**Digitization of manufacturing technologies for production of the future**

Dr. Martin Goede, Volkswagen AG

Digitalisierung in der Produktion, 07. Dezember 2017, Wolfsburg

Challenges for vehicle manufacturing of the future

Complexity increase of competition-relevant requirements

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<th>Model variety and drive variants</th>
<th>Demand of innovations through new competitors</th>
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Challenges for vehicle manufacturing of the future

Complexity increase of competition-relevant requirements

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6. Environmental awareness and sustainability
7. Big data as business model and data security
8. Complex and fast-paced software landscape
9. Intelligent equipment and production services
10. Drive electrically
11. Steer autonomously
12. Network globally
13. Connect digitally
14. Support personally
15. Share commonly

E-mobility in volume segment

VW Käfer
21.5 mio. units

VW Golf
> 32 mio. units

VW „ID“
? mio. units
Product architecture today

Product architecture of the future
Product architecture of the future – next generation

**Autonomous taxi drone**
From 2018 in Dubai in use

**Autonomous mobile supermarket**
Tests are running in Shanghai

Challenges for vehicle manufacturing of the future

**Change of added value**

- New technologies and higher customer requirements change the **PRODUCT**.
  - Innovative product design
  - Modular product design

- Use of **BIG DATA** to control business processes and new business cases
  - Data driven business models
  - Production as a service

- Autonomically controlled **PROCESSES** for efficient production and logistics
  - Consistent optimization

- Customers are involved as new **PLAYERS** in value creation and optimization
  - Open Innovation

- Plants are organized and optimized as a **PRODUCTION NETWORK** via a platform
  - Flexible product works
  - Value creation platform
Digitally connected vehicle production of the future
Change of processes in vehicle construction

Factories of the future

Conventional production

“Weißbuch” standard factory

Life cycle

time

Digital connected production

Technology leaps

Digital connected Production at Volkswagen
Key factors

Digital Process Chain
Continuous data supply and use in the production network leads to efficient value chains.

Flexible Production
Modular manufacturing systems enable flexible, agile production.

Internet of Things
Self-optimizing systems, reduced integration effort and permanent information.

Human Empowerment
Digitally supported decision processes and coexistence of human and machine.

Big Data & Smart Analysis
Plant monitoring and self-control increase availability and reduce maintenance.

Artificial Intelligence
Independently operating systems, self-learning systems and assistants relieve the strain on people.
Key factors – Digital Process Chain
Consistent development, planning and production

Current Factory and planning processes (2016)

Disruptive change

Factory and planning processes of the future (2025)

Autonomous and universally usable systems of the future with independent implementation of the production steps.

→ Scenario management instead of detailed layout and Plant planning (including process simulation and flexibility, quality and cost assessment)

New processes require new planning systems

Key factor Human Empowerment
Complexity control by digital assistants

Analogous
Computer-based
System supported
Connected
Mobile
Intuitive

We bring technology closer to the people.
**Key factor - Big Data und Smart Analysis**
Performance increase through intelligent machines and systems

- Press shop with self-controlling processes by coupling innovative technologies
- More transparency and productivity
- Reduced machine downtime
- 100% testing
- Reduction waste

**Active components**
- Capture of component characteristics in the production plant
- Active realignment without intervention of the press operator
- Predictive Maintenance

**Materials testing**
- Central control
- Central data acquisition
- Data processing, situation & context related

Press shop 4.0

**Smart Personal Assistent**
Chatbots do simple tasks:
- Home-automation
- Task lists
- Opel: Test drive
- BMW: Home & Car

**Automated Speech Recognition**
Chatbots recognize natural language:
- Use in schools / universities
- Control of software
- Convert error description into standard text

**Neural Machine Translation**
Detection and translation of different languages:
- Loss of communication limits
- Cultures are approaching
Key factor – Artificial intelligence
Performance increase through intelligent software and machines

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<th>Classic construction</th>
<th>Optimisation by simulation</th>
<th>Automated design</th>
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<td>Design according to the experience of the designer</td>
<td>Design according to simulation loops</td>
<td>Design and construction according to genetic algorithms, production by 3D printing</td>
</tr>
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</table>
| - Weight:  
- Cost: | - Weight:  
- Cost: | - Weight:  
- Cost: |

Key factor – Flexible production (Gripper)
Concept "moving screwing module" for flow operation (VW Tiguan) - Volkswagen Osnabrück

There are high potentials for the automotive industry

Potentials of new production technologies
Generative production of tools and components

1. Extended design freedom
   - Advanced design options
   - Functionalization

2. Individualisation and variant variety
   - Individualization
   - Complexity

3. Accelerated development cycles / Time-to-market

There are high potentials for the automotive industry
### Potentials of new production technologies

**Generative production of plastic components**

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<th>Series production tomorrow</th>
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<tbody>
<tr>
<td><em>Flashing blue light holder, Duplicate part R-GmbH</em></td>
<td></td>
</tr>
<tr>
<td>Weight: 687 Gramm (steel)</td>
<td></td>
</tr>
<tr>
<td>Small batch: &lt; 500 Units/Year</td>
<td></td>
</tr>
<tr>
<td><em>Flashing blue light holder, 3D printing, SLS-method</em></td>
<td></td>
</tr>
<tr>
<td>Weight: 137 Gramm (plastic PA12)</td>
<td></td>
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### 3D-Printing „Vision 2025“
Efficient production and factory automation
Automation in vehicle production

Life cycle

Digitization strategy

"Weiβbuch" standard factory

PW: Press shop
KB: Body shop
L: Paint shop
M: Assembly

Efficient volume production technologies in factories of the future
Conclusions

- Intensive transformation of products
- Significant Technology push
- Increase of Complexity

- Improving economic and ecologic efficiency
- Digitalization of entire Process Chain

- New Dimension of Innovation implementation
- New Dimension of Collaboration networks
Digitization of manufacturing technologies
for production of the future

Thanks for your attention!

Dr. Martin Goede, Volkswagen AG
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