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A.T. Kearney

Industry 4.0

Key speech
Munich, February 19, 2018

Dr. Joerg Schrottke

A.T. Kearney used the text and charts compiled in this report in a presentation; they do not represent a complete documentation of the presentation.

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The business environment is changing holistically

Change

Customer

- Anything, anytime, anywhere
- Personalization
- Connected consumers

Competition

- Faster innovation cycles
- Partnering approaches
- New entrants

Technology

- Cheaper and more application fields
- Increasing data availability
- Exponentially growing computing power & intelligence

Source: A.T. Kearney

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Production landscape is change-impacted

End-2-end value chain impact

Sectors included in production: manufacturing, trade, transportation and warehousing and support (engineering, design, admin…)

Production within global industrial goods industries

Collectively, these sectors have been a source of economic growth for developed and developing nations alike, providing well-paid jobs for an increasingly skilled workforce and contributing disproportionately to innovation and exports

~30%

Global GDP contribution

850+ mn

Jobs worldwide

>70%

Global innovation *(patents)*

>80%

Global exports

Source: A.T. Kearney and the World Economic Forum

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What is changing?

How we design ….

From "designing for manufacturing" to….

- Algorithmic design optimization
- Customer co-creation
- Functionally graded, custom materials
- **Voxel level control**

How we produce ….

From mass production to….

- Fewer processing steps, shorter lead time
- No / limited tooling required
- Reduction in fixed assets, CapEx
- Shorter lead times
- **Batch size of 1**

Where we interact …

From global supply chains to….

- Multi-component consolidation
- On-location production and use
- High ratio of productive output to space utilized (micro factories)
- **Distributed Production and reshoring**

How we work… ***How we skill…*** ***How we consume…***

How we compete… ***How we partner…*** ***How we sell…*** ***How we reuse / dispose…***

Companies are challenged on how cope with all changes

Challenge

Selection

Source: A.T. Kearney

Objective of today's speech

1. **Provide an overview how industrial goods companies are impacted by Digital trends**
2. Provide examples how different companies used digitization to enable or modify their business model
3. Give an overview on key success factors for industrial goods companies to win in Digital

Source: A.T. Kearney

One industry after the other is impacted by Digital – industrial goods still away from tipping point but pulled by its customers

Calibration

	Lagging	Digital escalation	New normal
Forward looking indicators	• Little exploitation of Digital opportunities	• Fast increase in Digital channel penetration • Price transparency and declining margins • Value chains atomizing	• start-ups coming in and pulling the trigger on incumbents • Old leaders decline and disappear
% revenue via Digital	<5%	~5-40%	>40%
Sectors (indicative)	• Chemicals • Infrastructure • Oil and Gas • Pulp & Paper/Forest • Semiconductors • Adhesives	• Consumer & Packaged goods • Industrial goods • Logistics • Retail banking & insurance • Telecom • Healthcare	• High-tech/IT giants & start-ups • Online media • Travel (Online) • Media (Print, Music) • Travel (High street) • Retailers
Digital revenue wave			

Source: Expert interviews; A.T. Kearney

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Disruptive drivers push Digital into industrial goods industry

Digital drivers

Disruptive technologies

... matured, scaled and became cost-efficient accelerating machine connectivity

Changing customer needs

… for Digital solutions to increase convenience and efficiency in B2C and B2B interactions

Market development

… towards new channels to research (e.g. social media like video platforms, blogs) and buy (e.g. online shop) – 360° customer journey

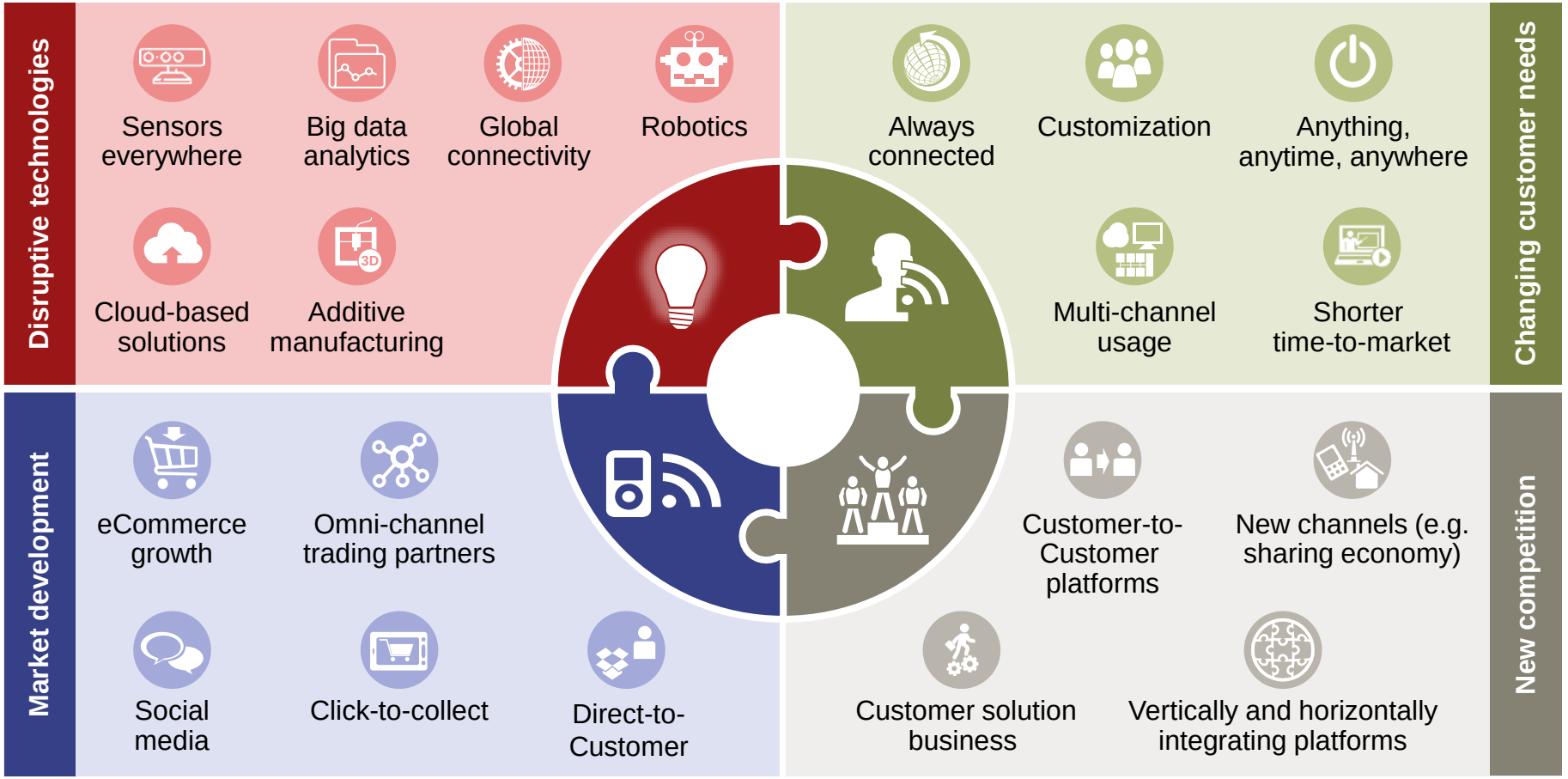
New competition

… from new entrants (end-to-end platforms, customer-to-customer platforms), but also start of solution business with customer lock-in

Source: A.T. Kearney

The Digital environment is fast paced and is gaining speed

Digital drivers – selected examples



Source: A.T. Kearney

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4 key capabilities are core, which in combination lead to blurred lines between physical, digital and human

Capabilities

Connectivity & Computing Power

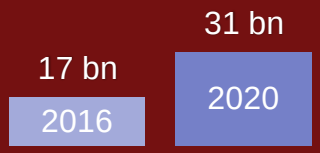
Internet of Things

Connecting the unconnected

85%

Of production assets today are still unconnected

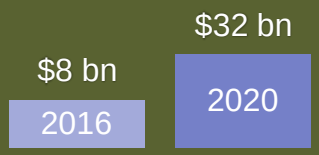
Number of IoT devices



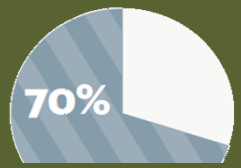
Analytics & Intelligence

Artificial Intelligence

Coming of age



70% of captured production data goes unused – ***AI can change that***



Human – Machine interface

Wearables

Digitizing the workforce

$700 mn market, projected to grow to **$5 bn by 2020**

Most industries still in early stages of adoption

Digital – Physical transformation

Advanced Robotics

Emerging from the cage

$38 bn market

250,000 units sold in 2015 – projected to grow to 400,000 units by 2020

10%

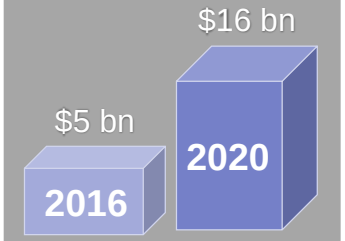
Handles 10% of production tasks today

Rising to 45% by 2030

3D Printing

Shaping the future one layer at a time

Global Market

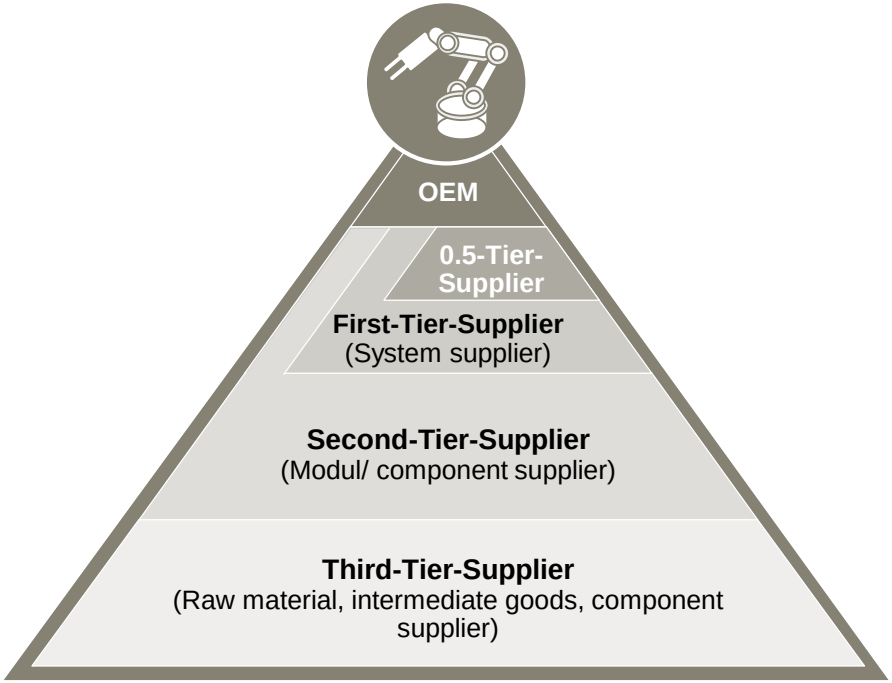


Recent surge in metal capabilities

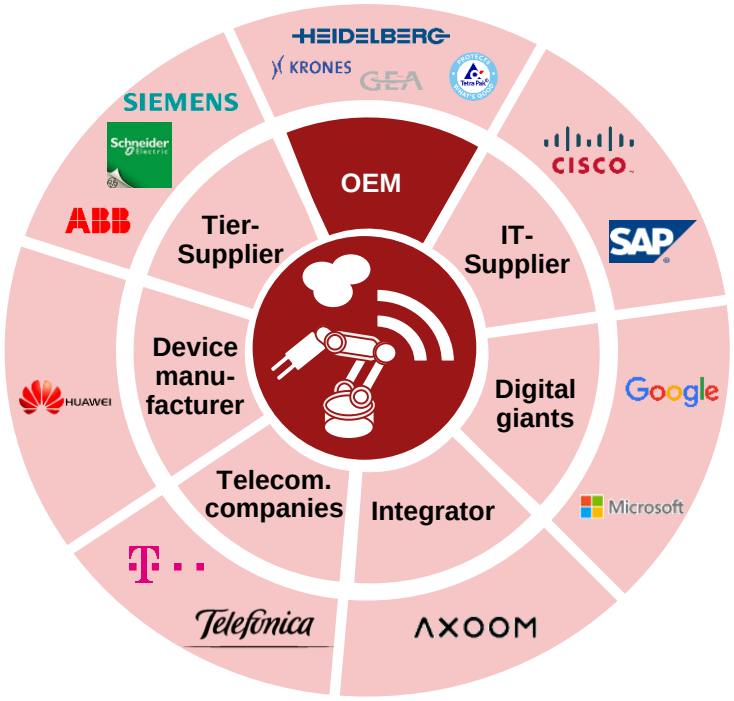
Source: A.T. Kearney

Digital reshuffles traditional hierarchy of customer interaction

Existing logics



New logics



Various players aim to take a cut in the software value share

Source: A.T. Kearney

Industrial goods companies face common Digital challenges

Client examples

Business model-wise

Digital to fuel growth	• Capture **new revenue streams** and **differentiate against competition** • Drive business via **customer centricity** and expanding into new markets/segments
Digital to protect status quo	• Adopt to **changing customer behavior** and expectations along **customer journey** • Hedge against **break-through innovation**

Technology-wise

New implementation logics	• **Heterogeneous protocols**/ integration of new ecosystems in industrial automation pyramid • Convergence of **distributed** and **centralized intelligence**
New interaction logics	• **Scalable platforms** and more dynamic resource management • More **ubiquitous user interface** i.e. at the machine, centrally or on a portable device

Source: A.T. Kearney

Customers' value perception shifts from hardware to software – industrial goods companies are preparing

Non-exhaustive

BOSCH

- ~ 2/3 of portfolio is currently connected – 100% targeted in 2020
- ~ 15,000 software developers employed
- ~ 50% of open positions are in the field of IT or software

GE

- > $1 bn investment in software center of excellence
- > 1,000 software developers and data scientists
- > 20,000 developers in community for Predix

HITACHI
Inspire the Next

- ~ $2.8 bn investment into IoT R&D over next 3 years
- ~ $5.4 bn revenues with IoT solutions (6% of total revenues)
- ~ 16,000 employees in digital businesses

Honeywell

- Acquisition of Movilizer, a cloud-solution software provider
- Transition to "software-engineering" company targeted for 2020

SIEMENS

- ~ $4.5 bn investment for acquisition of software developer in 2016
- ~ 5% of revenues generated with software solutions in 2016
- > 17,500 software engineers (~ 5% of employees)

TRUMPF

- Investment into software platform (Axoom) to connect supply chains end-to-end
- Hiring of more software developers than mechanical engineers in 2015

Source: Bosch; GE; Siemens; Trumpf; Manager Magazine; Honeywell; Hitachi; A.T. Kearney

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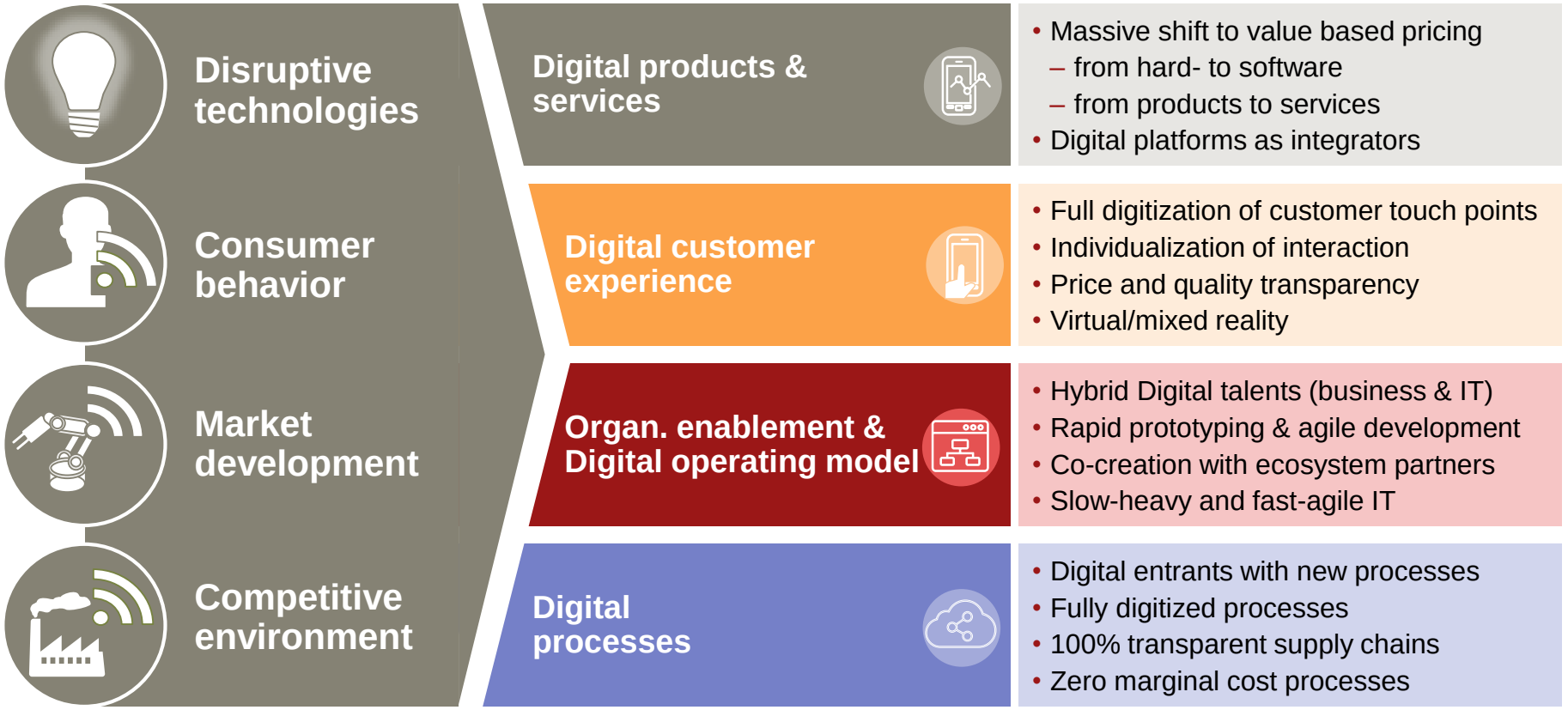
Digital creates a new normal for industrial goods companies

Non-exhaustive



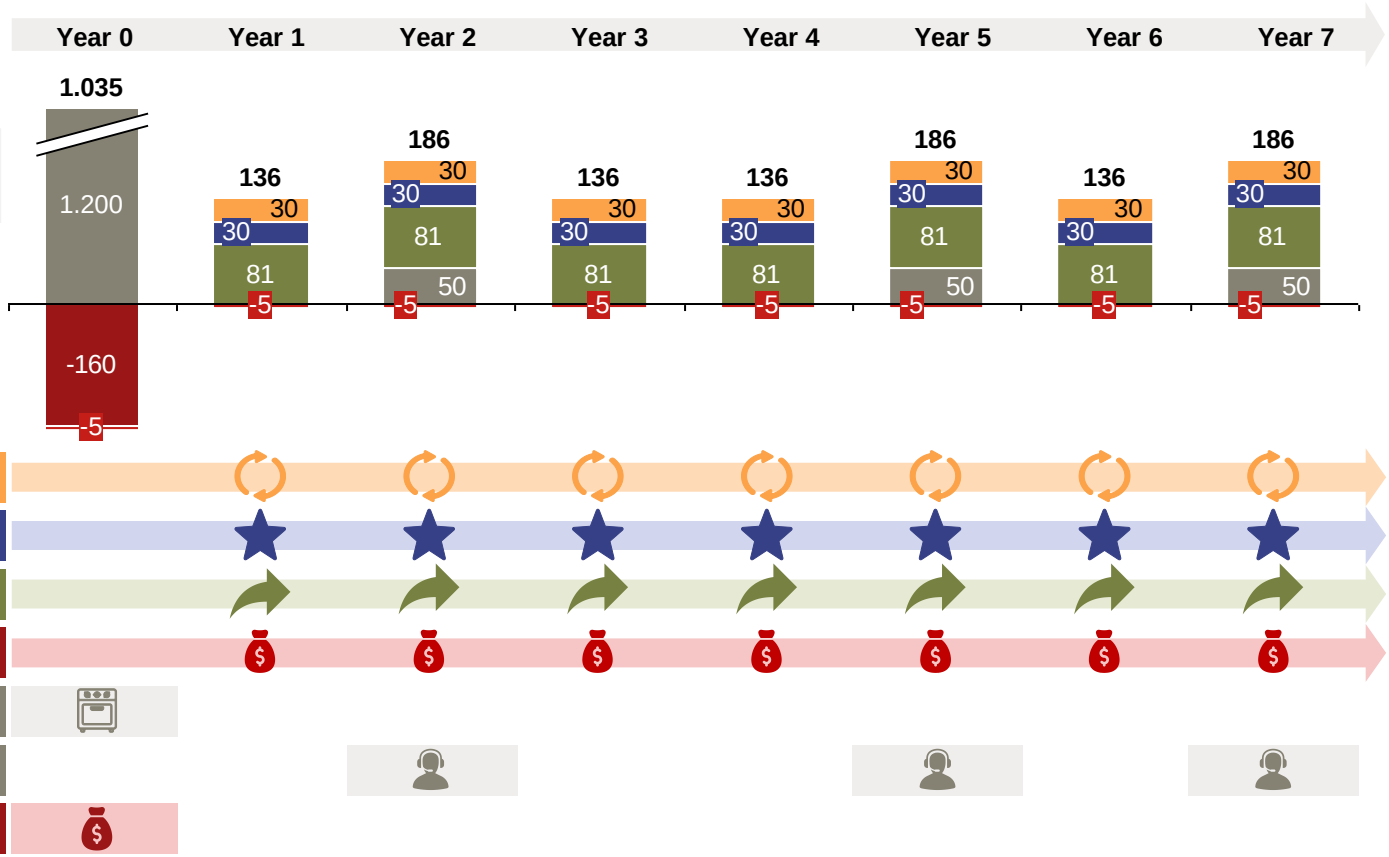
Source: A.T. Kearney

Digital changes the game: From one-off to reoccurring revenue

Client Example

Revenue & cost per avg. customers

Relational relationship:
One-off and re-occurring



1. E.g. subscription for certain content (avg. 6 months subscription for 5€ per month)
2. E.g. accessories (avg. basket size 30€)
3. E.g. commission of 3.5% for leads for consumables (avg. basket size 238€), groceries (avg. basket size 152€ per month), cooking utensils (avg. basket size 240€)

Source: Client; Diane Jacob; Instacart; Statista; P&G; A.T. Kearney

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Competitive moves are observable along all dimensions

Excerpt

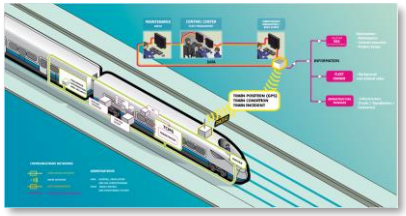
Digital products & services	1 Switch from product to output-**as-a-service**	2 Refocus **from hard- to software and maintenance**	3 Move from **integrators to platforms**
Digital customer experience	4 Full digitization of - current and prospect - **interaction**	5 Adaptation of Sales and Marketing based on **D2C tools**	6 Shift of **human-machine** interfaces
Organizational enablement & Digital opera-ting model	7 **Agile** development and **rapid prototyping**	8 **Partnerships** with **start-ups** and **pure Digitals**	9 Rigorous **analytics** and **data-driven approach**
Digital processes	10 Full **digitization** of own and customer's **supply chain**	11 Digitization of **maintenance** and **servicing**	12 Further automation of **production and procurement** processes

Source: A.T. Kearney

ALSTOM offers operators of rolling stock and equipment a broad range of individualized services

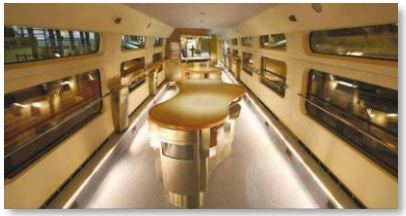
1 Switch from product to output-as-a-service

"TrainLife Services"



Maintenance services
- Broad range of services from purely offering know-how to full technical maintenance
- Real-time online maintenance solutions for own and externally produced trains

Parts supply services
- Repair and overhaul services with fixed lead times and immediate delivery
- Online spare part catalog with fixed prices and quantities



Modernization services
- Development of concepts and building of prototypes
- Offering full modernization of rolling stock and equipment including test series

What it is
- Selling services for rolling stock produced in-house or by 3rd parties

How it works
- Offer different services along the whole lifecycle of rolling stock
- All service solutions with the aim to be uncomplicated and efficient
- Different payment options from regular monthly installments to pay-per-use

Others
- ALSTOM offers own solution for preventive maintenance (incl. retro-fit)

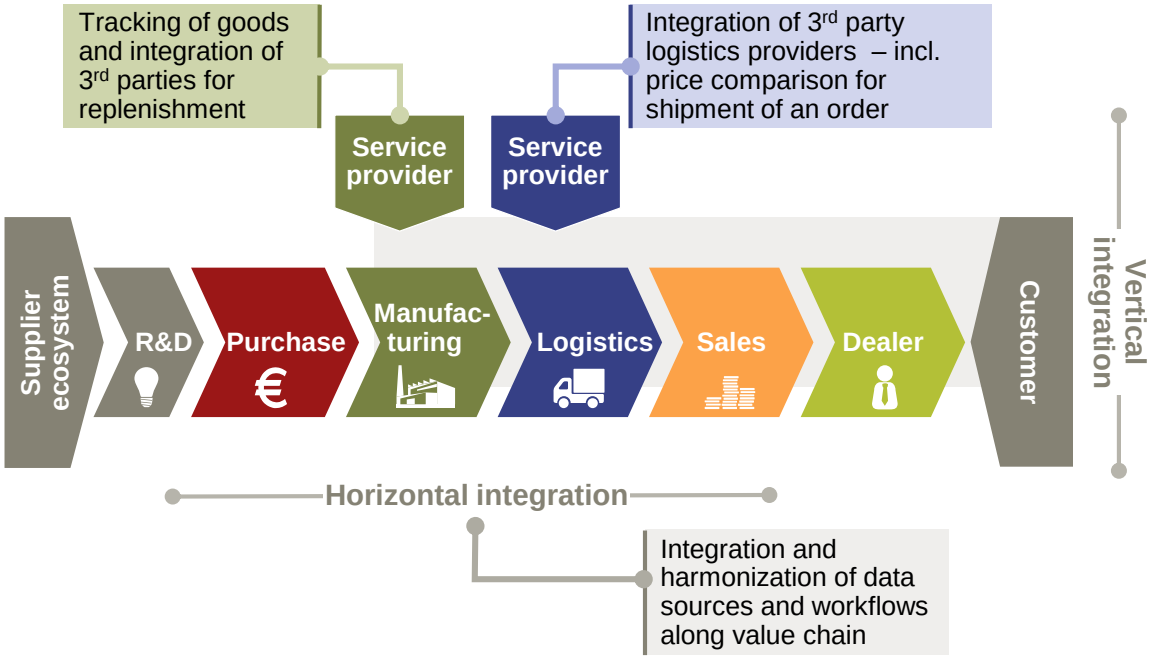
ALSTOM recognized the need for comprehensive services for rolling stock and incorporated large service offers in its business model

Source: Alstom; A.T. Kearney

AXOOM is building a platform to optimize production processes by horizontal and vertical integration along value chain

3 Move from integrators to platforms

AXOOM



What it is

- Marketplace to receive offers and assign orders to service providers
- Integration and analytics along value chain to optimize production processes

How it works

- Browser-based for ubiquitous access
- Modular to integrate existing client IT or install new ones from app store
- Ecosystem/app store to integrate with 3rd parties (e.g. Kloeckner, Linde, Zeiss)
- Integration via AXOOM IoT cloud

Others

- Subsidiary to TRUMPF
- Founded in 2015

With AXOOM, TRUMPF is moving from pure hardware supplier to a platform; however, AXOOM yet to prove its business model and customer value

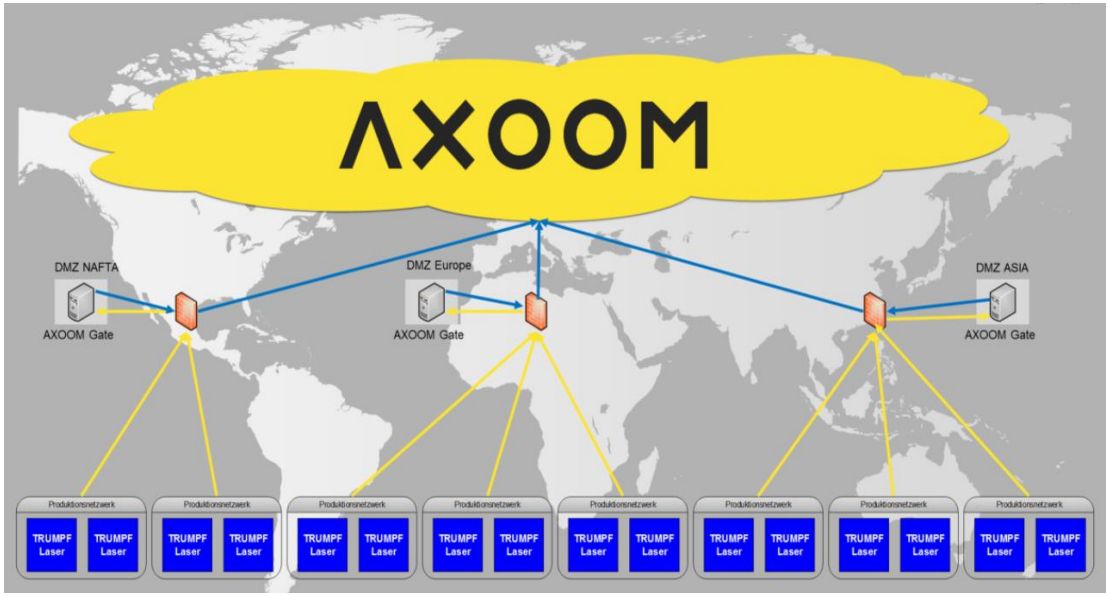
Source: Trumpf; A.T. Kearney

Combining multiple data sources Axoom is able to improve predictive maintenance significantly

3 Optimize – Example Axoom and Daimler

AXOOM

Over 230 TRUMPF Laser machine online



Predictive Maintenance Algorithms

Machinery data only	16 Rules
Machinery & Production data	20 Rules
Machinery, Production & Service data	55 Rules

Holistic view is important crossing traditional disciplines

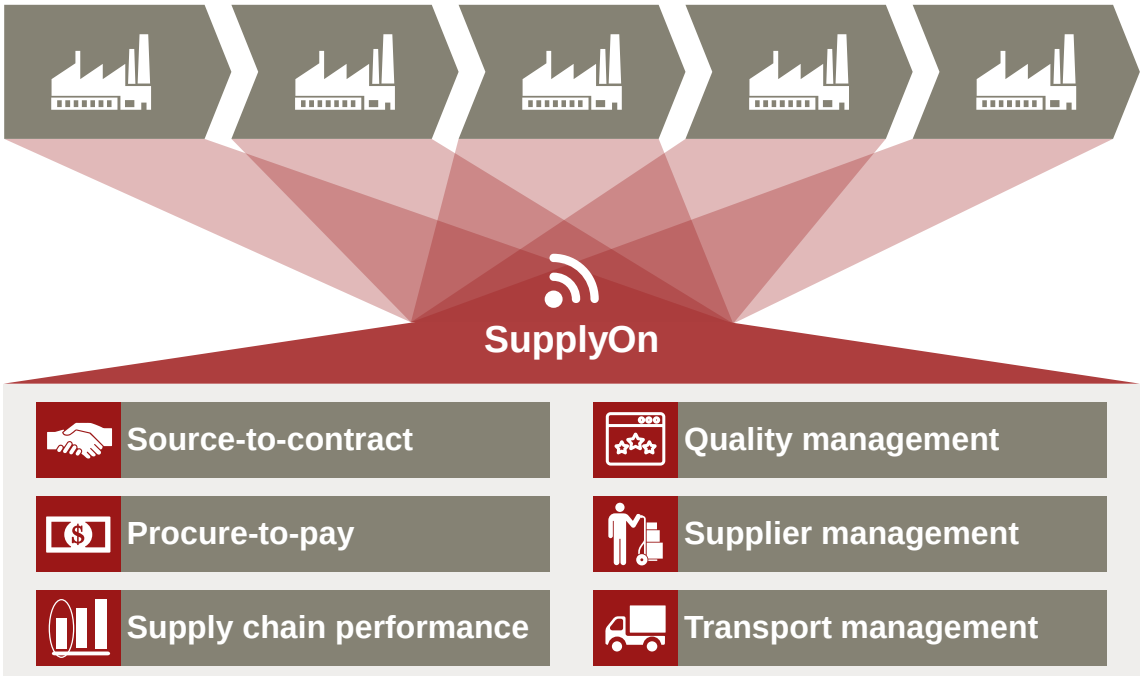
Source: Axoom, A.T. Kearney

SupplyOn is a central platform to digitize business processes

4 Full digitization of - current and prospect - interaction

SUPPLYON

Supply chain



What it is

- Central platform to manage customers' business processes with suppliers

How it works

- Software-as-a-Service solution to connect processes across companies within the manufacturing industry
- Open-platform without access restriction
- No transaction data given to platform owners to foster trust in platform use

Others

- Initiated by competing players (e.g. Bosch, Continental, ZF) to build "counter-platform" to existing solution

SupplyOn connects companies along their value chain to create more efficient processes and facilitate communication

Source: SupplyOn; A.T. Kearney

Kloeckner's eCommerce service platform provides customers direct access to relevant processes around buying activities

5 Adaptation of Sales and Marketing based on D2C tools

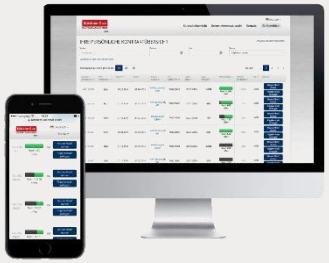
klöckner & co

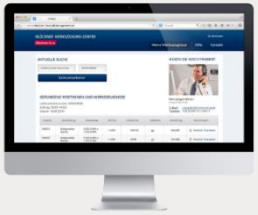
Integrated B2B web shop

Personalized mailings for transparency on prices

Late delivery time notice

Contract platform





Billing platform

What it is

- First B2B eCommerce service platform in steel industry by Kloeckner & Co[1]

How it works

- Browser-based for B2B customers to access
- Re-invention of current ERP-system and additional mobile applications for contract management, delivery notices and billing
- Mobile access to contract document and contract fulfillment monitoring

Others

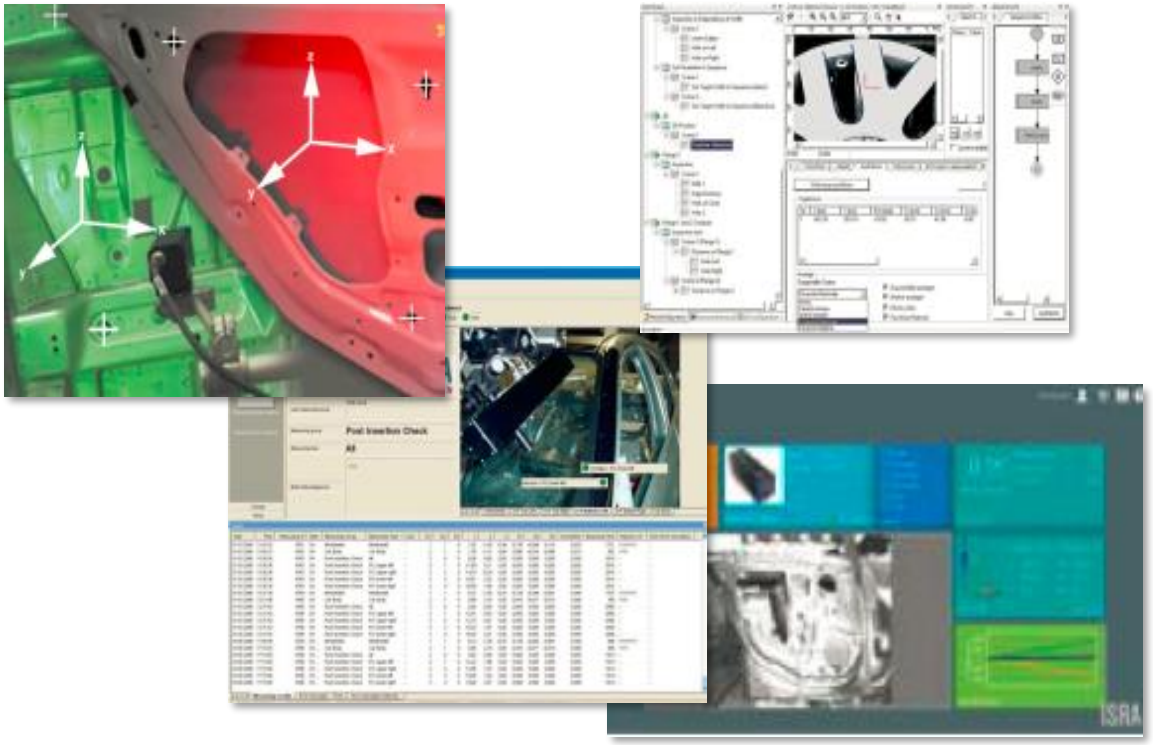
- Launched in 2016

With its B2B eBusiness platform Kloeckner is taking a start-up perspective to develop an industry leading sales platform for its B2B customers

1. Steel and aluminum trading; ~€5 bn sales (2015), 220 locations in 15 countries
Source: Kloeckner; A.T. Kearney

ISRA's visual analytics and automated learning capabilities significantly reduce robot set-up cost by up to 95%

9 Rigorous analytics and data-driven approach



What it is

- Use of visual recognition system and learning software for robot set up

How it works

- Use of a single camera based 3D position recognition system to provide automatic learning abilities to robots
- Up to 95% less set-up time, ROI for automation reachable in shorter time
- Automation becomes more attractive for small batch sizes

Others

- Innovation price1 winner 2015

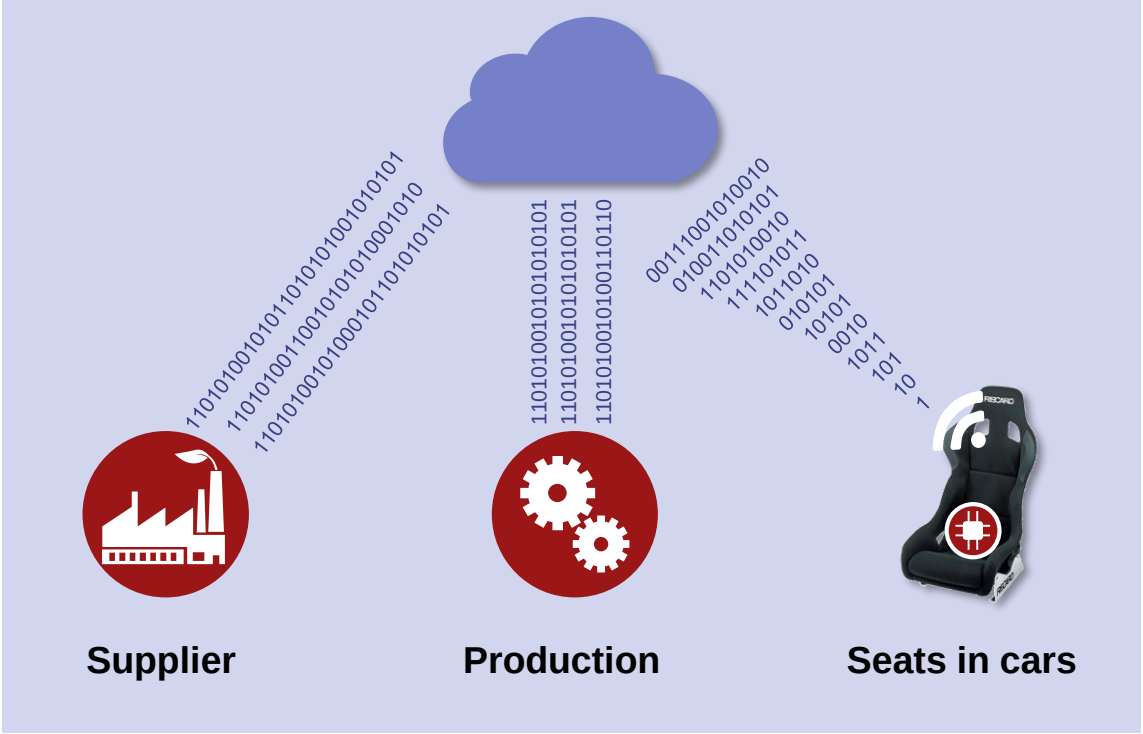
Analytics and real-time data crunching allow almost real-time automation for small batch sizes

1. "Innovationspreis der Deutschen Wirtschaft"
Source: A.T. Kearney

RECARO digitally connects its supply chain to collect valuable learnings for optimization

10 Full digitization of own and customer's supply chain

RECARO



What it is

- Supply chain integration of suppliers, production assets and customers

How it works

- Integration of RFID chips in seats during production
- Collection of data regarding product configuration and customers
- Automated adjustment of machines during production process
- Placement of automated material orders

Others

- Continuous improvement of products and customer service with collected data

The usage of RFID chips improves throughput time and failure rates, enables real time tracking of production and makes spare parts easily identifiable

Source: Recaro; A.T. Kearney

Daimler uses ad hoc cross linkable sensors to make material and part movements transparent and enable dynamic logistics

10 Full digitization of own and customer's supply chain

What it is

- Reliable and self regulating production logistic system with supply chain linkage

How it works

- Usage of ad hoc cross linkable sensors for temporary and permanent use
- Traceability of components makes production logistics process including upstream and downstream logistics completely transparent and flexible
- Interfaces to existing CPS and elements of the logistics chain allow retro-fitting

Others

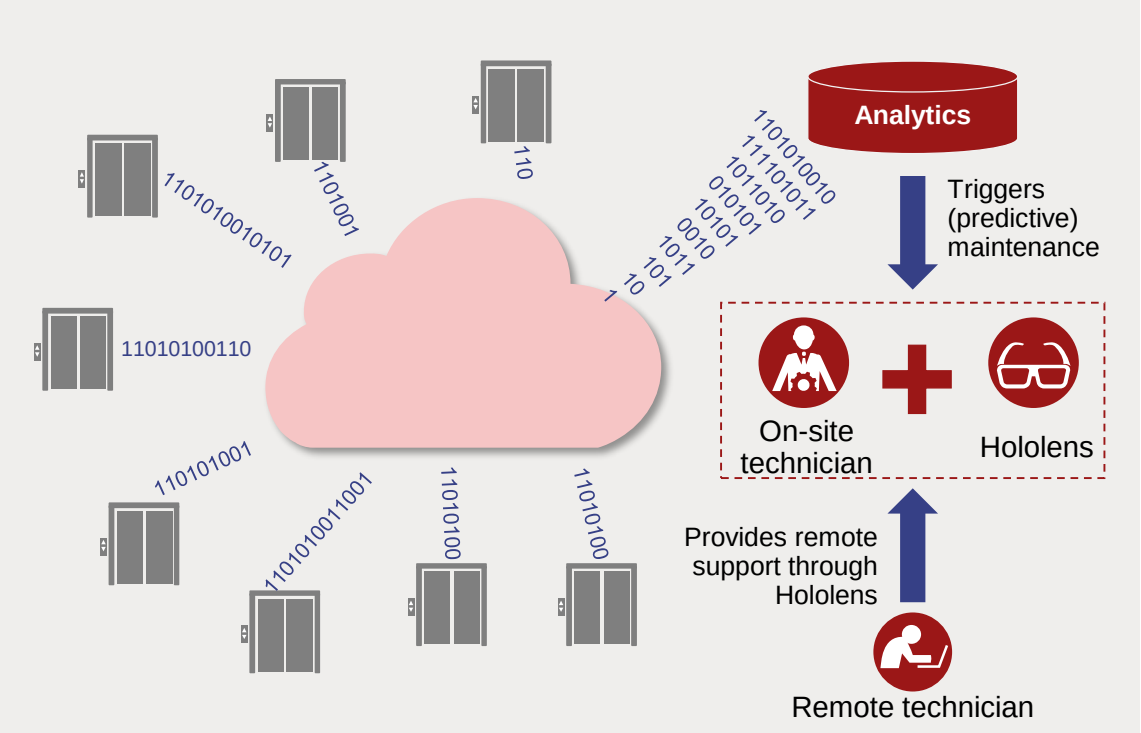
- Huge potential for perishable goods

Industrial production is the first industry where supply chains are fully digitized – for agriculture this will eventually mean "From Field to Fork[1]"

1. Tracing solution by Tech Mahindra; CPS = Cyber Physical Systems
Source: Daimler; Tech Mahindra; A.T. Kearney

ThyssenKrupp made its elevators and technicians smart – preventive maintenance services instead of malfunction fixing

11 Digitization of maintenance and servicing



What it is

- Cloud-based and augmented service innovating maintenance-business

How it works

- Elevator data captured by sensors
- Usage data evaluated by IoT platform to predict maintenance needs
- Augmented reality glasses used by on-site technicians for e.g. elevator history
- Additional support by remote technicians leveraging augmented reality glasses

Others

- Alliance with Microsoft Azure

ThyssenKrupp teamed up with Microsoft to increase safety, reliability and availability of their elevators – including retro-fitting of installed base

Source: ThyssenKrupp; A.T. Kearney

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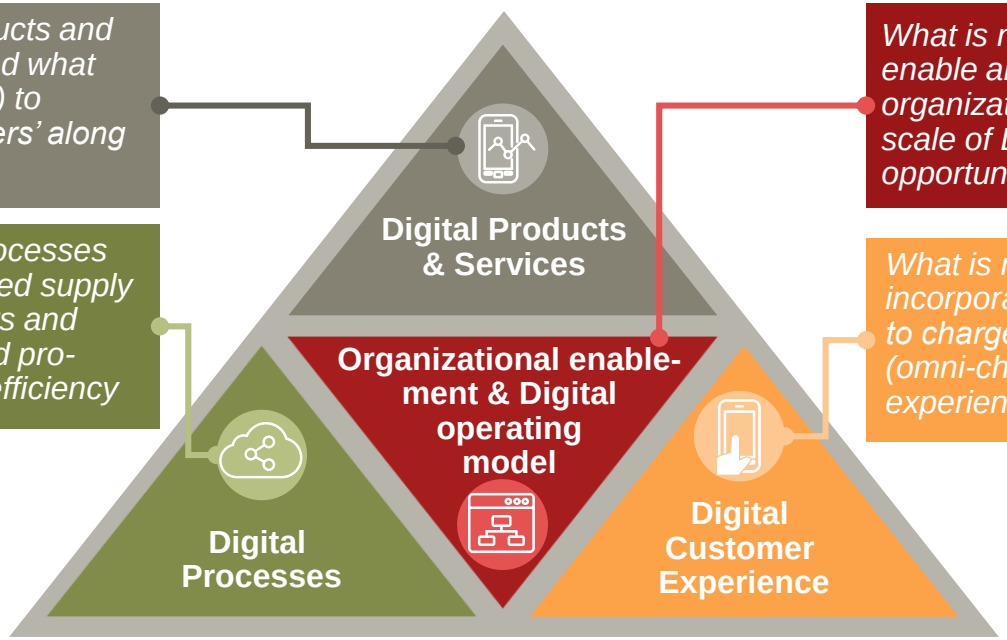
3. **Give an overview on key success factors for industrial goods companies to win in Digital**

Source: A.T. Kearney

Call for action: Digital changes the game holistically

What Digital products and services to sell and what business model(s) to monetize customers' along product lifecycle

How do Digital processes create an integrated supply chain with partners and how do automated pro-cesses increase efficiency



What is necessary to enable and set up the organization to leverage full scale of Digital opportunities

What is necessary to incorporate Digital means to charge customers' (omni-channel) customer experience journey

But how to move forward?

Source: A.T. Kearney

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Five key success factors to win in Digital

Key success factor	Description	Rationale
Top-down mandate	• Clear CEO commitment to Digital • Sufficient financial resources	• Break up resistance/silos for Digital • Provide financial freedom to engage
Holistic digital vision	• Digital vision and ambition as guide for Digital transformation • Holistic view– all aspects of business to be addressed	• Align team to one common goal • Provide a base point to identify value creating activities
One Digital accelerator	• One responsibility as anchor and accelerator of Digital transition • Direct report to CEO	• Ensure delivery and synchronization due to one clear responsibility • Ensure topic's top management focus
Start-up culture	• Failure as learning – not blame • Agile working methodologies (e.g. MVP) • Capabilities extension through partners	• Allow bottom-up intrapreneurship • Attract to new talents • Shorten time to market in Digital
Active change management	• Communication of successes & learnings • Build-up of a Digital community of people from different departments	• Create a positive environment • Scale Digital across departments for further momentum

Source: A.T. Kearney

Change in mindset, triggering a digital journey

Example from Consumer Goods

1 Visioning

Case for Change

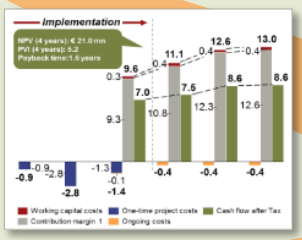
Envisioning workshops

- Senior management
- Multiple days
- Pain points vs. digital solutions
- First draft of target picture

2 Experiment and Scale-up

Lighthouses & business case

Business case & target picture refinement

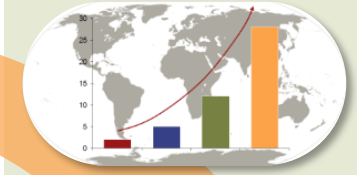


Selection of experiments

- 58 digital initiatives
- Focus: Quality, safety, material flow, energy, and asset mgmt

Full potential

Roll-out of digital initiatives



- Roll-out across entire manufacturing network (400+ sites)
- 3 waves defined over 1.5 years

3 Enable

Cultivation of tight eco-system with partners

Hiring, training & managing competency

Feedback collection

Source: A.T. Kearney

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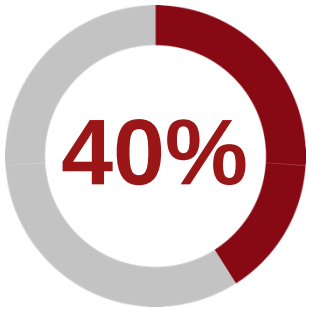
Speed is of essence to survive and prosper in the Digital Age

LIFETIME EXPECTANCY OF COMPANIES ON THE FORTUNE 500 HAS FALLEN FROM

1965 **23yrs**

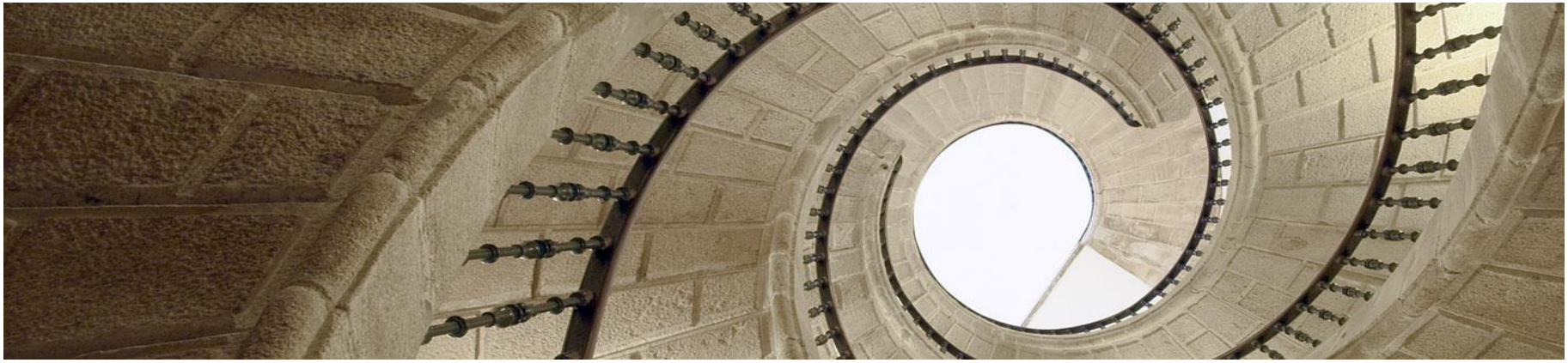
2014 [1,2] **15yrs**



IN 5 YEARS
of incumbent companies across 12 industries
WILL BE DISPLACED DUE TO RAPID DIGITAL DISRUPTION[3]

1. Based on A.T. Kearney analysis of Fortune 500 data: lifetime expectancy has been derived from the five year moving average of the turnover rate of that year
2. Don't Get Cozy, Fortune 500: It's Do-Or-Die Time for Digital Disruption (Upstart Business Journal)
3. Digital Vortex: How Digital Disruption is Redefining Industries (Global Center for Digital Business Transformation)

Thank you very much!



I case of questions:

Dr. Joerg Schrottke

+49-175-2659 488

joerg.schrottke@atkearney.com

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