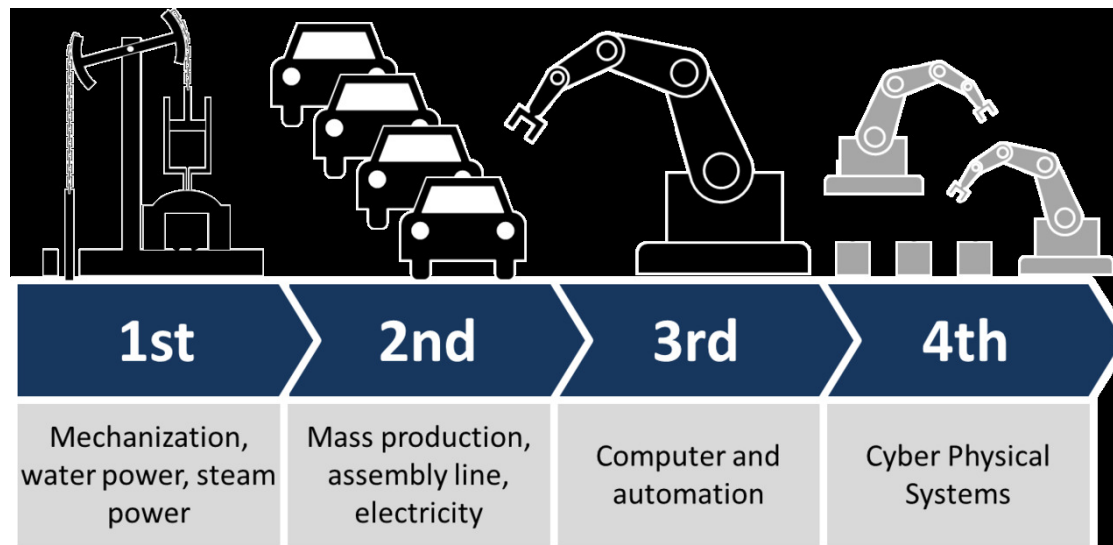
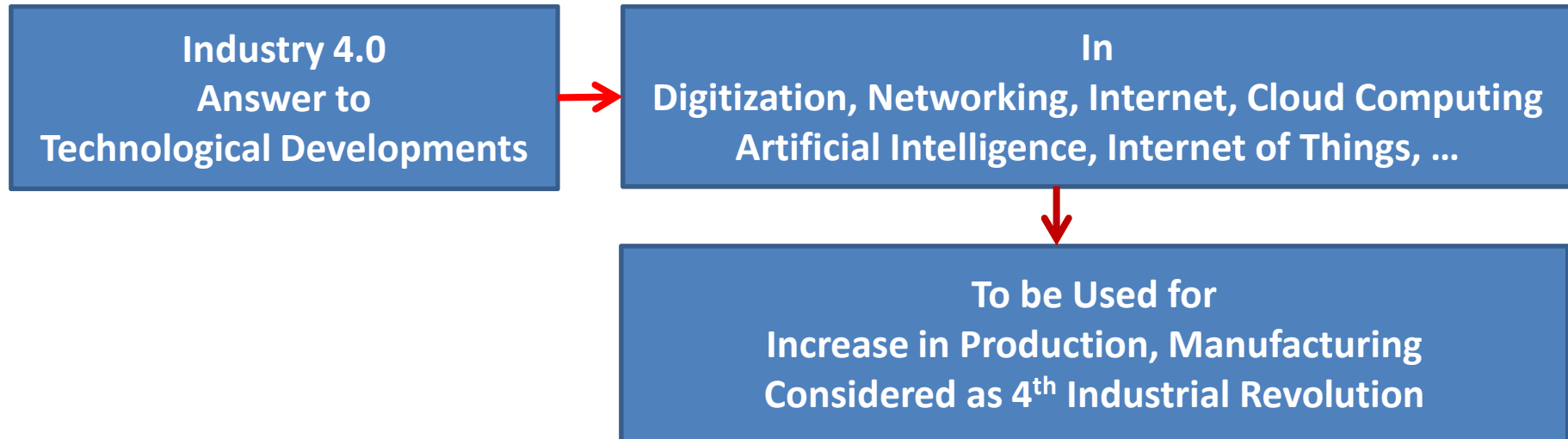


Industry 4.0 – Overall Significance and Implications to NDT

Rainer Link, Consultant, rainer.link@gmx.info

Nathanael Riess, CEO Helling Company, n.riess@helling.de



Industrial Revolutions

Wikipedia

**In Germany Project Industry 4.0 founded 2011 at Hannover Fair
Supported by Government (BMBF) with Large Financial support****

**** Today mostly used by Research Institutes and Large Companies
(Offering Solutions and Equipment)**

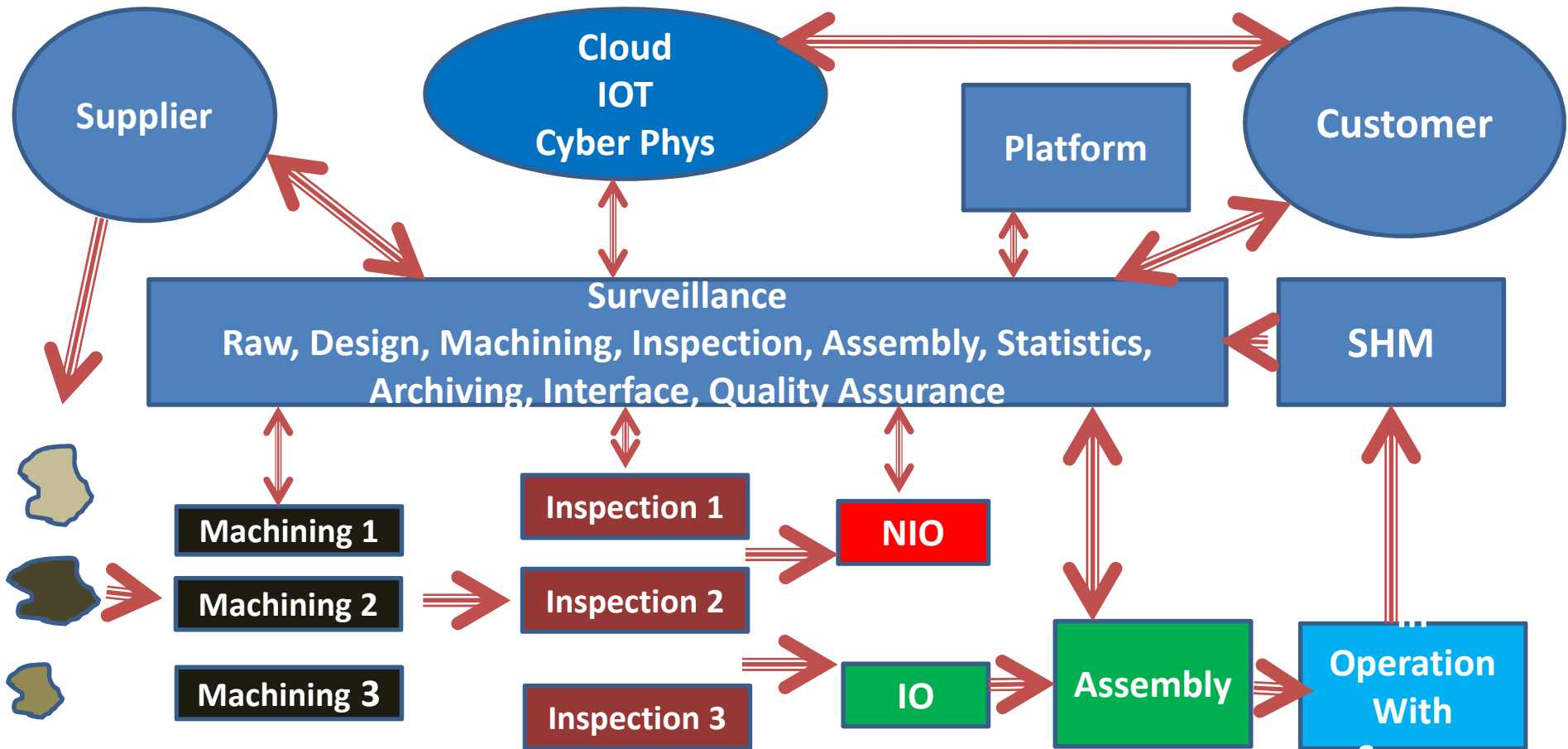
**Industry 4.0
Support For
Small and Medium Sized Business**

- **Increase Participation in Innovations**
- **Strengthen Innovation Competence**
- **Improve Support for R&D and Innovation**
- **Strengthen Innovation Possibilities in East Germany**
- **Improve Participation in Technical Programs in R&D**

**Result:
Smart Factory
Consequences for NDT – NDT 4.0**

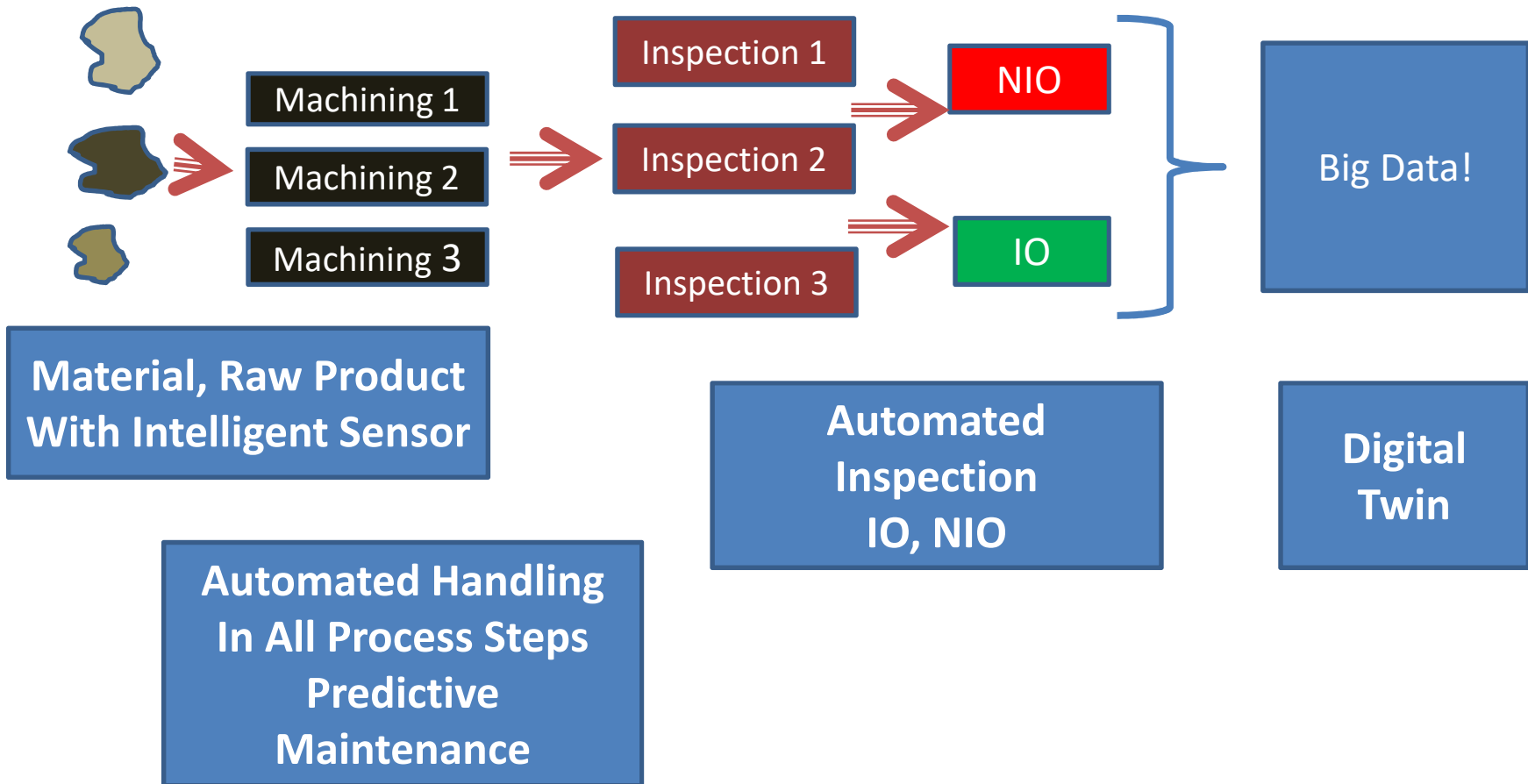
**e.g. Mercedes, May 2018
Factory 56
Including Industry 4.0**

Smart Factory and NDT 4.0



Implications to NDT 4.0

SMB in NDT:
Production of NDT Equipment
with/without Machining Tools



Inspection 1

Inspection 2

Inspection 3

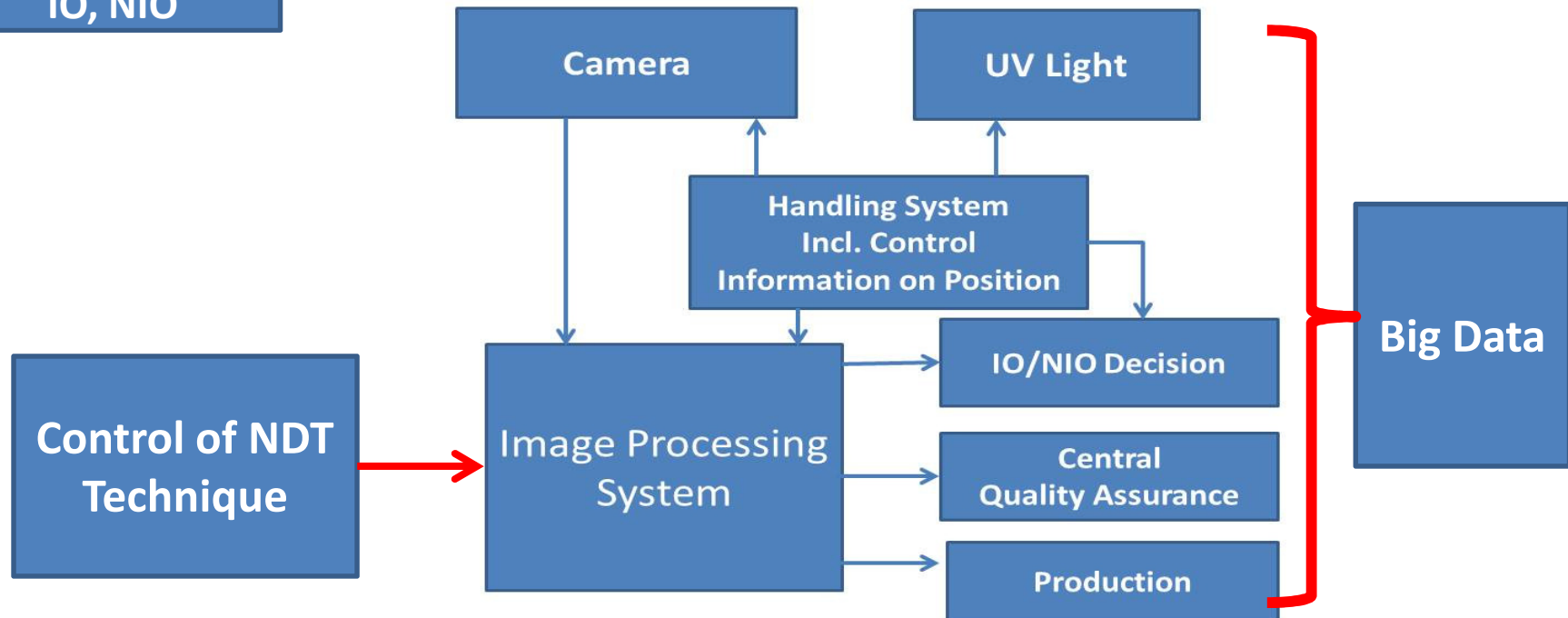
**Automated
Inspection
IO, NIO**

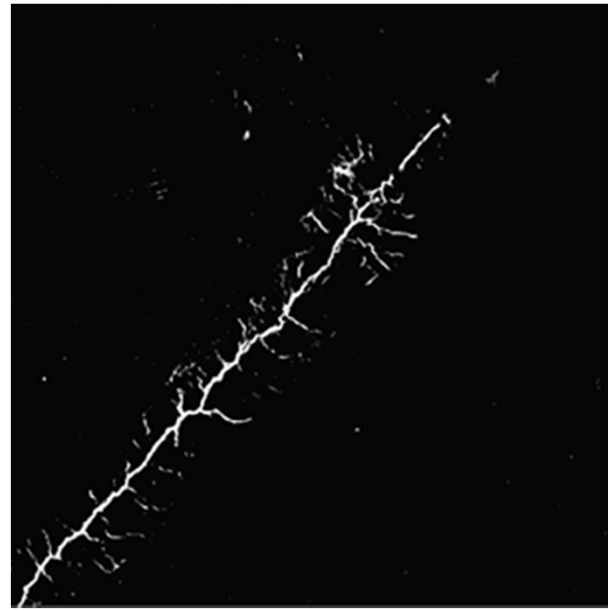
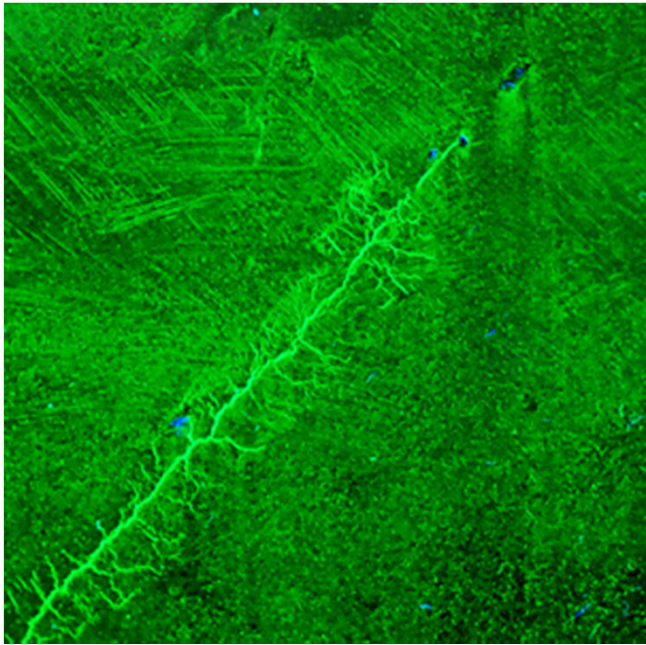
Automated Systems in NDT with Automated
Decision (examples),
Magnetic Powder Technique

Karl Deutsch GmbH 1981

Dr. Sauerwein Isotopenforschung GmbH 1989

K+D Flux-Technic GmbH 2008

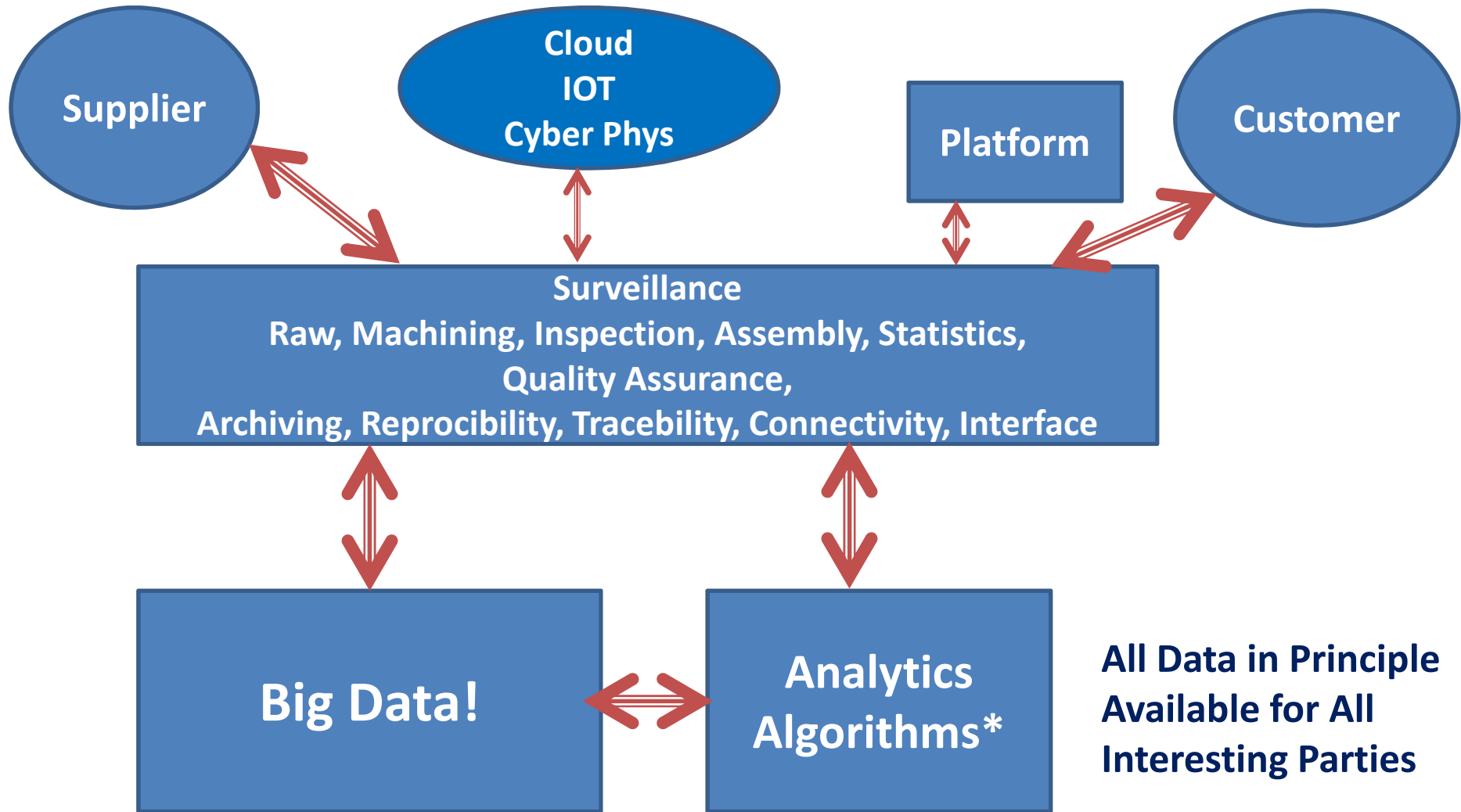




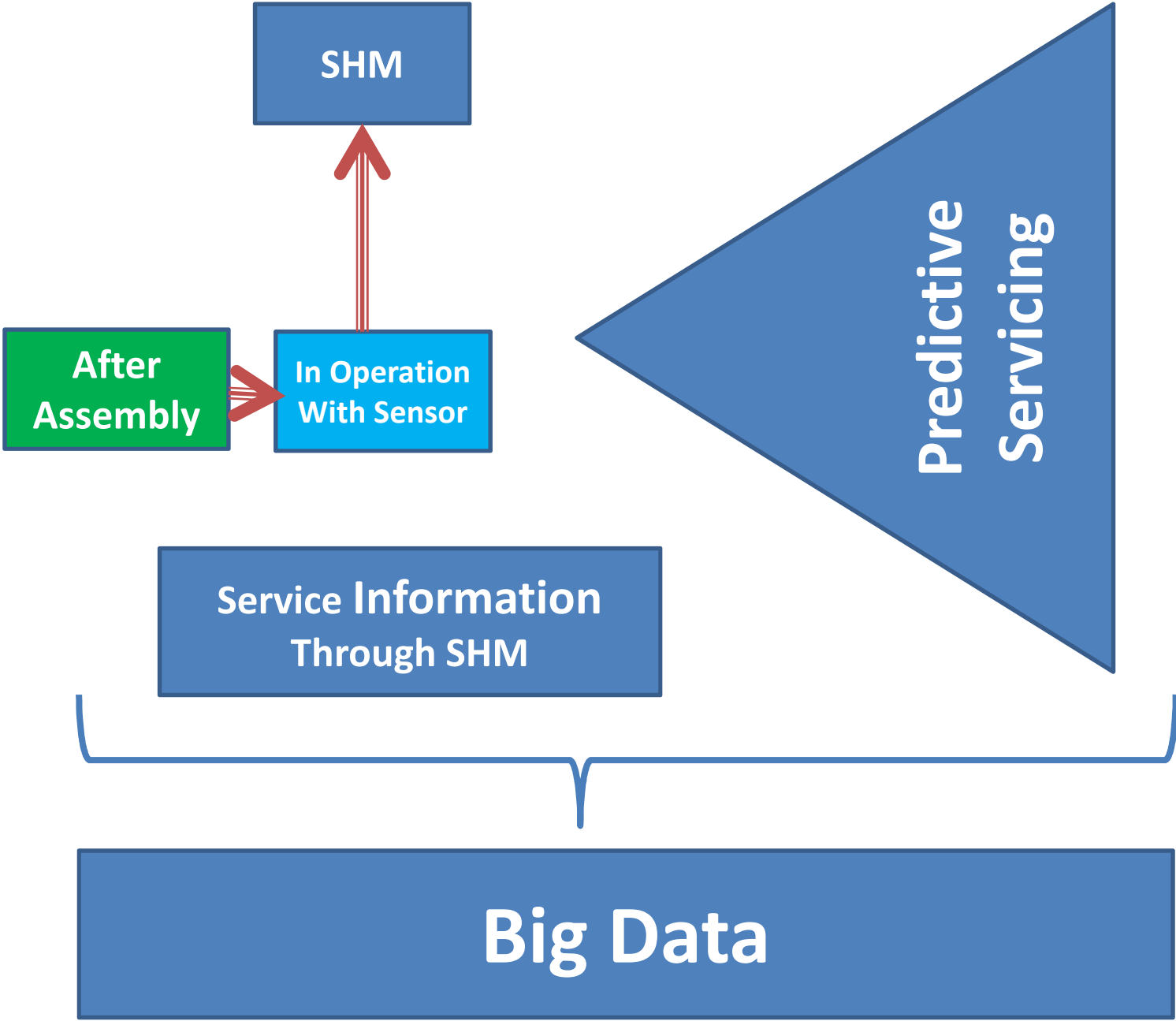
**Included
in
Big Data!**

**Archiving
Traceability**

Images: Helling GmbH; Image Processing System: BAM ic



**Complicated Situation: Solution by Algorithms versus Complex Situation: Solution by AI*



**German Society for
Non-Destructive Testing
DGZfP**

Technical Committee: ZfP 4.0

Sub-Committees:

- **Additive Manufacturing (WG)**
- **Interface, Documentation**
- **Intelligent Sensors**
- **Machine-Human Interaction**
- **Education and Training**

SWOT Analysis

Not Complete!

Strengths:

- Digitized Information
- Easy Provided for All Parties
- Data Analysis

Horizontal and Vertical Exchange of Data through:

- Cloud
- Cloud Computing
- Platforms

Weaknesses:

- Connectivity between Machine and Humans
- Standards of Digital Interfaces
- Available Personal with Adequate Qualification
- Lack of Support for SMC
- Cost for Personal and Investment in Equipment

Opportunities:

- Increase of Production
- Digital Interface between All Internal and External Procedures
- Completely Automated NDT System
- Real Time Analysis
- Real Time Detection of Problems in Development, Production, Inspection
- New Business SHM
- New Training, Education
- Use of AI

Threats:

- Acceptance by Employees
- Loss of Know How through Internet Connections
- Lack of Qualified Personal
- Hacker Attacks
- Acceptance by Society

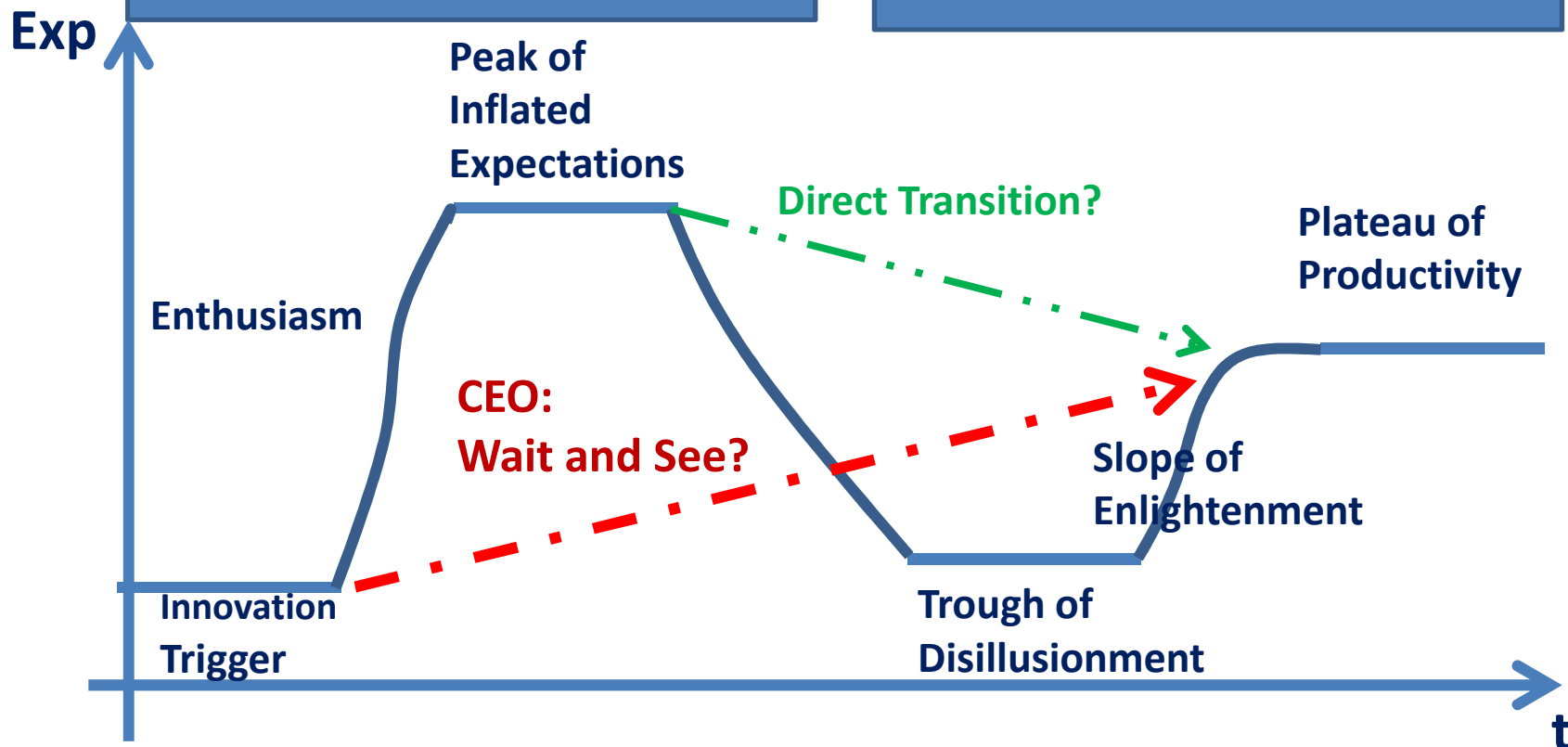
CEO's of SMB
Reluctant to Join NDT 4.0!

- Lack of Qualified Personal
- Cost of Qualified Personal
- Cost of Equipment
- Lack of Immediate Advantage

Hype (Duden)
Powerful promotion, inducing euphoric excitement for a product!

Not essentially bad!

Question:
When to Join the Hype-Curve?



Whatever Could be Thought of

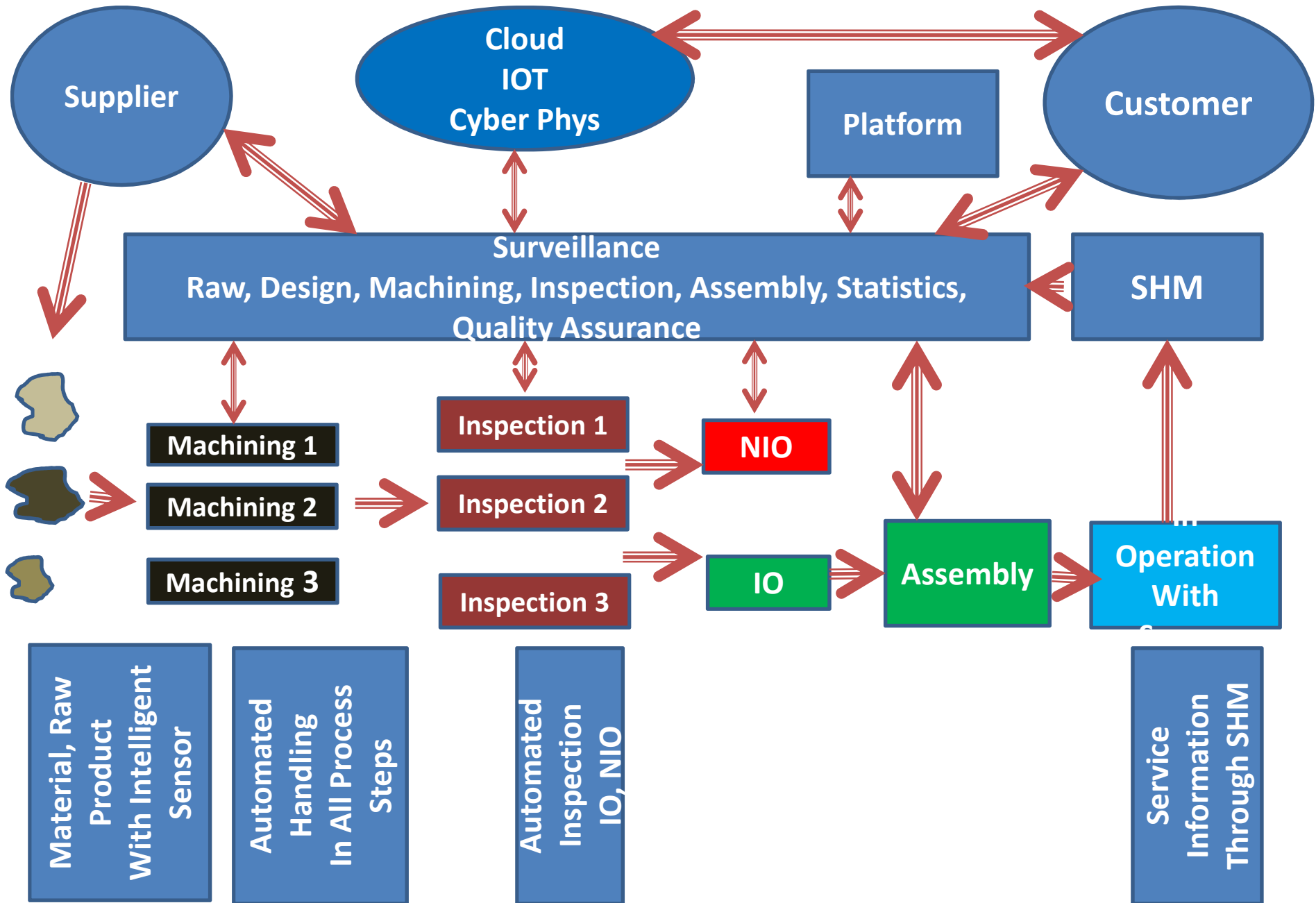
- **If Physically Achievable**
- **If it Makes Sense**

Will be Realized!!!

(Sometimes it Will be Realized

- **Even if it Makes No Sense!)**

Smart Factory and NDT 4.0





Attribution-NonCommercial 4.0 International (CC BY-ND 4.0)

This is a human-readable summary of (and not a substitute for) the [license](#). [Disclaimer](#).

You are free to:

Share — copy and redistribute the material in any medium or format for any purpose, even commercially.

The licensor cannot revoke these freedoms as long as you follow the license terms.

<https://creativecommons.org/licenses/by-nd/4.0/deed.en>