INNOVATION & THE FUTURE OF LOGISTICS

Dr. Markus Kückelhaus
September, 2019
OUR SUPPLY CHAINS ARE CHANGING

Source: CB Insights 2018
### THE DIGITAL OPPORTUNITY IS HUGE...

#### TECHNOLOGY

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>40%</td>
<td>Of all data generated by 2020 will come from connected sensor</td>
</tr>
</tbody>
</table>

**Source:** Frost & Sullivan

#### VALUE

<table>
<thead>
<tr>
<th>Amount</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1.7 Trillion</td>
<td>Worldwide IoT Market by 2020</td>
</tr>
</tbody>
</table>

**Source:** IDC

#### OPPORTUNITY

<table>
<thead>
<tr>
<th>Reduction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>25%</td>
<td>in maintenance costs through IoT</td>
</tr>
</tbody>
</table>

**Source:** U.S. Department of Energy

<table>
<thead>
<tr>
<th>Amount</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$25 Billion</td>
<td>Connected 'Things' will be used in 2020</td>
</tr>
</tbody>
</table>

**Source:** Gartner

<table>
<thead>
<tr>
<th>Amount</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$10-$15 Trillion</td>
<td>Added to the global GDP by the 'Industrial Internet' market within the next 20 years</td>
</tr>
</tbody>
</table>

**Source:** GE

<table>
<thead>
<tr>
<th>Amount</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$90 Billion</td>
<td>Savings of $90 Billion generated by connected industrial machinery to make oil &amp; gas exploration 1% more efficient</td>
</tr>
</tbody>
</table>

**Source:** GE

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The biggest future impact on revenue and EBIT growth is set to occur through the digitization of Supply Chains.

- Adoption of e-AWB (Electronic Air Waybill): 46%
- Share of manually operated warehouses: 80%
- Transportation and logistics companies with no digital strategy: 25%

→ Through digitization of Supply Chains

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McKinsey
NEW TRENDS – SMART CONTAINERIZATION
NEW TRENDS – SERVITIZATION

Social & Business Trends

- Supergird Logistics
- Self-driving Vehicles
- Artificial Intelligence
- Robotics & Automation
- Internet of Things
- Cloud Logistics
- Big Data Analytics
- Low-cost Sensor Solutions
- Virtual Reality & Digital Twins

- Grey Power Logistics
- Tube Logistics
- Fresh Chain
- Omni-channel Logistics
- Big Data Analytics
- Internet of Things
- Cloud Logistics
- Low-cost Sensor Solutions

- Servitization
- Containerization
- Batch Size One
- Sharing Economy
- Fair & Responsible Logistics
- Connected Life

- Relevant in < 5 years
- Relevant in > 5 years
- High

2018/19

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NEW TRENDS – NEXT-GENERATION WIRELESS
NEW TRENDS – VIRTUAL REALITY & DIGITAL TWINS

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INNOVATION VALUE CHAIN

1. Trend Radar
2. Trend Report
3. Innovation Center Exhibit
4. Proof of Concept

Initiate Global Accelerators
Commercialization

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NEAR FUTURE – EXAMPLES IN LOGISTICS

- Autonomous Cleaning
- Autonomous Identification
- Follow me Robots
- Task to Person Robots
- Collaborative Picking Robots
- Mobile Piece Picking
NEW ACCELERATOR – INTERNET OF THINGS
NEW DATA-DRIVEN SERVICES

Evolution of IoT Technologies

- New data-driven services
- Real-time Solutions
- Sensor-Network
- Semi-active Sensors
- RFID
- Barcode

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IoT Solutions @ DPDHL
- DHL Ocean Thermonet: GSM
- Agheera GPS Solar: GSM
- DHL Air Thermonet: NFC/RFID
- Pharma Express: NFC/RFID
- DHL-MyID: RFID
FROM 2G TO 3G TO FUTURE SENSOR NETWORKS

- Tampering
- Shock
- Pressure
- Rechargeable Battery
- Motion
- GPS/UMTS/HSPA
- Temperature
- Humidity
- Light
- Airplane mode
- Real-time location
USE CASE: SHOCK MONITORING FOR AUTOMOTIVE PARTS

General Information
• Use Case: Shock Monitoring for Automotive Parts
• Objective: Detect Shock Hotspots
• Technologies: Smart Sensor

Details
• Objectives: Shock Monitoring to avoid deformations and damages, reducing shock impact on rack
• Notifications/ alerts: Waypoints, Shock thresholds
• Special features: Identification of critical shock hotspots
# PROMISING
## LOW-POWER-WIDE-AREA-NETWORKS

<table>
<thead>
<tr>
<th>Overview</th>
<th>Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>LP-WAN</td>
<td>Sigfox</td>
</tr>
<tr>
<td>NB-IoT</td>
<td><em>Industrialized nations</em> and (Air)Ports</td>
</tr>
<tr>
<td>WiFi</td>
<td>LORA</td>
</tr>
<tr>
<td>NFC</td>
<td><em>Industrialized and emerging markets</em></td>
</tr>
<tr>
<td>Bluetooth RFID</td>
<td>NB-IoT</td>
</tr>
<tr>
<td>3G, 4G/LTE, 5G</td>
<td><em>Europe, China and South Africa</em></td>
</tr>
<tr>
<td>Low</td>
<td>2G/3G/LTE/4G</td>
</tr>
<tr>
<td>Medium</td>
<td>Global</td>
</tr>
<tr>
<td>High</td>
<td></td>
</tr>
</tbody>
</table>

1) Standard for local and metropolitan area networks

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**Cost-Effectiveness**

| $   | $ $ | $ $ $ |
| GPS | Wi-Fi | 3G, 4G/LTE, 5G |

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**Energy Efficiency**

| Low | Medium | High |
| GPS | Wi-Fi | Bluetooth RFID |
USE CASE: SMART BUILDING AND TEMPERATURE MONITORING

General Information
• Location: DHL Asia Pacific Innovation Center, Singapore
• Use case: Warehouse Temperature

Objectives
• Reporting intervals of 10min; Battery lifetime of 1-1.5 years
• Live heatmap with configurable temperature scale as well as automated alerts

Particularities
• Reduced manual workload in monitoring indoor conditions
• Automated storage of indoor conditions data for future investigations
USE CASE: ASSET TRACKING FOR ROLLERCAGES

General Information
- Use Case: Low Cost Asset Tracking for Rollercages in Europe
- Objective: Get visibility of assets europewide
- Technologies: Sigfox

Details
- TBM property of DHL, but in continuous exchange (internal and external)
- High cost due to loss of roller cages
- Flow visualization and resource tracking
- Improvement of relocation and utilization rates
WHY IS BLOCKCHAIN BEING DISCUSSED IN THE LOGISTICS INDUSTRY?

- **Industry fragmentation** is driving low levels of supply chain transparency, unstandardized processes that today are often very manual (e.g. paper-based documentation for import/export), data silos and diverse levels of technology adoption

- In the US alone, there are over 500,000 individual trucking companies demonstrating the potential value blockchain can bring to connect and streamline the logistics industry
USE CASE: ENHANCING PARTS VISIBILITY FOR CAR DEALERS

Challenge
- Fragmentation in IT systems language/translation across different partners leads to lack of end to end visibility in order status for the dealers. Dealers have no one place to track status of all their orders.

Objectives
- To bring OEM system, PDC, DHL and AU dealers on a private blockchain platform
- Include business logic on matching data to eliminate all manual reconciliations (smart contract)
- Seamlessly integrate exiting systems with blockchain without introducing new identifiers/app
- Provide a mobile app for dealers to have full visibility
USE CASE: ENHANCING PARTS VISIBILITY FOR CAR DEALERS
PREDICTING, SENSING, AUTONOMOUS LOGISTICS

**Prediction**
- Global Trade Flows
- Route Optimization
- Maintenance

Enable predictive, self-learning networks

**Sensing**
- Dimensioning
- Identification
- Inspection

See and understand the world in new ways

**Autonomous Transport**
- Autonomous Robots
- Line-Haul Platooning
- Last-Mile Delivery

Improve operational efficiency & safety
AI IN LOGISTICS: PREDICTIVE LOGISTICS

DHL Global Trade Barometer

DGF Air Freight Delay Prediction

Predictive Maintenance

DHL Global Trade Barometer – World

2013 2014 2015 2016 2017 2018

Shaded area indicates -5% to 5% trade growth

January 2018 index: predicting Jan’18 – Mar’18 trade development

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AI IN LOGISTICS:
SEEING, SPEAKING, & THINKING

Conversational WMS
Vision-Based Sorting
Visual Quality Control
VISUAL QUALITY CONTROL: FREIGHT DIMENSIONING
AI IN LOGISTICS: AUTONOMOUS LOGISTICS

Yard Logistics
AGV’s on the rise

Line-Haul
Truck Platooning & driver assistance

Last Mile
from follow-me to full autonomy
EXPLORING TRENDS – UNMANNED AERIAL VEHICLES

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Robotics & Automation
Internet of Things
Augmented Reality
Low-cost Sensor Solutions

High: Creates new (potentially disruptive) ways of doing business
Low: Provides incremental improvement opportunities

RELEVANT IN < 5 YEARS
RELEVANT IN > 5 YEARS

2018/19

DHL

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USE CASE:
INVENTORY & CYCLE COUNTING
USE CASE:
DRONES FOR SURVEILLANCE IN MEXICO

RESILIENCE
USE CASE: DRONES FOR URGENT DOCUMENT DELIVERY
OPEN INNOVATION APPROACH

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