DIGITAL FACTORY

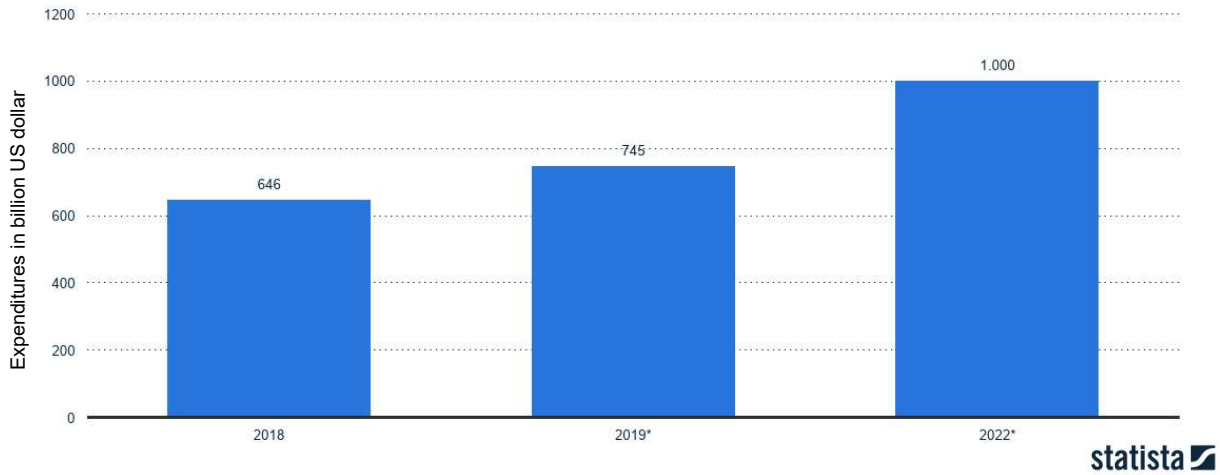
NOW

DIGITAL FACTORY NOW

The Power and Potential of Digitalization

Potential

Forecast for expenditure on the Internet of Things (IoT) worldwide in the years 2018 to 2022 (in billion US dollar)



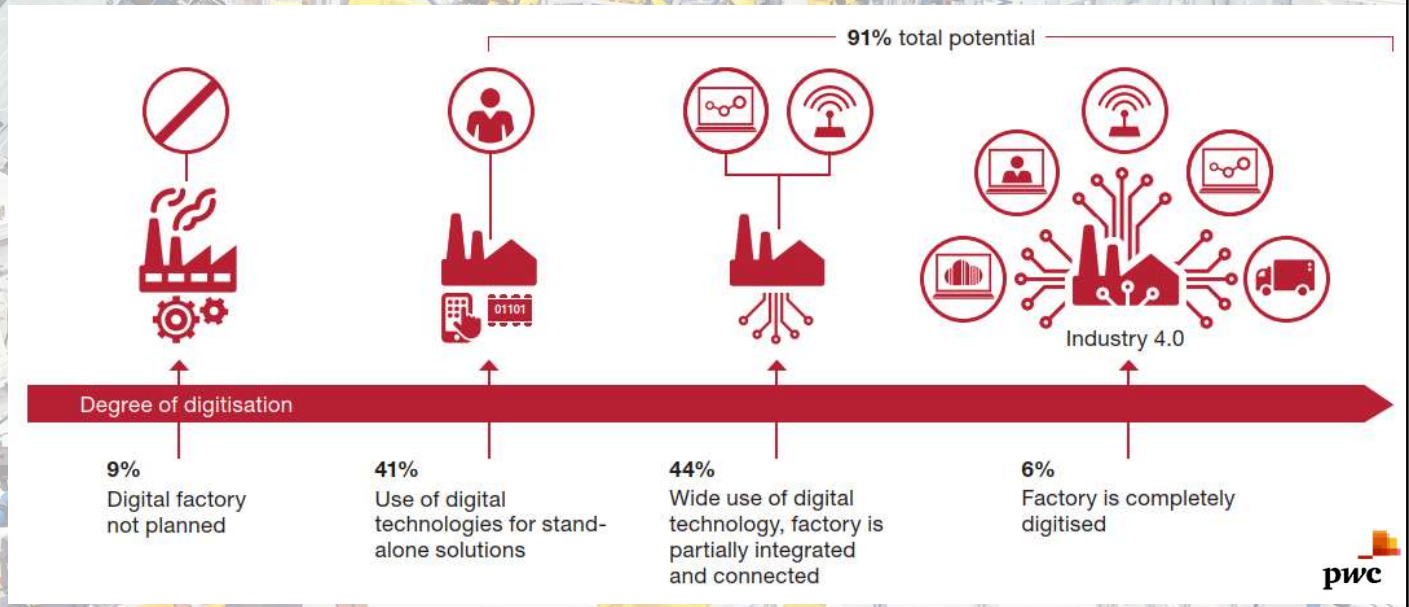
Countries all over the world are investing into digitalization

PHOENIX CONTACT
INSPIRING INNOVATIONS

Source: Statista: ID537226 (https://de.statista.com/)

Digital Factory | The power and potential of digitalization

Potential



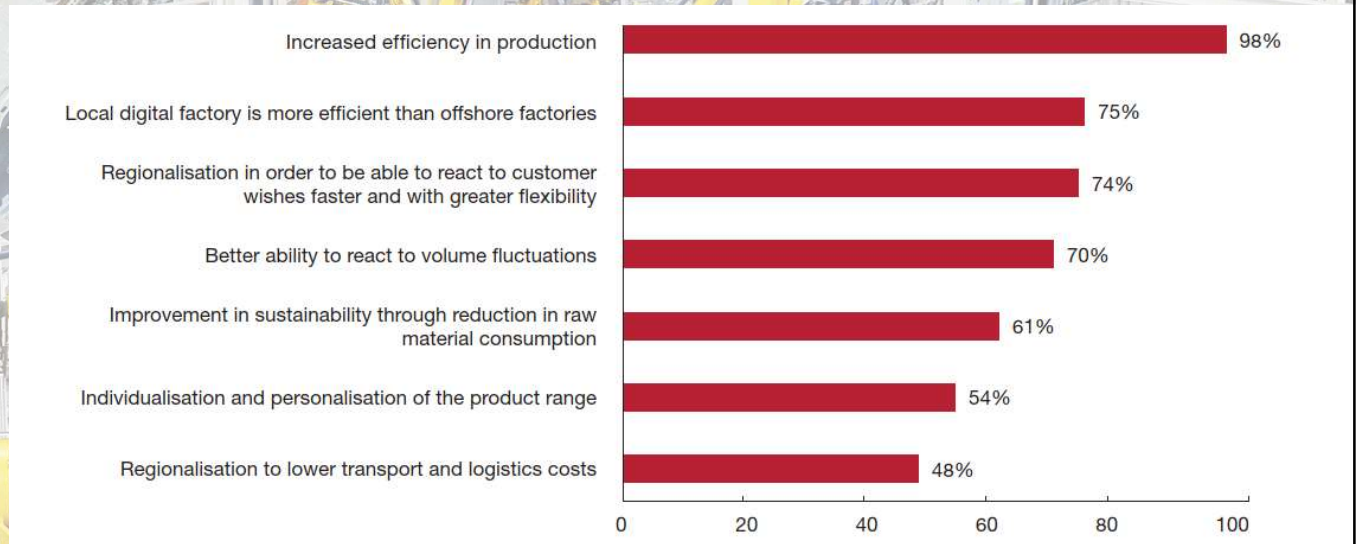
9 out of 10 companies are investing in Digital Factories

PHOENIX CONTACT
INSPIRING INNOVATIONS

Source: pwc: Digital factories 2020 - Shaping the future of manufacturing: (https://www.pwc.com/gx/en/industries/industrial-manufacturing/publications/digital-factories-2020.html)

Digital Factory | The power and potential of digitalization

Why invest in Digital Factories?



Q: What are your significant reasons for setting up or expanding digital factories?
Base: Respondents planning to set up or expand digital factories

pwc

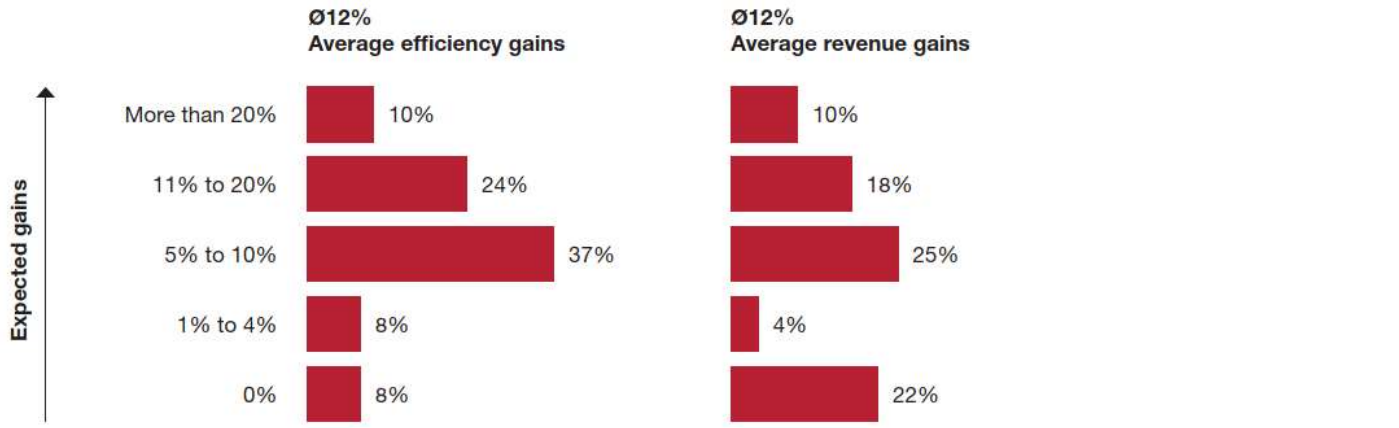
Efficiency and customer centricity are top reasons for expanding Digital Factories

PHOENIX CONTACT
INSPIRING INNOVATIONS

Source: pwc: Digital factories 2020 - Shaping the future of manufacturing: (https://www.pwc.com/gx/en/industries/industrial-manufacturing/publications/digital-factories-2020.html)

Digital Factory | The power and potential of digitalization

Why invest in Digital Factories?



Q: An efficiency gain by how many percent in comparison to now do you expect for your company over the next five years from digital factories? A revenues gain by how many percent in comparison to now do you expect for your company over the next five years from digital factories?

Base: Respondents whose companies have or are planning a digital factory or the use of at least one digital concept

pwc

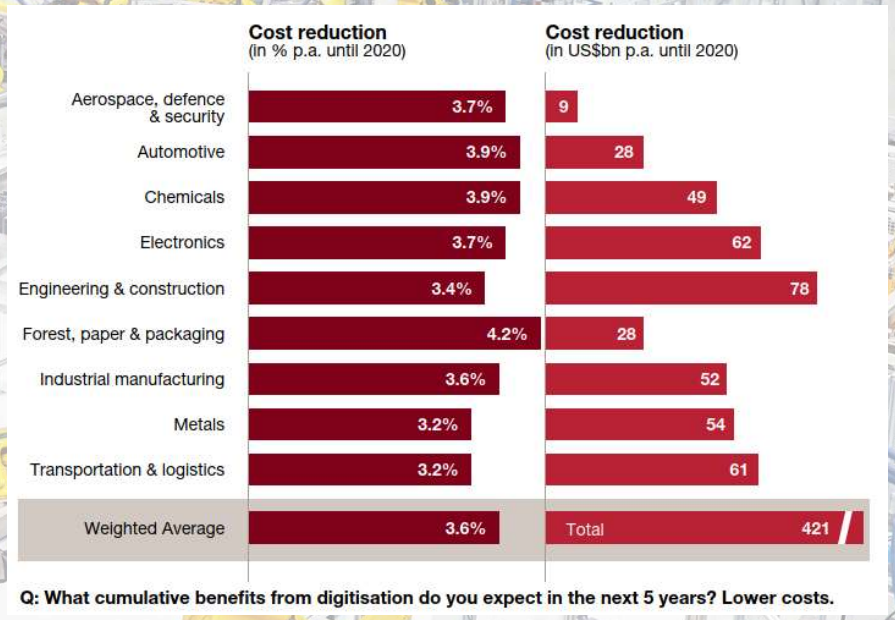
Respondents expect both efficiency and revenue gains of 12% on average over the next 5 years

PHOENIX CONTACT
INSPIRING INNOVATIONS

Source: pwc: Digital factories 2020 - Shaping the future of manufacturing: (https://www.pwc.com/gx/en/industries/industrial-manufacturing/publications/digital-factories-2020.html)

Digital Factory | The power and potential of digitalization

Why invest in Digital Factories?



pwc

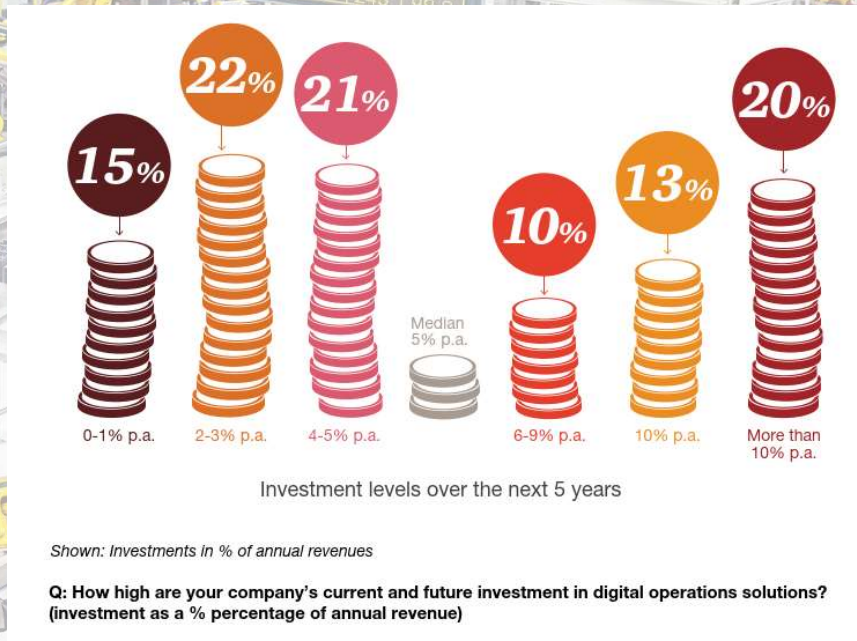
Companies in every industry sector expect significant cost reductions

PHOENIX CONTACT
INSPIRING INNOVATIONS

Source: pwc: Industry 4.0 - Building the digital enterprise (https://www.pwc.com/gx/en/industries/industries-4.0/landing-page/industry-4.0-building-your-digital-enterprise-april-2016.pdf)

Digital Factory | The power and potential of digitalization

Why invest in Digital Factories?



pwc

Companies that do not strategically invest will lose competitive advantage

PHOENIX CONTACT
INSPIRING INNOVATIONS

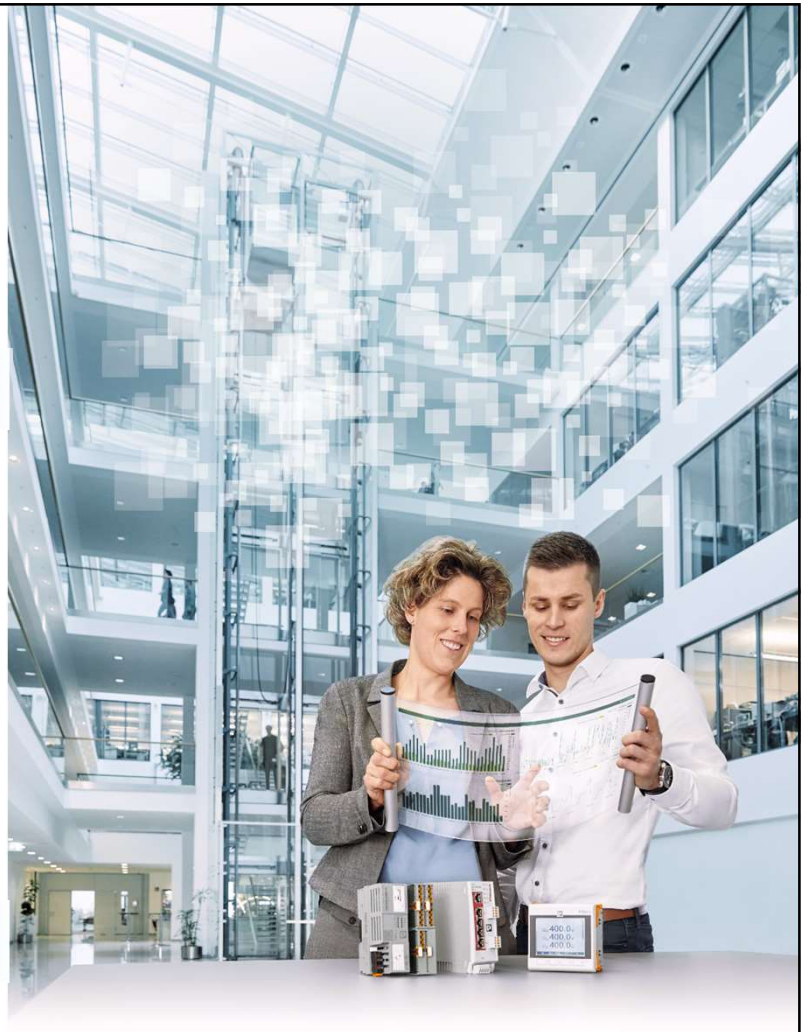
Source: pwc: Industry 4.0 - Building the digital enterprise (https://www.pwc.com/gx/en/industries/industries-4.0/landing-page/industry-4.0-building-your-digital-enterprise-april-2016.pdf)

Digital Factory | The power and potential of digitalization

Digitalization and mankind

Digitalization does not replace people

Digitalization creates new jobs



PHOENIX CONTACT
INSPIRING INNOVATIONS

DIGITAL FACTORY

NOW

From a Factory to a Digital Factory

Digital Factory

PHOENIX CONTACT
INSPIRING INNOVATIONS

Digitalization changes our world

Flexible consumption

New, data centric business models

Mass customization

Economic production with batch size one

Smart devices / IoT

Networked systems as a basis

Knowledge sharing

Lack of skilled workers and efficient development processes

PHOENIX CONTACT
INSPIRING INNOVATIONS

Goals of Digital Factory

1. **Optimized production**
2. **Reduced costs**
3. **Idea-to-cash**

PHOENIX CONTACT
INSPIRING INNOVATIONS

Digital Factory | From a factory to a Digital Factory

Customer requirements and benefits

Enable new ideas

The Digital Factory transfers data into information. This information will be used to optimize processes and reduce costs.

- New business models
- Idea-to-cash

Flexible infrastructure

Our solutions are scalable to respond quickly to growth potentials. Independent on the factory and production size and amount of data – we are able to adapt a solution to every industry.

- Optimized production
- Update capability

Proof-of-concept

Everything was proven in our own production facility. From concept to maintenance, we provide finished and tested use cases.

- Reduced engineering costs
- Benefit from experience

PHOENIX CONTACT
INSPIRING INNOVATIONS

Challenges

- Extract relevant information from a huge amount of data automatically
- Get more information output with lower investment
- Reduced engineering costs by increasing automation and communication

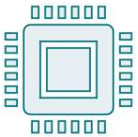
Technological aspects (technology push)

Industrial revolution

1.	Mechanical production	18th century
2.	Mass production	1870
3.	Automation of production	1969
4.	IIoT	Currently

- Steam machine
- Simplify and accelerate hard work

- Sequential work flow
- Increased production rate



- From relay to PLC
- Flexible control adaptions

- **Every device is connected**
- **Big data**

Illustration according to:
G. Reinhart, Handbuch Industrie 4.0, S.XXXI

PHOENIX CONTACT
INSPIRING INNOVATIONS

Changes through Digital Transformation

BEFORE INTERNET

- Clipboard
- Stack lights
- Memos
- Meeting
- Scheduler board
- Push buttons
- Phone calls
- Bells
- Daily reports

DIGITAL TRANSFORMATION

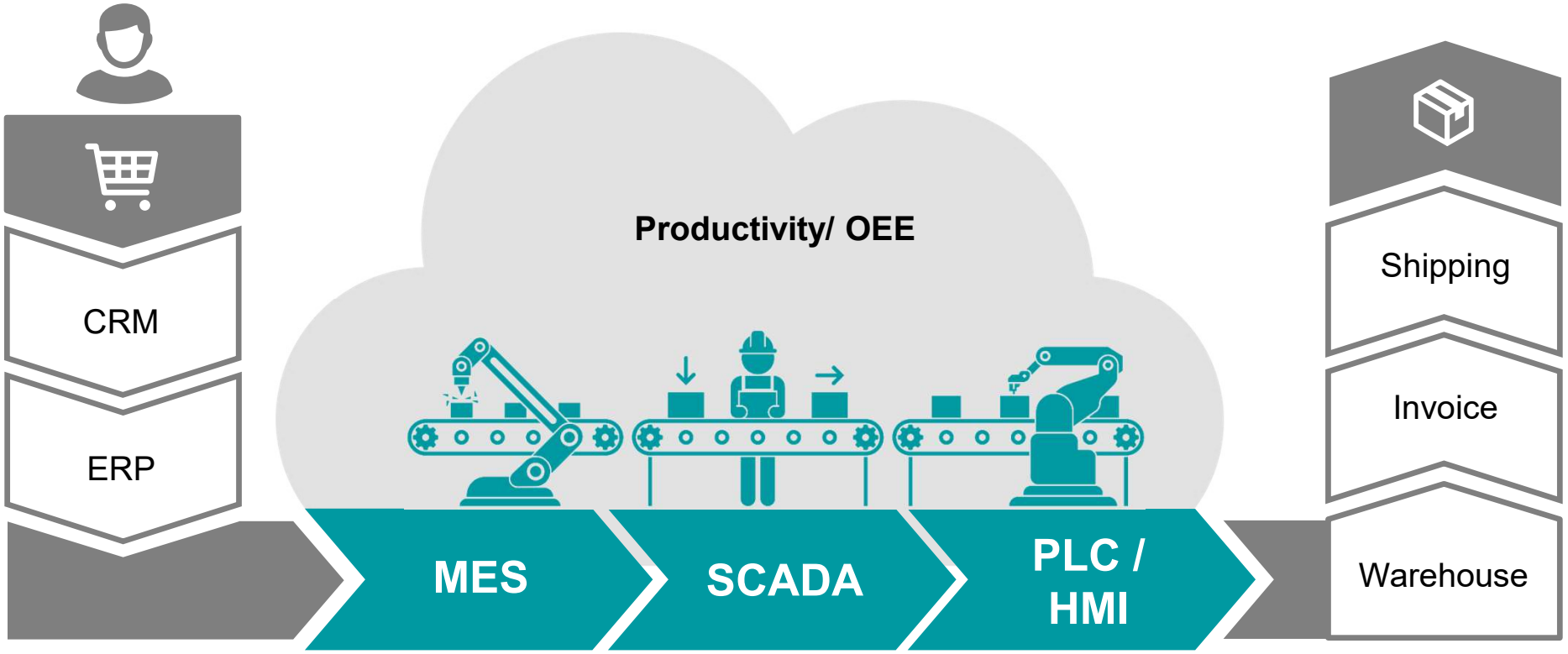
Process information available and accessible from everywhere
– No PAPER –

How to do the move to a Digital Factory?

WITH INTERNET

- E-mail/ SMS
- Andon board/ notification
- Digital comments (MES)
- Webpage (machine)
- Teams/ Zoom (Flow)
- Digital/ realtime
- Control room/ MES/ SCADA
- Video messaging
- Realtime opportunities

Why do many digitalization strategies fail?



OEE = Overall equipment effectiveness

PHOENIX CONTACT
INSPIRING INNOVATIONS

How to calculate OEE (overall equipment effectiveness)

1. Locate source of inefficiencies
2. Quantify the degree of inefficiency

OEE combines three factors:

Availability (**A**)	100% machine is available at scheduled time
Performance (**P**)	100% performance at max. speed
Quality (**Q**)	100% of all parts are OK

$$OEE = A * P * Q$$

PHOENIX CONTACT
INSPIRING INNOVATIONS

The six big losses of OEE

A. Planned output

B. Gross output

C. Net output

D. Valuable output

5. Start up scrap
6. Scrap

3. Idling
4. Reduced speed

1. Breakdowns
2. Set-ups & changeover

$$\underbrace{\frac{Gross\ output}{Planned\ output}}_{\downarrow\ Availability\ rate\ \boldsymbol{A}} * \underbrace{\frac{Net\ output}{Gross\ output}}_{\downarrow\ Performance\ rate\ \boldsymbol{P}} * \underbrace{\frac{Valuable\ output}{Net\ output}}_{\downarrow\ Quality\ rate\ \boldsymbol{Q}} = \boldsymbol{OEE}$$

PHOENIX CONTACT
INSPIRING INNOVATIONS

How to move to a Digital Factory?

Digital Transformation

- Digitization of business
  - No paper
  - Unified data
- Gather information with actual data
- Use of digitalization **to inform and guide** people

Industry 4.0

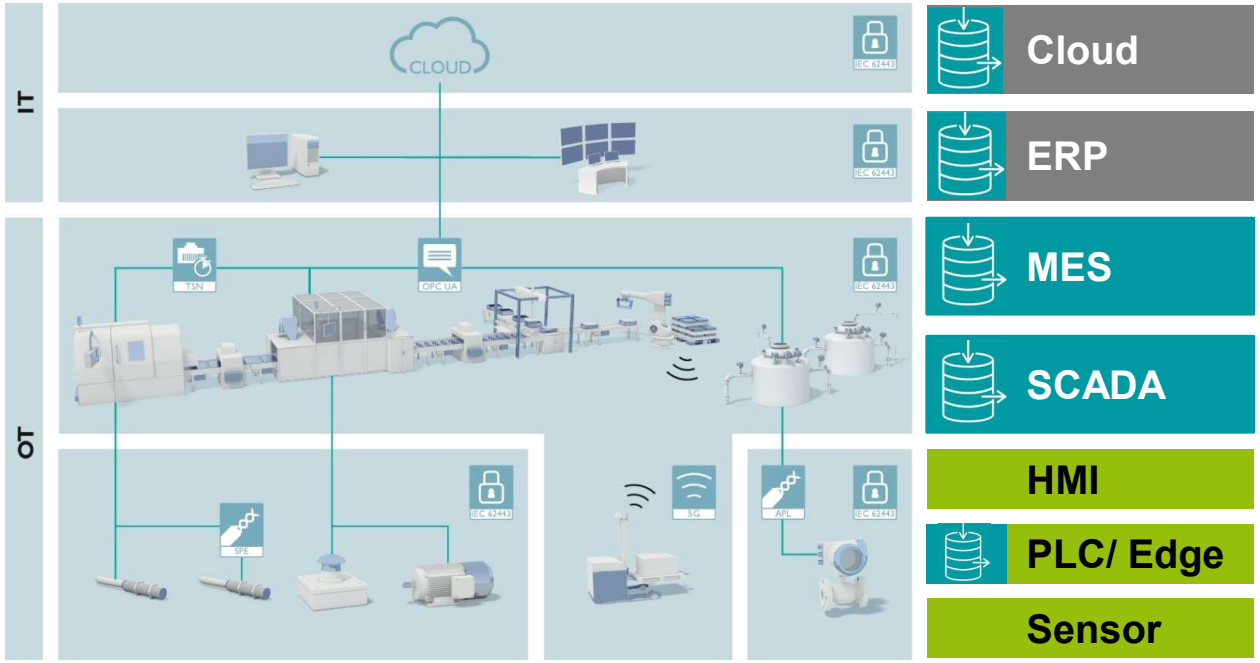
- 4th industrial revolution
  - Network/ technology
  - Standards/ protocols
- Smart production principles
  - Connection of all machines and systems
  - Open architecture

Digital Factory

- The result of Digital Transformation and Industry 4.0
- Information from each producer to each consumer
- Available data anytime, everywhere
- Translation of data into information

PHOENIX CONTACT
INSPIRING INNOVATIONS

Why does the current architecture prevent innovation?



Cloud

ERP

MES

SCADA

HMI

PLC/ Edge

Sensor

Solut ntered

- No normalization
- No abstraction
- No standard
- Only high-value projects
- Data silos

Show stopper for optimization projects !

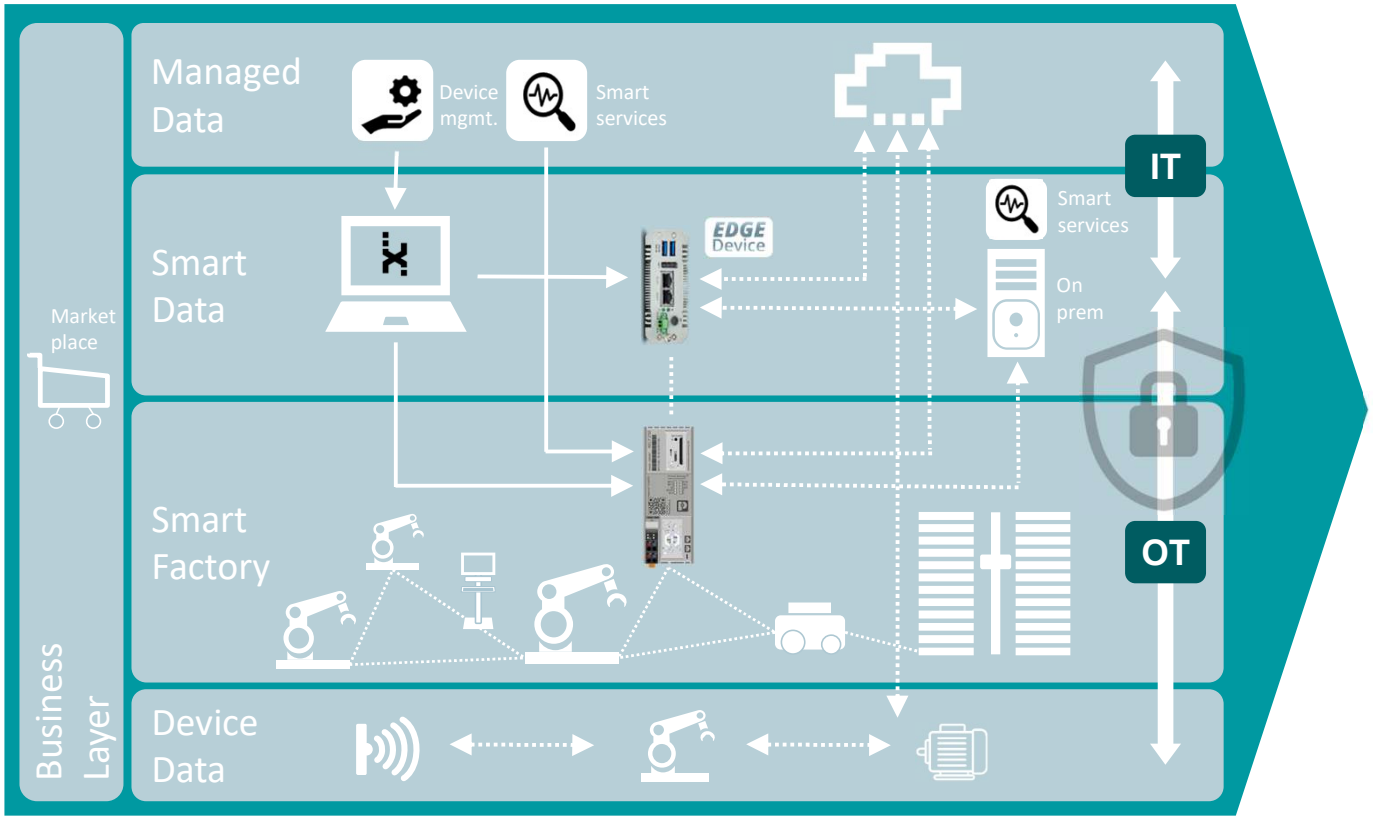
PHOENIX CONTACT
INSPIRING INNOVATIONS

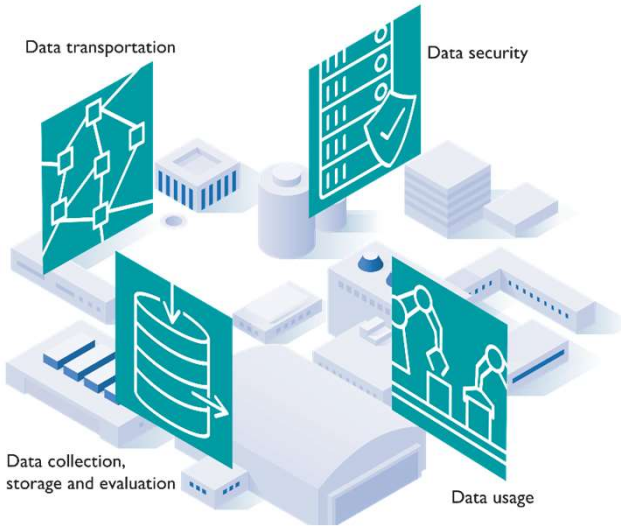
What Is Industry 4.0 and Smart Manufacturing? 2019 META SMART FACTORY

PHOENIX CONTACT
INSPIRING INNOVATIONS

Digital Factory | From a factory to a Digital Factory

Create a solution to enable factory optimization

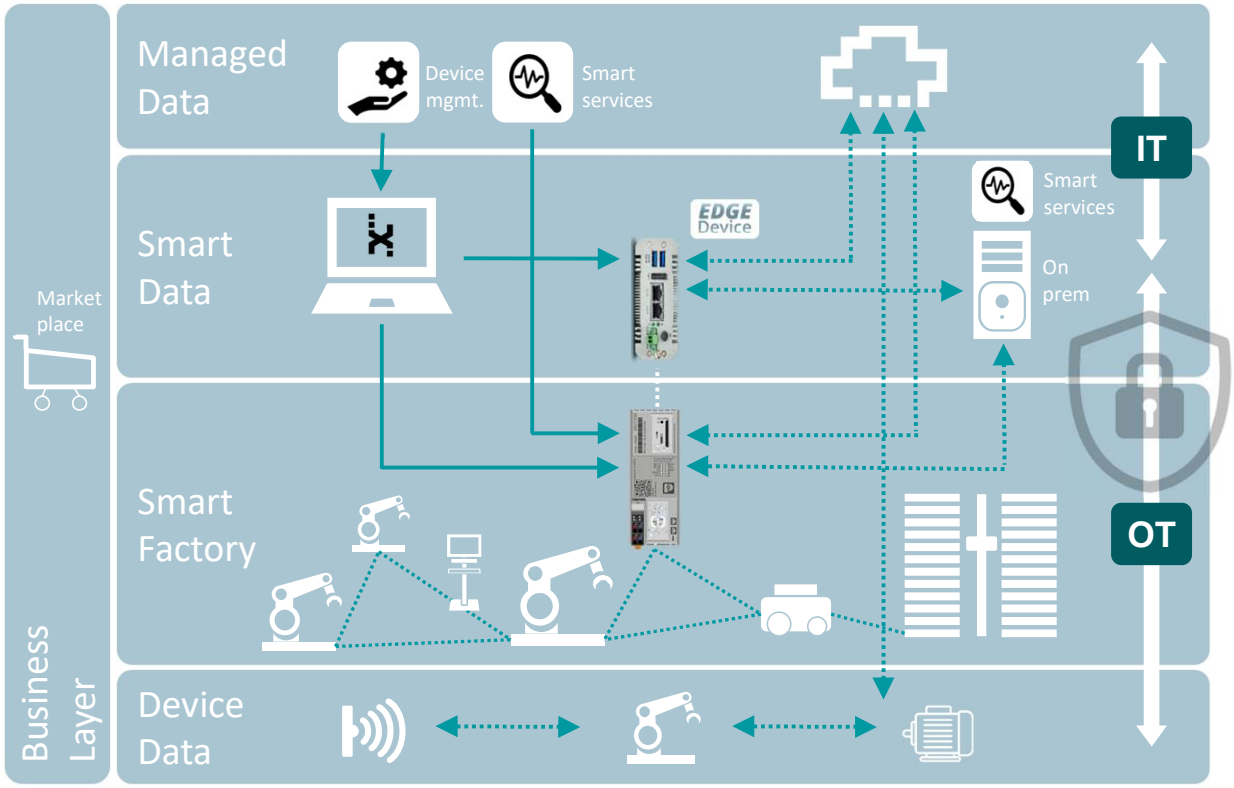




PHOENIX CONTACT
INSPIRING INNOVATIONS

Digital Factory | From a factory to a Digital Factory

Application-oriented customer approach



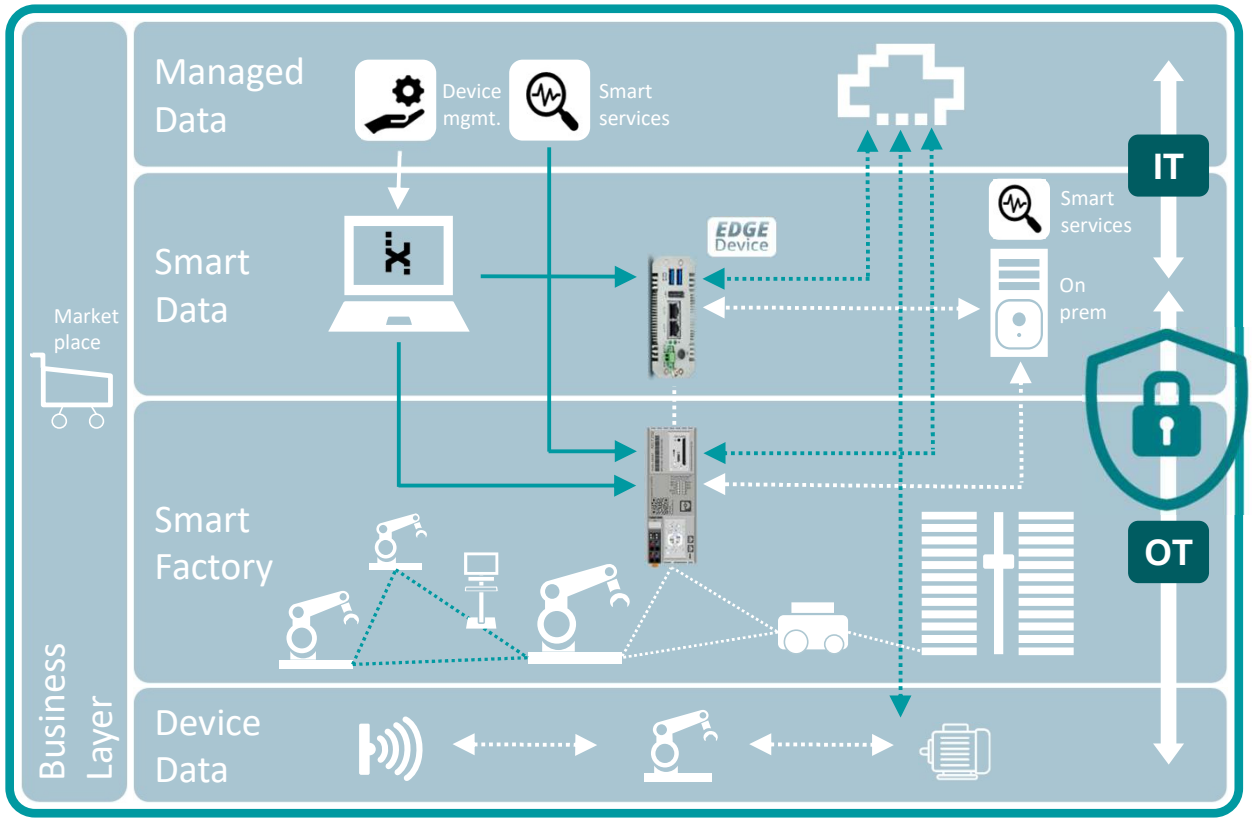
Data transportation

- Network structuring and management
- Ensure data quality and bandwidth
- Select the ideal digital infrastructure

PHOENIX CONTACT
INSPIRING INNOVATIONS

Digital Factory | From a factory to a Digital Factory

Application-oriented customer approach



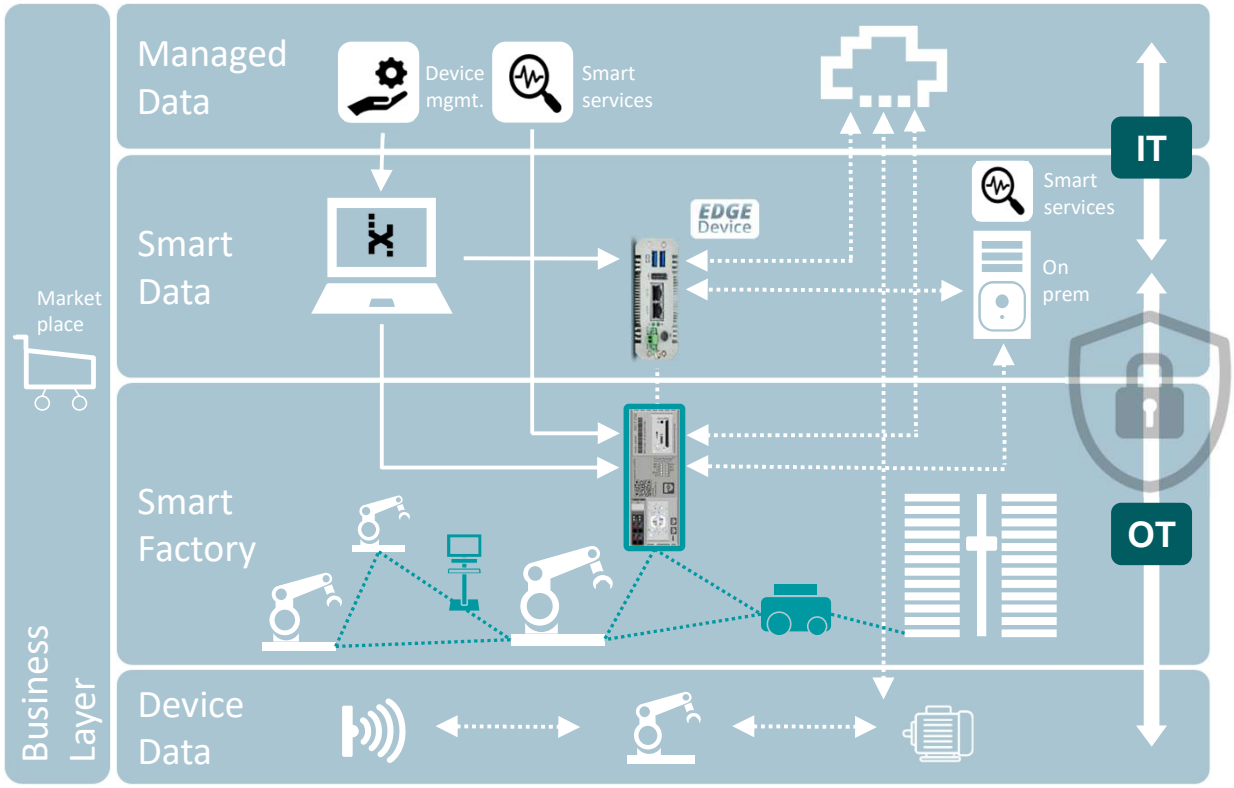
Data security

- Protect the factory against hacker attacks
- Ensure a state-of-the-art protection
- Worldwide support

PHOENIX CONTACT
INSPIRING INNOVATIONS

Digital Factory | From a factory to a Digital Factory

Application-oriented customer approach

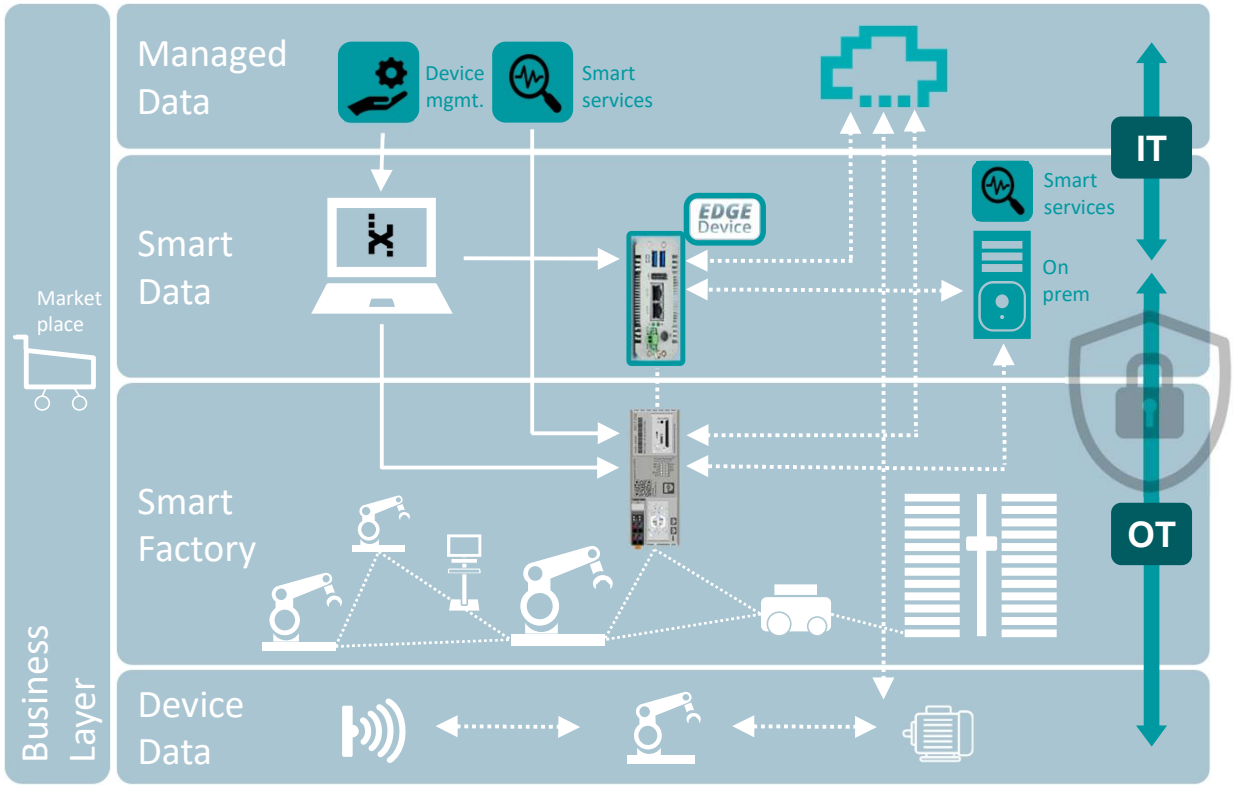


Data usage

- Smart production
- Horizontal and vertical integration – easy and fast
- Ensure openness to other systems

PHOENIX CONTACT
INSPIRING INNOVATIONS

Application-oriented customer approach



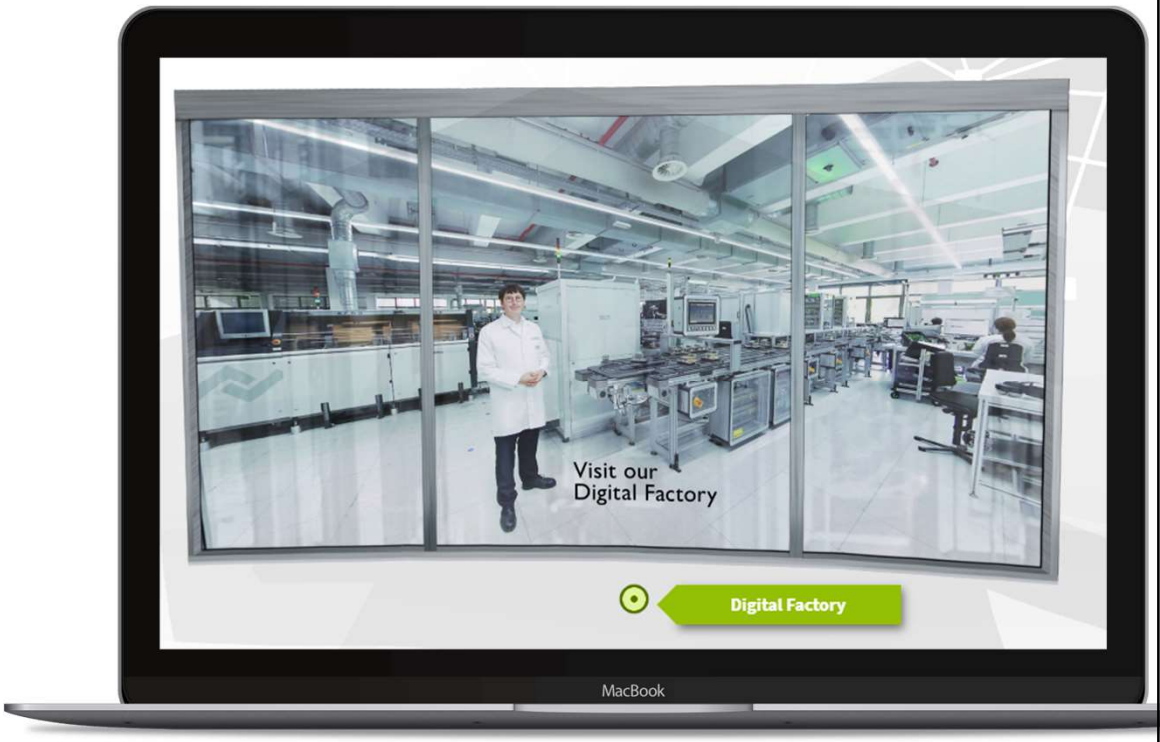
Data collection, storage and evaluation

- Data acquisition with full connection from OT to IT
- Ensure normalized data
- Transform data into information

PHOENIX CONTACT
INSPIRING INNOVATIONS

Digital Factory | From a factory to a Digital Factory

Proof-of-concept in our own Factory in Bad Pyrmont



PHOENIX CONTACT
INSPIRING INNOVATIONS

DIGITAL FACTORY

NOW

Our Uses Cases for your Productivity Increase

Segments of Digital Factory

Data transportation

Network structuring and management

Data collection, storage and evaluation

Data conversion into information

Data security

Investment protection against unwanted access

Data usage

Simple horizontal and vertical integration

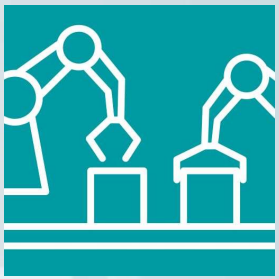
PHOENIX CONTACT
INSPIRING INNOVATIONS

How to Turn a Regular Factory into a Smart Factory | Joachim Hensch | TEDxDEU

PHOENIX CONTACT
INSPIRING INNOVATIONS

DIGITAL FACTORY

NOW



Data Usage

Digital Factory

Data usage

- Easy and fast integration
- Openness to other systems
- Reduced engineering costs

Smart production

Flexible production with AGVs

PHOENIX CONTACT
INSPIRING INNOVATIONS

Digital Factory | Data usage

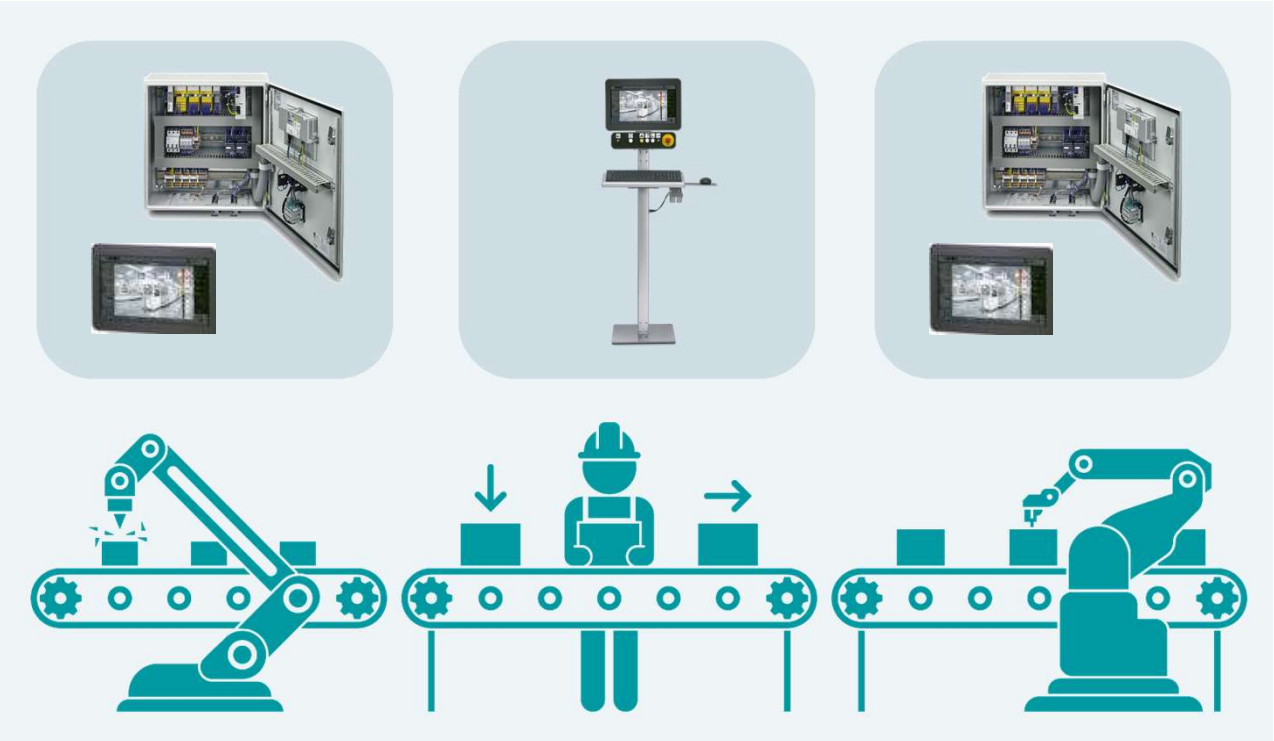
Implementation of a smart production

A smart production is based on a good integration

- 3 important functional aspects
  1. Automation and control of the machine
     (cobot, manual workstation, quality monitoring ...)
  2. Horizontal integration
     (safety, data, energy, status ...)
  3. Vertical integration leads to a Smart Factory
     (MES, ERP, IT systems ...)
- ROI is the main focus
  1. Faster implementation speed
  2. Error reduction
  3. Update capability/ openness

PHOENIX CONTACT
INSPIRING INNOVATIONS

Existing production line



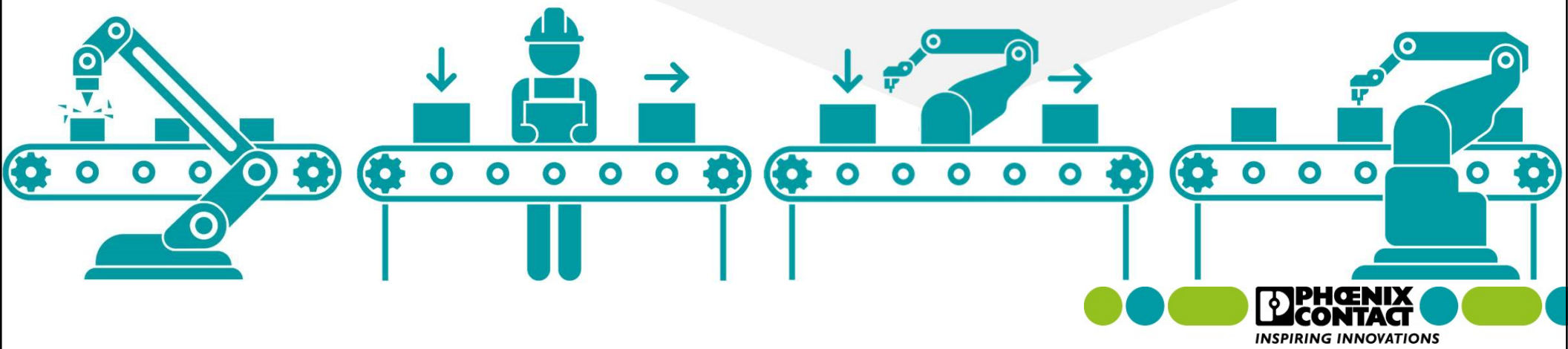
Each machine or working place has:

- Automation needs
- Information needs
- Safety requirements

What are the requirements for a new machine?

Integration requirements

- Cabinet with automation hardware
- Engineering of PLC, HMI and line integration
- Integration in global emergency stop
- Connection to IT level (MES, ERP ...)

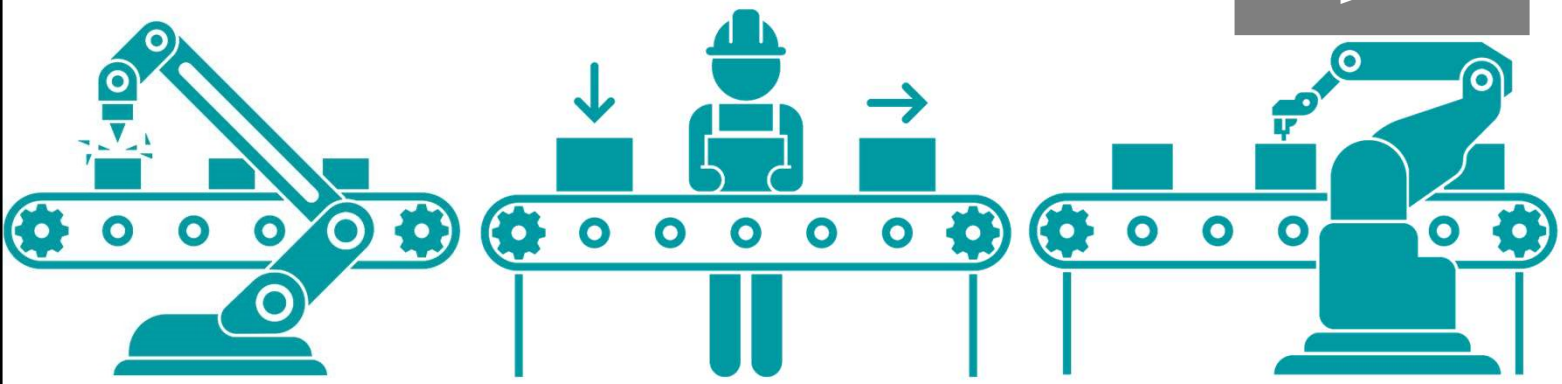


PHOENIX CONTACT
INSPIRING INNOVATIONS

Digital Factory | Data usage

Where do we spend too much money?

A **new machine** must be **integrated**



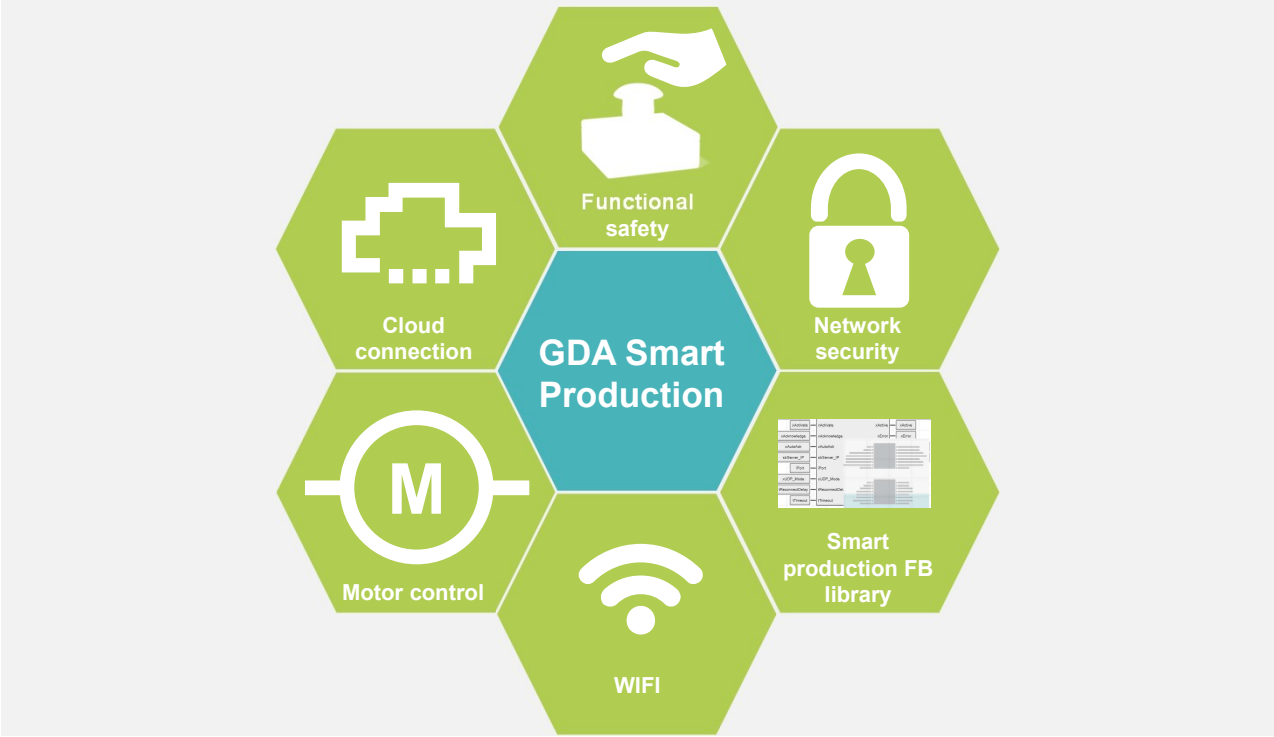
PHOENIX CONTACT
INSPIRING INNOVATIONS

Digital Factory | Data usage

A Smart Factory needs smart integration

Smart integration

- Parameterization instead of programming
- Integration in any system
- Standard IoT interfaces
- AI compatibility
- Open and future-proof



PHOENIX CONTACT
INSPIRING INNOVATIONS

Digital Factory | Data usage

ROI project

- Reduced set-up time by using PoC
- Less engineering costs
- Shorter delivery time
- Reduced error searching
- Open and future-proof

Example: cobot integration

PHOENIX CONTACT
INSPIRING INNOVATIONS

DIGITAL FACTORY

NOW

Summary

Our value proposition for your Digital Factory

In order to meet today's digitalization requirements and profitably realize opportunities, our solutions offer you the following added values:

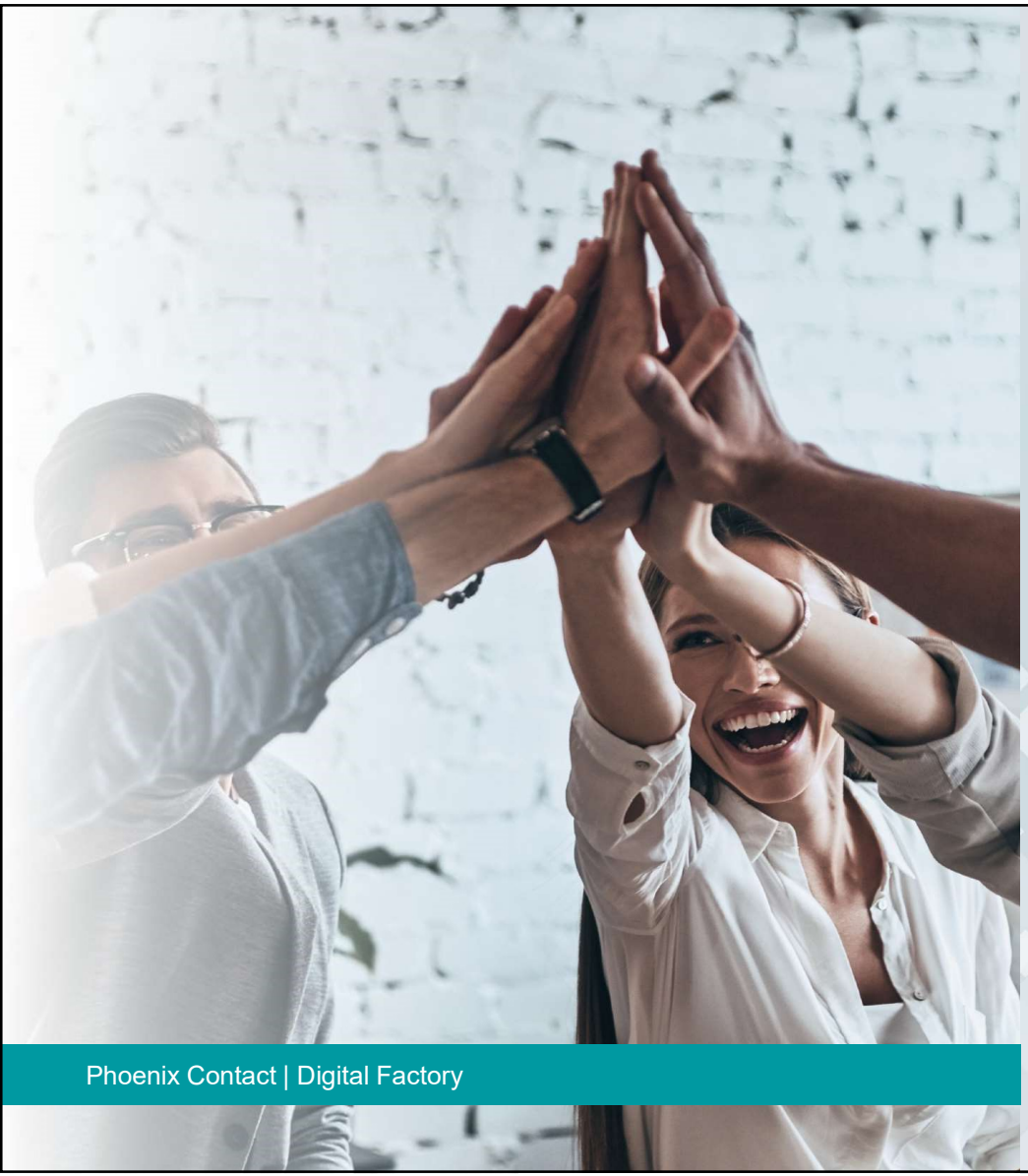
- Scalable – individually tailored your requirements
- Tested and validated – in our own production
- Ready-to-use – benefit from the Digital Transformation today

With goal-oriented consulting, we find together the right solution for your Digital Factory. Let's tackle the challenges of digitalization together and seize the opportunities.

PHOENIX CONTACT
INSPIRING INNOVATIONS

Industry 4.0 | Model Factory **Singapur** **Agency for Science Technology and Research**

PHOENIX CONTACT
INSPIRING INNOVATIONS



Phoenix Contact | Digital Factory

DIGITAL FACTORY

NOW