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• business risks associated with the volatile global economic environment and political conditions
• costs associated with compliance activities
• market acceptance of new products and services
• changes in governmental regulations and currency exchange rates
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Driving profitable growth
RA in sustainable transport

1. Sustainable transport offers attractive profitable growth opportunities
   • Growth of electric vehicle production
   • New manufacturing needs

2. We are well positioned
   • Portfolio of solutions for EV manufacturing
   • Flexible manufacturing
   • Sustainable manufacturing

3. Resulting in incremental profitable growth

4. High growth beyond sustainable transport
High growth of EV sales
EV sales to surpass non-EV sales by 2035

Global xEV¹ vehicle sales forecast

[Million units]
% - EV share of total global new passenger and commercial vehicle sales
CAGR

1. Incl. battery electric, plug-in hybrid and fuel cell electric passenger and commercial vehicles
Source: Long-term Electric Vehicle Outlook 2021, BloombergNEF
>$500 bn. announced investments by OEMs until 2040

xEV investment announced by major global OEMs

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<th>ICE leaders: $ +440 bn.</th>
<th>EV players: $ +100 bn.</th>
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<td>Others</td>
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Source: S&P Global Market Intelligence, per Sept. 17, 2021, company announcements
Vehicle anatomy: difference between ICE and EV

Internal combustion engine (ICE)  Lead battery  Exhaust  Fuel tank  Transmission

ICE Powertrain
ICE vehicle manufacturing

- Engine/motor component manufacturing
- Engine machining & assembly
- Chassis assembly
- Docking / marriage
- Final trim & assembly
- Final inspection
- Sub-assemblies
- Press shop
- Body shop
- Paint shop
EV manufacturing

Battery cell manufacturing → Battery module → Battery pack

- Engine machining & assembly
- Electric motor assembly

Chassis assembly

Docking / marriage → Final trim & assembly → Final inspection

Sub-assemblies → Press shop → Body shop → Paint shop

Battery cell manufacturing → Battery module → Battery pack → Electric motor assembly

Additional processes for EV
Changed processes for EV
Processes with limited / no changes for EV
Omitted processes for EV
EV manufacturing

- Battery cell manufacturing
- Battery module
- Battery pack
- Engine/motor component manufacturing
- Electric motor assembly
- Engine machining & assembly
- Chassis assembly

Processes:
- Additional processes for EV
- Changed processes for EV
- Processes with limited / no changes for EV
- Omitted processes for EV

Sub-assemblies
- Press shop
- Body shop
- Paint shop

- Docking / marriage
- Final trim & assembly
- Final inspection

ABB Capital Markets Day 2021
Sustainable transport as part of our business
Orders of ~$600 million, ~20% of RA order intake\textsuperscript{1}

Sustainable transport market growth drivers

01. New powertrain architecture
   → *E-motor, battery manufacturing investment*

02. More variants
    → *Higher flexibility*

03. Lower powertrain complexity
    → *Increasing robotization level*

04. New players
    → *Additional green field investment*

ABB: innovative solutions to outgrow the market

Mid-teen market CAGR in the coming years

ABB EV manufacturing orders CAGR

Addressable market CAGR

~50%  

2017 – 2021E

1. Total orders based on end of Q3 L12M, management estimation
Changes will increase market for robotization

Total automotive robotics market size by major manufacturing steps

- **Sub-assembly**
  - Today: ~$20 bn.
  - Future: +~5% CAGR

- **Body shop**
  - Future: +~5% CAGR

- **Powertrain, battery manufacturing**
  - Today: ~$20 bn.
  - Future: +~5% CAGR
    - ~10% CAGR

- **Paint & sealing**
  - Future: +~5% CAGR

- **Final trim & assembly**
  - Future: +~5% CAGR

- **Press shop**
  - Future: 

**Major growth drivers**

- **New powertrain solutions**
  - Batteries
  - Electric motors

- **Increasing flexibility**
  - New EV variants
  - Higher uncertainty of EV adoption speed

- **New players**
  - Greenfield investments

1. Management estimation

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Driving profitable growth
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4. High growth beyond sustainable transport
Complete portfolio for flexible automation

- Application services
- Field service
- Spare parts

Robotics

AMR

Smart systems

Robot Studio, Automation Studio, digital twin

Common operations apps

Business apps

Common platform

Application cells and modules

Peripherals

Robots

Embedded software

Machine Automation

1. Autonomous mobile robots
Creating value
Strong portfolio of products, software and domain expertise

Technologically leading product portfolio

Software and digital twin for engineering and simulation

Industry and process expertise

EV manufacturing solutions

Of total EV manufacturing order intake¹:

- Sub-assemblies ~25%
- Body shop ~20%
- EV powertrain, battery mfg. ~20%
- Others ~35%

1. Based on 2020 3rd party order intake, management estimation
Nondestructive spotwelding quality inspection for EVs

Ultrasonic, nondestructive

Integrated, ready-to-use solution

AI based welding spots screening, higher efficiency

For EV by major OEM
High speed battery manufacturing

Robotics combined with flexible transport technology by B&R

High throughput: 45 million units / year\(^1\)

High precision: +/- 10 micrometer

Installed in: 🇺🇸 🇬🇧
Scalable battery assembly cell

Scalable, standard solution
Reduced delivery time
Integrated vision module
Installed in: 🇺🇸 🇪🇺 🇨🇳
Flexible automotive manufacturing with Asti AMR
Outdoor logistics

First commercial SLAM\(^1\) navigation outdoor AMR

Optimized high volume outdoor logistics flows

Private and reliable network\(^2\)

---

1. Simultaneous localization and mapping
2. Realized through cooperation with telecommunication partner
Enabling sustainable manufacturing
Example: PixelPaint

- \( \frac{1}{3} \) electricity use vs. spray applications

Eliminates the 30% paint waste that occurs from spray paint applications

46 tons CO\(_2\) saved per PixelPaint robot (IRB 5500) due to paint savings\(^1\)

Additional environmental and cost savings thanks to no masking

Water-borne paint, hence zero VOC emissions
Leading through technology

Business opportunities have various levels of market maturity

Market position

1. By robot units, management estimation

- **EV Sub-assemblies** ~$5.5 bn
- **EV body shop** ~$5 bn
- **EV powertrain, battery manuf.** ~$2.5 bn
- **EV paint & sealing** ~$1 bn
- **EV final trim & assembly** ~$0.5 bn
- **EV press automation** ~$0.2 bn

Emerging → Commercialized / take-off → Mature
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4. High growth beyond sustainable transport
RA is well positioned for the transition from ICE to xEV
Total addressable robotics market for automotive

Increasing market share
- Strong portfolio for EV
- Lead in flexible manufacturing

1. Management estimation
Driving profitable growth
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Strong portfolio, domain expertise for high growth automation

Technologically leading product portfolio

Software and digital twin for engineering and simulation

Industry and process expertise

Automation solutions for flexible manufacturing and smart machines

Of total revenue:
- Automotive
- Electronics
- General industry
- Consumer Segments & Service Robotics
- Machine builders
Scalable high growth Robotics & Automation solutions