FIND YOURS.

Current European Trends in Material Handling Technology

Presented by:
ELOKON Inc.
Alexander Glasmacher
Managing Director
ELOKON GmbH
THE ELOKON Group

• German company, founded 1986, 130 employees
  • Subsidiaries in Atlanta, GA; United Kingdom; Poland
• Leading global supplier of lift truck safety & warning systems
• Strong partnerships with all major lift truck OEMs
• History of innovation, service, customer-first focus
• Speaker: Alexander Glasmacher
  • President/CEO
  • Stanford University educated
  • 20+ years of experience in material handling industry

3,000+ Customers  40 Countries  1986 Established  130 Employees
Seminar Content

01 Digitization: Threat or opportunity?

02 Autonomous driving: Threat to many business models

03 Impacts on material handling industry

04 Which technological trends are important?

05 Examples from research and development

06 Added value for the material handling industry
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Digitization: Threat or Opportunity?

Threat?
- Elimination of millions of jobs
- Loss of over ½ of current job profiles
- Threat to businesses
- Diminished data protection & privacy laws

Or Opportunity?
- Emergence of more/different work/jobs
- Creation of new job profiles
- Increased profitability; therefore more employment
- Creation of new industrial value chains and customer groups

We need to keep pace with changing trends and a new business landscape
## Seminar Content

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Autonomous Driving: A Threat to Many Business Models

The five stages of autonomy

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<tr>
<th>Stage</th>
<th>Description</th>
<th>Level</th>
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<tr>
<td>0. Driver</td>
<td>No assistance</td>
<td>Human</td>
</tr>
<tr>
<td>1. Feet Off</td>
<td>Assisted</td>
<td>Assisted</td>
</tr>
<tr>
<td>2. Hands Off</td>
<td>Partially automated</td>
<td>Partially automated</td>
</tr>
<tr>
<td>3. Eyes Off</td>
<td>Highly automated</td>
<td>Highly automated</td>
</tr>
<tr>
<td>4. Mind Off</td>
<td>Fully automated</td>
<td>Fully automated</td>
</tr>
<tr>
<td>5. Passenger</td>
<td>Autonomous</td>
<td>Autonomous</td>
</tr>
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Transfer of responsibility

Sources: Evercore ISI, SAE International
Autonomous Driving: Individual Car Ownership will Come to an End

• Autonomous driving creates a new business model
  • “Transportation as a Service“
• RethinkX* forecasts that by 2030, 95% of all U.S. passenger miles will be in autonomous electric vehicles

• Consequences
  • Almost no one will continue to own a car
  • Fewer cars will travel more miles
  • The number of US passenger vehicles will drop from 247 million to 44 million
  • Conventional industries will suffer substantial job losses

* Source: RethinkX Disruption, Implications and Choices, Rethinking Transportation 2020-2030
Disruption: Car Value Chain will Witness Revenue Collapse

- What implications does this have for...
  - Auto industry workers (13.3 million in the EU28 alone)?
  - Us, as suppliers to the auto industry?

Source: RethinkX Disruption, Implications and Choices, Rethinking Transportation 2020-2030
Doubt, Distrust and Glitches? Revenue Collapse in the Auto Industry

Yes… however…

- Current legislation does not allow for highly/fully autonomous driving.
- How green are electric cars, really?
- The speed of technological advances is too optimistic.
- The TaaS business model is not for everyone/does not work everywhere.

However…

Doubt, Distrust and Glitches?

- It is only a question of time: when it will be available and what implications it will carry.
- N.Y. registers 500K Uber users daily.
- Range of highly automated vehicles is increasing rapidly.
- Many countries are progressive in testing use of autonomous vehicles.
- Fewer accidents; much improved safety.
- TaaS model = major economic impact.
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Impacts from Digitization & Autonomous Driving on EU Material Handling Industry

1. New value chains are emerging
2. New legislative frameworks need to be developed
3. New technologies enable innovative products and solutions
Impacts on New Product Solutions for EU Material Handling Industry
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EU Trends on the Road toward Autonomous Driving

1. Enhancement of today’s sensor-based applications
2. Improvement of man-to-machine interfaces
3. Increased use of car-to-car communication
4. Increased use of car-to-infrastructure integration/communication

Source: http://citycollision.ca
1. Enhancement of Today’s Sensor-Based Applications

**Via sensor-data fusion!**

**3D Environment Recognition**

**Principle**
- Acoustic
  - Ultrasound
    - 3D Ultrasound
    - Mono
    - Stereo
    - 3D

- Optical

- Electro-magnetic
  - Radar
    - Short Range
  - RFID
  - Car-2-I
    - 802.11p

**Type**
- Source: http://www.cbcity.de/fahrzeugumfeldsensorik-ueberblick-und-vergleich-zwischen-lidar-radar-video
Sensor-Data Fusion Facilitates 3D 360° Environment Recognition
2. Even More Important: Improvements in Man-to-Machine Interfaces

What can we learn from digitization?

Why?

• Distractions from assistance systems must be minimized
• Concentration needs to remain with the actual driving process
• Handling and warnings must influence drivers only minimally

Solutions:

• Use of touch-sensitive screens
• Engineering of highly intuitive visual, acoustic, and haptic (touch-based) feedback mechanisms
• Integration of mobile devices
• As simple as an analog car radio
3. & 4. Cooperative Communication Systems
High importance in product development for material handling

✔ Systems that enable vehicles to communicate with each other in real time

Positioning Solutions
• Car-to-X, Car-to-Car
• Cooperative detection vs. autonomous or way detection

Example
• An “intersection assistant” identifies vehicles on a collision course
  • Locations determined via GPS; vehicles share in real time, SW algorithm prevents collision

Quelle: https://www.car-2-car.org/
Implications for Products in Material Handling

- **Products**
  - Sensor-Data Fusion

- **Networking**
  - New Wireless Technologies

- **Vehicles**
  - Car-to-Car and Car-to-Infrastructure

- **Competition**
  - Software, Sensors, and Wireless

- **Solution Prices**
  - Cost Degression

*FIND YOUR WOW*
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Engineering of a Warning System for Very Narrow Aisle (VNA) Trucks

Objectives: Cost reduction; integration of new technologies

• Status quo: Lidar solutions used today as collision warning/safety solutions in VNA aisles
• At same time, RFID used for navigation
• Future: cooperative warning system
  • Trucks exchange communication data in real time
  • RFID collects location data
  • Data fusion occurs within software application on trucks
  • Result: real-time collision avoidance evaluation/warning on trucks
• Also possible TODAY, thanks to new site license-free wireless communication standards
Engineering of 3rd-Gen Fleet Mgmt System

Objectives: New functions; improved man/machine interfaces

- Implement fleet management as an APP
  - Use off-the-shelf mobile devices
- Provide private or public cloud platforms
- Enable predictive collision warning through redundant use of multiple sensor technologies
  - Integrate fleet management with proximity detection systems
- Implement impact sensor as a MEMS chip
  - Reduce size and number of system components
- Take advantage of car-to-car communication technology
- Integrate fleet management on WMS terminals
Research Project:
Safety-Rated Mobile Picking Robot

• Implement a predictive, redundant solution
  • Warn of collisions between picking robots & floor workers
• 3D 360° environment recognition
  • Via sensor-data fusion
• Automatic intention recognition in competitive, dynamic environments
  • Automatic obstacle avoidance
• Autonomous steering without use of infrastructure
• Added Values
  • Higher picking rates of robots
  • Higher employee and site safety
Conceptual Project: Intelligent Hi-Viz Safety Vest
Idea: Vest is to Act as a Personal Intelligent “Buddy“ to a Floor Worker

• Actively monitors worker’s safety in real time and provides emergency alerts

• Proximity detection system
  • Integrated in high-visibility vest

• Functions
  • Wi-Fi location
  • Alcohol sensor
  • “Charge or wear” alarm
  • Falling down sensor
  • Nametag & speaker to personalize vest
  • Inductive charging
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Added value for the material handling industry 06
Added Value due to Digitization & Autonomous Driving in Material Handling

• Much improved employee and site safety
  • Significantly reduced workplace accidents

• Much smaller vehicle fleets / higher productivity
  • Optimized route guidance

• Promotion of new products and applications
  • Picking robots as safety systems
  • Fully automatic “dark Stores”

• Much improved and faster productivity recordings
  • For products and services with live data
  • For long-term resource planning
But: What Will Happen to Material Handling Value Chain?

Revenue distribution along the car value chain in billions of U.S. dollars

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Source: RethinkX Disruption, Implications and Choices, Rethinking Transportation 2020-2030
Key Takeaways from Trends in European Material Handling Industry

Key Takeaways

1. New value chains are emerging
2. Industrial policy needs to take good account of the changes we are witnessing
3. Technological trends are usable one-to-one
4. The future: Computers on wheels
5. Software, sensors, and wireless technology will provide competitive advantages
6. Disruptive change = major opportunity!
For More Information

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Mr. Glasmacher at MODEX 2018, accepting MHI Innovation Award for best innovation of an existing product