

Fact Book

Knorr-Bremse AG



Agenda

- **Introduction**
- Key Company Highlights
- Rail Vehicle Systems (RVS)
- Commercial Vehicle Systems (CVS)
- R&D Focus
- Financials
- Sustainability
- Capital Markets Summary
- Appendix



The Knorr-Bremse leadership team



Dr. Jan Mrosik
CEO

- 2021-present: Knorr-Bremse | CEO
- 2019-2020: Siemens AG | COO Digital Industries
- 2016-2019: Siemens AG | CEO Digital Factory Division
- 2014-2016: Siemens AG | CEO Energy Management Division
- 2011-2014: Siemens AG | CEO Smart Grid Division
- PhD in Engineering

Professional Experience **24**

Start at Knorr-Bremse **01/21**



Frank Markus Weber
CFO

- 2020-present: Knorr-Bremse | CFO
- 2016-2020: Daimler AG | Head of Corporate Development
- 2019-2020: Mercedes-Benz AG | Head of Transformation
- 2013-2016: Daimler Trucks Asia | CFO
- 2011-2013 Mitsubishi Fuso Trucks & Bus Corporation | CFO
- Diploma in Bus Administration

Professional Experience **24**

Years with Knorr-Bremse **1**



Dr. Peter Laier
Member of the Board (CVS)

- 2016-present: Knorr-Bremse | Head of CVS
- 2014-2015: Benteler International | COO
- 2013-2014: Osram Licht | CTO
- 2000-2012: Continental | Executive Vice President
- PhD and Diploma in Mechanical Engineering

Professional Experience **24**

Years with Knorr-Bremse **5**



Dr. Claudia Mayfeld
Member of the Board (Integrity & Legal)

- 2021-present: Knorr-Bremse | Head of Integrity & Legal
- 2013-2019: RWE Pensionsfond | Member of the Executive Board
- 2016-2020: Innogy SE | Senior Vice President Group Legal & Compliance, General Counsel
- 2013-2016: RWE AG | Senior Vice President Group Legal & Compliance, General Counsel
- PhD in Accounting Principles

Professional Experience **28**

Start at Knorr-Bremse **05/21**



Dr. Jürgen Wilder
Member of the Board (RVS)

- 2018-present: Knorr-Bremse | Head of RVS
- 2015-2017: DB Cargo AG | CEO
- 2013-2015: Siemens AG | CEO Mainline Transportation Global Business Unit
- 2011-2013: Siemens AG | Head of Strategy Infrastructure and Cities Sector
- PhD in Physics

Professional Experience **20**

Years with Knorr-Bremse **3**

Notes: RVS - Rail Vehicle Systems; CVS - Commercial Vehicle Systems

Knorr-Bremse – One of Germany’s most successful industrial companies



**Family-Ownership,
heritage and unique DNA**



**Global market leader
for braking systems**



**Shared pneumatics experience
between RVS and CVS**



**Technology
leadership**

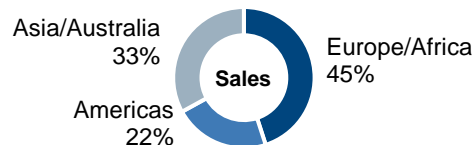
2020 Key financials

Sales € 6.2bn (>9% CAGR ¹⁾ since 1989)	EBITDA € 1.1bn (margin 18.0%)	EBIT € 0.8bn (margin 13.2%)	R&D € 396m (~6.4% of sales)	Aftermarket ~37% of sales
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BALANCED PORTFOLIO²⁾ ...



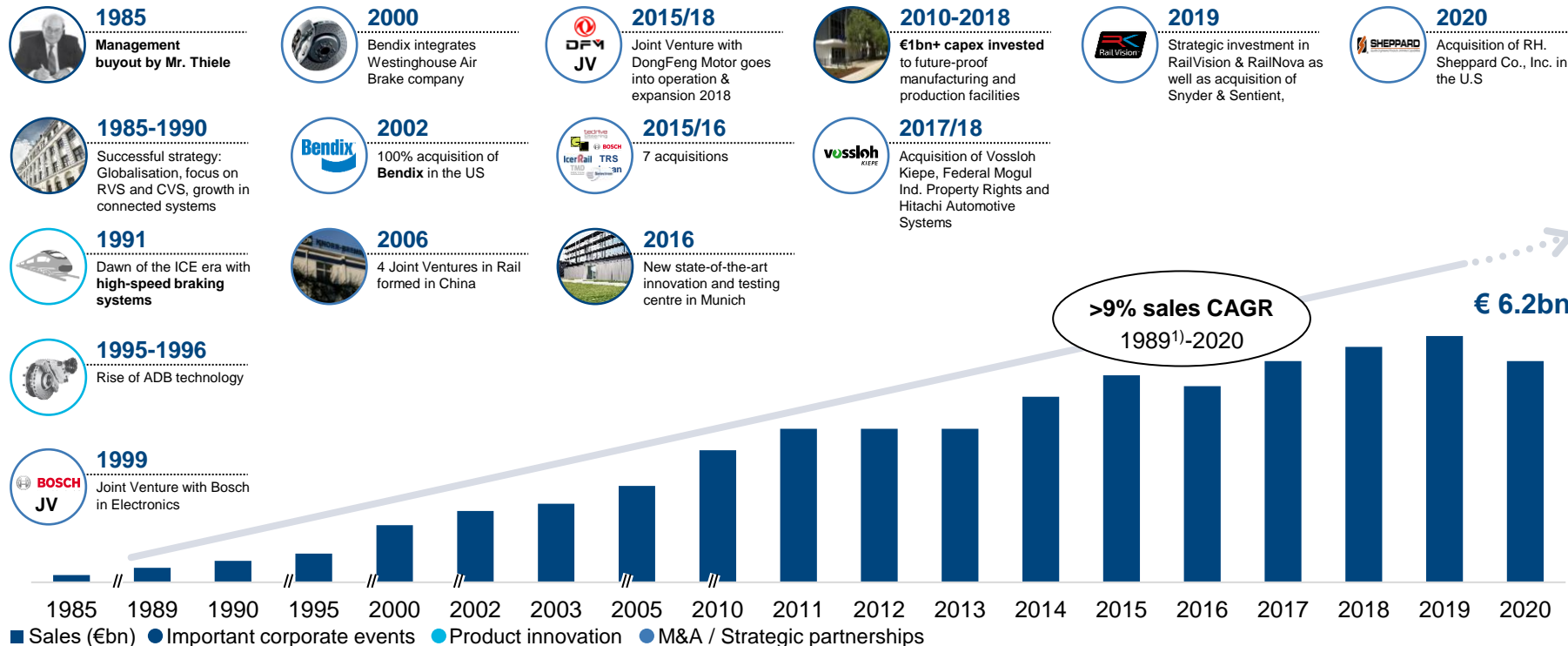
... AND DIVERSIFIED GLOBAL FOOTPRINT WITH HIGH LOCAL CONTENT



- 30+** countries
- 100+** sites
- c. 29k** employees³⁾

Notes: Sales, EBITDA, EBITA, and EBIT for 2020 based on annual report prepared in accordance with IFRS, other financial figures for 2020 prepared in accordance with German GAAP (HGB); Aftermarket share based on German GAAP (HGB) where BilRUG sales allocated proportionally between OE and aftermarket; RVS – Rail Vehicle Systems; CVS – Commercial Vehicle Systems; 1) CAGR 1989–2019 based on German GAAP (HGB), 1989 – first year when consolidated accounts are available; 2) Excluding consolidation/other; 3) Including human resources leased staff; Source: Knorr-Bremse information

Over 30 years of consistent strong growth



Notes: 1986-2016 based on financial statements prepared in accordance with German GAAP (HGB) and 2017-2019 based on financial statements prepared in accordance with IFRS. 1) 1989 – first year when consolidated accounts are available

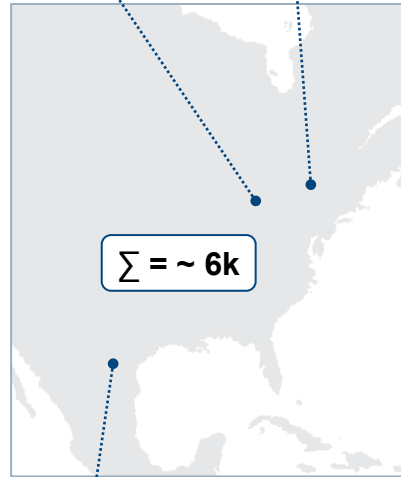
Global Footprint w/ ~29k headcount: international value added structure at KB

Group: 29k | Rail: 16k | Truck: 12k | Others: 1k

Americas

Elyria, USA
~700 employees

Watertown, USA
~500 employees



Acuña, MEX
~1,700 employees

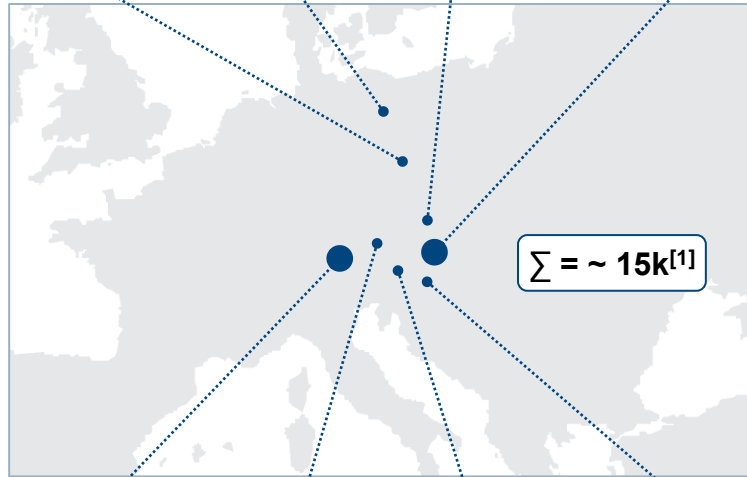
Europe

Liberec, CZE
~800 employees

Berlin, DE
~1,000 employees

Brno, CZE
~900 employees

Budapest, HUN (F&E*)
~1,800 employees



München, DE (F&E*)
~2,100 employees

Aldersbach, DE
~1,000 employees

Mödling, AUT
~600 employees

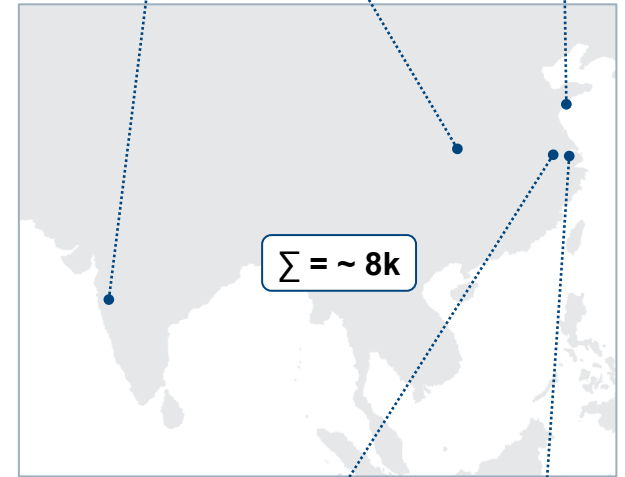
Kecskemét, HUN
~950 employees

Asia

Pune, IND
~1,000 employees

Shiyan, CHN
~700 employees

Qingdao, CHN
~600 employees



Wuxi, CHN
~500 employees

Suzhou, CHN
~1,600 employees

15 largest sites in terms of workforce size *Research and development sites; As of 31.12.2019 1) incl. Africa

Corporate values



Entrepreneurship

- Knorr-Bremse regards challenges as opportunities for generating long-term, profitable growth



Passion

- We are passionate about what we do



Reliability

- Safety is the basis for everything we do – and we do not compromise on this



Responsibility

- As a globally operating company Knorr-Bremse incorporates a workforce with a wide range of cultures and strengths



Technological Excellence

- Knorr-Bremse stands for technological expertise and competence in all company divisions

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Business model of Knorr-Bremse at a glance

GLOBAL #1

- Market leader in brake systems rail (~50%)
- Market leader in brake systems truck (~42%)
- Leading supplier of other safety-critical rail and commercial vehicle systems protected by high entry barriers



MARKET OUTPERFORMANCE

Consistent outperformance of attractive end-markets driven by

- Megatrends and
- Increasing content per vehicle and aftermarket

RESILIENCE

Resilient business model, supported by

- Broad geographical and customer diversification
- High aftermarket exposure
- Strong localization



SUPERIOR FINANCIAL PROFILE

- Strong growth, profitability and cash generation with high earnings visibility
- Strong balance sheet & financing structure

INDUSTRY INNOVATOR

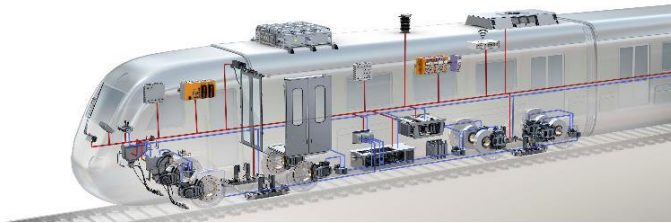
- Driving innovation in mobility and transportation technologies for 115 years
- Quality excellence and edge in connected systems



Global #1 – Leading supplier of safety-critical rail and commercial vehicle systems

RVS offering (2020: 54% of sales, 67% of EBITDA)

Brake systems	Entrance systems	HVAC ¹⁾	Train Control Management Systems	LRV ²⁾ traction systems
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Power electrics	Auxiliary power supply	Signaling systems
Modernisation and support		Modernisation and support

CVS offering (2020: 46% of sales, 33% of EBITDA)

Fuel efficiency <ul style="list-style-type: none"> ■ Engine components ■ Transmission 	Brake systems, steering & vehicle dynamics <ul style="list-style-type: none"> ■ Brake control ■ Brake systems ■ Automated driving ■ Steering systems
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Energy supply & distribution	Connectivity	Electrification
Aftermarket services including Alltrucks network ³⁾ ALLTRUCKS		

Our customers

Example car builders



Example operators



Notes: 2020 financials based on IFRS excluding consolidation/other; 1)HVAC – Heating, ventilation and air conditioning; 2)LRV – Light rail vehicle; 3) Joint Venture between Bosch, Knorr-Bremse and ZF providing a range of workshop services relating to the repair and maintenance of commercial vehicles across all brands; 4) OEM – Original Equipment Manufacturer

Global #1 – ... protected by high barriers to entry

Barriers to entry for RVS and CVS markets

Regulation / homologation

Low volumes, high number of variants with high level of customisation

High initial capital requirements, highly protected IP landscape and economies of scale

Highest quality and safety requirements

Long life-cycle with resulting customer loyalty, long gestation period for aftermarket

Same industry leaders since creation of the industry over 100 years ago

Market specifics

RVS

Only supplier world-wide

certified for all global and local standards and norms (GOST, UIC, AAR, ARA)

Vast array of product variants to homologate

(e.g. >100k active brake articles by Knorr-Bremse)

Homologation time typically 4-8 years

for recent Knorr-Bremse products

CVS

One of only two suppliers able to offer harmonised products globally

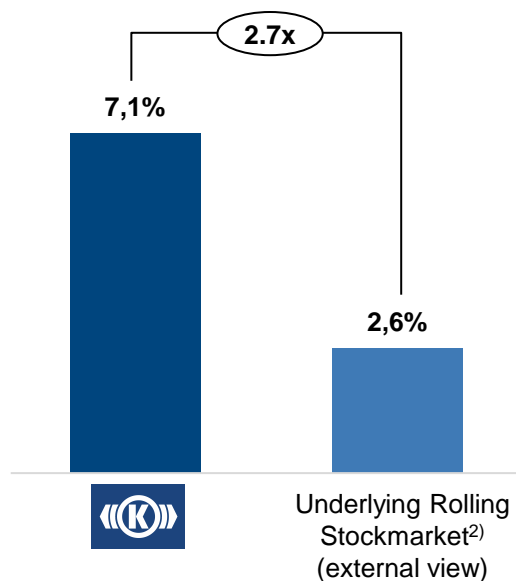
Continuously increasing safety and emission standards requirements



Market outperformance – Knorr-Bremse is well positioned to deliver continued growth above rail industry levels

Strong track record of industry outperformance

CAGR (2010-2019) RVS sales¹⁾ (HGB) and market



Notes: 1) Based on German GAAP (HGB); 2) Unife: average market growth 2015-2017 and 2021-2023

Growth drivers

Asia Growth

- China rail market, esp. AM
- Mass urban transport
- Expansion and upgrade of Indian rail rolling stock
- CRRC international expansion

Outsourcing

- Outsourcing from rail OEM's (trend towards de-verticalisation)

Digitisation

- Increasing demand for connected systems and other digital solutions

Aftermarket

- Global rail services and aftermarket for rolling stock

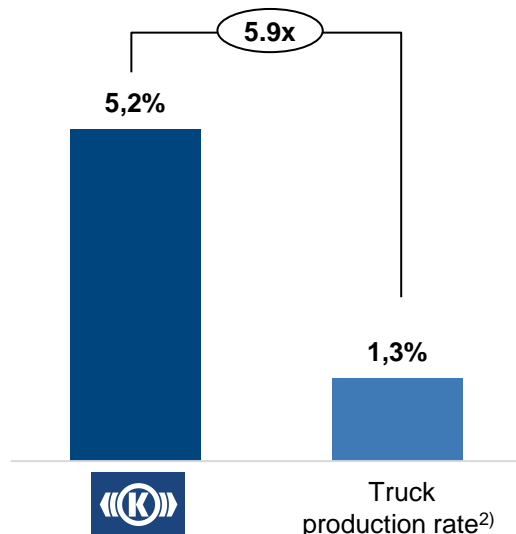
- Certification capability for all global core markets
- Partner of many OEMs, operators and large installed base
- Leading control and monitoring technology
- Innovation leader of rail systems



Market outperformance – Strong growth in content per vehicle driven by continued market outperformance

Knorr-Bremse with strong track record of industry outperformance

CAGR (2010-2019) CVS sales¹⁾ (HGB) and market



Notes: 1) Based on German GAAP (HGB); 2) CAGR 2010-2019 Global Truck and Bus market excluding aftermarket and Trailer; Source: LMC Automotive Global Commercial Vehicle World Truck Query Q3 2019 3) Addressable Truck, Bus and Trailer OE market for "Brake Systems & Vehicle Dynamics (incl. Automated Driving)", "Energy Supply & Distribution" and "Fuel Efficiency" 4) Advanced Driver Assistance Systems/Highly Automated Driving; Source: Knorr-Bremse information; LMC Automotive for truck production rate

Key future growth drivers

Megatrends and conversion of regulatory standards

- Global megatrends provide attractive growth opportunities
- E-mobility, autonomous driving, new emission regulations, etc.
- Disc brakes replacing drum brakes

Content increase

- Traffic Safety
- Fuel efficiency

Market share gains

- Product upgrading
- Regional expansion strategy

- Market leader in a consolidated industry with only 2 global players
- A strong technology innovator shaping the industry
- Multiple trends driving growth independent of underlying market dynamics
- Ideally positioned to win in market defining trend towards ADAS/HAD⁴⁾

Resilience – Strong business model

Strong resilience of growth and profitability

Different economic cycles

- ~50/50 split RVS and CVS (by sales)
- **Different** market drivers
 - short vs. long cycle
 - private vs. public investment
- **High sales visibility** in RVS

High aftermarket share

- ~37% total sales¹⁾
 - 45% of RVS sales¹⁾
 - 27% of CVS sales¹⁾
- **Large installed base**

Diversified customer base

- Partner to **all** major local and **global players**

Global footprint and local content

- High level of **local content** in manufacturing, purchasing and R&D
- Presence in **30+** countries with **100+** sites
- ~80% of employees **outside Germany**
- ~15% of employees in **China**, catering to local market



Notes: 1) Based on IFRS in 2020

Resilience – Attractive aftermarket business with comprehensive service offering drives profitability and contains high future potential

Aftermarket is the growth and resilience backbone

Key features

Annuity-like

- Regulated maintenance intervals
- Leverages high installed base
- 20-30 years long relationships



Close to the customer

- RVS
 - 36 service centres²⁾
 - 20 service locations at customers' premises
- CVS
 - >1,600 certified service partners
 - >700 Alltrucks workshops



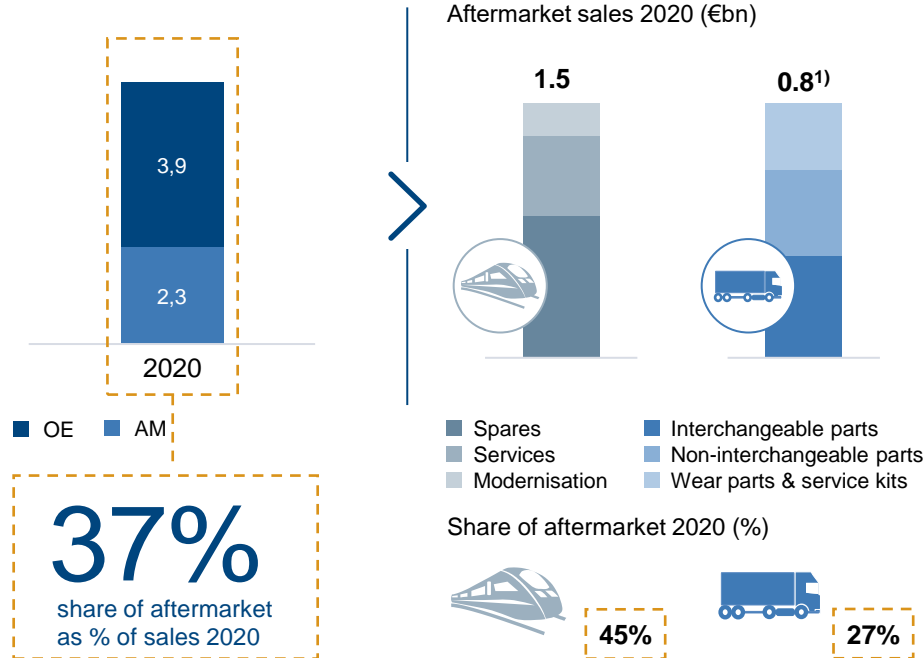
Strong customer retention (homologation)

- High switching costs
- Focus on safety and quality
- IP protection



Innovative business model

- New connectivity-based business models
- Preventive
- Predictive



Notes: 1) Total CVS aftermarket sales and independent aftermarket sales EMEA (excl. South Africa & Skach) as proxy for the global split; 2) Does not include service locations at customers' premises;

Synergistic business – Technology and scale benefits between Rail and Commercial Vehicles

Interdependence of RVS and CVS

- Same core technologies
- Shared components and materials
- Co-located R&D centers
- Shared overhead functions

Future technology development

- Shared research centres
- ADAS¹⁾ / HAD²⁾ technology transfer
- Condition monitoring, condition-based and predictive maintenance
- Electrification and connectivity
- Electromechanical brake systems

Differences of RVS and CVS

- Serial business (CVS) vs. project business (RVS)
- Different customer group

RVS



CVS



Electric compressors
Friction materials
Air disc brakes (ADB)

Driver assistance
Trailer control valve
Electronic air supply

Notes: 1) ADAS – Advanced driver assistance system; 2) HAD – Highly automated driving

Strong R&D secures our Technology leadership

~12,000

single patents granted and applied

Targeted long-term R&D ratio

5 – 6 %

of revenue

~3,800

R&D employees¹⁾

1) FTE at YE20

Industry trends

addressing industry trends with superior technological solutions

Commercial Vehicle Systems



Traffic Safety



Emission Reduction
+ E-Mobility



Automated Driving



Connectivity

Rail Vehicle Systems



Transport Capacity



Availability



Eco Friendliness



Life-Cycle
Management

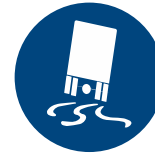
Clear vision for future value creation



Targets until 2022¹⁾: organic revenue growth of 4.5-5.5% p.a. and EBITDA margin expansion by +150bps

1) Base year FY17

We confirm our successful strategy



Road safety



Emissions reduction & e-mobility



Transportation capacity



Availability



Automated driving



Connectivity



Eco-friendliness



Life cycle management

Targets until 2022¹⁾: organic revenue growth of 4.5-5.5% p.a. and EBITDA margin expansion by +150bps

1) Base year FY17

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RVS – Outperformance and resilience



1 Market leadership

Global market leader → scale advantage

2 Technology leadership

Strong technology innovator shaping industry standards, return on R&D spend outperforming peers

3 High barriers to entry

Safety-critical products with significant homologation barriers, RVS only supplier certified for all standards and norms globally

4 Strong growth profile

Attractive transportation and mobility end-markets, **long track record of outperforming underlying markets** – through both OE, AM business and abroad product portfolio

5 Resilience

Steadily growing business through customer/region/product mix, **strong aftermarket**

6 Profitability

Outstanding profit margins and track record of margin expansion and disciplined cost management

RVS – the leading safety critical systems supplier for rail with a track record of market outperformance



Highlights



Rail brake systems supplier globally¹⁾



Rail entrance systems supplier globally¹⁾



HVAC systems supplier globally¹⁾



Global brakes market share¹⁾



Present in 50-55% of global installed base²⁾



c.16k employees

2020 key financials

€ 3.3bn sales

5.1% CAGR 2010-2020³⁾

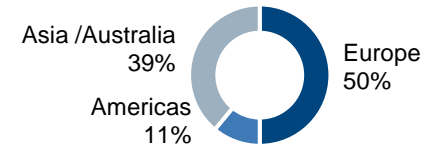
€ 764m EBITDA (22.9% margin)

€ 637m EBIT (19.1% margin)

45% aftermarket share⁴⁾

2020 sales split

by region (€ 3.3bn)



by channel

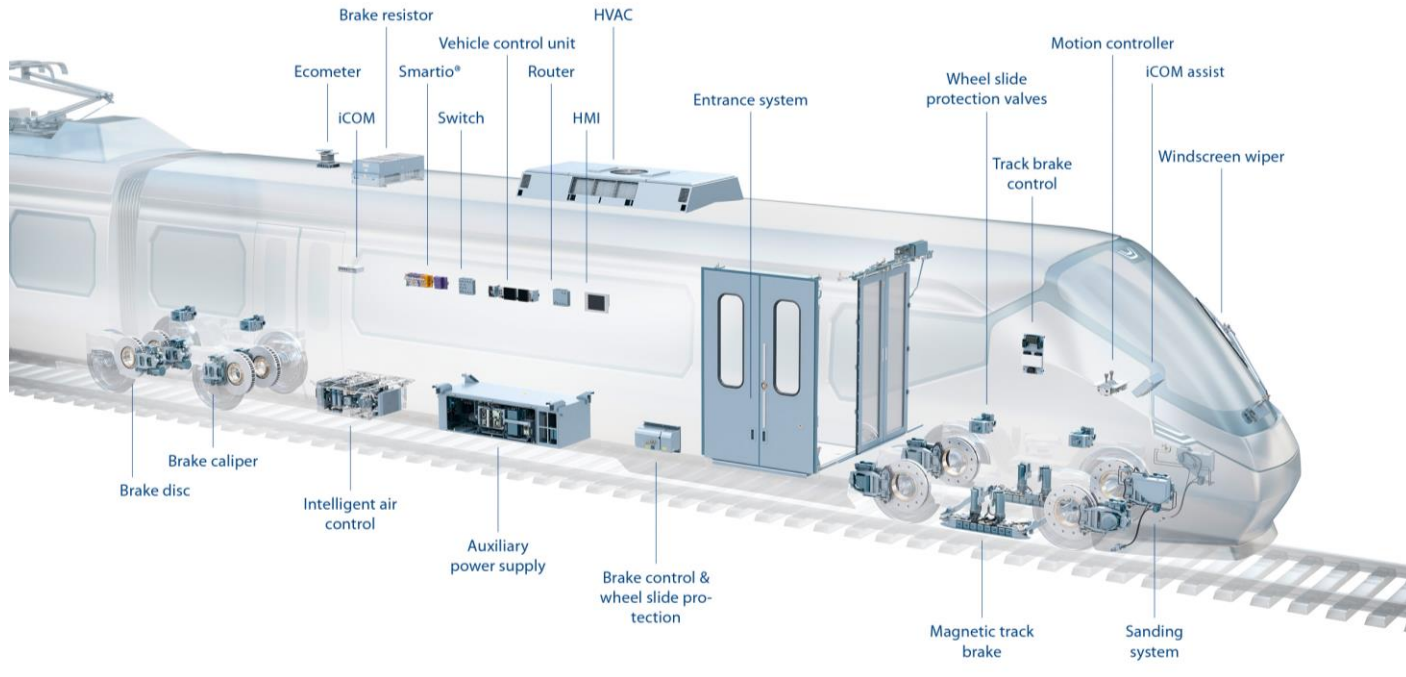


Notes: BilRUG sales allocated proportionally between OE and aftermarket; 1) RVS market share estimates for OE and aftersales without labour; 2) All active rail vehicles without freight cars with a minimum of one Knorr-Bremse system related to brakes, entrance systems and HVAC installed; 3) Total reported RVS sales growth including OE and aftermarket based on German GAAP (HGB) 2010-2016; from 2016 IFRS 4) BilRUG sales allocated proportionally between OE and aftermarket

Deep dive into RVS braking technologies of Knorr-Bremse



Key elements of a braking system in RVS



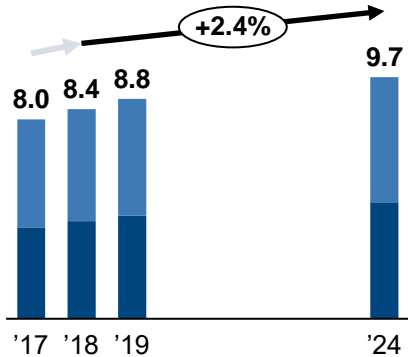
Underlying global rail market with steady and robust growth



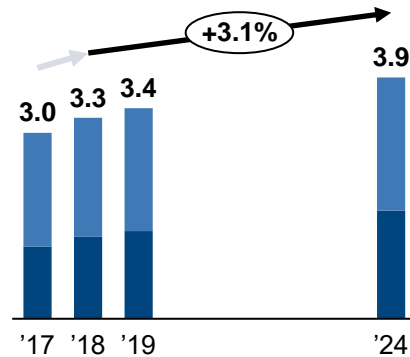
Development of markets

Market volume Brakes, Doors, HVAC, incl. labour [€bn, CAGR in %]¹

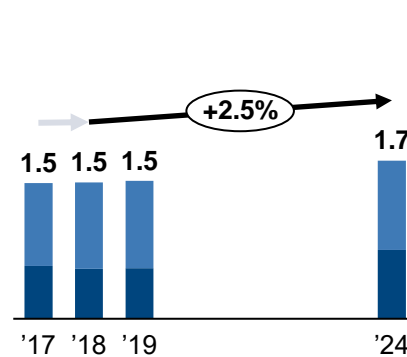
World



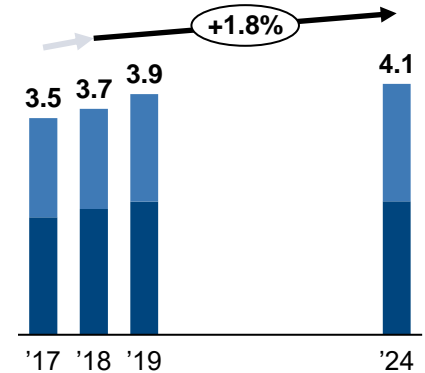
Europe / Africa



North & South America



Asia Pacific



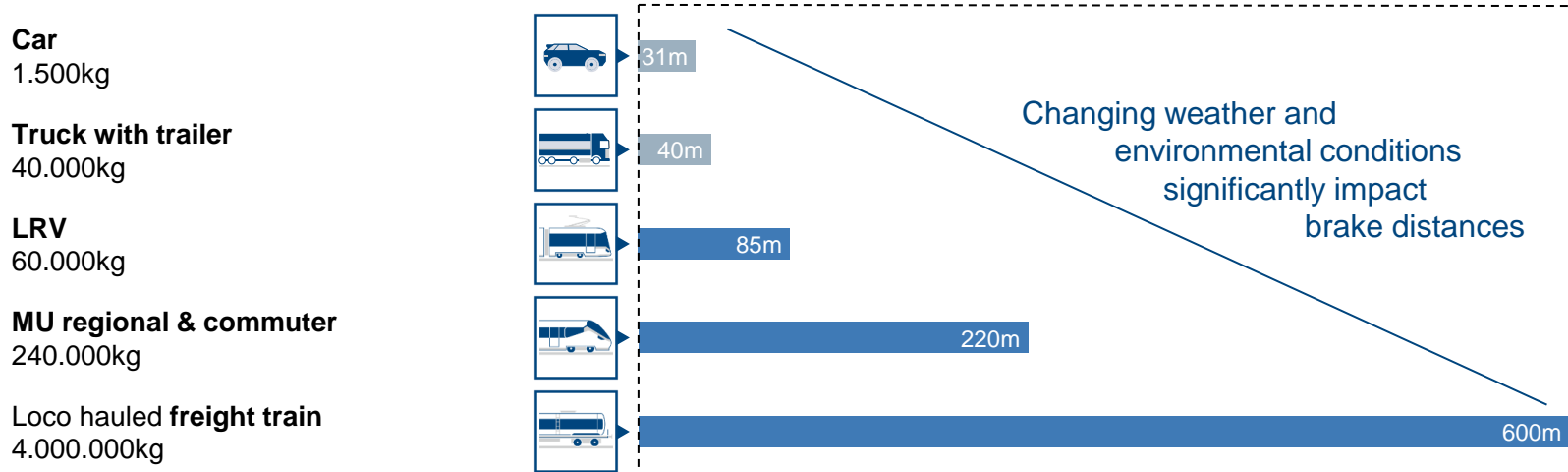
AM OE

¹) Based on internal analyses for the relevant segments, taking into account the study "World Rail Market" (2018) by the UNIFE

The enormous brake distances in Rail require outstanding braking performance



Different braking distances at 80km/h



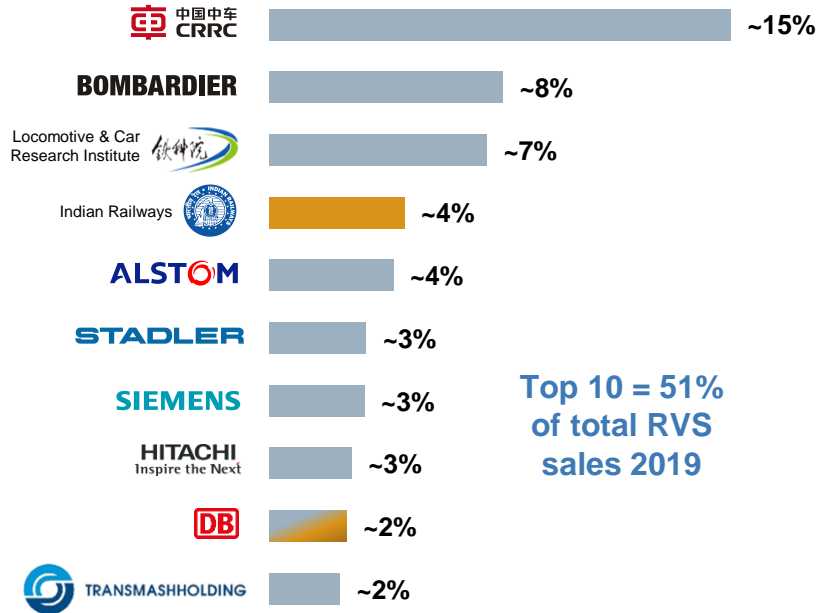
Different braking distances at 330km/h



Global Tier-1 partner of choice for OEMs and rail operators in all regions



Top 10 customers 2019 (% of sales)¹⁾



Top 10 = 51%
of total RVS
sales 2019

■ OEMs ■ Rail operators

1) Share of top 10 customers as % RVS sales 2019 may not add up due to rounding

Other major Knorr-Bremse customers

>>300 Relevant rail operator customers



>50 Relevant OEM customers

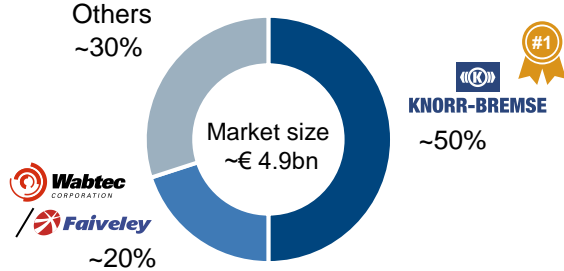


RVS is the global #1 across key product categories

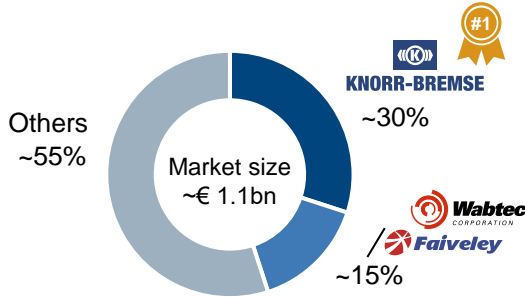


Global market share 2019 ¹⁾ (% of sales)

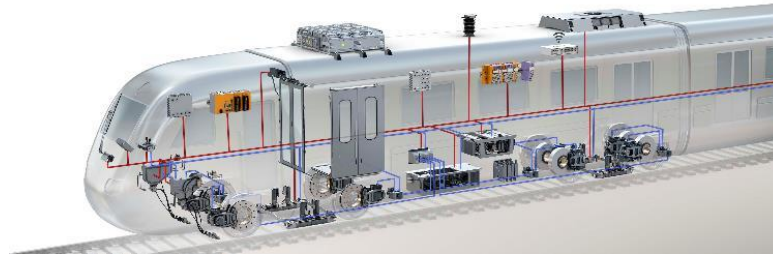
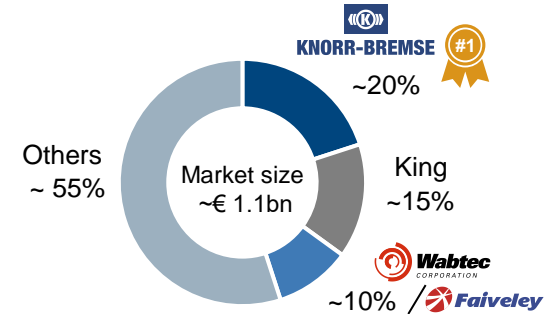
Brake systems (~68% of RVS sales)



Entrance systems (~9% of RVS sales)



HVAC (~7% of RVS sales)



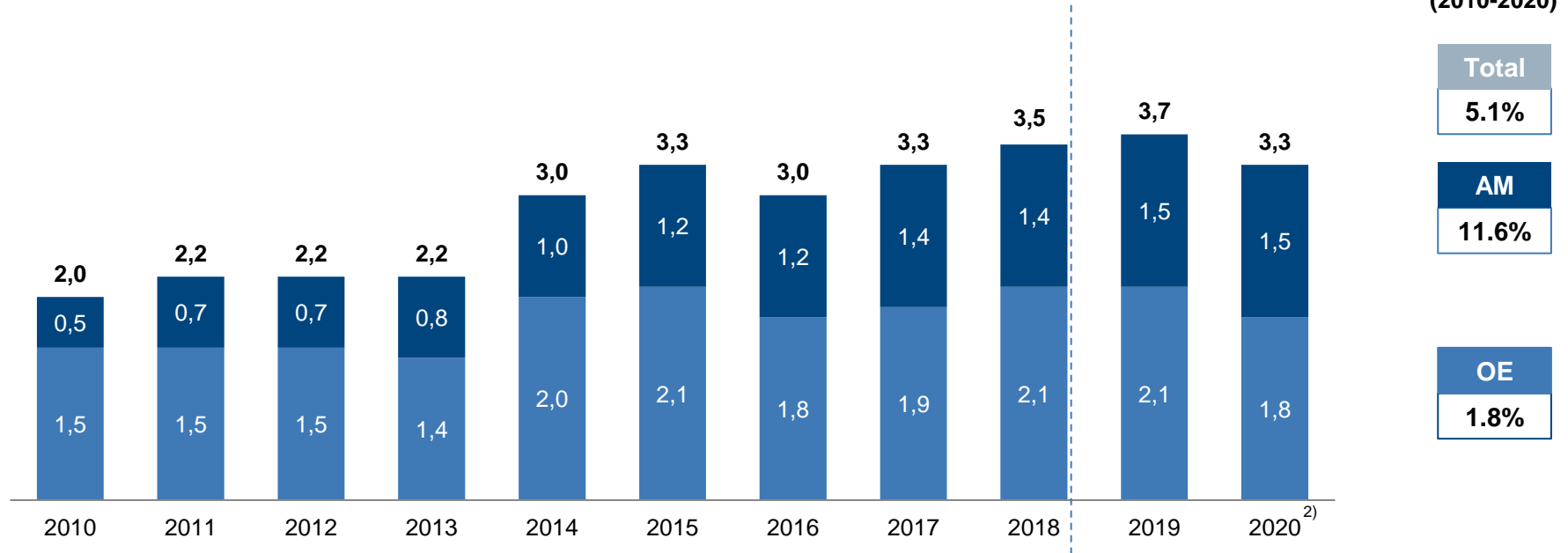
Notes: Market share estimates are rounded to the nearest multiple of 5%; For competitors a price estimate was used; 1) Market share estimates for OE and aftermarket without labour

Historic development of OE and AM business



Strong growth both in OE and AM

RVS sales by type (until 2017 German Gaap/HGB, 2018-2019 IFRS, €bn, 2010-2020) ¹⁾



1) BilRUG sales allocated proportionally between OE and aftermarket; 2) RVS sales split 2019 may not add up due to rounding

Expected development of Aftermarket (RailServices) business



Characteristics aftermarket

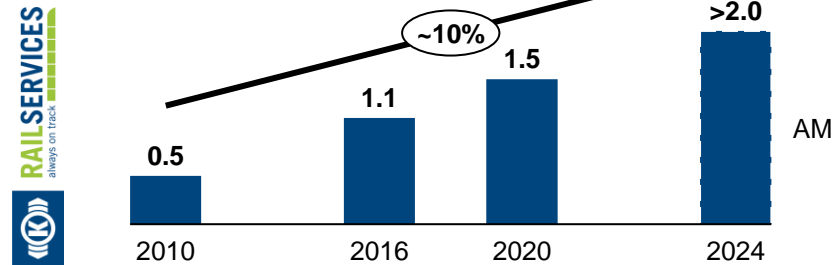
- Long customer relationships & loyalty of >30 years
- Through tear & wear very attractive, high margin business
- Underlying global Rail market +2.3%²⁾

Development aftermarket

- Higher focus on **life-cycle costs** and **availability commitments** (contractually binding)
- **Digitization** with new players
- Increased business demand for **reduced energy** consumption

RVS aftermarket

Revenue development (€bn)¹⁾



- **Global footprint with a strong local presence**
- **High installed base**
- **High customer retention rate**
- **Additional data driven business models**
- **Development of energy efficient solutions**

Notes: 1) Revenue based on external (third party) sales German GAAP (HGB); Values recognize FX rates; 2) Unife: expected average market growth until 2025

RVS is the only supplier world-wide certified for all local standards and norms



Market protected by unique level of complexity ...

	Major global standards	4
	Unique configurations for vehicle types	7
	Brake subsystems	3
	Safety-critical components	>100
	Country- and customer-specific variants	Multiple
	100k active brakes articles to homologate	

... and long homologation time for each component

Standard ¹⁾	Key regions	Typical time-to-market	
		Development (yrs) ²⁾	Certification (yrs) ²⁾
		4	4
		4	3
		3	1
		3	1

Combination of IP ownership and homologation creates high barriers to entry

1) GOST based on recent homologation process, other norms based on expert estimates by Knorr-Bremse; 2) Estimated average required "time-to-market" of a basic freight car solution

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CVS with high-quality business model – Outperformance and resilience



1 Market leadership

Global market leader → scale advantage

2 Technology leadership

Technology leader with innovation power shaping major industry trends

3 High barriers to entry

Safety-critical highly technological products
One of only two suppliers with global technology know-how and capabilities

4 Strong growth profile

Attractive end-market in goods and people transport (incl. buses)
Continuously **outperforming markets** through content and market share growth

5 Resilience

Strong aftermarket share and **content per vehicle growth**
Strength in cost efficiency

6 Profitability

Attractive margins based on differentiation, scale advantage and consequent cost management

CVS – One of two global leaders with an outstanding position in braking and safety-relevant systems



Highlights



Global market position¹⁾



Technology leader



Global market share



c.12k Employees

2020 key financials

€2.8bn sales

5.2% CAGR 2010-2020²⁾

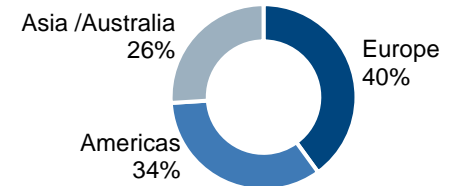
€381m EBITDA (13.5% margin)

€235m EBIT (8.3% margin)

27% aftermarket share

2020 sales split³⁾

by region



by end-market



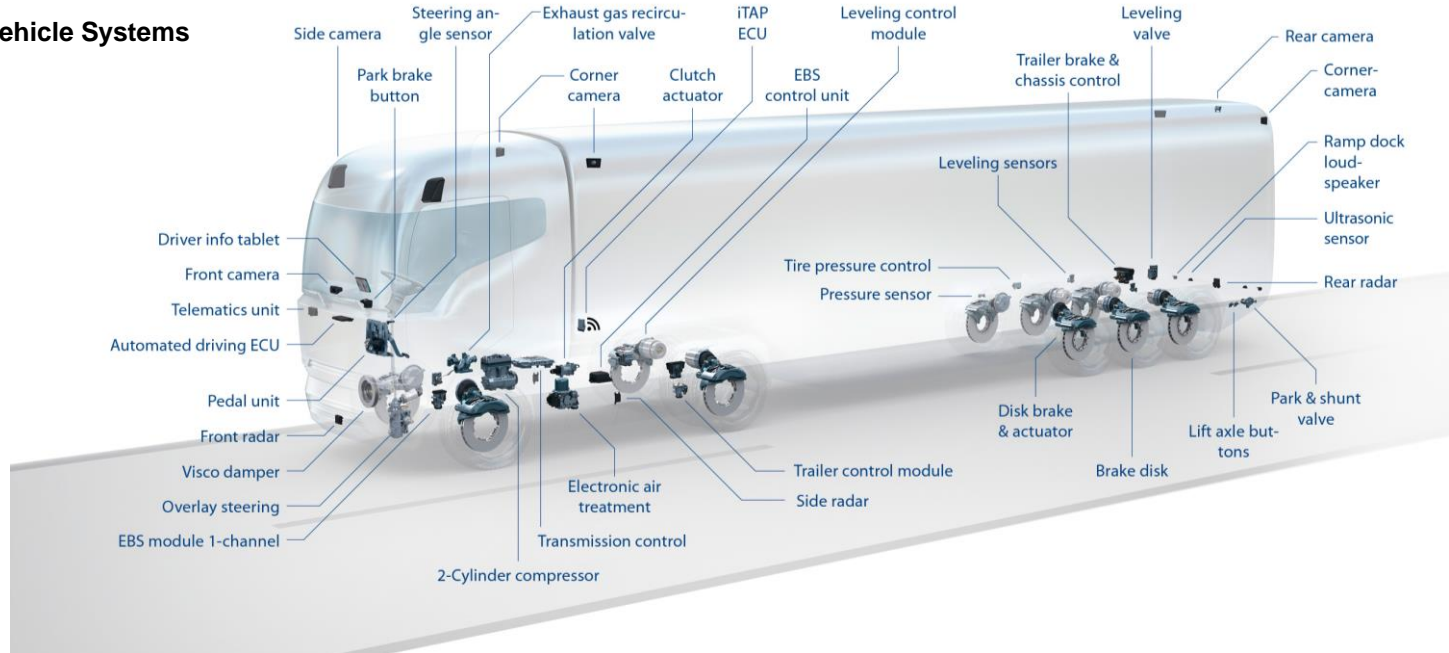
Notes: Sales, EBITDA, EBIT and respective margins based on IFRS; other figures based on German GAAP (HGB) 1) 2017 global addressable Truck, Bus and Trailer OE market; 2) Total reported CVS sales growth including OE and AM 3) Sales split by region based on IFRS; Other splits based on German GAAP (HGB)

Complementary product portfolio provides foundation for positioning as key integrated systems and services provider



Knorr-Bremse CVS comprehensive offering

Commercial Vehicle Systems



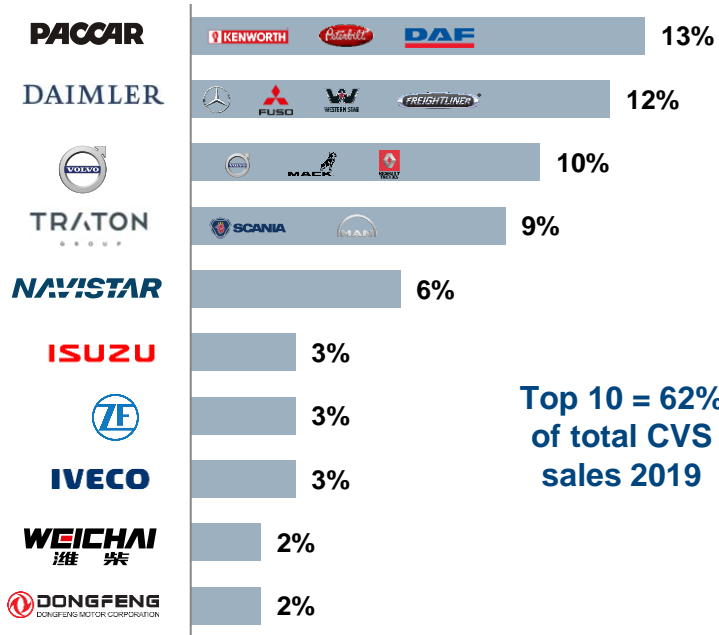
Knorr-Bremse is the partner of choice for global OEMs with long-standing relationships



Top 10 customers 2019 (% of sales)

Years of relationship

Other major Knorr-Bremse customers



1) Share of top 10 customers as % RVS sales 2019 may not add up due to rounding

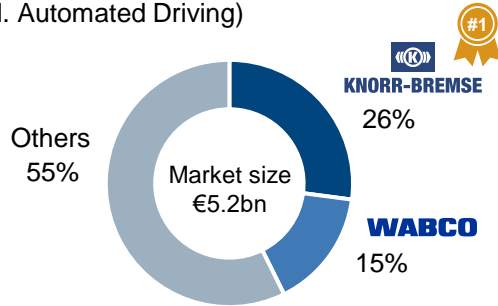
Knorr-Bremse is a global leader in safety-relevant products across key geographies



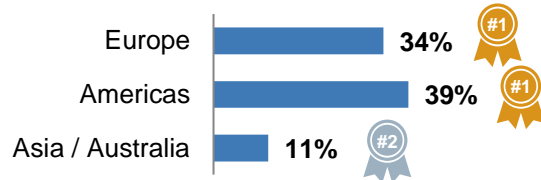
Global market share 2019¹⁾ (% of sales)

Brake Systems & Vehicle Dynamics²⁾

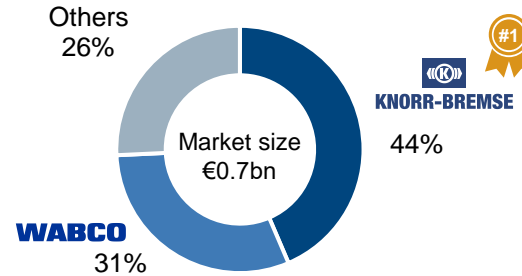
(incl. Automated Driving)



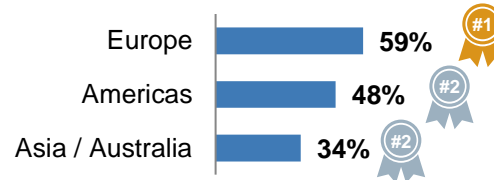
Market share by region



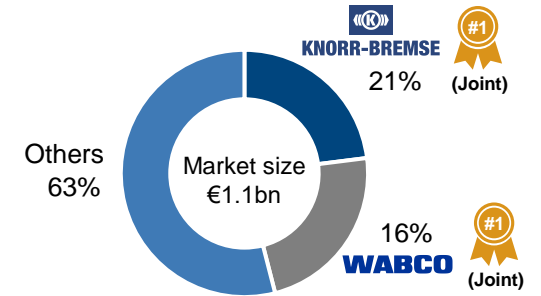
Energy Supply & Distribution³⁾



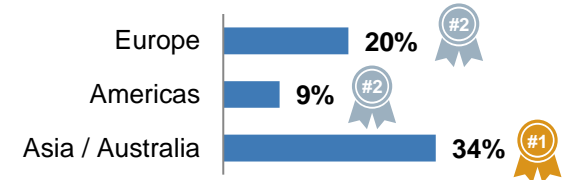
Market share by region



Fuel Efficiency⁴⁾



Market share by region



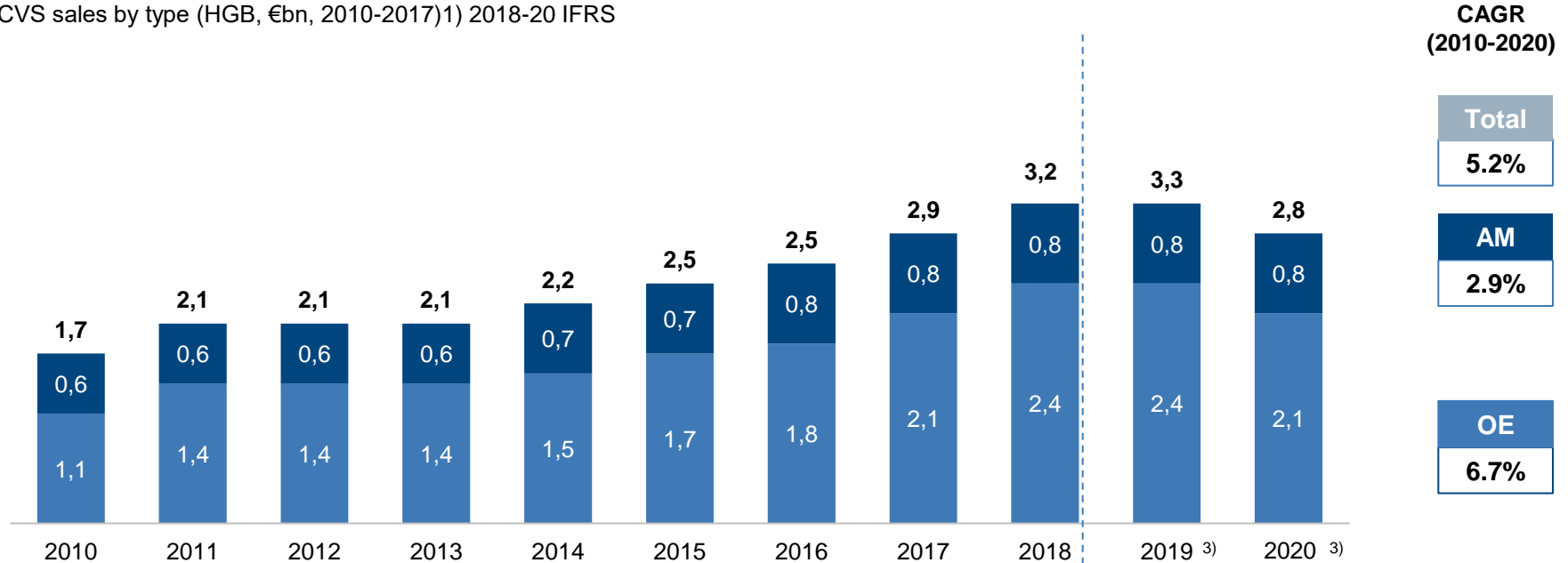
Notes: 1) 2019 addressable Truck, Bus and Trailer OE market, including "Brake Systems & Vehicle Dynamics (incl. Automated Driving)", "Energy Supply & Distribution" and "Fuel Efficiency"; excluding aftermarket; Knorr-Bremse data based on market intelligence and experts estimate in 2019; 2) Air Disc Brake, Valves / Pedal Unit, Actuators, Foundation Drum Brake, Steering, ABS, EBS, ESP, DAS, ELC; including segment Others; 3) Compressors, Air Treatment; 4) Vibration Dampers, Engine Air Control, Transmission - Gear Actuation, Transmission - Clutch Actuation;

Historic development of OE and AM business



Strong growth both in OE and AM

CVS sales by type (HGB, €bn, 2010-2017)¹⁾ 2018-20 IFRS

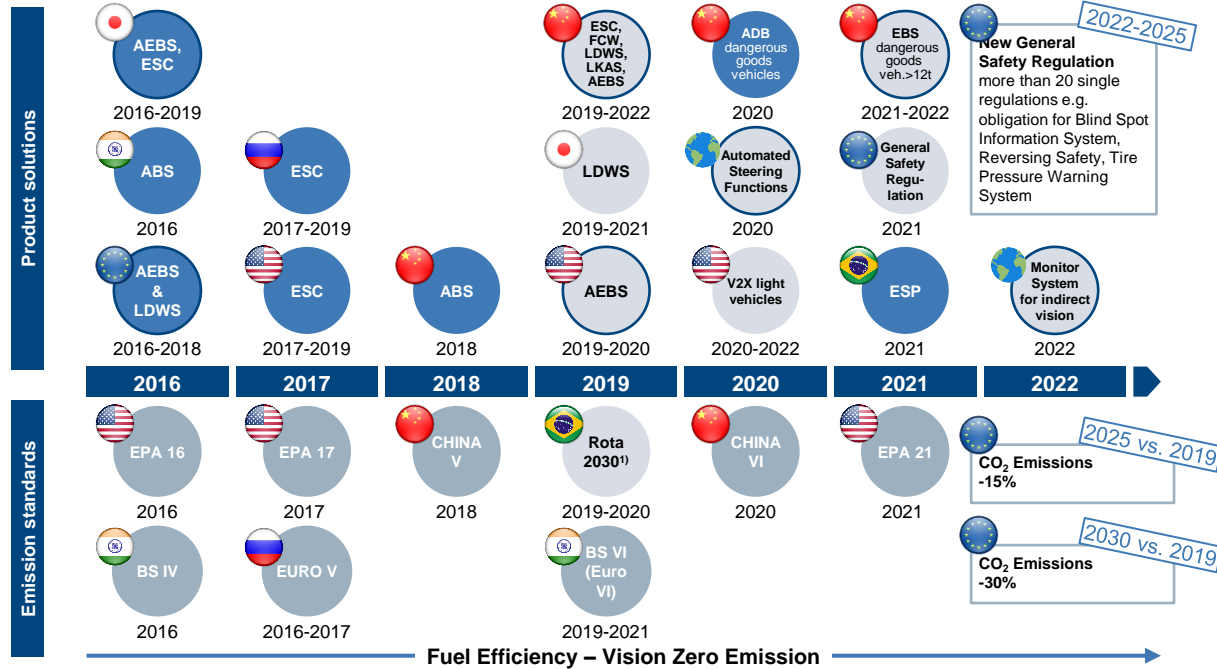


Notes: 1) BilRUG sales allocated proportionally between OE and aftermarket; 2) Global Truck and Bus market excluding aftermarket and Trailer; Source: Knorr-Bremse information and internal market research; IHS for truck production rate; 3) CVS sales split may not add up due to rounding

Conversion in legislation drives the global adoption of technologies provided by Knorr-Bremse



Convergence of legislation creates growth opportunities for products respectively



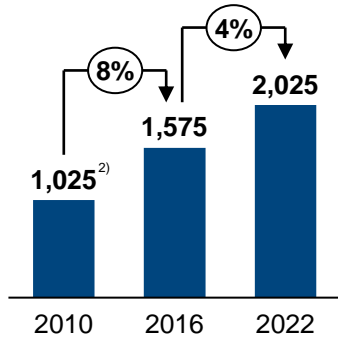
Legislative decisions foster demand for Knorr-Bremse solutions

● Emission standards ● Traffic and safety ● Automated Driving ● Expected/in discussion
 Notes: 1) Approved in May 2018, government intends to stimulate efficiency & vehicle safety; 2) European Commission: COM(2018) 286 & Vulnerable Road Users Directive (VRUD); 3) General Administration of Quality Supervision, Inspection & Quarantine of People's Republic of China, technical specification for safety of power driven vehicles operating in roads; Source: Knorr-Bremse internal market research; Roland Berger market study: Trends in the truck & trailer market (August 2018)

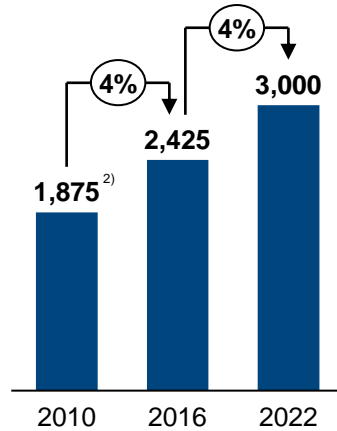
Continued content growth expected in all regions



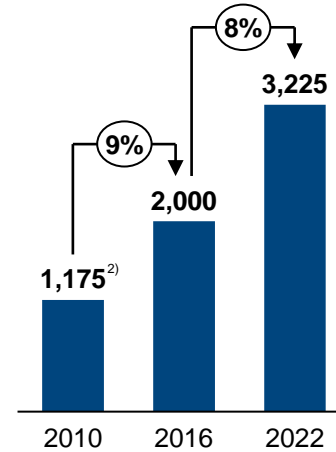
World



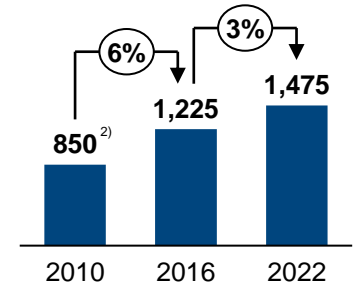
Europe



North America



Asia / Pacific

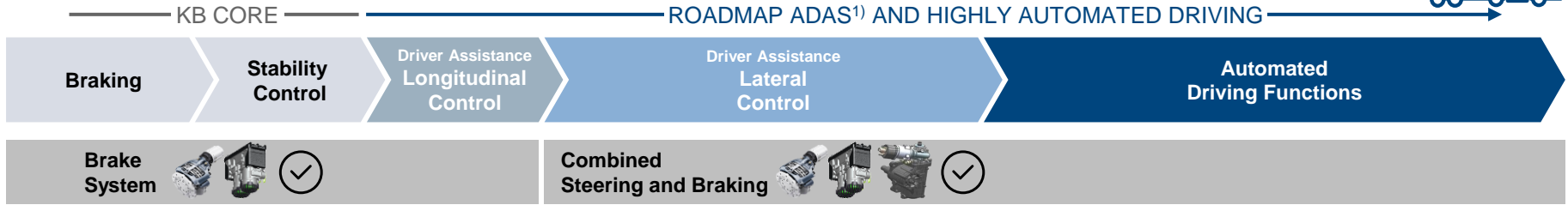


Growth of content per vehicle mainly driven by local regulation and total cost of ownership

% CAGR Content per Vehicle 2010 - 2016 / 2016 - 2022

Notes: CPV data rounded to nearest €25; 1) CPV for four specific categories analysed in Roland Berger market study: Trends in the truck & trailer market (August 2018): Braking systems, Powertrain, Steering and ADAS; Roland Berger scope excludes Valves / Pedal Unit, Actuators, Compressors, Air Treatment and Others; 2) Implied: applying Knorr-Bremse proprietary market growth CAGR 2010-2016 (made comparable to Roland Berger's market definition) to Roland Berger's 2016 absolute CPV data; Source: Knorr-Bremse internal market research for the CAGRs 2010-2016 and commentary; Roland Berger market study: Trends in the truck & trailer market (August 2018) for 2016 and 2022 CPV data as well as for the CAGRs 2016-2022; Data for Asia/Australia for 2016-2022 calculated based on separate Roland Berger data for (i) Asia/Pacific without China and (ii) China

Strategy: combined braking and steering system

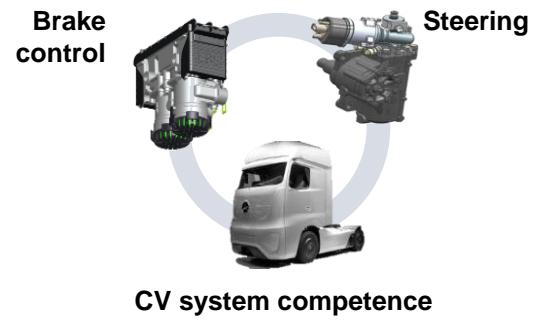


→ Successful M&A strategy
→ KB Global #2 steering supplier

KB driving steering innovation and vehicle content growth


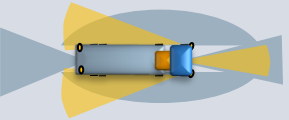








- Base steering gear
- Torque overlay steering (TOS) for ADAS¹⁾ functions and Automated Driving
- Electric Power Steering

Combined braking and steering for superior vehicle dynamic control and obligatory redundancy



Notes: 1) ADAS = Advanced Driver Assistance Systems

Knorr-Bremse with clear strategy for Automated Driving

Steps	Action	Provider
1 Perception 	Complete environment perception of truck & trailer 	Partner + 
2 Decision 	Continuous situation analysis for motion planning  HAD ¹⁾ ECU ²⁾ Situation analysis Trajectory planning Truck Motion Control (GSBC ³⁾ 	Partner + 
3 Actuation 	Coordinated interaction of actuators for vehicle dynamics  Actuators physically perform actions such as applying brakes, steering or changing lanes	

4 Redundancy concept


Safety-relevant functions backed up by redundancy:


- Control
- Sensors
- Steering
- Braking
- Electric on-board net


Continuous vehicle dynamic control ensured



System supplier – one interface for customers as the system integrator

5  Optimally designed for commercial vehicle needs

 Cost efficient redundant system architecture

 Profound ADAS⁴⁾ and truck dynamics expertise as solid basis for HAD¹⁾ up to level 5

Notes: 1) Highly Automated Driving; 2) Electronic Control Unit; 3) Global Scalable Brake Control; 4) Advanced Driver Assistance Systems; Source: Knorr-Bremse information

Knorr-Bremse teams up with Continental to become a leading Automated Driving system supplier for commercial vehicles



- Function know-how based on passcar experience & carryover from passcar
- Hardware for localization (radar, camera) and Automated Driving Control Unit



- Truck- & trailer-specific vehicle dynamics: Vehicle guidance and stability control
- Fail-operational architecture
- Commercial vehicle-specific function development, application and release

Perception

Decision

Actuation



Redundancy

System integration 

Consumer Benefits

- Industry benchmark perception decision and actuation from the one source
- Superior performance through full-system approach
- Cost-optimized systems for commercial vehicles

Joint Project Scope

- Development of systems, components and functionality for Automated Driving
- Validation and release of complete highly Automated Driving systems
- Collaboration in joint project house

Internationalisation: Global growth strategy focuses on North America penetration as well as Chinese and Indian market share expansion



Exploit leading position



Leverage local presence



Expand market share



Footprint



- Bendix acquisition as enabler for footprint expansion
- Sheppard acquisition to strengthen position as global system supplier of integrated steering and braking systems
- Capitalisation of technological expertise and brand
- Increased content per vehicle (technology as driver)
- Continuous cost structure improvements



- Intensive localisation with key local players
- Capitalise on strong position in OE channel
- Increased content per vehicle (technology as driver)
- Expand network to establish truck aftermarket
- Exploit position in electric bus



- Strong business growth with major Indian customers
- Expansion of product portfolio (dampers, drum brakes)
- Localisation programme creating scale effects

Notes: Based on German GAAP (HGB); FTE includes leasing (EOP) 1) Plant under expansion; Source: Knorr-Bremse information

Agenda

- Introduction
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- Rail Vehicle Systems (RVS)
- Commercial Vehicle Systems (CVS)
- **R&D Focus**
- Financials
- Sustainability
- Capital Markets Summary
- Appendix



R&D is at the very core of Knorr-Bremse's DNA

With over **12,000** patents¹⁾

Knorr-Bremse secures the future innovation roadmap. Largest patent portfolio in the industry²⁾

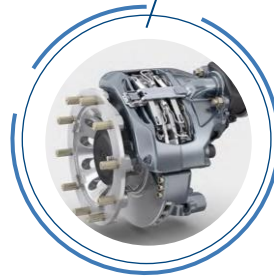
5 state-of-the-art R&D centres globally complemented by 23 local engineering entities with customer proximity

Focused & disciplined approach ensuring highest efficiency

Significant synergies between RVS and CVS

More than **80%** of the most industry-defining **innovations** over the last decades came from Knorr-Bremse






Extensive external network with over **15** R&D partnerships

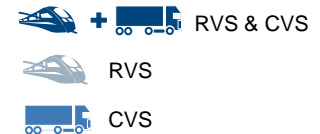


Long-term targeted R&D ratio: **5-6%** of revenues³⁾

Notes: 1) Granted and applied patents; 2) Based on published number of patent families (granted and applied); 3) Knorr-Bremse 2020 R&D financial information based on IFRS;

R&D portfolio synergies between RVS and CVS...

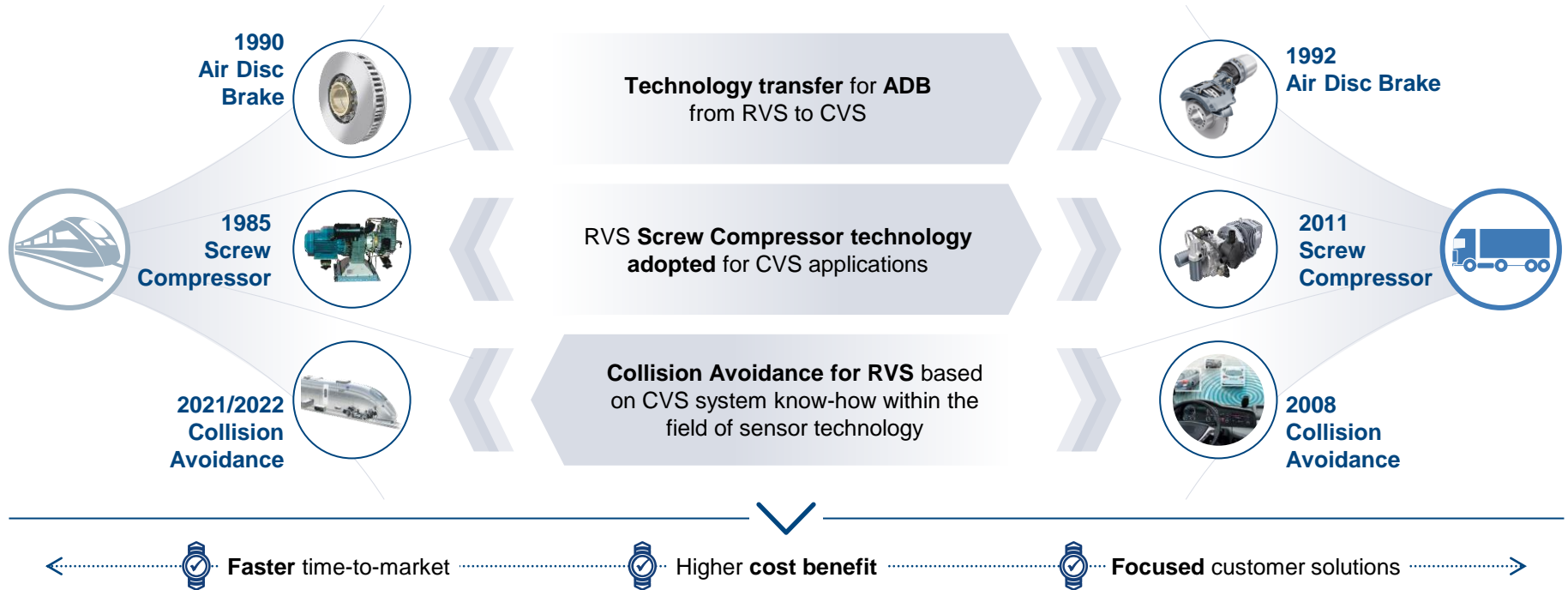
Services	Vehicle control & automated driving 	Chassis systems 	Braking 	Driving 	Energy Supply & Distribution 
Telematics (iCom maintenance, iTAP-push)	Driver assistance (ACC, AEBS, ASR, LEADER)	Hydraulics	Wheelend / bogie equipment	Conventional actuation	Compressed air
Remote & on-demand maintenance and diagnostics	Motion control	Electronics	Disc brake	Combustion engine components	Compressed air generation
Training drivers/ work shops (Safety direct, dimulator)	Brake control	HMI & driver information (iTAP, etc.)	Brake actuator	Electronic actuation (Kiepe)	Air treatment
Spare parts	ABS / wheel slide protection	Level control	Wear-resistant brakes	E-motor	
Remanufacturing	Emergency brake	Electronic board net / Charge regulation (Kiepe)	Electrodynamic brakes / recuperation	Converter / traction control	
Energy measurement	V2X communication	Pantograph (Kiepe)	Tread brake	Automated manual transmission	
Ticketing	Vehicle control (TCMS / UCS)	Windscreen wiper and wash systems	Electromagnetic brake system		
Transport and logistics optimisation	Brake distance management / sanding	Entrance systems / doors	Eddy current brake		
	Dynamic driving control (ESP)	Air conditioning	Drum brake & adjuster		
	Vehicle dynamics	Conventional steering	Exhaust brake		
	Torque overlay steering system				



In >50% of Knorr-Bremse's portfolio the underlying technology can be applied to both divisions

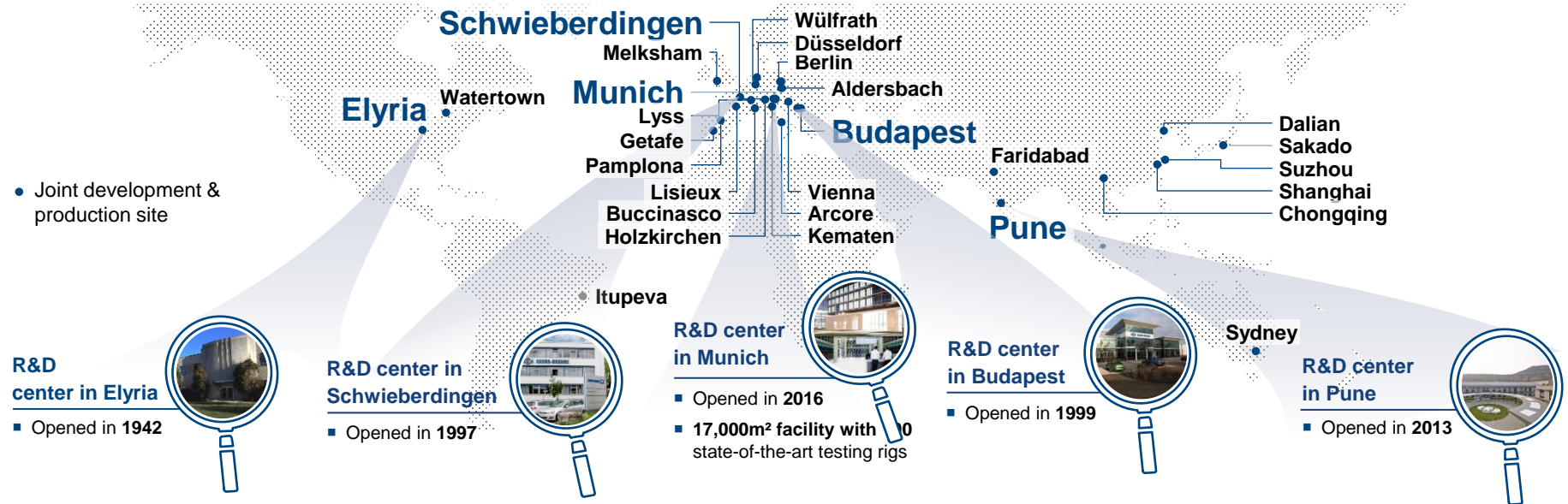
...resulting in synergies and cross-proliferation

Cross-divisional R&D examples



Leveraging Knorr-Bremse's synergies & partnerships: centres of excellence as basis for sustained technology leadership

Globally Σ ~3.600 FTE¹⁾

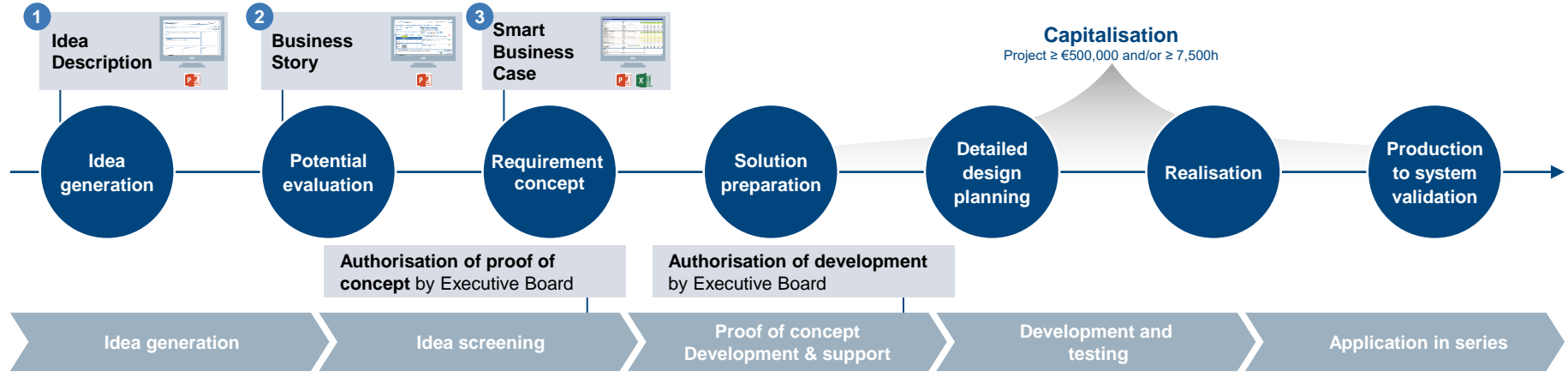


Knorr-Bremse's innovations are supported by a network of specialized development centres with joint production and R&D

Notes: 1) FTE refers to number of employees in R&D function (includes engineers, technicians, merchants) EOP 2019, TCI allocated to Asia

Knorr-Bremse deploys structured and effective processes to drive innovation results

Knorr-Bremse R&D process



Knorr-Bremse's innovations are designed for clear customer impact...

- Optimisation of TCO¹⁾
- Reduction of energy consumption, noise, weight
- Safety & reliability
- Connectivity, wireless solutions, ethernet
- Adaption to regulation

...and maximum economic benefit for Knorr-Bremse

- All projects assessed based on NPV²⁾
- Prioritisation of projects according to IRR³⁾
- Optimise time-to-market
- Short payback time of investment
- Ability to leverage innovation across customer portfolio

Notes: 1) TCO refers to total cost of ownership; 2) NPV refers to net present value; 3) IRR refers to internal rate of return

Close co-operation with customers & strategic partners

Government partnerships

- Shift2Rail: EU supported initiative amongst suppliers and OEMs to jointly develop an efficient transportation system
- VDA¹⁾ participation in ~20 committees
- ✓ Design of norms/standards
- ✓ Early anticipation of industry trends
- ✓ Grants/subsidies



VC partnerships with Start-ups

- Partnerships with accelerators
- Investment in start-ups
- ✓ Technology access
- ✓ R&D acceleration



Partnerships with Universities

- Research cooperations
- ✓ Access to future talent
- ✓ Scouting of new technologies at minimal cost



Acceleration of
PRODUCT INNOVATION
in digital age requires
DIVERSE PARTNERSHIPS
to outperform competitors

JVS with OEMs / technology partners

- 18 joint ventures globally
- Joining complementary competences to extend product and service lines, and capacities
- ✓ IP protection
- ✓ Local presence
- ✓ Flexible solutions for customers



🌐 Countries Knorr-Bremse is present

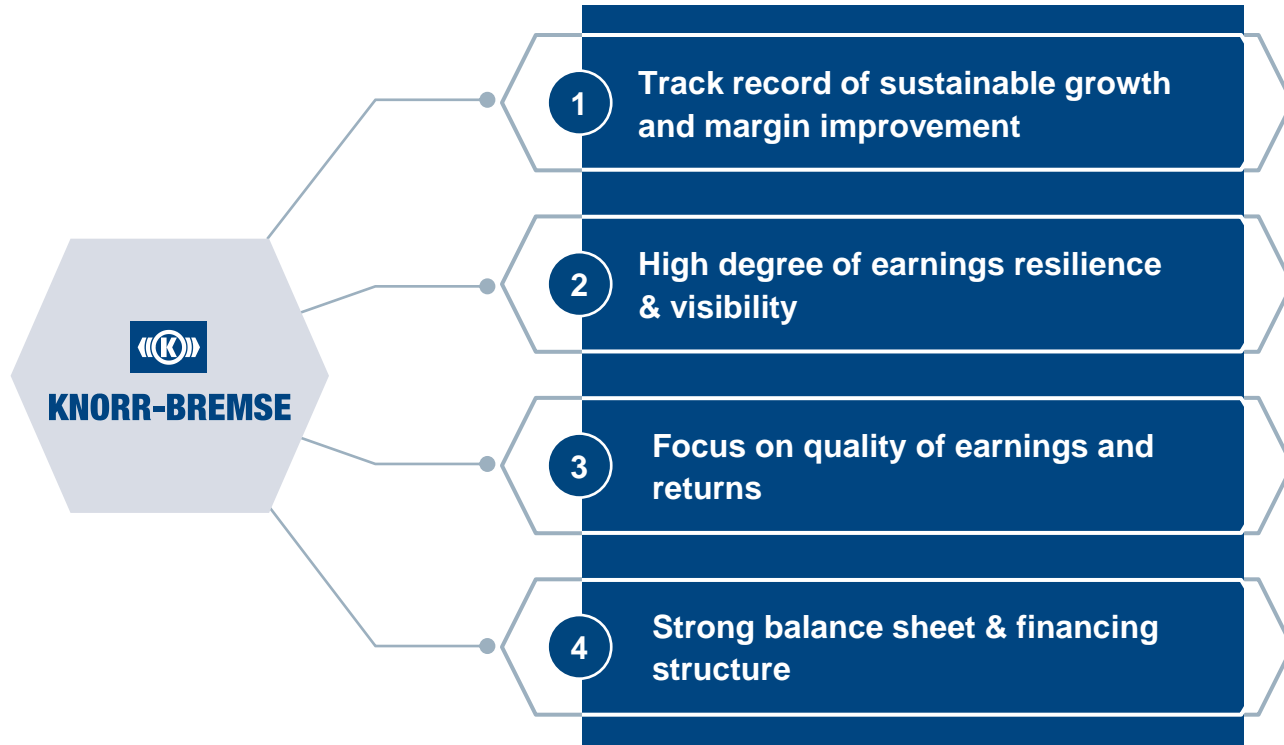
Notes: 1) VDA - Verband der Automobilindustrie (German Association of the Automotive Industry)

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Review of Knorr-Bremse financial profile



Strong financials prove KB's remarkable business model

Track record of organic growth market outperformance

~5% sales CAGR (2010–2020)¹⁾ plus selective, value-added M&A



Strong profitability & cash flow vs. peers

Sustainable EBITDA margin range of ~18–20% (2014–2020)²⁾

Sustainable cash conversion range of ~80–90% (2014–2019)²⁾, ~ 129% in 2020³⁾



Consistent high return on capital

ROCE range of ~26–53 % (2014–2020)²⁾



Proven resilience through the cycle

Aftermarket exposure of ~30–37% of sales (2014–2020)

Well-balanced regional and divisional sales mix

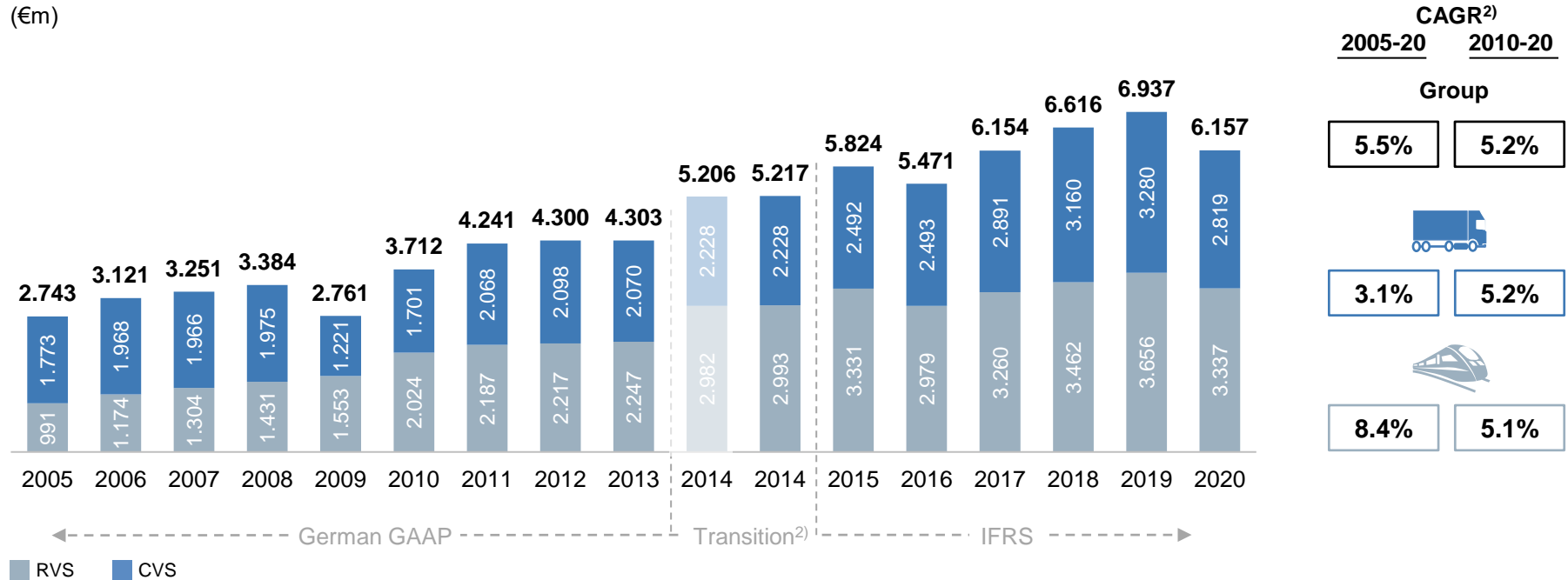


Notes: 1) Based on financial statements prepared in accordance with German GAAP (HGB); Group net sales including BilRUG without acquisitions for RVS and CVS; 2) Based on financial statements prepared in accordance with IFRS; 3) Significant cash preservation measures during COVID-19 crisis lead to strong CCR, which is not sustainable

Track record of strong and sustainable top-line growth ...

Historical sales¹⁾²⁾ by division

(€m)



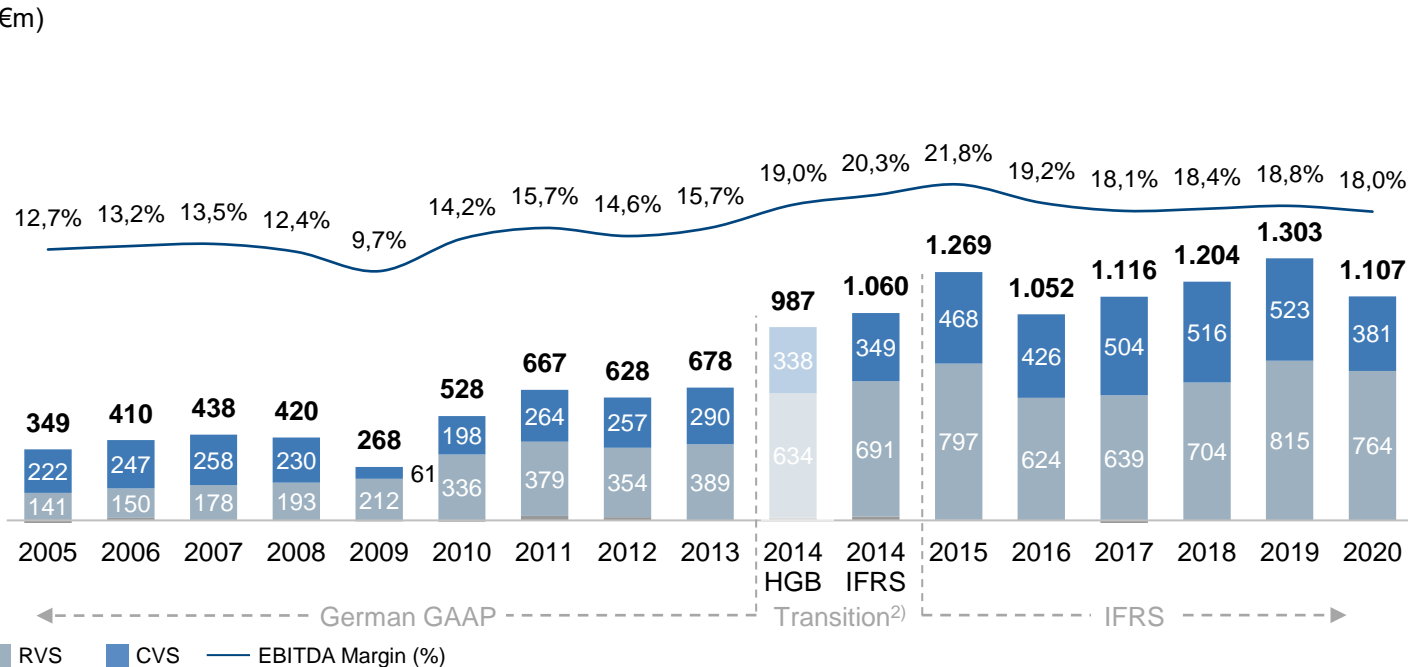
■ RVS ■ CVS

Notes: 1) Divisional historic figures do not add up to group sales excluding consolidations/other; 2) 2014 represents the first year that Knorr-Bremse prepared its financial statements in accordance with IFRS. Prior to 2014, financial statements were only prepared in accordance with German GAAP (HGB). IFRS differs in certain aspects from German GAAP (HGB), and accordingly data presented in accordance with German GAAP (HGB) may not be comparable to data prepared in accordance with IFRS; Source: Knorr-Bremse information

... combined with disproportionate EBITDA growth

Historical EBITDA¹⁾²⁾ profitability

(€m)



CAGR²⁾
2005-20 **2010-19**

Group

8.0% **7.7%**



3.7% **6.8%**



11.9% **8.6%**

■ RVS ■ CVS — EBITDA Margin (%)

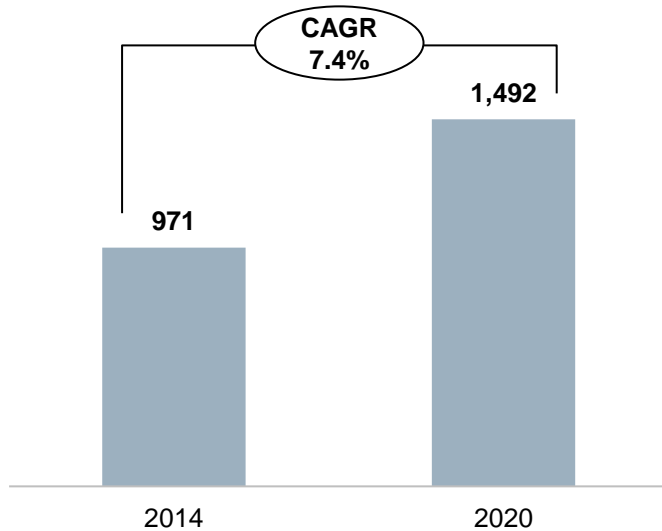
Notes: 1) Divisional historic figures do not add up to group sales excluding consolidations/other; 2) 2014 represents the first year that Knorr-Bremse prepared its financial statements in accordance with IFRS. Prior to 2014, financial statements were only prepared in accordance with German GAAP (HGB). IFRS differs in certain aspects from German GAAP (HGB), and accordingly data presented in accordance with German GAAP (HGB) may not be comparable to data prepared in accordance with IFRS; Source: Knorr-Bremse information

... all supported by solid aftermarket sales growth

RVS – Aftermarket sales¹⁾



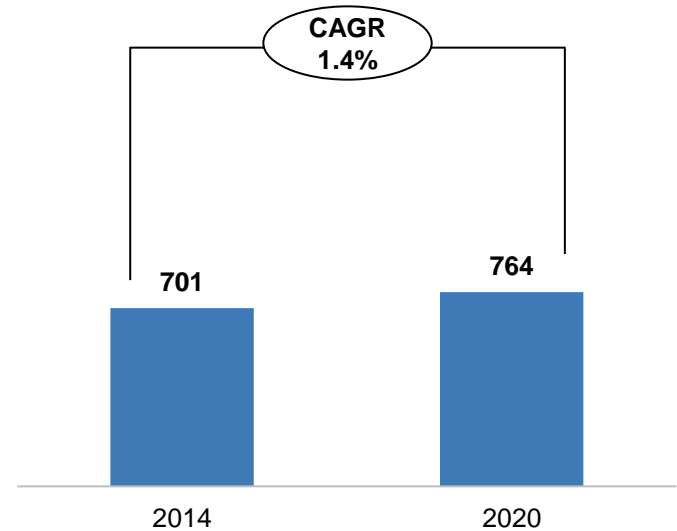
(€m)



CVS – Aftermarket sales¹⁾

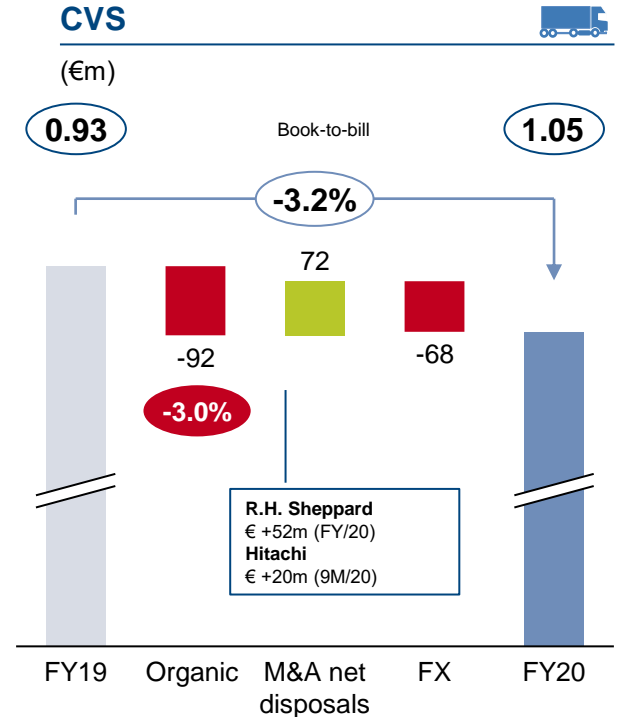
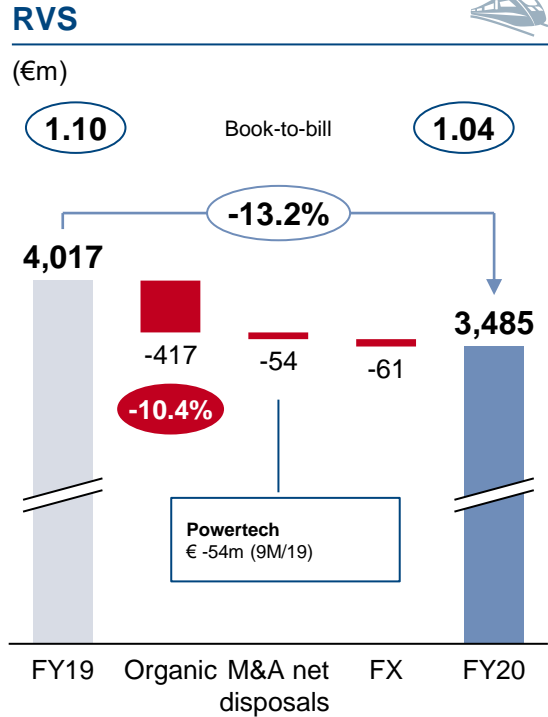
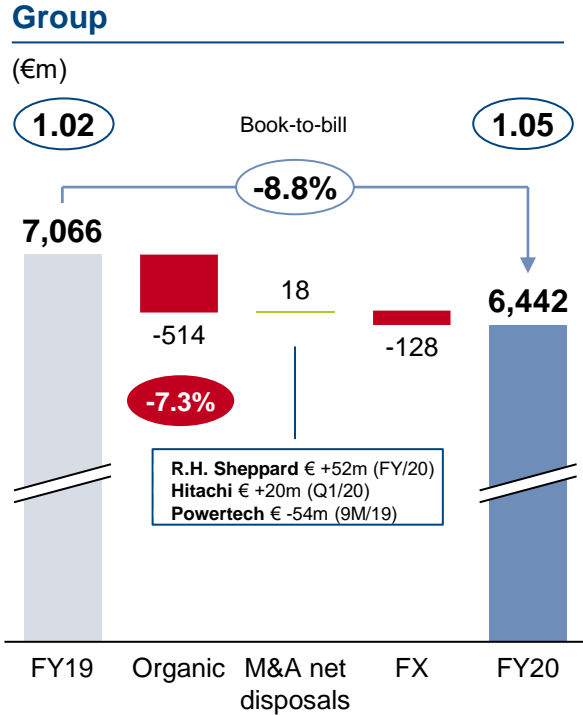


(€m)



Notes: 1) Based on IFRS; BilRUG sales allocated proportionally between OE and aftermarket

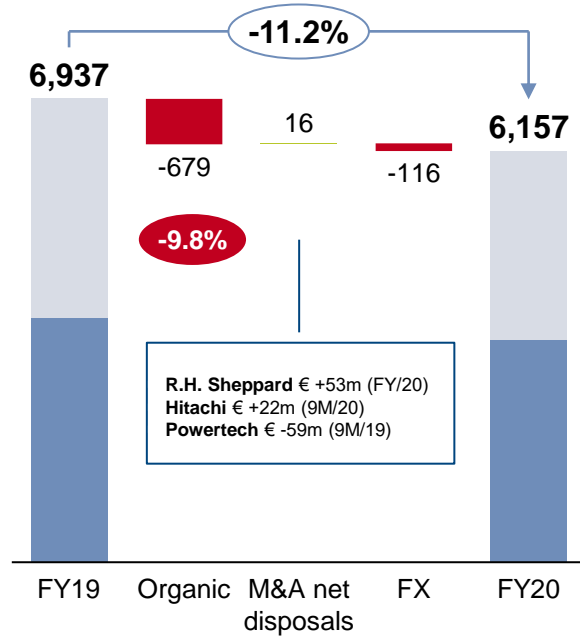
Order Intake for Group, RVS & CVS FY/20



Revenue for Group, RVS & CVS FY/20

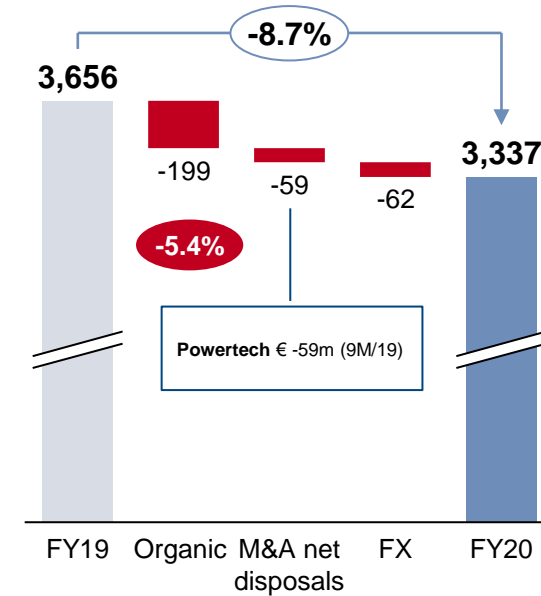
Group

(€m)



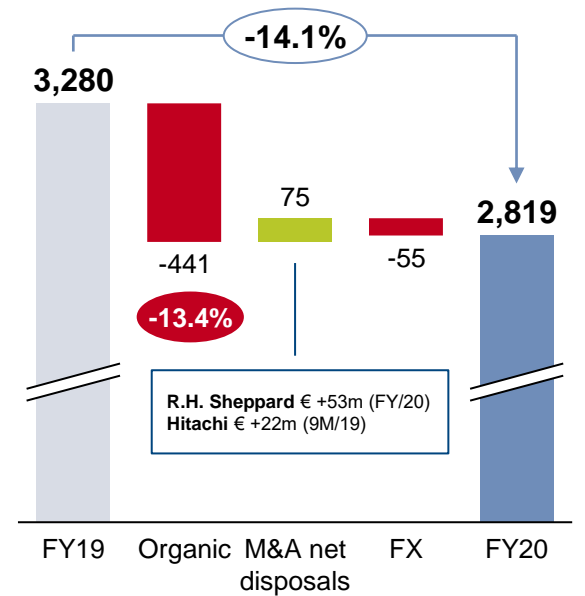
RVS

(€m)



CVS

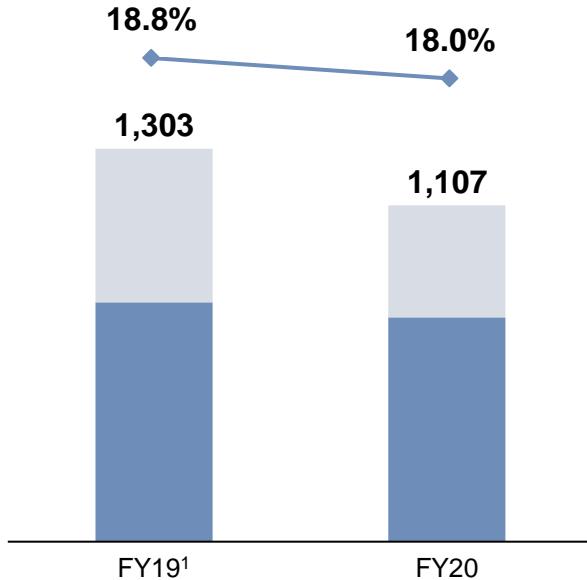
(€m)



EBITDA for Group, RVS & CVS FY/20

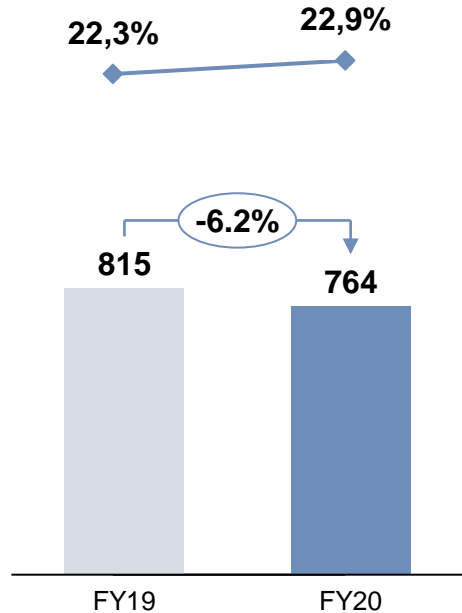
Group

(€m)



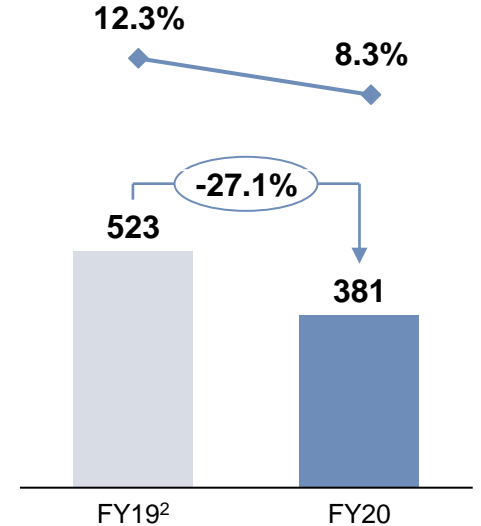
RVS

(€m)



CVS

(€m)



1) Operating | rep.: EBITDA: EUR 1,329m (19.2%)

2) Operating | rep.: EBITDA: EUR 504m (15.4%)

Focus on quality of earnings – a closer look at key P&L items

Key items

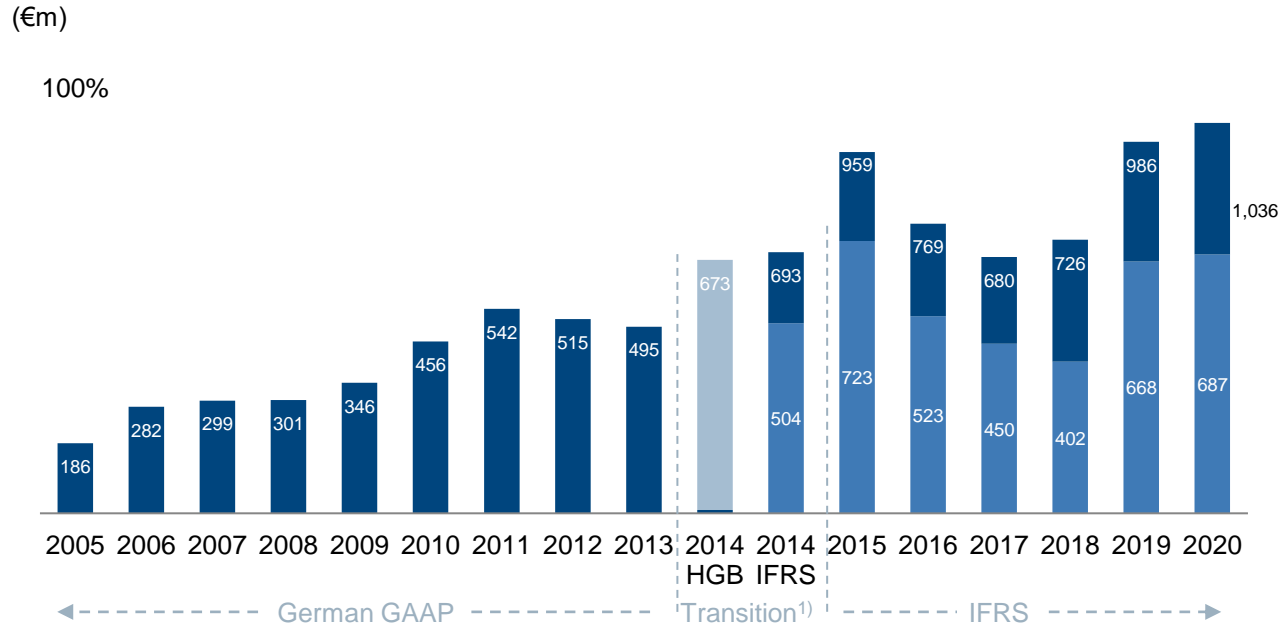
€m	2015	2016	2017	2018	2019	2020
Net sales	5,824	5,471	6,154	6,616	6,937	6,157
<i>% growth</i>	11.6%	(6.0%)	12.5%	7.5%	5.4%	-11.2%
Changes in inventory of finished and unfinished goods	(7)	(11)	39	34	6	(11)
Own work capitalised	19	21	32	48	73	76
Total operating performance	5,836	5,481	6,224	6,698	7,016	6,222
Other operating income	89	83	81	66	117	92
Material expenses	(2,747)	(2,571)	(3,010)	(3,318)	(3,429)	(2,961)
Personnel costs ¹⁾	(1,272)	(1,272)	(1,439)	(1,497)	(1,594)	(1,526)
Other operating expenses	(636)	(669)	(741)	(771)	(782)	(720)
EBITDA	1,269	1,052	1,116	1,178	1,329 ²	1,107
<i>Margin, %</i>	21.8%	19.2%	18.1%	17.8%	19.2%	18.0%
Depreciation / Amortisation	(170)	(166)	(211)	(206)	(266)	293
EBIT	1,099	886	904	972	1,063 ²	814
<i>Margin, %</i>	18.9%	16.2%	14.7%	14.7%	15.3%	13.2%
Financial result	(51)	(45)	(52)	(97)	(156)	(63)
EBT	1,048	841	852	876	907	751
<i>Margin, %</i>	18.0%	15.4%	13.9%	13.2%	13.1%	12.2%
Income tax	(337)	(274)	(265)	(246)	(275)	(218)
<i>Effective tax rate</i>	32.2%	32.6%	31.1%	28.1%	30.3%	29.1%
Net income	711	567	587	629	632	532

Notes: Based on financial statements prepared in accordance with IFRS;

1) Including leased personnel; Source: Knorr-Bremse information 2) Reported figures shown; op. EBITDA € 1,303m (18.8%); op. EBIT: € 1,063m (15.4%)

Knorr-Bremse is a high return and cash generative business

Strong cash generation abilities



Key drivers and factors

EBIT margins

FCF generation

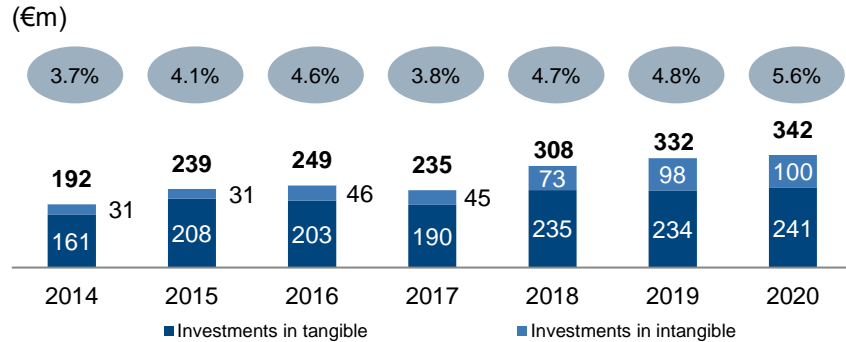
Asset turnover

■ Operating cash flow ■ FCF²⁾ — ROCE³⁾

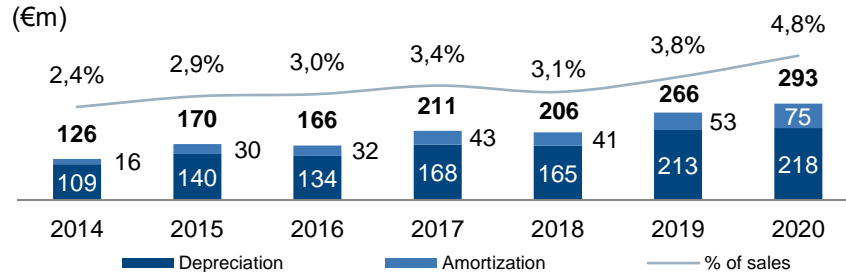
Notes: 1) 2014 represents the first year that Knorr-Bremse prepared its financial statements in accordance with IFRS. Prior to 2014, financial statements were only prepared in accordance with German GAAP (HGB). IFRS differs in certain aspects from German GAAP (HGB), and accordingly data presented in accordance with German GAAP (HGB) may not be comparable to data prepared in accordance with IFRS; 2) FCF (Free Cash Flow) defined as cash flow from operations minus cash-relevant capex; 3) ROCE defined as EBIT divided by capital employed (Fixed assets + Intangible assets + Net working capital); 5) Asset turnover defined as sales divided by capital employed; Source: Knorr-Bremse information

Fully invested asset base driving low capex requirements

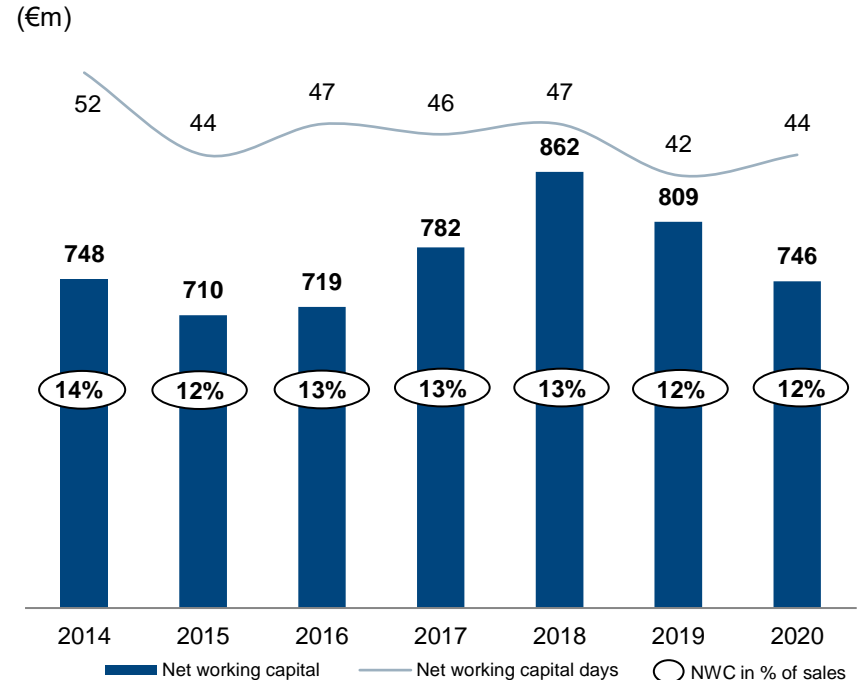
Capex¹⁾



D&A



Net working capital²⁾

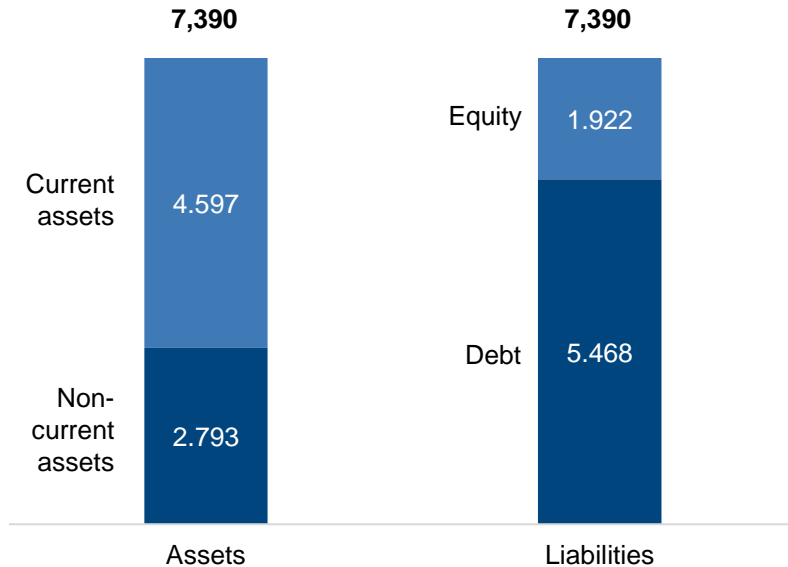


Notes: Based on financial statements prepared in accordance with IFRS; 1) As per asset register, defined as investments in fixed and intangible assets incl. finance leasing; 2) Net working capital defined as Inventory + Accounts receivables + Construction contracts with positive balances - Accounts payables - Construction contracts with negative balances - Pre-payments received; 3) Step-ups from key PPA's (Selectron, Powertech, GT & Kiepe Electric); 4) Including €25m from impairment of assets held for sale; Source: Knorr-Bremse information

Healthy capital structure and financial position

Capital structure as of December 31, 2020

(€m)



Solid financial position as of December 31, 2020

- Equity ratio: 26%
- Net cash: €103m
- Cash and cash equivalents: €2,345m



Notes: Based on financial statements prepared in accordance with IFRS

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- Introduction
- Key Company Highlights
- Rail Vehicle Systems (RVS)
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- Financials
- **Sustainability**
- Capital Markets Summary
- Appendix



The basis of our responsibility

Our values

Growing with Values.



- Entrepreneurship
- Technological Excellence
- Reliability
- Passion
- Responsibility

UN Global Compact



Commitment to ten basic principles:

- Human rights
- Labor standards
- Environmental protection
- Anti-corruption

CR Policy



- Comprises our understanding of Corporate Responsibility
- Sets down guidelines for our CR focus areas
- Points out the main focus of our efforts to realize social and environmental responsibility

Our CR policy and focus areas

Strategy and management



We aim for **sustainable value creation**. By this we understand achieving long-term economic success while at the same time acting responsibly towards our employees and business partners as well as the environment and society.

We are committed to **sustainable corporate governance** that includes environmental and social aspects in strategic planning, management and corporate processes.

We act and work according to **legal and ethical principles** laid down in our Group-wide Code of Conduct.

Products and partners



We consistently work on developing **innovative products** and solutions that combine a high degree of customer value with a contribution to sustainable development. Safety is always our overriding goal.

We **work closely with our customers and suppliers** to jointly ensure continuous improvement of product quality and minimal undesirable impact on the environment and society.

We take into account and support the activities of our **business partners aimed at improving their environmental and social compatibility**.

Commitment and society



We are involved, as a member of society, in **social issues** and are engaged world-wide as a **good corporate citizen**. We supplement the activities of the charitable organization Knorr-Bremse Global Care e.V. with social projects implemented directly at our production sites (Local Care).

We encourage and support **social involvement on the part of our employees**.

We see ourselves as **partners for the regions** in which we live and work, and we support their long-term development.

Employees and governance



We create an attractive working environment in which the principles of **mutual trust, team-work, diversity and equality of opportunity** as well as fair and respectful treatment of each other are recognized and practiced.

We offer a **safe and healthy working environment** and enable our employees to develop their **own individual potential**.

We conduct an ongoing **dialogue with our managers** on the subject of value-oriented, sustainable corporate governance.

Environment and climate



We accept our **responsibility for ensuring a clean environment and protecting the climate** and operate in compliance with our **HSE Policy** (Healthy, Safety and Environment).

We have set ourselves the goal of handling **resources in a responsible manner**, consistently reducing **CO₂ emissions, minimizing** and where possible **avoiding** undesirable **impact** on nature and the environment and actively using opportunities to **protect the environment**.

We are concerned to optimize the **environmental compatibility** of our products across their **entire life-cycle**.

Communication and co-operation

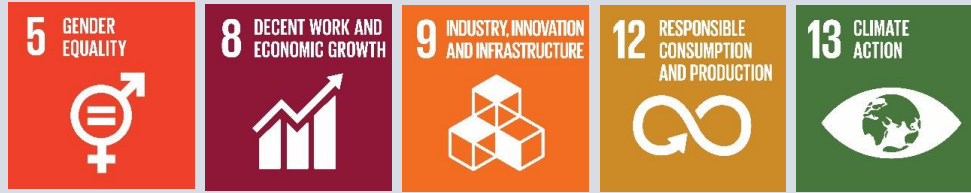


We seek constructive **dialogue with our stakeholders** and provide them with regular and transparent updates on our sustainability activities.

We support social, educational and environmental projects and enter into **partnerships with organizations** that contribute towards sustainable development.

In 2018 Knorr-Bremse selected its Core Sustainable Development Goals (SDGs)

 **KNORR-BREMSE**



+

KNORR-BREMSE 
global care



Knorr-Bremse to become carbon neutral from 2021

Carbon neutrality from 2021

- KB renews its climate strategy with even more ambitious targets
- 50% CO₂ emission reduction by 2030
- Additionally: Increasing purchase of renewable energy and carbon offsetting
- Starting point of CO₂ emissions in 2018 at 143,000 tons

Contribution by our products

- Rail is a cornerstone of eco-friendly transport solutions
- Truck products support lower fuel consumption
- ~9% of KB's revenues are driven by remanufactured and recycled products
- Circular economy supported by remanufactured and overhauled products

Focus on 5 SDGs

- In 2018 ~150 top managers of KB committed to 5 core United Nations Sustainability Development Goals
- Sponsorship of Executive Board Members to drive initiatives around the KB world



Knorr-Bremse AG is part of the new **DAX 50 ESG index**



The KB climate strategy 2030 is currently rolled out, governance and control tools are set up



- Reduction measures for 2020
 - Energy efficiency
 - Own production
 - Green power supply
 - Compensation
- Governance for the implementation
 - House of Climate Initiative Group
- Implementation Control
 - Integration with existing financial controlling process
 - Steering of the target achievement via to be defined sub-targets



Knorr-Bremse takes active part in corporate memberships throughout the world

United Nations Global Compact (participation since 2010)



APTA - American Public Transportation Association, USA



AAR - Association of American Railroads, USA



AIAG - Automotive Industry Action Group, USA



MEMA - Motor & Equipment Manufacturers Association, USA



New York and New Jersey Minority Supplier Development Council, USA



UNIFE - Sustainable Transport Committee of the Union des Industries Ferroviaires Européennes, BEL



VDA - Verband der Automobilindustrie e. V., GER
Working Groups: Sustainable supply chain & products



Railponsible – founding member (sustainable rail supply chain initiative)



VDB - Fachgruppe Umwelt im Verband der Bahnindustrie e. V., GER



APRA - Automotive Parts Remanufacturers Association - Chairman Europe

Achieved CSR ratings and awards

Ratings



A-



50



A



19.0



C+

Awards



Top employer 5th time in a row



Supplier Sustainability Award 2014



Industrial Sustainability Supplier 2015



Special Price: "Green Award" 2018

Our 9 material (non-financial) corporate responsibility areas

Evaluation of non-financial facts was carried out in the workshop on the basis of qualitative considerations regarding the extent of business relevance and its impact (2018)



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Share data

Share data

Type of share	Bearer shares with no-par value
Bloomberg ticker	KBX
Reuters ticker	KBX.DE
German security identification number (WKN)	KBX100
ISIN	DE000KBX1006
Shares outstanding as at December 31, 2018	161.200.000

Bond Data

The Corporate Bonds of Knorr-Bremse AG

Security Identification Number	A2LQP5
International Securities Identification Number	XS1837288494
Issuer	Knorr-Bremse AG
Issuer ratings	A2/outlook stable (Moody's), A/outlook stable (Standard & Poor's)
Volume	EUR 750 million
Term	7 years
Settlement	June 14, 2018
Maturity	June 13, 2025
Coupon	1.125% p. a.
Reoffer spread	1.188% p. a.
Listing	EURO MTF Luxembourg
Denomination	EUR 1,000
Applicable law	German law

Security Identification Number	A2DARP
International Securities Identification Number	XS1531060025
Issuer	Knorr-Bremse AG
Issuer ratings	A2/outlook stable (Moody's), A/outlook stable (Standard & Poor's)
Volume	EUR 500 million
Term	5 years
Settlement	December 6, 2016
Maturity	December 8, 2021
Coupon	0.5% p. a.
Reoffer spread	0.571% p. a.
Listing	EURO MTF Luxembourg
Denomination	EUR 1,000
Applicable law	German law

Strong current rating: S&P (A) and Moody's (A2)

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Glossary (1/2)

%	Percentage	CF	Cash flow	ELC	Electronic leveling control
ABS	Anti-lock brake system	CFO	Chief Financial Officer	EOP	End of period
ACC	Adaptive Cruise Control	CKR	Czech Koruna	ESP	Electronic stability program
AD	Automated Driving	CNY	Chinese Yuan	EU	Europe, European Union
ADAS	Advanced driver assistance systems	CVS	Commercial Vehicle Systems	EUR	Euro
ADB	Air Disk Brake	D&A	Depreciation & Amortization	FTE	Full-time equivalent
AEBS	Advanced Emergency Braking System	DE	Germany	GAAP	Generally Accepted Accounting Principles
AG	Aktiengesellschaft (German: Stock Corporation)	DoI	Date of Implementation	GBP	British Pound
AM	Aftermarket	e	Expected	GDP	Gross domestic product
BDM	Brake Distance Management	EAC	Electronic Air Control	GSBC	Global Scalable Brake Control
bn	billion	EBIT	Earnings before Interest, Tax	HQ	Headquarters
CAGR	Compound Annual Growth Rate	EBITDA	Earnings before Interest, Tax, Depreciation, Amortization	HSR	High-speed rail
CAPEX	Capital expense	EBS	Electronic brake system	HU	Hungary
CEO	Chief Executive Officer	EGR	Exhaust Gas Reduction	HUF	Hungarian Forint

Glossary (2/2)

HVAC	Heating, ventilation & air conditioning	LDW	Lane Departure Warning	TCO	Total cost of ownership
IAA	International Automobil-Ausstellung (German: International Motor Show)	m	million	TPR	Truck Production Rate
IAM	Independent Aftermarket	M&A	Merger & acquisitions	UIC	International union of railways
iCOM	Intelligent Condition-Oriented Maintenance	OEM, OE	Original equipment manufacturer	US	United States
IFRS	International Financial Reporting Standards	OES	Original equipment service	USD	US Dollars
IN	India	OPEX	Operating expense	WC	Working Capital
IoT	Internet of Things	p.a.	per annum		
IPO	Initial Public Offering	PWM	Private Wealth Management		
JV	Joint venture	R&D	Research & Development		
KB	Knorr-Bremse	ROE	Return on Equity		
KB2020	Knorr-Bremse 2020	ROS	Return on Sales		
KPI	Key Performance Indicator	RVS	Rail Vehicle Systems		
LCC	Life-cycle cost	TCMS	Train Control Management System		

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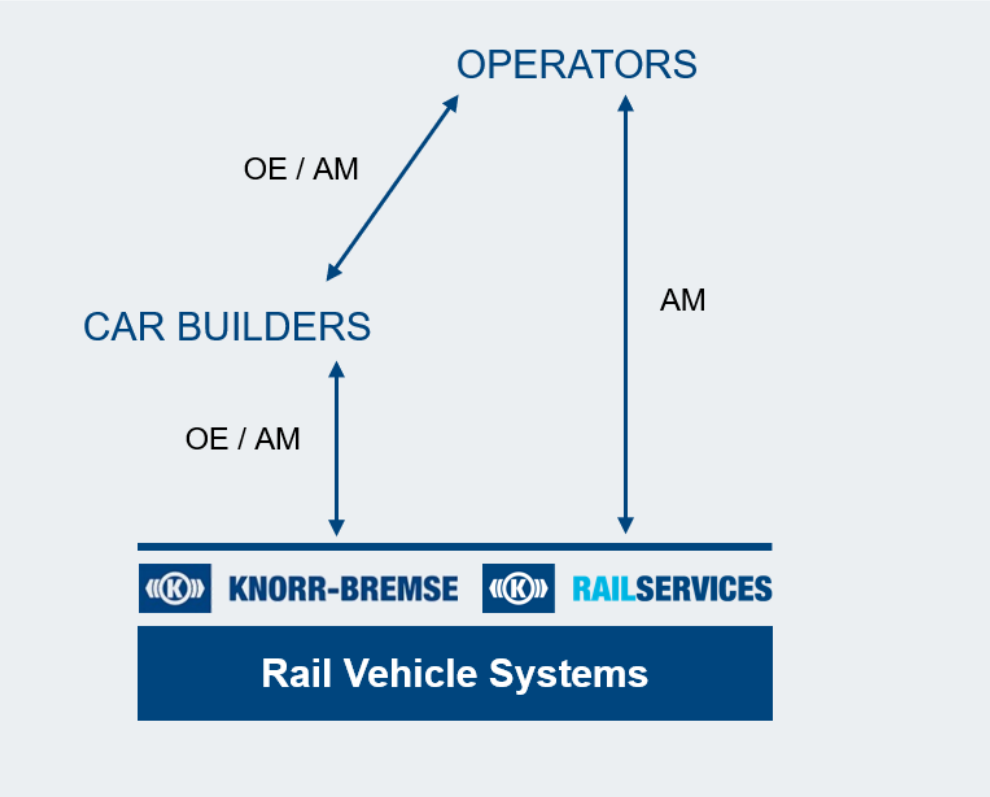
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Knorr-Bremse offers best-in-class solutions for the entire life cycle



Strong partnership with our customers

- Joint development of innovative solutions and products
- System development and construction
- Life cycle cost-optimized solutions
- Project management
- Pre-installed units (plug & play)

Product portfolio – A variety of subsystems and additional services

On-Train

Off-Train

KNORR-BREMSE

- Braking systems
- Windscreen wiper and wash systems
- Sanitary systems
- Couplers
- Test rigs

NEW YORK AIR BRAKE

- Brake control systems

IFE

- Entrance systems

MERAK

- Climate control systems (HVAC)

ZELISKO

- Signalling systems

KNORR-BREMSE

Rail Vehicle Systems

MICROELETTRICA

- Power electrics

SELETRON

- Train control and management systems (TCMS)

















KIEPE ELECTRIC

- Electrical systems
- Traction
- Auxiliary power supply
- System integration

RAILSERVICES

- Original parts
- Maintenance, overhauls and repairs
- Modernization and upgrades
- Extended services and training

Knorr-Bremse systems are installed in all relevant types of vehicle

	Mainline			Urban				
	Locomotives & Cars		Integrated Trains					
	Freight cars	Locomotives (electric & diesel)	Passenger cars	Multiple units High-speed trains	Multiple units Regional & commuter trains	Metros (pneumatic & hydraulic)	Tramways/ light rail vehicles (pneumatic & hydraulic)	Monorails (pneumatic & hydraulic)
								
 Braking systems	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
 Entrance systems	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
 HVAC systems	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
 Power electrics	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
 TCMS	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
 Electrical systems	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
 Sanitary systems	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
 Windscreen wiper and wash systems	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Relevant
 Partly applicable
 Not relevant

Knorr-Bremse: Wir machen Transport sicher und effizient – innovativ und nachhaltig



Radbremse

- Scheibenbremsen
- Trommelbremsen
- Aktuatoren

Luftbeschaffung

- Kompressoren
- Elektronische Luftaufbereitung
- Luftaufbereitungseinheiten

Antrieb

- Getriebeaktuatorik
- Kupplungssteller
- Visko-Dämpfer
- Abgasbremsklappen
- Abgasrückführungsventile
- Traktionsumrichter
- Lösungen für E-Mobilität

Lenkung

- Kugelumlauflenkungen
- Überlagerungslenkung

Fahrzeugdynamik

- ABS, EBS, ESP
- Elektronische Niveauregelung
- Ventile
- Fahrerassistenzsysteme
- Automatisiertes Fahren
- iTAP®: intelligent trailer access point

