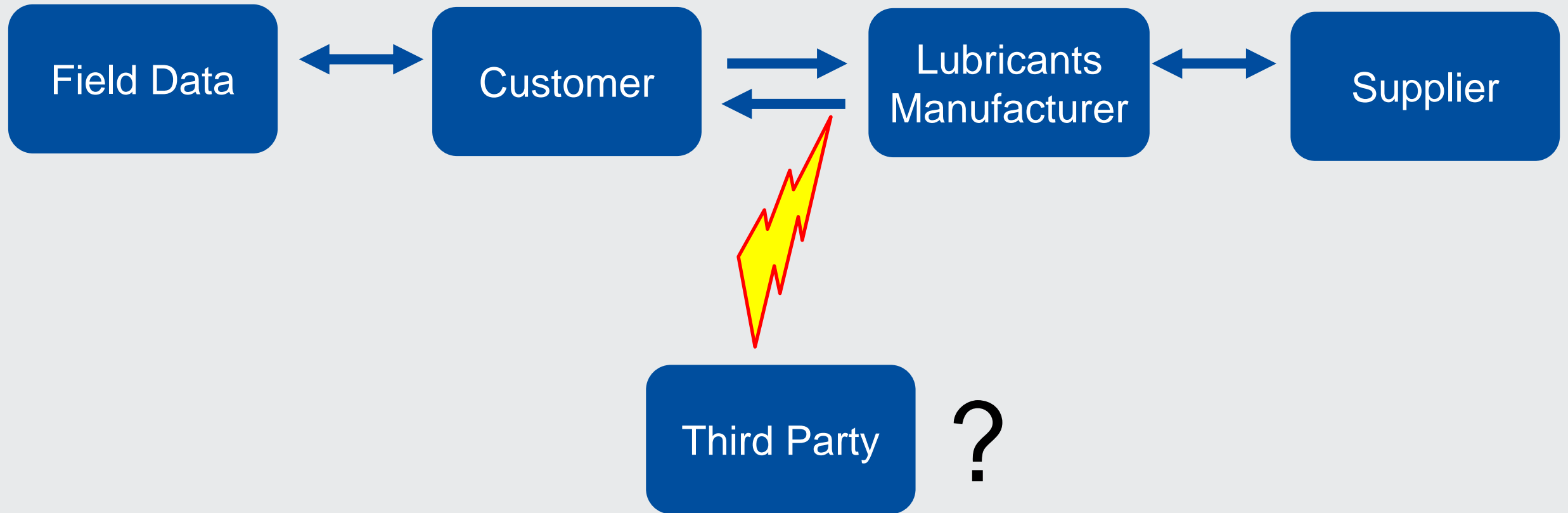
03 Digitalization



1. Sensoric – condition monitoring, control, prediction
2. Statistics / Simulation
 - Explorative statistics (Data Mining, Big Data)
 - System modelling (chemical, tribological, logistic, manufacturing)
3. Business Models

New Technologies

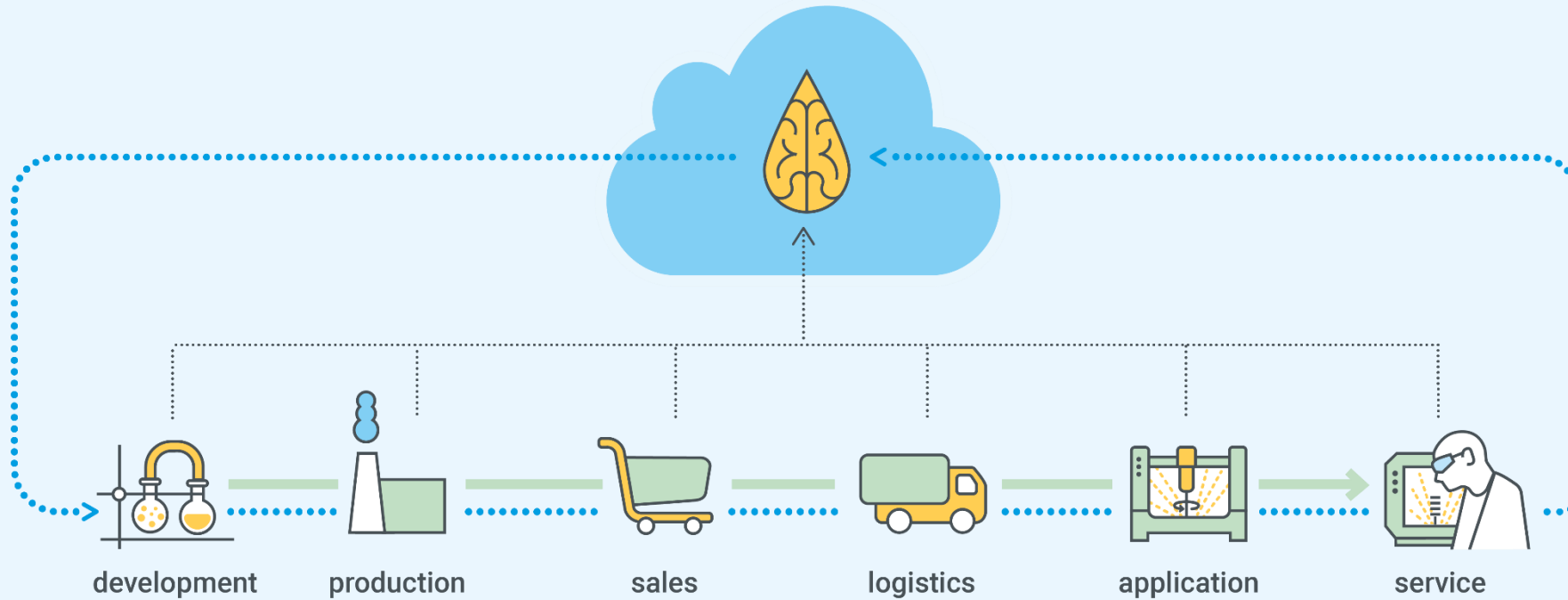
CPS (Cyber Physical Systems)



inoviga

inoviga

Digitalization will fundamentally change our value creation



...to a more integrated value chain due to data integration and feedback loops

technologies to be integrated



Internet of Things

Connecting things with people and processes



Big Data

Manage vast amounts of big data



Analytics

Insights that enable transformative actions



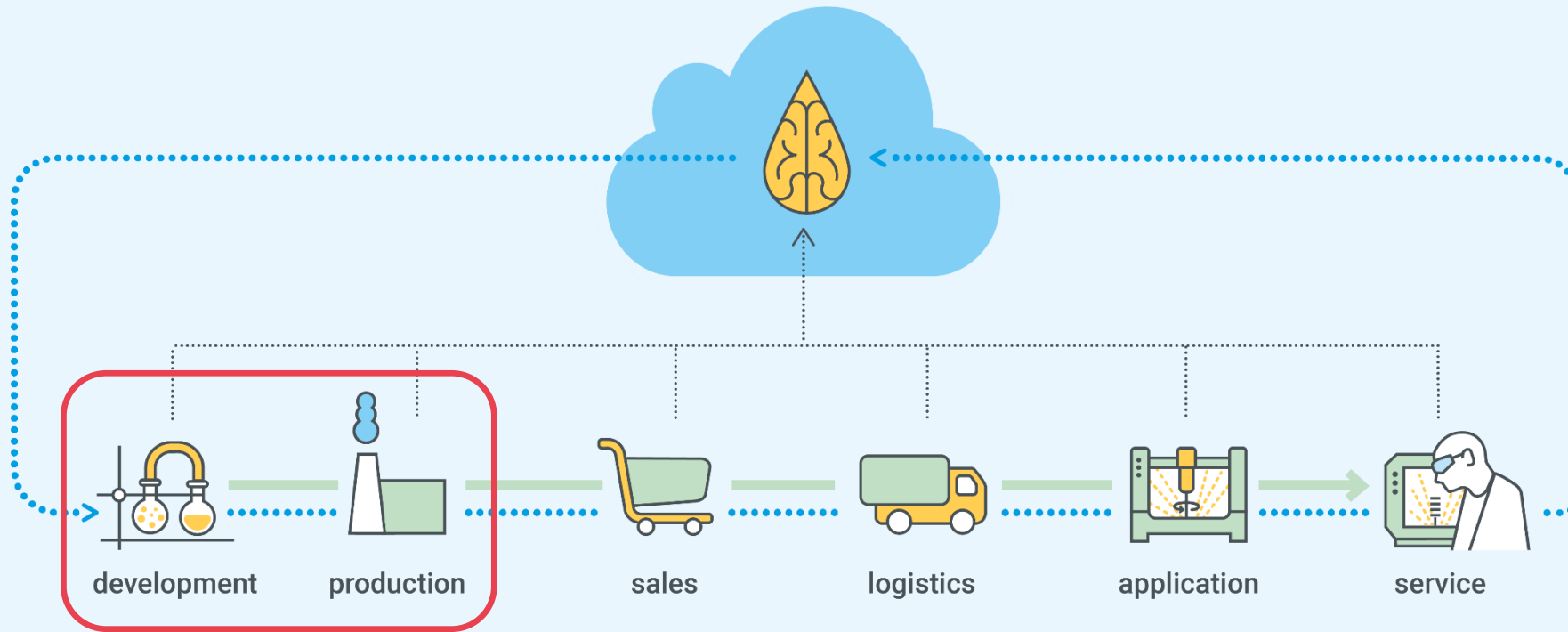
Machine Learning

Intelligence enabled by learnings from data

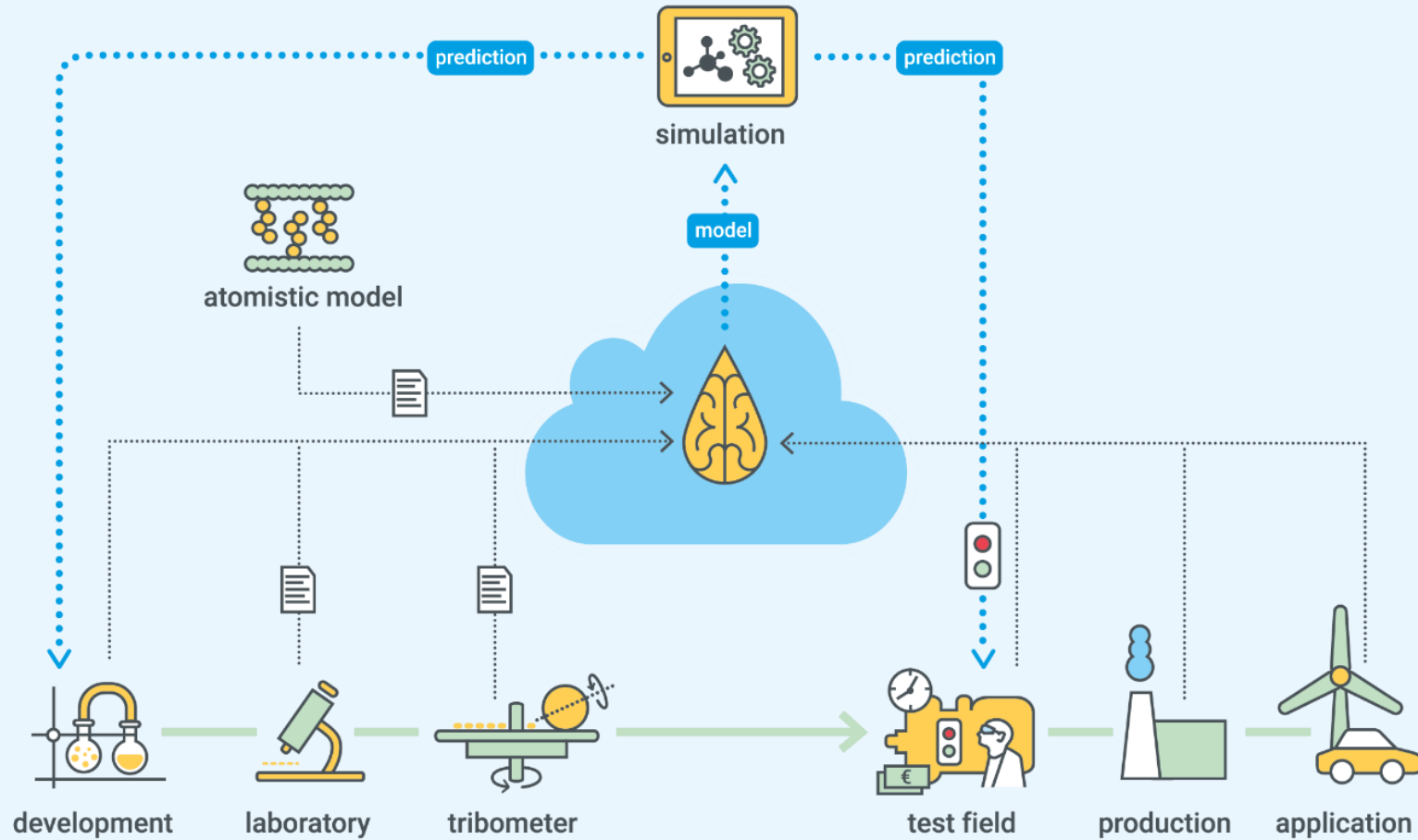


Blockchain

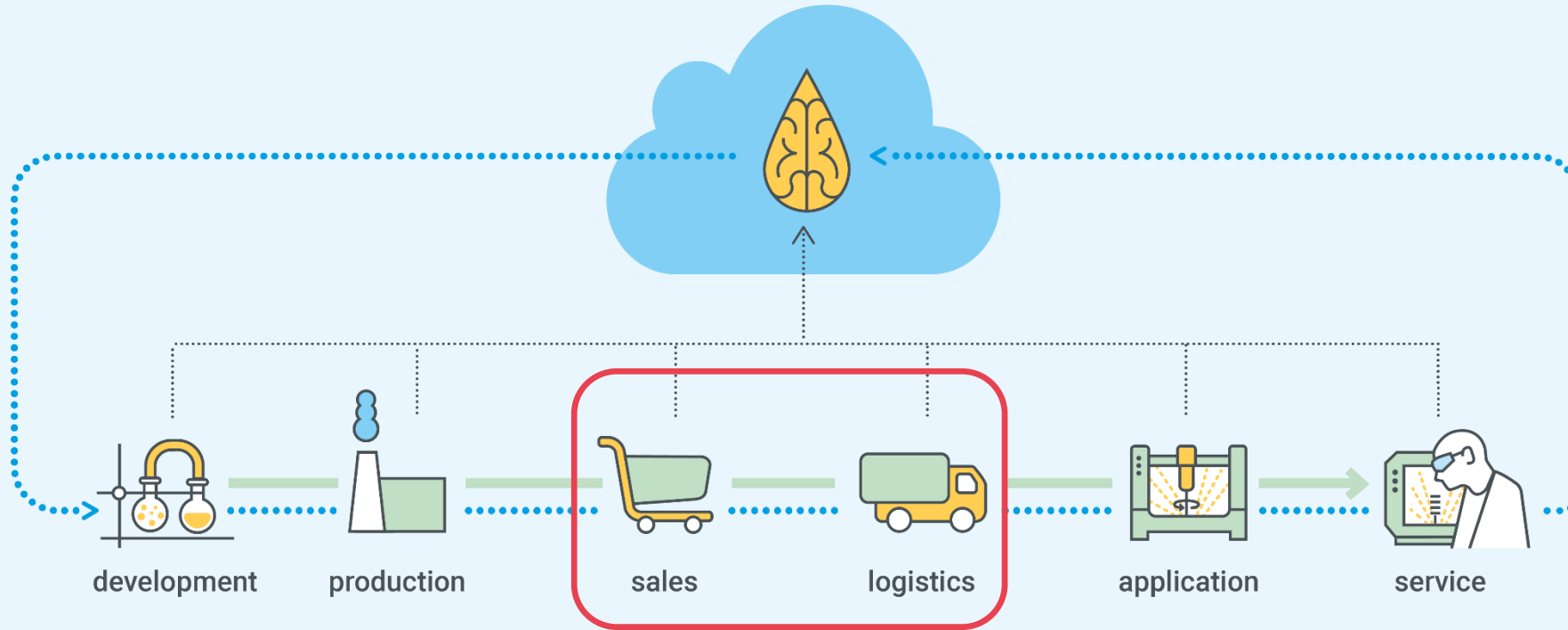
Blockchain services embedded into business apps



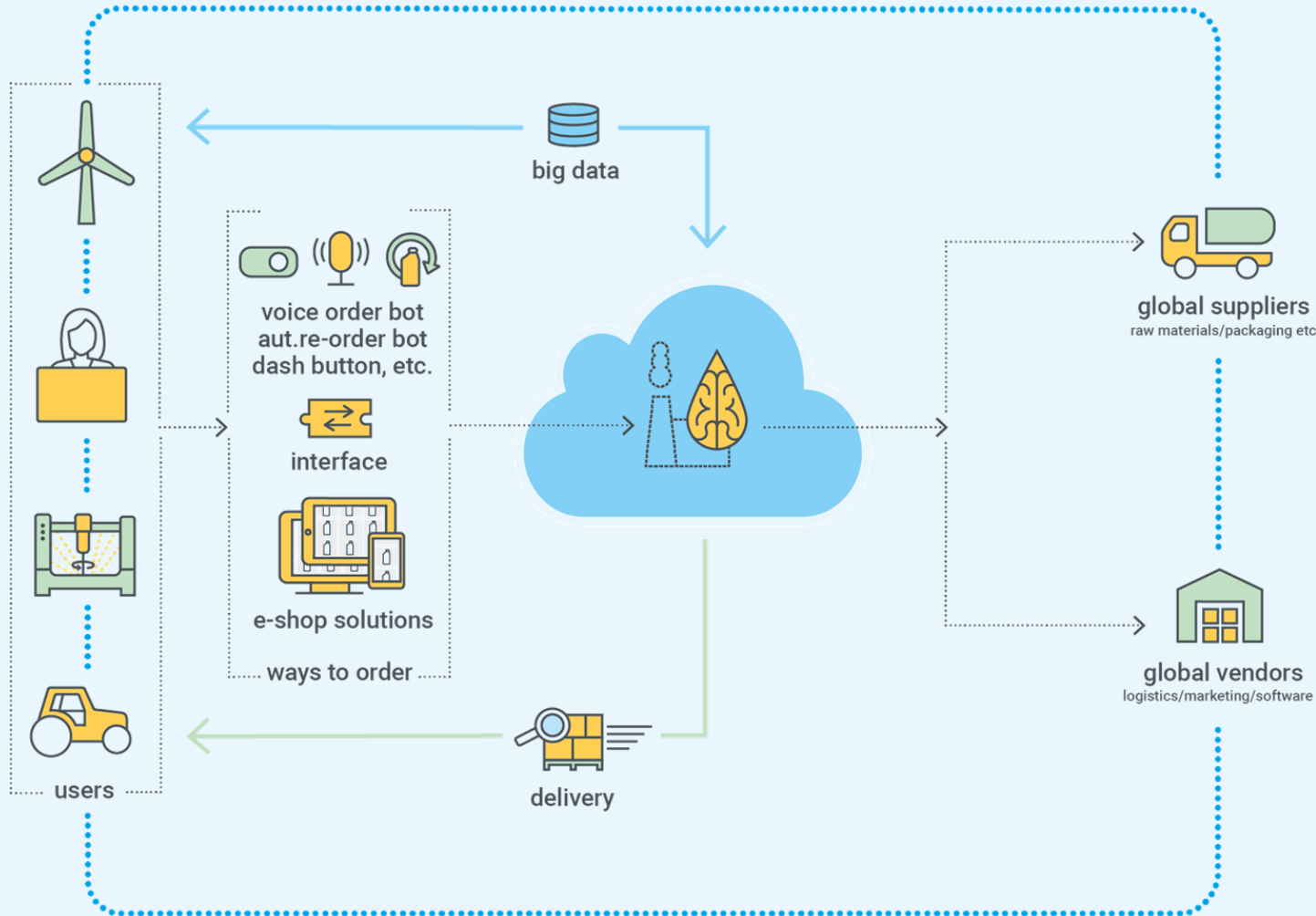
digitized product development & lubricant production



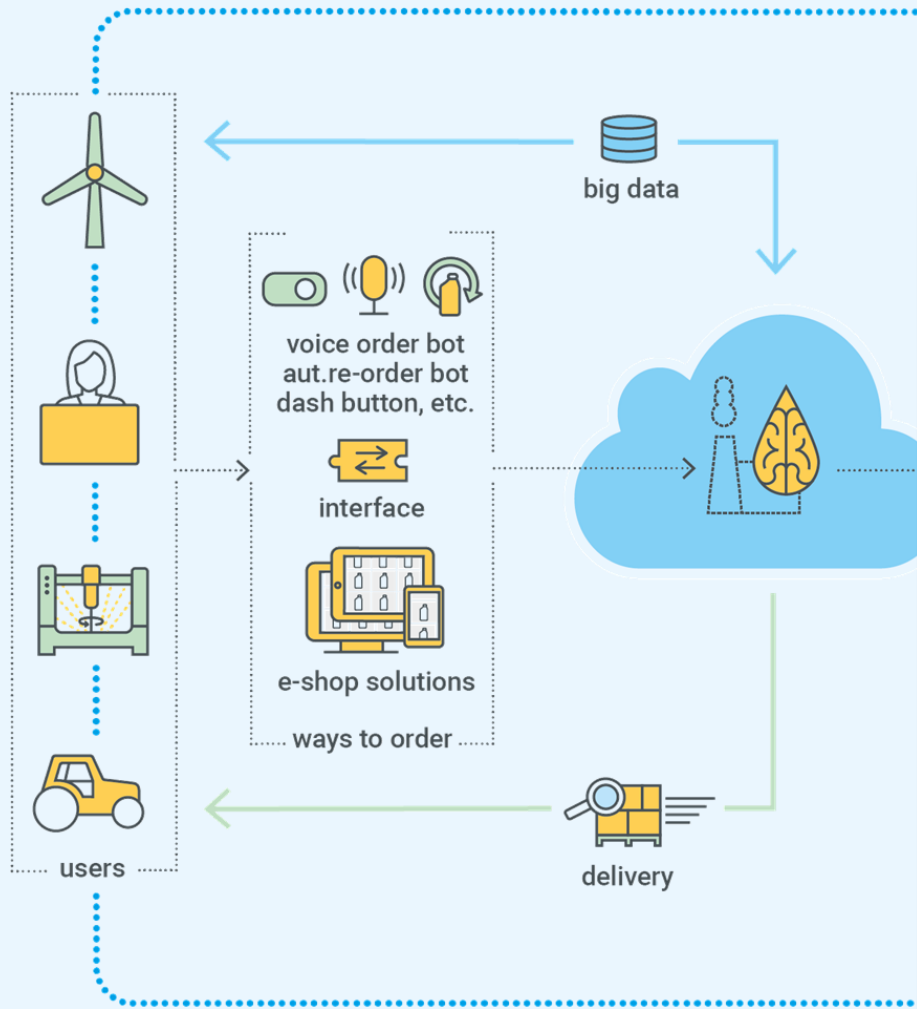
- From empirically-driven product development to simulation approaches
- Application-linked data such as field data or test field results serve as a statistical/Big Data backbone
- Circle the application-linked data back into the development process for precise product development



eCommerce



- eCommerce involves facilitation of the sale of goods and services via electronic networks such as the internet
- Our eCommerce vision is driven by the idea that more than 80% of our customer create less than 20% of revenue. Therefore, transforming the interaction with these 80% to a streamlined & digitized contact leverages the globalized effort to reduce the complexity in all areas of our business



1

A subsidiary's Master Web-Shop:
A Customer's Exclusive Log-In

Who?
Any Customer: ePO placement

- Fuchs distributors (all product lines)
- Small ordering volume OEMs (e.g. first fill)
- EDI customers (as an alternative to EDI)
- SME, any other customer who needs a secured/simple way to place an PO

2

Microsite:
Shop in Shop Concept

Who?
Customers, who already have their own web shop

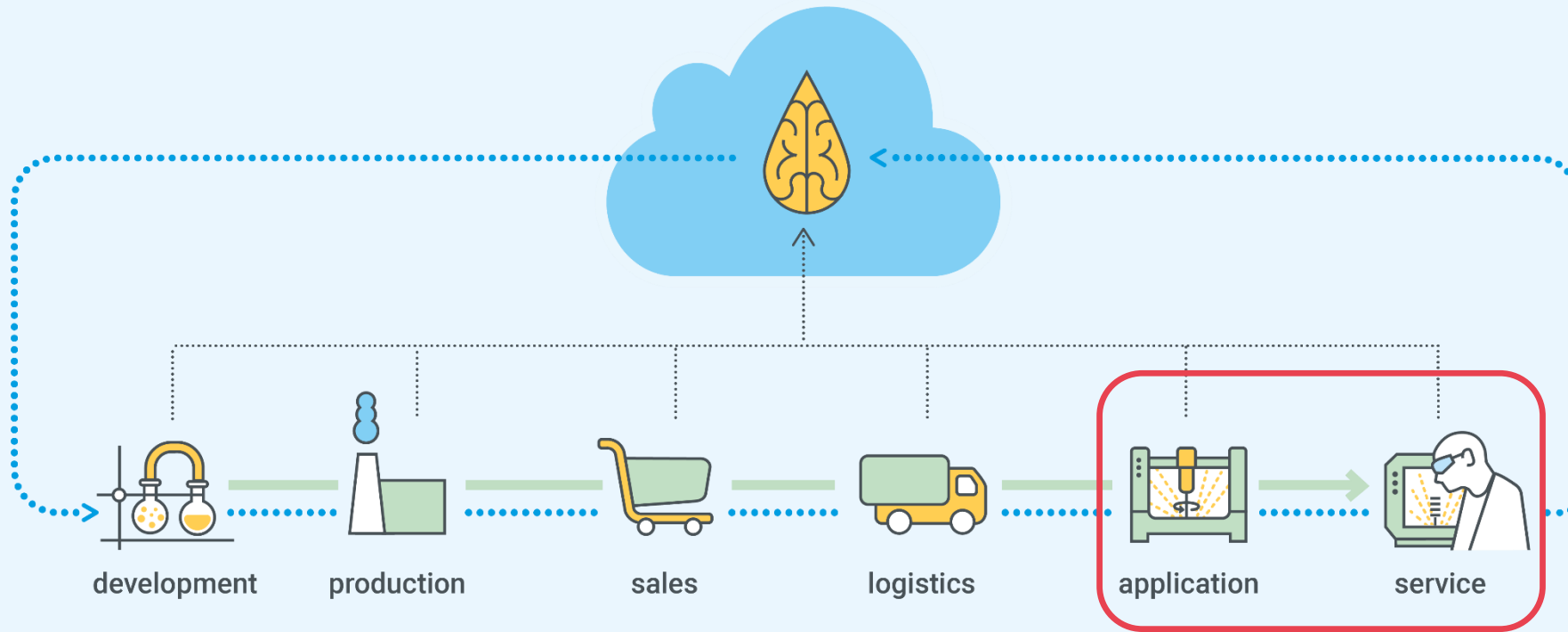
- OEMs: Integration with OEMs', their aftermarket divisions
- Large rental fleets
- Large e-retails (i.e. AutoZone)

3

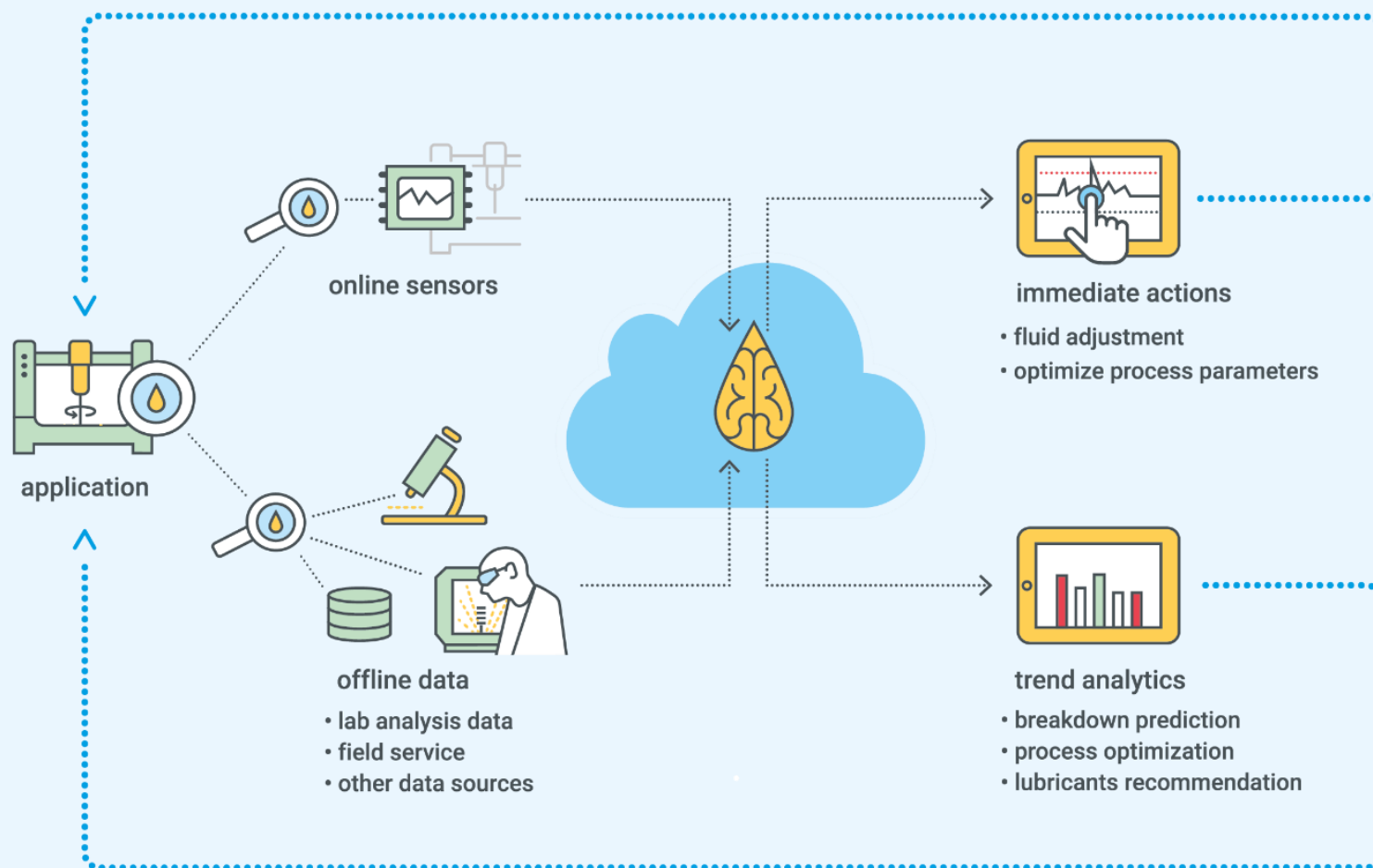
Webshop
as a service Concept

Who?
Customers, who don't have any web shop

- Small sole proprietors
- Small private label customers
- Low volume – high potential customers



smart services: objectives



- Make the lubricant talk in real-time by introducing online condition monitoring via sensors
- Combine lubricants data with machine data (e.g. vibration or load) to generate a holistic view
- Empower customers to take immediate actions to keep the lubricant and the machine healthy, preventing unplanned downtime
- inoviga is working on technologies to make lubrication-related smart services possible

FVT - Fluid Vision Technologies

Fluid Vision technologies

Automate the monitoring of your **Metalworking** and **Processing Fluids** with a configurable, easy to integrate and maintain IOT ready technology

- Wireless and Battery Operated
- MT Connect Compliant
- Automated Alert Notification
- Remote Monitoring
- Shop-Floor Display Ready
- Trend Analysis
- Data Log

Configurable Fluid Sensor Integration

- Concentration
- pH
- Conductivity
- Dissolved Oxygen
- Temperature

www.fluidvision.co

automate
monitor
control

MTConnect

- Fluid Vision Technologies started with the idea to provide an easy and economical inline measurement of coolants
- The sensor-part is in the validation phase

Company acquired in 2018

DMG Mori – mwf monitoring

CELOS VON DMG MORI

HOME PC-VERSION APPS STEUERUNG NEWS **KONTAKT**

Machine Views

Status Monitor Messenger Tool Analyzer **NEU!** **NEU!** **NEU!** Condition Analyzer Performance Monitor

CONDITION ANALYZER
OPTIONAL*

ANALYZER

Erfassen und Analysieren von Maschinendaten mit direktem Feedback an den Kunden für höchste Maschinenproduktivität.

Analyse von Maschinen- und Prozesssignalen

- Erfassung, Speicherung, Analyse und Visualisierung von Maschinensensordaten (z. B. Kraft, Vibration, Temperatur und Schmierung)
- Standortunabhängige Analyse einer oder mehrerer Maschinen z.B. zur Früherkennung von Maschinenstörungen

DEMO UND ANGEBOT ANFORDERN ...

DMG MORI ERGOline

CONDITION ANALYZER

CELLOS

20160927 13:52

Max Mustermann Logout

BEIHELFFELD / BEIHELFFELD DREHM... / DMU 210 P 06121

CONDITION ANALYZER

KÜHLWASSERREINHEIT	ALLGEMEINE MASCHINEN DATEN	KÜHLAGGREGAT
Tank Level Paper Level Quality Filter	Energy Effective Power Effective	Platz 1 Platz 2 Man-Manager
SCHALTSCHRAUK KÜHLER	HYDRAULIK	X-ACHSE
Temperatur Filter Minimale geschlossene Schicht	Pressure Tank Level Temperatur Öl Temperatur Sensor Filter	Actual Feed Rate Actual Position WCS Actual Power

- DMG wants to include the lubricant status into their condition analyzer app
- FUCHS is asked to provide a sensor

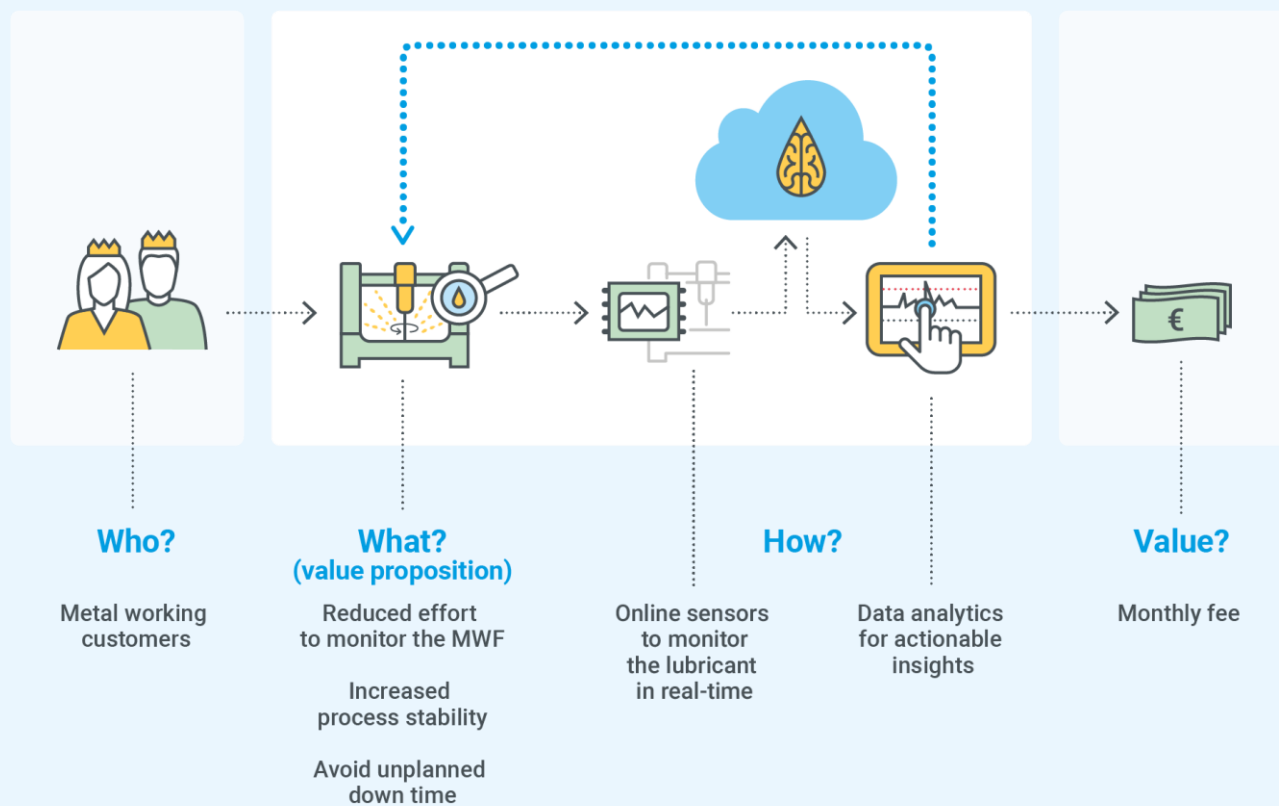
FUCHS Meter



- FUCHS Meter so far is a prototype
- Converting the prototype to a product is the next step
- Design will be reviewed
- Aspects like connectivity, automated asset recognition and many more need to be developed

bringing it all together
for new business models

Delivering new value propositions through sensors smart services



Online sensors and data analytics tools allow for new, data driven (“smart”) services

- Monitoring the lubricants in real-time
- Monitor the health status of the machine through monitoring the lubricant
- Take immediate actions to keep the lubricant and the machine healthy, preventing unplanned downtime
- Predictive Maintenance of lubricants
- “Lubrication as a service”: customers to pay for performance instead for a product

In Short

- Connecting Value chains incl. condition monitoring will result in new business models
- Today we sell technical solutions to our customers
- Today we offer excellent customer service in logistics and customer service
- **Tomorrow** we offer availability, performance or availability of systems – holistic approach

04 Sustainability



Sustainability is substantial part of our industry

- Raw material choice
- Additional regulatory from EU and China – Life Cycle Assessment
- Upcycling to be considered as part of our business model
- Customer requirements
- CO2 Footprint as part of product specifications

- KEY  to quantify sustainability we need frameworks, models and common understanding in the industry

Code of Responsible Conduct for Business Subscriber



Sustainability

Cross Initiatives

Responsible Care

FUCHS is a signatory to the Responsible Care Global Charter of the International Council of Chemical Associations (ICCA). FUCHS is committed to this initiative



Chemie³

FUCHS is engaged in the Chemie³ sustainability initiative of the German Chemical Industry Association (VCI), the German Mining, Chemical and Energy Industrial Union (IG BCE) and the German Chemical Industry Employers' Federation (BACV).



Wittenberg-Zentrum für Globale Ethik/econsense

FUCHS is engaged in a cross-industrial initiative of German companies with the objective of creating sustainability networks in emerging and developing nations. This initiative has been set up by the sustainability network econsense and the WZGE.



Sustainability

Engagement with Academic Institutions

University of Mannheim

CHAIR OF CORPORATE SOCIAL RESPONSIBILITY
Prof. Dr. Laura Marie Schons

*Presentations / Lectures at the
Sustainable Business Summit*

*Financial support of the
endowed chair of CSR at the University of Mannheim*

Cooperation with Student Initiatives



Sustainability Initiative Lubricants Industry

- Proposed and named by FUCHS, the lubricants industry sustainability initiative **NaSch*** was established in Germany in 2016
- Founding Members:** FUCHS, BANTLEON, ROWE, KLÜBER LUBRICATION, ZELLER+GMELIN, **Lube/Oil** associations VSI&UNITI
- Objective:** Creation of sustainability standards, KPIs, **benchmarks** for the lubricants industry to emphasize its social value
- UEIL cooperation with NaSch carrying sustainability forward to the level of the Union of the **European lubricants industry**

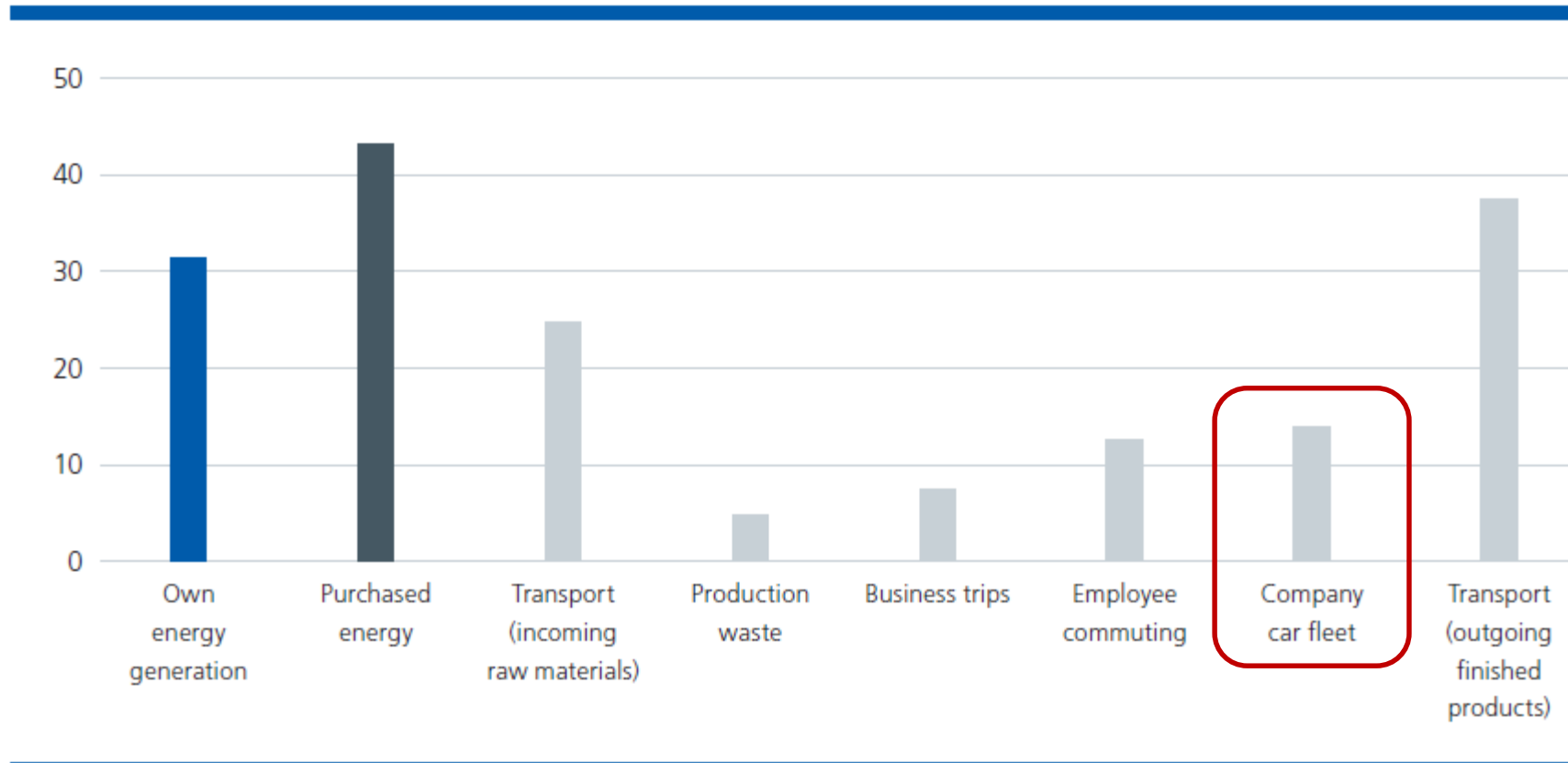


Sustainability Awards



Sustainability

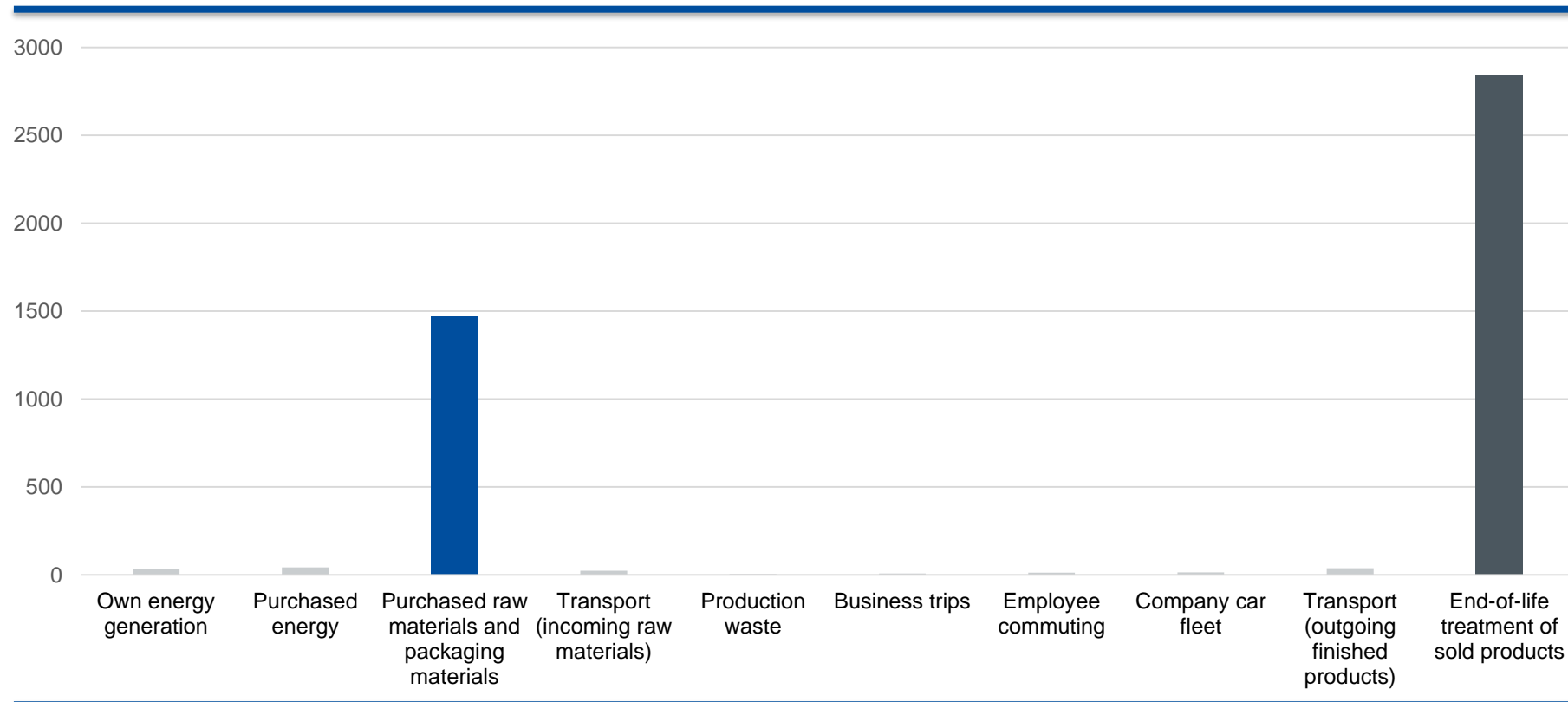
FUCHS Corporate Carbon Footprint* (in kilogramm CO2e per ton produced)



- Scope 1: Direct emissions through own energy generation
- Scope 2: Indirect emissions through purchased energy
- Scope 3: Indirect emissions along the value chain


Sustainability

FUCHS Corporate Carbon Footprint (in kilogramm CO₂e per ton produced)

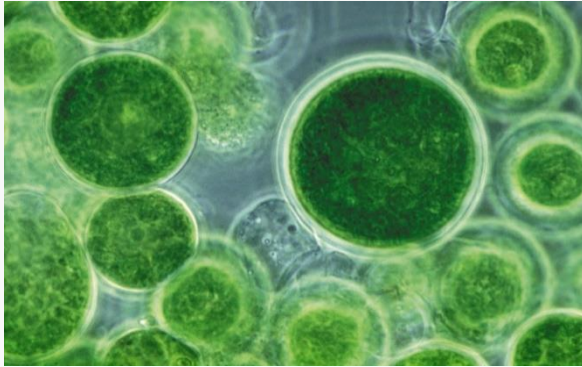


Sustainability

Raw Materials

- Petrochemical industry will see a significant change
 - Sustainability aspects will become part of future requirements
 - Paris Agreement
 - EU-Ecolabel – includes sustainability requirements
 - Customer requirements i.e. OEM's require → CO₂ Footprint must
 - Availability of some raw materials will be limited – disruptive changes in technology – new requirements for different applications
-  Need for sustainable raw materials / backwards integration

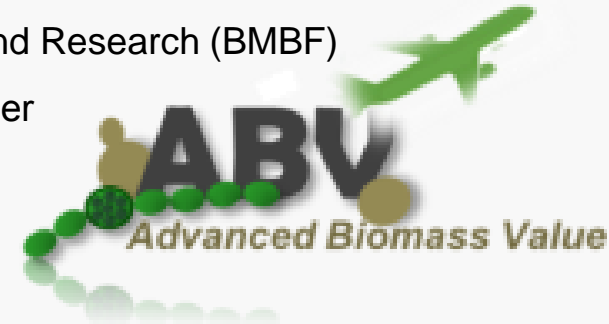
Project: "Advanced Biomass Value" / Idea: "Green Gold"



The "Advanced Biomass Value (ABV)" project is a joint interdisciplinary initiative with 8 partners, focused on isolating lipids from rapidly growing algae and turning them into high-quality lubricants. The remaining algae biomass is used to produce bio-kerosene using yeast. Any further remains are then incorporated into CO₂-adsorbing materials. Therefore, no waste accumulates.

For FUCHS, the participation in the projects opens up new access routes to different raw materials that ensure a stable, reliable supply. With an eye on dwindling resources, this also makes economic sense.

The project is funded with € 5 million by the German Federal Ministry of Education and Research (BMBF) "BioProFi" program under the leadership of the Technical University (TU) of Munich.



Project “ZeroCarbFP” / Idea: “Waste2Value”



In the “ZeroCarbFP (Zero Carbon Footprint)” alliance, 14 partners from various industries are working on a project to convert carbon containing industrial waste streams into valuable materials, using microorganisms. The project is supported by the German Federal Ministry of Education and Research (BMBF) from 2012-2021 with a budget of € 48 million. The idea of the project is “Waste2Value”.

For FUCHS, the focus of research activities lies in the field of functional base oils and additives. Complex molecules to be gained through enzymatic modification for use as base fluids or additives.

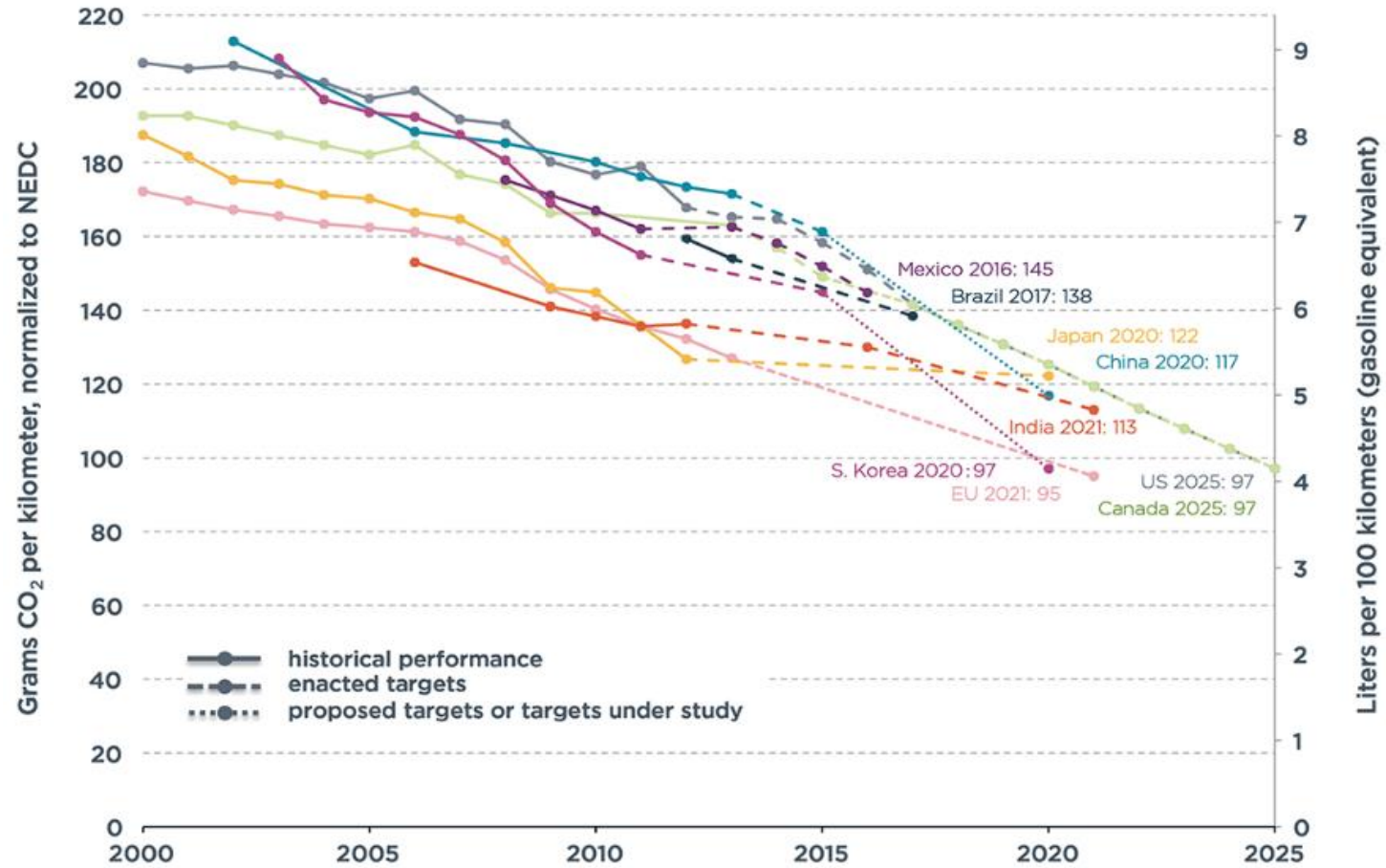
Within the “Waste2Value” project, FUCHS is investigating on the application of the residual-based materials in lubricant products.



05 E-Mobility



Technologies to reduce automotive CO₂-emission

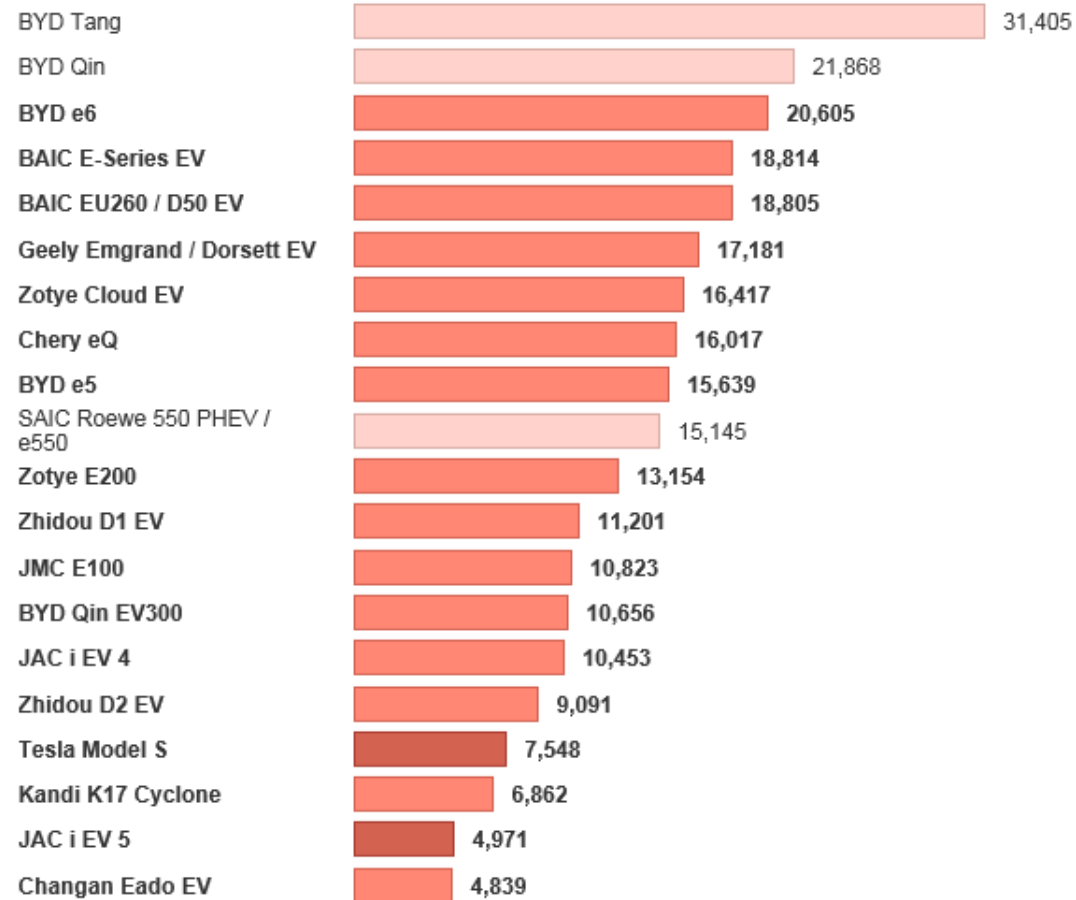


New Technologies – e-Mobility

- Politics, legislation and industry require and push the e-mobility
 - VW-Strategy: Together 2025: 30 % of the cars will be e-cars by 2025
 - Netherlands and Norway decided, that starting with 2025 no new car with combustion engines will be approved anymore
 - China: 10% (2019), 12% (2020) Quota by law
- Alternatives to “traditional“ e-mobility:
 - Hybrid-technology
 - H2-cells (BMW, Toyota)
 - Combustion engine remains by using environmental friendly fuel: Power to Liquids: fuel from CO₂ und H₂ (H₂ from water via renewable energy)

China EV-Sales 2016: Est 2017 +70%

507.000 cars (+53%), Market Share 1.8%



23 mn passenger cars 2017

0.8 mn EV cars

3.4% market share

10% (2019), 12% (2020) quota by law

507,000 cars sold

336,000 passenger cars

171,000 commercial vehicles (esp. busses)

409,000 battery electric vehicles (= 80%)

98,000 plug-in hybrids

10% (2019), 12% (2020) Quota by law

E-mobility ramp up scenario

- Paris Climate Agreement „COP21“: from **2050** on, CO₂ emissions shall not exceed CO₂ absorption
- Existing world car fleet 2017: 1000 Mio cars
- Annual production 2016: 72 Mio cars – in 2030 81 Mio cars
- Time to replace conventional cars with „clean“ cars: **14 years**
(20 years incl. expected fleet growth 0.9%/a OICA Statistics)
- Based on an average model life cycle of 6 years, OEMs shall be prepared to provide the majority of their car fleet based on new/clean technology from **2030** onward
- i.e. the **2nd model generation from now** should be „clean“ cars

E-mobility ramp up scenario - Europe

- Not only new cars shall meet CO₂ emission targets by 2050, but also the existing car fleet at this time need to comply accordingly
- As a consequence: By 2028, e-cars will have 30-35% market share in the EU, combustion 28%, Hybrid 40%
- Car population stable 255 Mio cars (EU-Statista)
- Significant influence on market demands in automotive and metal processing oils
- the scenario neglects that EU is far away in providing the needed infrastructure and energy supply (renewable)

E-mobility ramp up scenario - USA

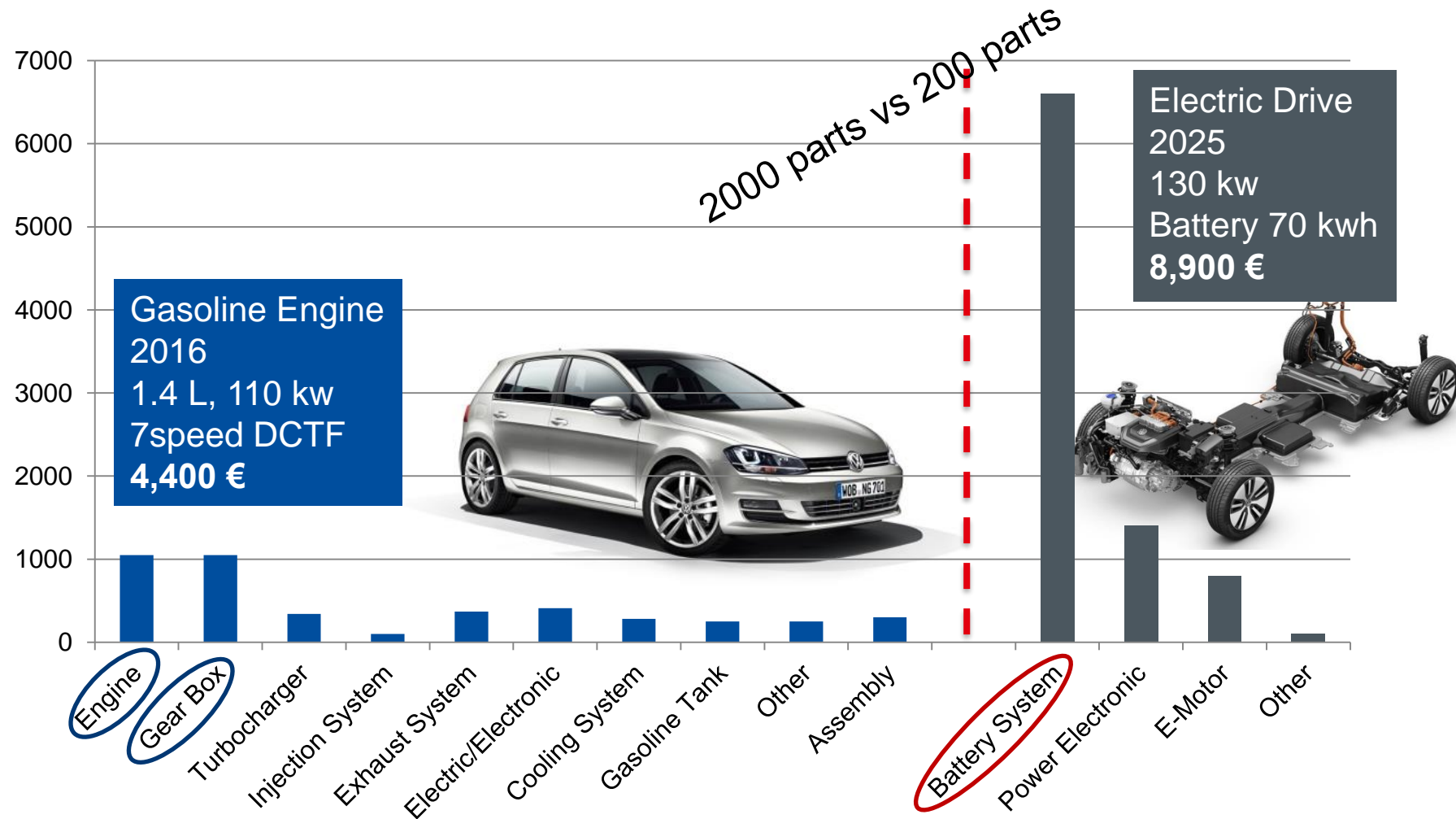
- USA car population around 270 Mio cars – stable car population
 - no predictability of political behavior
 - terminates the “Paris Climate Agreement”
 - Average reduction of market demand by 2%/a the past 5 years
 - Next 4-8 years no dramatic change due to e-mobility to be expected

E-mobility ramp up scenario - China




- China e-mobility share given by law eff. 2019 10%, 12% from 2020 onwards expectation 30-40% to come due to massive urbanization push
 - In 15 years 38-40 mn cars produced thereof 16 mn EV cars – 24 mn ICE (2016 22 mn) – CAGR 6-8%
 - 172 mn cars registered in China – (Ministry of Public Security bulletin 01/2016)
 - China Center on Energy and Transportation – University of California – Car population in 2030 around 400 mn cars – correlates with 7% CAGR car population
 - Assumption in 2030 car population 160 EV - 240 mn ICE
 - Average demand per car/ICE will reduce by 1.2% year

ICE- vs. EV-Powertrain: Different Value Creation (€)

Example: VW Golf 2016 vs. VW e-Golf 2025 lost value chains



What's different

<u>Powertrain Applications</u>	ICE 	Hybrid 	Battery 
Engine oil	✓	✓	-
Transmission oil	✓	✓	✓ / -
Greases	✓	✓	✓
Specialty greases	✓	+	+
Lubricants for Auxiliary systems	✓	+	+
Cooling & functional liquids	✓	+	+

- Omitted ✓ Required + Increased

E-Mobility/New Materials/Efficiency

Impact on demand next 15 years

- Europe

⇒ decrease automotive:	18%
decrease metal processing oils	30%
stable : industrial	0 %
decrease total market:	10% = 400 KT

- USA

⇒ decrease ≈ 20% (efficiency, e-mobility)	= 1200 KT
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E-Mobility/New Materials/Efficiency

Impact on demand next 15 years

- China
 - ⇒ automotive increase \approx 15-20%
 - metal processing stable in MPO
 - industrial increase 15%
 - increase overall: 10% = 700 KT
 - ROW
 - ⇒ unchanged or not predictable
- ⇒ Ø decrease in demand worldwide by 900 KT – 5% overall

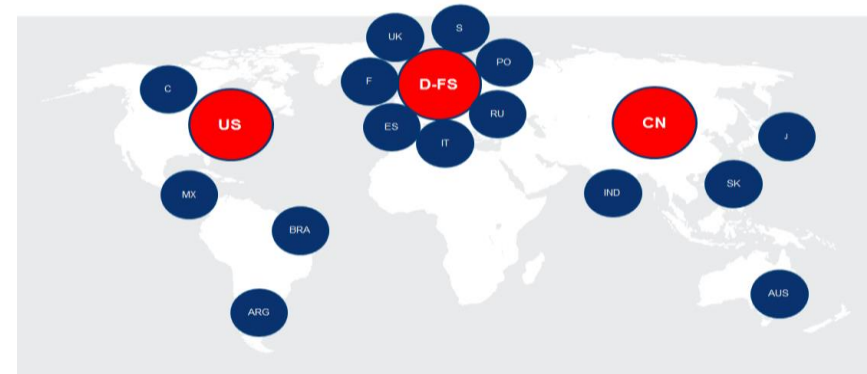
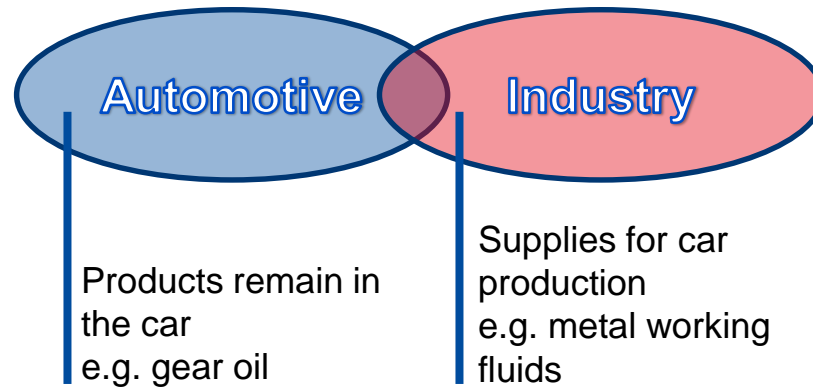
06 E-Mobility – set up



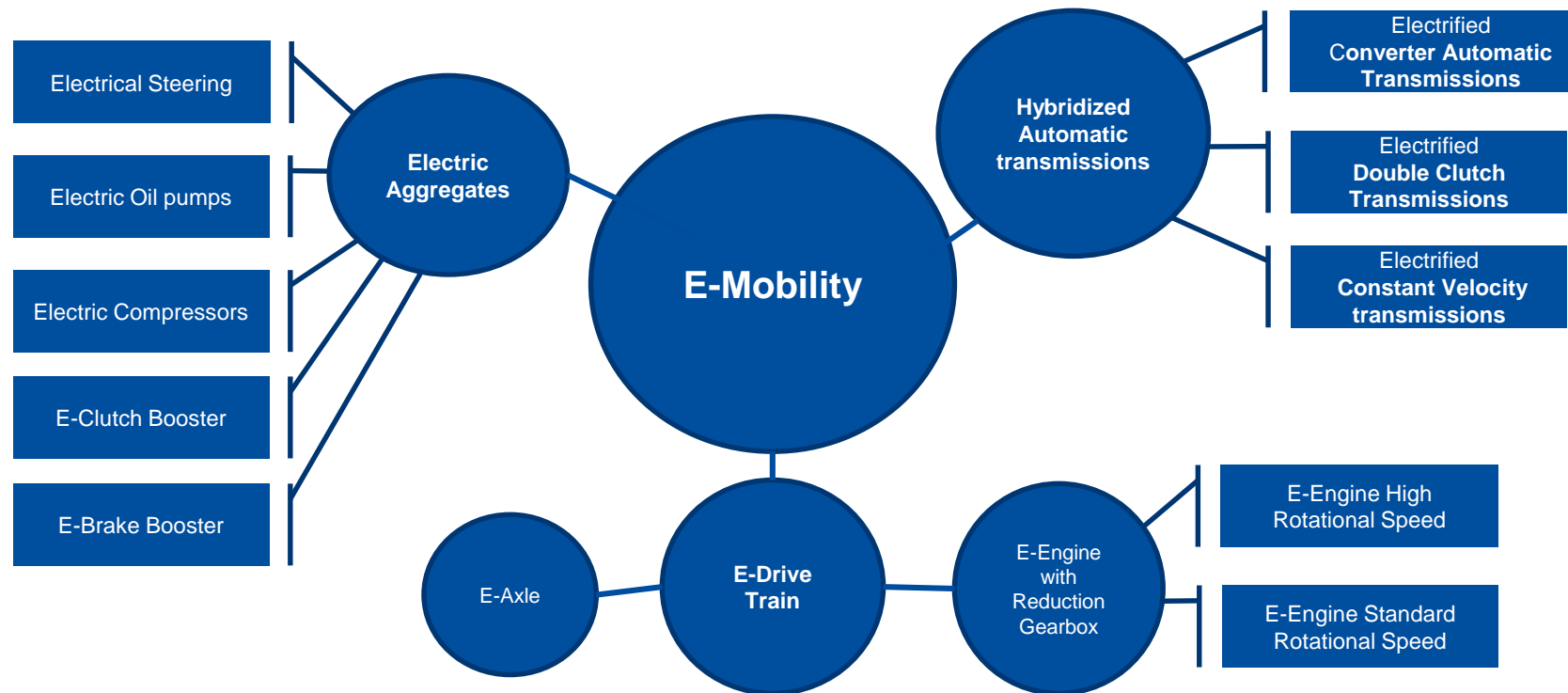
E-Mobility @ FUCHS

Coordination of all R&D activities with E-Mobility perspective:

- Cross functional project development work
- Holistic coordination over all applications and project segments
- Regional R&D support on the 3 main R&D hubs with coordinative responsibility



E-Mobility Drives New Technologies



E-mobility

Impact on lubricants

Automotive
<ul style="list-style-type: none"> • Decline of engine oil- and gear oil-usage • Increase in grease demand as new applications come up • New specifications, Behaviour of fluid chemistry under influence of electric currents and influence on electromagnetic fields • low friction/high speed, reduced noise etc, yellow metal compatibility, • New applications e.g. battery cooling, cooling lubricants

Industrial applications
<ul style="list-style-type: none"> • General trend to weight reduction • Lightweight materials - car body will change from steel to more Aluminum, thermoplastics and CFK • Optimized geometry of the parts <ul style="list-style-type: none"> – Less machining allowances – Tighter tolerances – Higher requirements on die filling and surface quality



FUCHS – Quo Vadis

- FUCHS with a broad range of abilities in many fields sees a lot of opportunities to develop the business especially in the digital world
- The changes in the market environment will create new opportunities due to our technical level, international set up, high flexibility, our committed employees and broad customer base – unique
- Sustainability as an established element in FUCHS' mindset offers opportunities to be ahead competition

Thank you for your attention

