DIGITAL TRANSFORMATION AND FUTURE ROLE OF HUMANS WITHIN THE WORK PROCESS

International Symposium Future of Work, 3rd of July 2019

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Institute director University of Stuttgart, Institute for Control Engineering of Machine Tools and Manufacturing Units (ISW)

Universität Stuttgart
Institut für Arbeitswissenschaft und Technologiemanagement IAT

Fraunhofer IAO

Fraunhofer

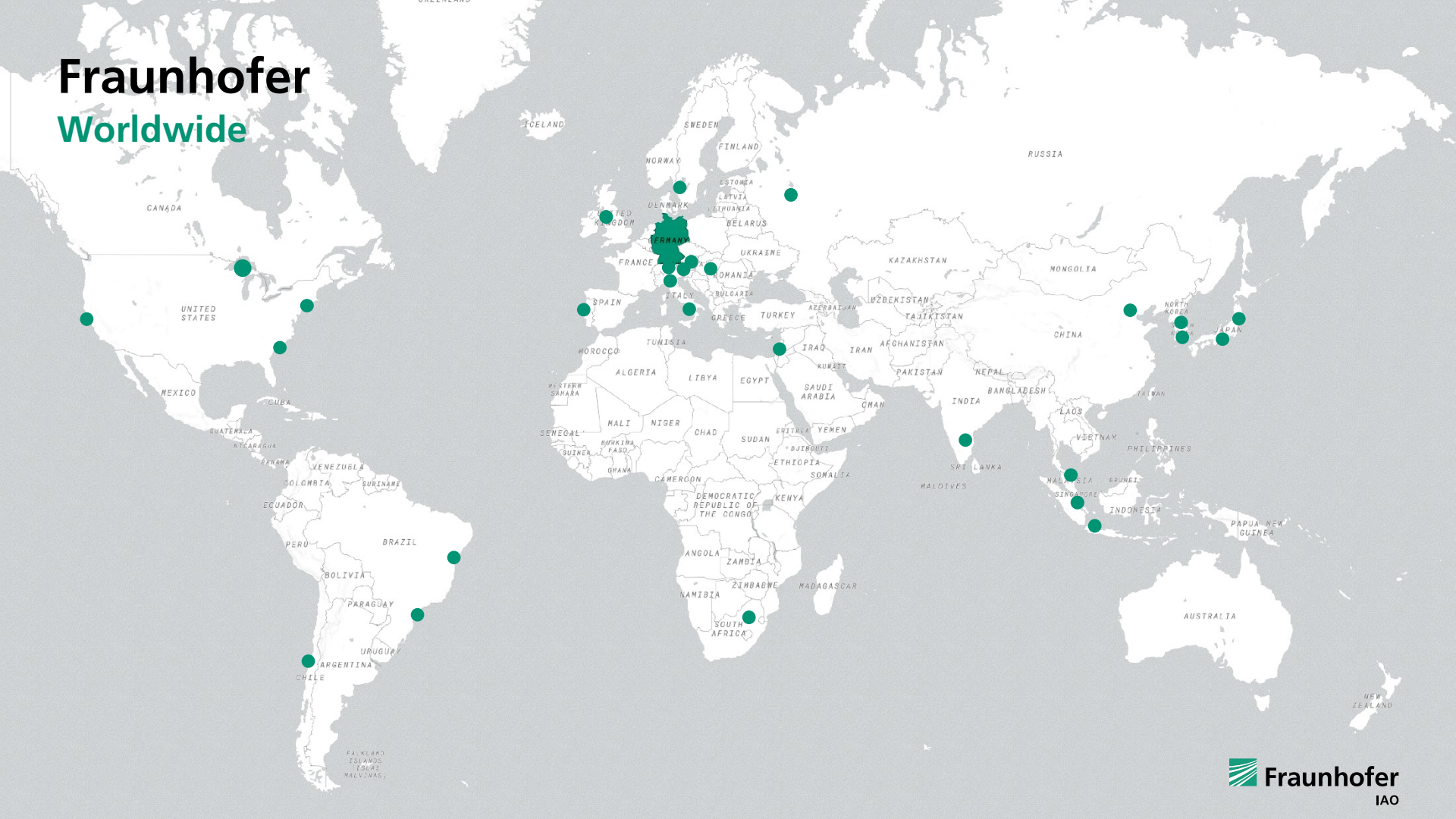
Joseph von Fraunhofer

The organization takes its name from Joseph von Fraunhofer (1787-1826), the illustrious Munich researcher, inventor and entrepreneur.

Researcher Joseph von Fraunhofer, born in 1787, brought us closer to the stars. Counted as one of the founders of modern optics, he succeeded in manufacturing telescopes in a quality that had never been seen before. In 1814, he made his most significant discovery, which was then named after him – Fraunhofer lines. These make it possible for us to get a closer look at space and to understand how stars are born.

Fraunhofer

Worldwide



Fraunhofer
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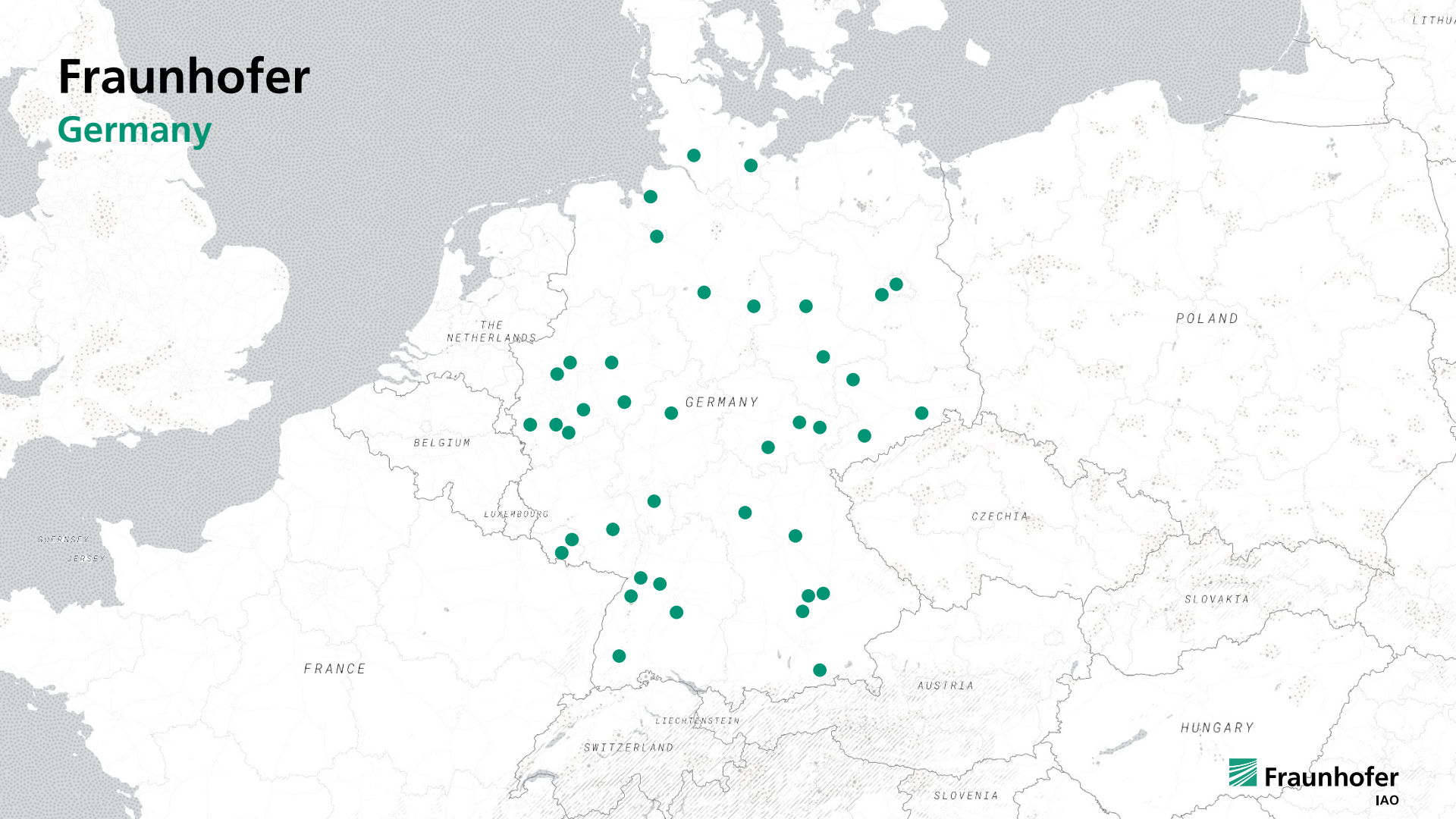
Germany



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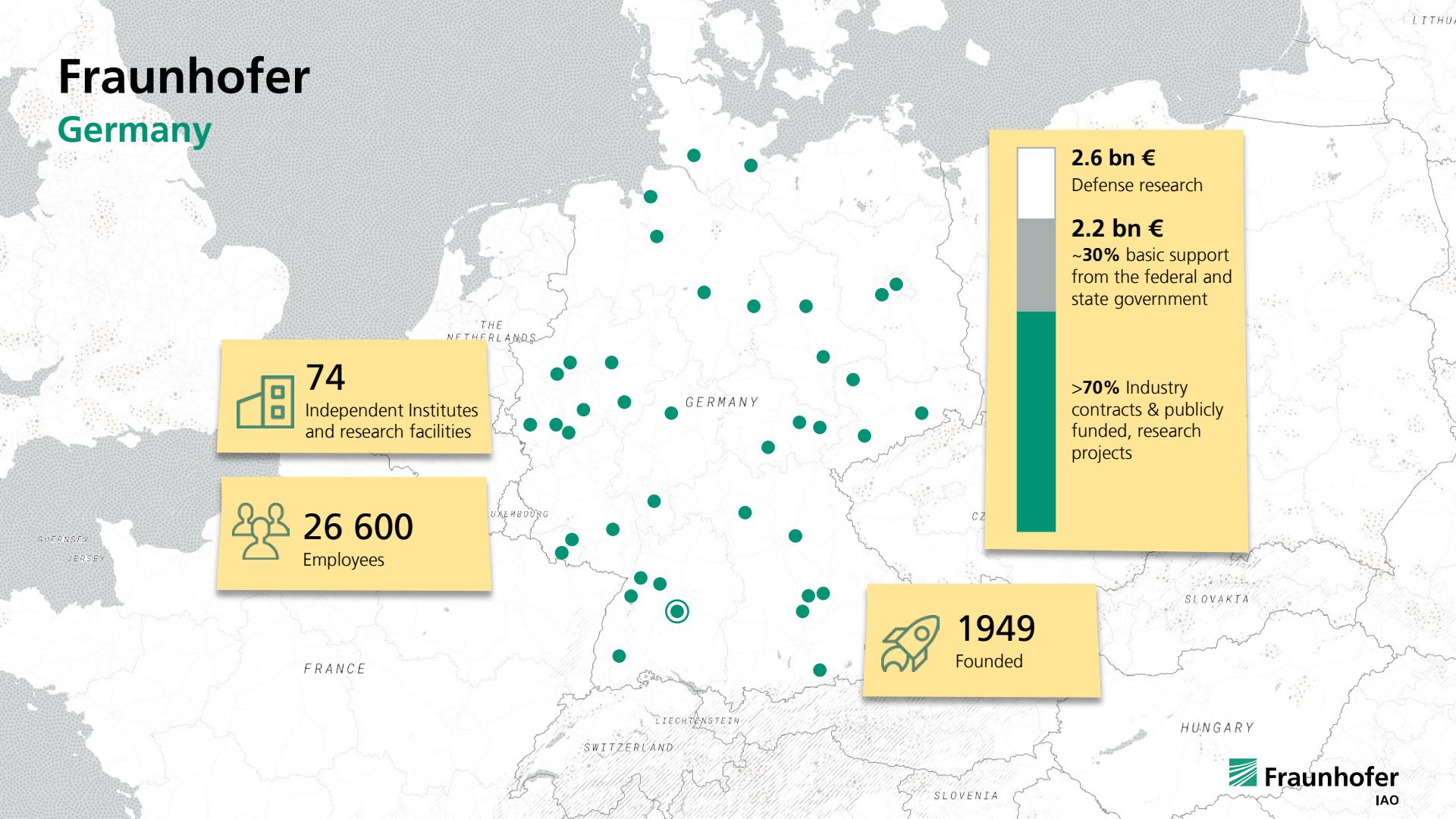


74
Independent Institutes and research facilities

26 600
Employees

2.6 bn €
Defense research

2.2 bn €
~30% basic support from the federal and state government

>70% Industry contracts & publicly funded, research projects

1949
Founded

Fraunhofer IAO

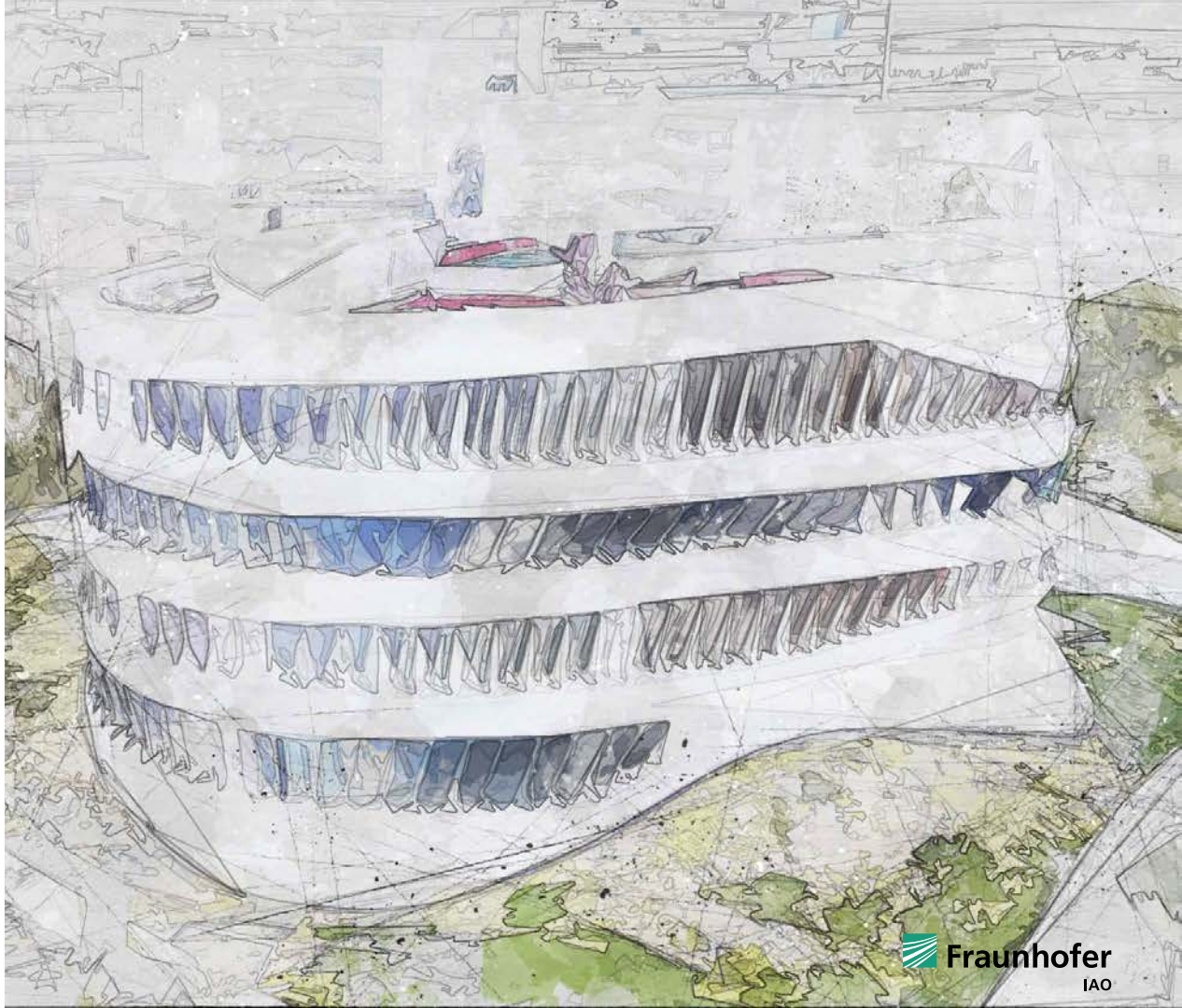
IAO & IAT

Key figures 2018

42.6
Mil. € Finance Volume

628
Staff

226
Scientific Publications



IAO & IAT

Key figures 2018

42.6
Mil. € Finance Volume

628
Staff

226
Scientific Publications

173
Public Sector Projects

30
EU Projects

337
Industry Projects

Fraunhofer IAO

IAO & IAT

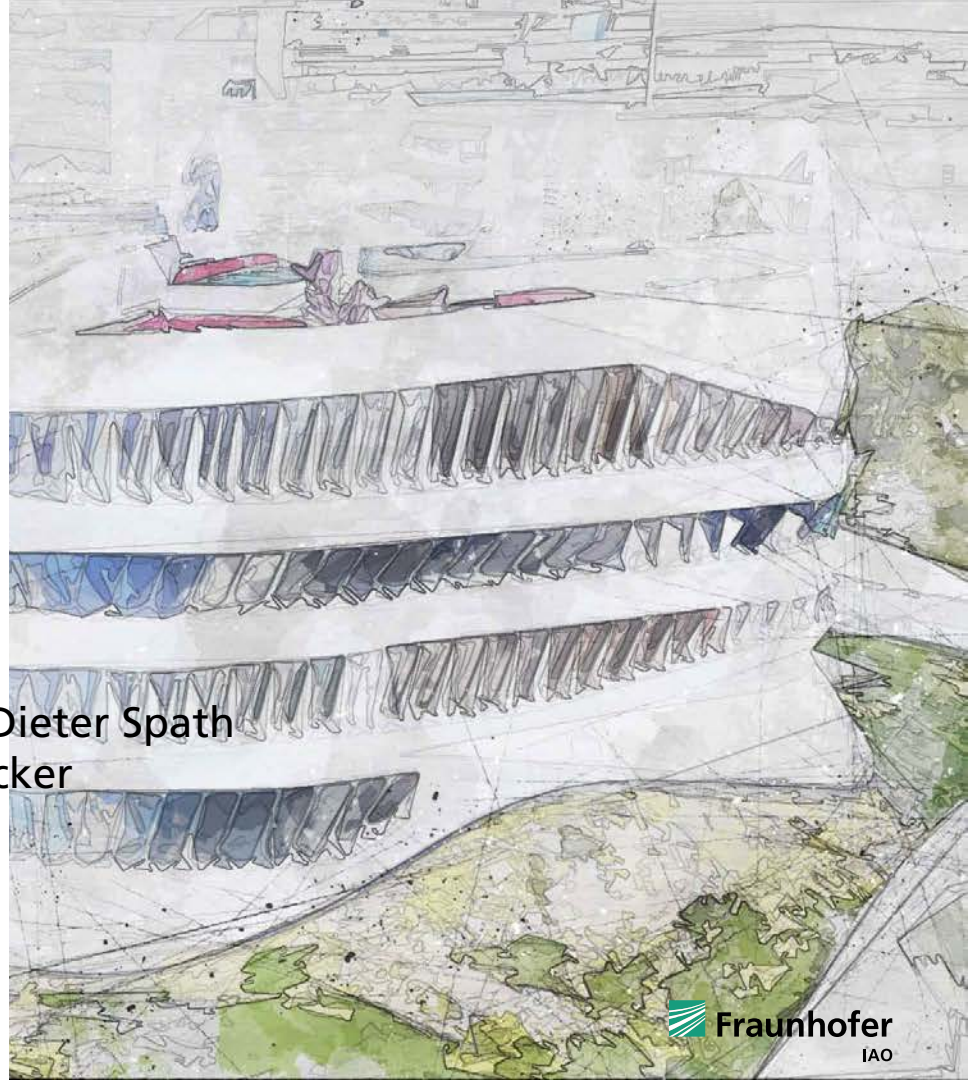
Key figures 2018

42.6
Mio. € Finance Volume

Fraunhofer Institute IAO 1981
University of Stuttgart IAT 1991
Founded

637
Staff

Prof. Dr.-Ing. Prof. e.h. Wilhelm Bauer
Univ.-Prof. Dr.-Ing. Oliver Riedel
Univ.-Prof. Dr.-Ing. Dr.-Ing. E.h. Dr. h.c. Dieter Spath
Apl. Prof. Dr.-Ing. habil. Anette Weisbecker
Board of directors



Fraunhofer IAO

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Our research departments

Responsible Research and Innovation

Human-Technology Interaction

Urban Systems Engineering

Service and Human Resources Management

Mobility and Innovation Systems

Cognitive Engineering and Production

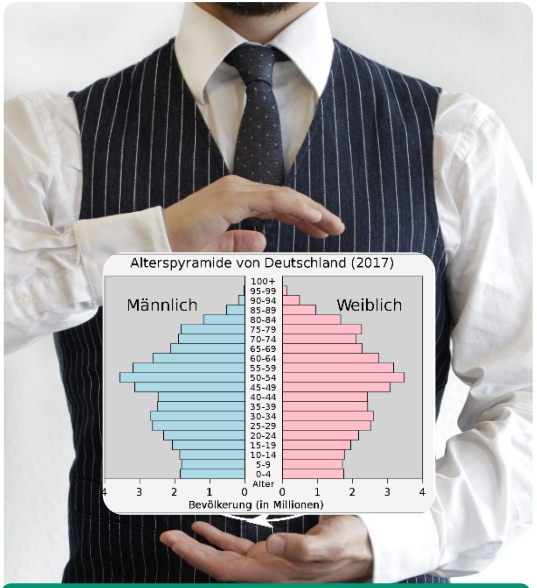
Organizational Development and Work Design

Digital Business

Fraunhofer IAO

Megatrends as Drivers of Change

More and more dynamics, volatility and change



Demographic Change

Digital Transformation

Globalization- Glocalization

Megatrends as Drivers of Change

More and more dynamics, volatility and change

- Diversity
- Individualization
- Work & Life-Integration
- Ageing societies
- Lack of specialists

Demographic Change

- Ubiquitous information availability - Big Data
- Anywhere & Always 24/7
- Cognitive Systems
- Digital Business Models
- Blockchain

Digital Transformation

- Political world (un)-order
- Volatile economy
- Business Ecosystems
- Urbanisation
- Environmental impacts

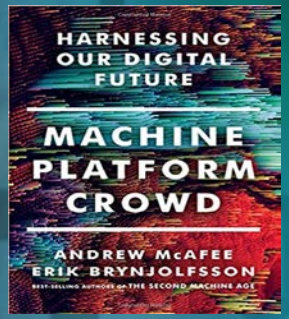
Globalization-Glocalization

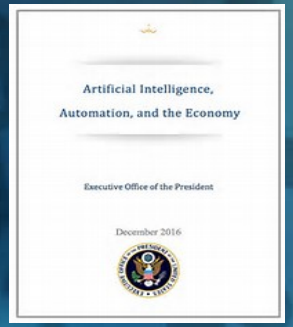
Future Work at IAO

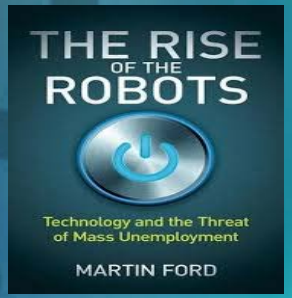
Ongoing research

Examples

- Future Work – how we change work, how work changes us
- Productivity of service-related work
- Working environments 4.0
- Competence management in German companies
- Production work of the future



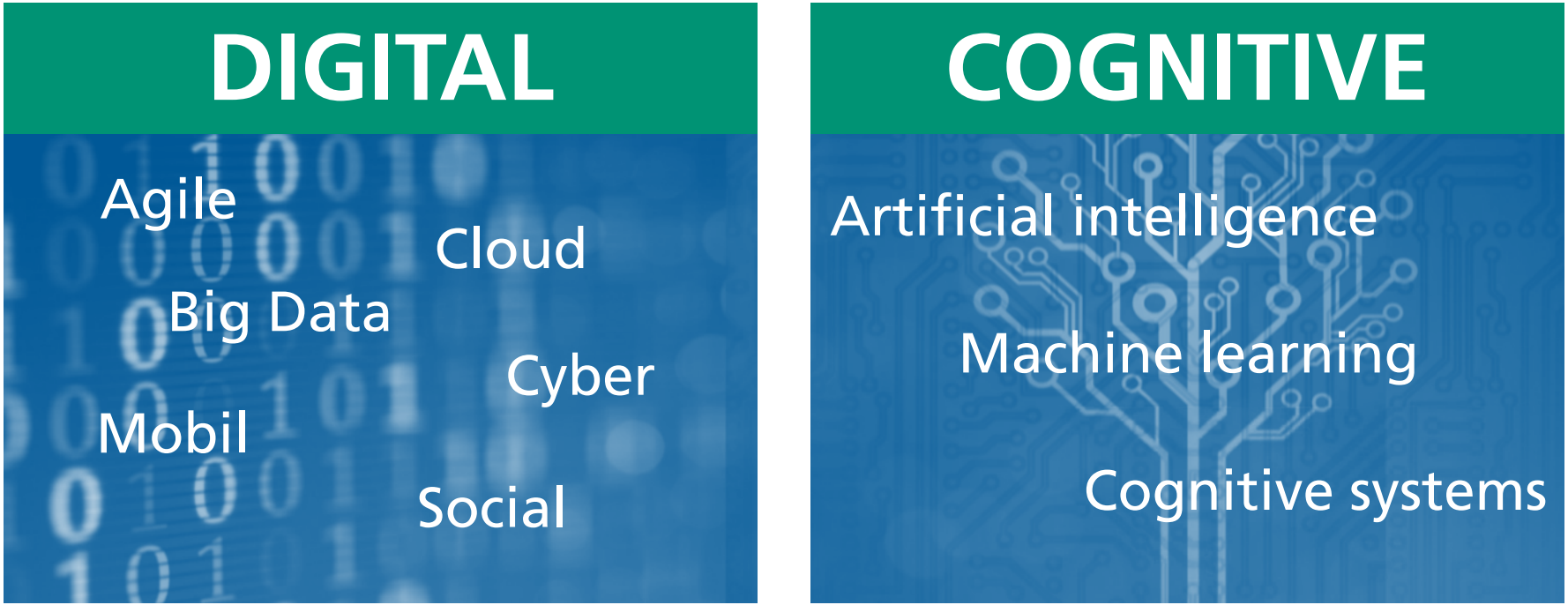




Artificial Intelligence - a hot topic in literature

Cocktail of different technologies changing our work

Digitization, the »new normal« – Cognitive Systems are »disruptors«

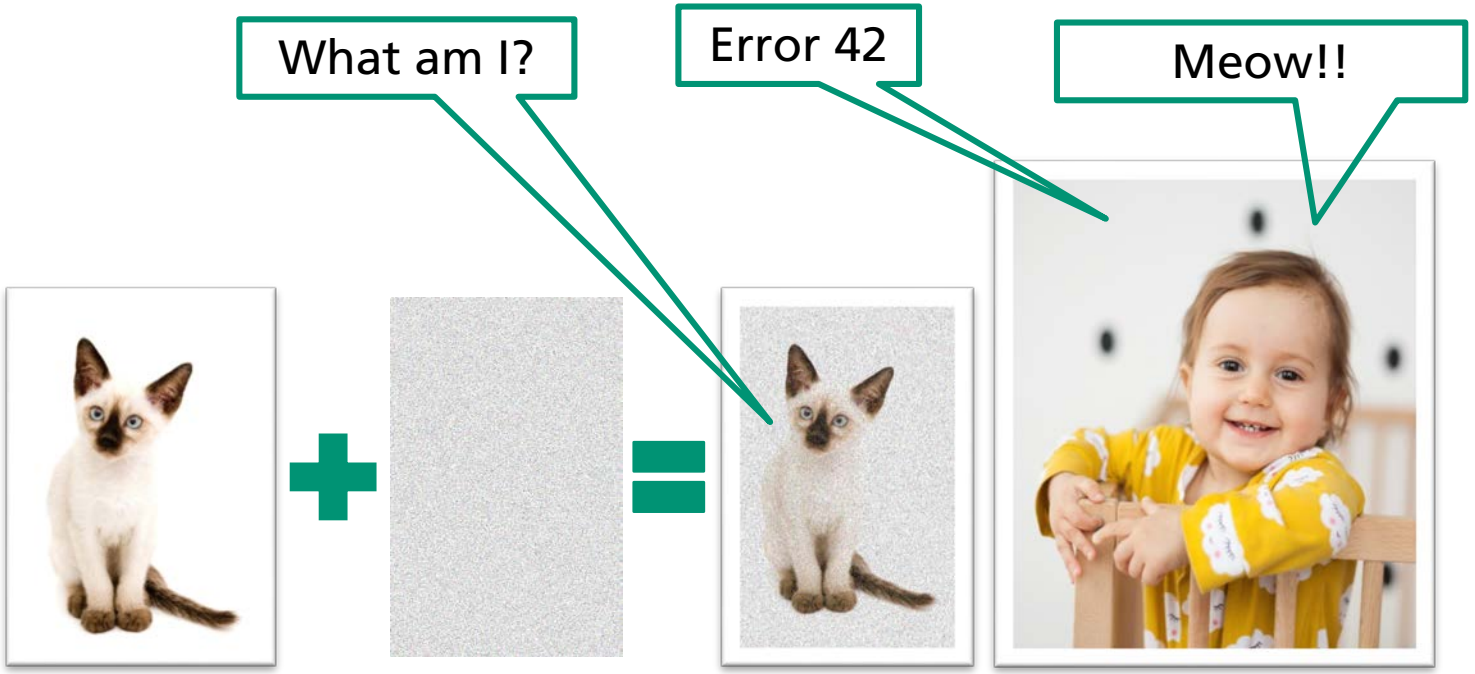


Machine Learning as an example for AI

AI does not work on its own

Understanding the

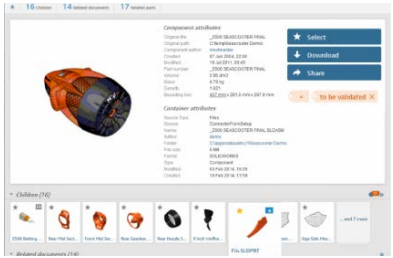
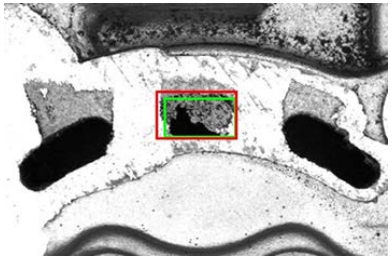
- process
- data
- preparation
- modelling
- evaluation
- provision



Machine Learning as an example for AI

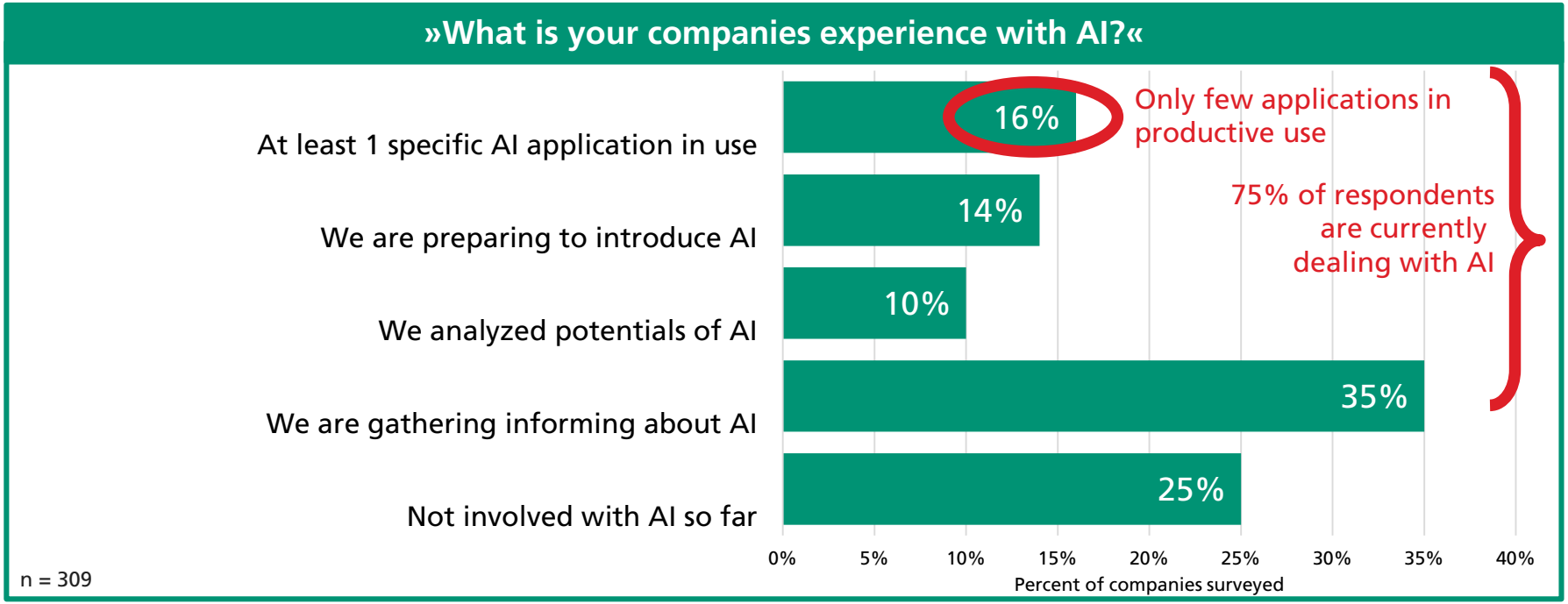
Good, better, the best?

AI and machine learning are based on many learning cycles with correct data and results

Unsupervised Learning	Supervised Learning	Reinforced Learning
		
The data records of the group are based on similarities, which have been identified in available data pools.	The application trains identifying pattern within data pools using an algorithm, which is derived from well known data and pattern.	Continuous improvement of a model, which is derived from positive and negative feedback, by trial and error on unknown data and pattern
Understand	**Predict**	**Understand and predict**

Big potential – little experience

IAO-Study on the use of Artificial Intelligence

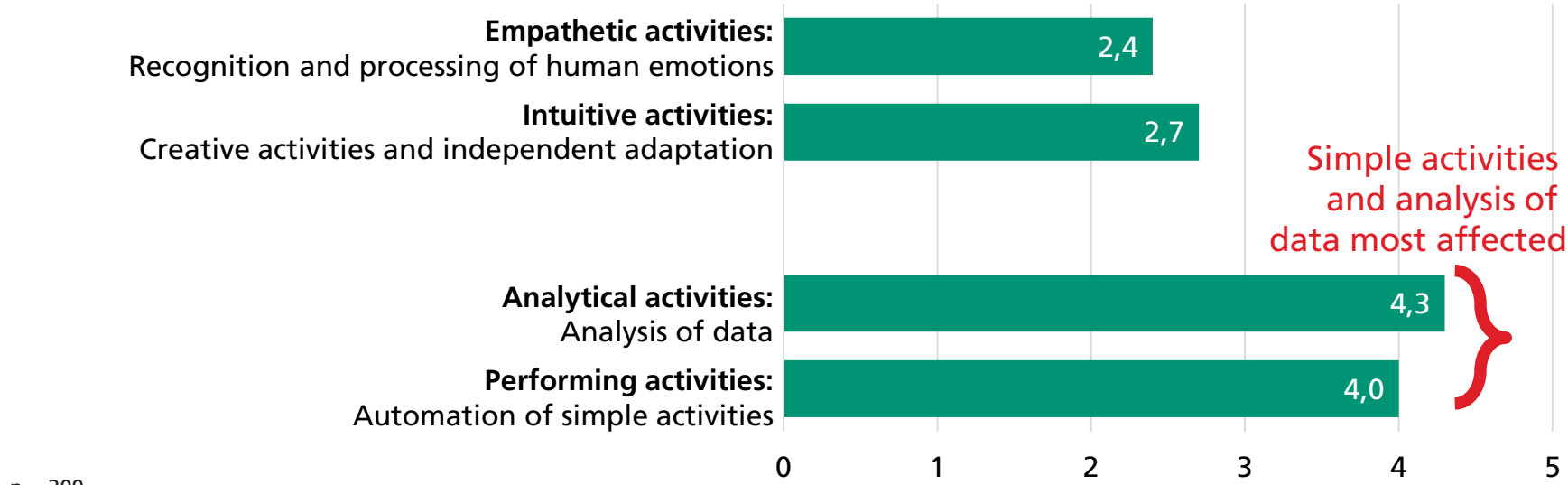


Source: IAO-Study of Artificial Intelligence, Interim Analysis, January 2019

Artificial intelligence changes the work of the future

Results of an ongoing IAO study on artificial intelligence

»To what extent will artificial intelligence change the division of labor between humans and technology over the next five years?«



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Source: IAO-Studie zu Künstlicher Intelligenz, Zwischenauswertung

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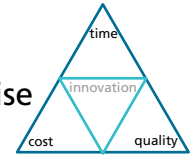
Dimensions of the »*AI SachArbeit*« Analysis Method

AI application, processes and work

AI application quality

- Degree of digitization and readiness for AI of the enterprise
- Evaluated data and business model for the use of AI
- Recommendation for AI product selection
- Requirements for data management and IT



Process quality

- Critical areas of process quality
- Indicators for ability to automate AI
- Potentials of process design
- Risks for the process quality resulting from AI automation

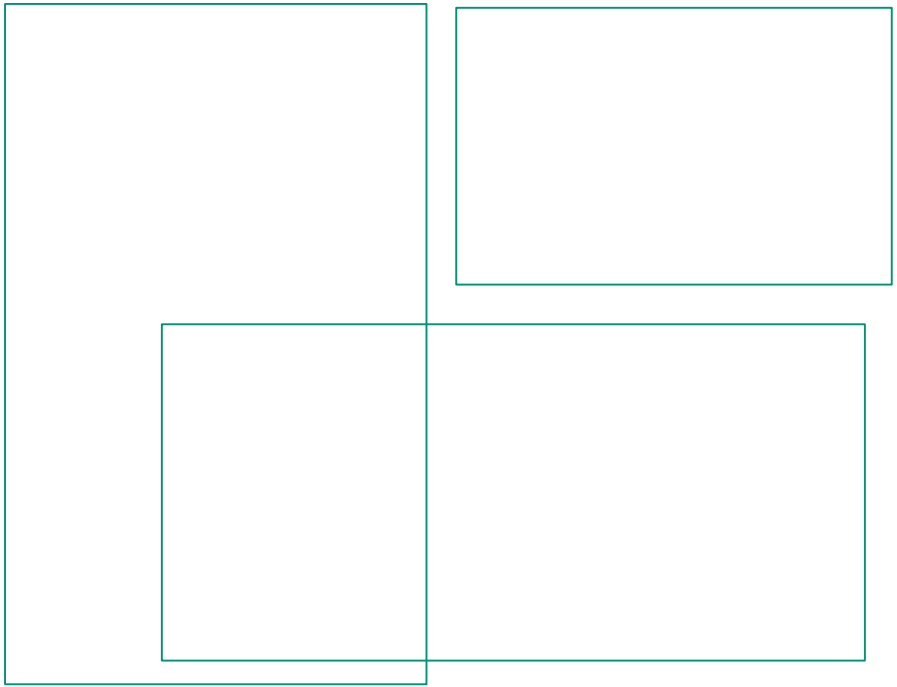
Quality of work

- Critical aspects of quality of work
- Indicators for ability to automate AI
- Potentials of job design
- Risks for the quality of work due to AI automation

IAO Projects

A few example projects with AI

REX	System for fraud detection
ARPOS	Chat bot for damage report
Textominado	Text document analysis
PUG (*Current*)	Order forecast & monitoring
WSW (*Current*)	Digital complaint workflow



All projects focus on putting the employees' focus is directed towards essential value creating tasks.

»SmartAIwork« Cooperative Project

Using AI to raise productivity and competencies in clerk jobs

The »SmartAIwork« cooperative project

- studies the impact of AI on office work
- develops design options for AI-supported office work
- designs pilot solutions in three SMEs
- transfers guidance and recommendations

The SmartAIwork cooperative project is running from 01 Nov. 2017 to 31 Oct. 2020 and supported by the German Federal Ministry of Education and Research (BMBF) under the subsidy ID 02L17B00ff.

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Bundesministerium für Bildung und Forschung

Project Partners

acatech – Deutsche Akademie der Technikwissenschaften
INPUT consulting
Fraunhofer IAO
DOG Präzisionsoptik Gera
WSW
DHI – Institut für Technik der Betriebsführung
bad heizung Schimmel – Wasser . Wärme . Wohlgefühl
IGM
Universität Stuttgart – Institut für Arbeitswissenschaft und Technologiemanagement IAT

Value Partners (selection)

DAIMLER
ZF
MIT Management Sloan School
Akademie Würth
Südwestmetall

»SmartAIwork« Cooperative Project

Project definition: Artificial Intelligence (AI)

IT solutions and methods that perform tasks independently, whereby the rules underlying the processing are not explicitly defined by humans.

Until now, these tasks required human intelligence and dynamic decisions. Now, AI takes over and learns how to improve orders and workflows based on data.

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Three waves of the current and upcoming AI

Spectrum ranges from support to expansion to autonomy

Technological development

Algorithm Wave

- Automation of simple tasks and processes
- Analysis of unstructured data
- Example: Translation of texts with Deepl.com

today

Augmentation Wave

- Dynamically interact with technology with mental-intelligent support and decision making
- Automation in flexible and complex environments
- Example: Parametric Design and Planning Tools »KI-CAD«

2020er

Autonomy Wave

- Automation of physical work and human capabilities
- Actions in complex environments with full environmental response
- Example: Deliveries with autonomous drones

2030er

Source: PricewaterhouseCoopers: Artificial Intelligence as an Innovation Accelerator in Companies - Confidence and Trust in Artificial Intelligence, 2018

Optimization is for processes, Innovation is for humans.

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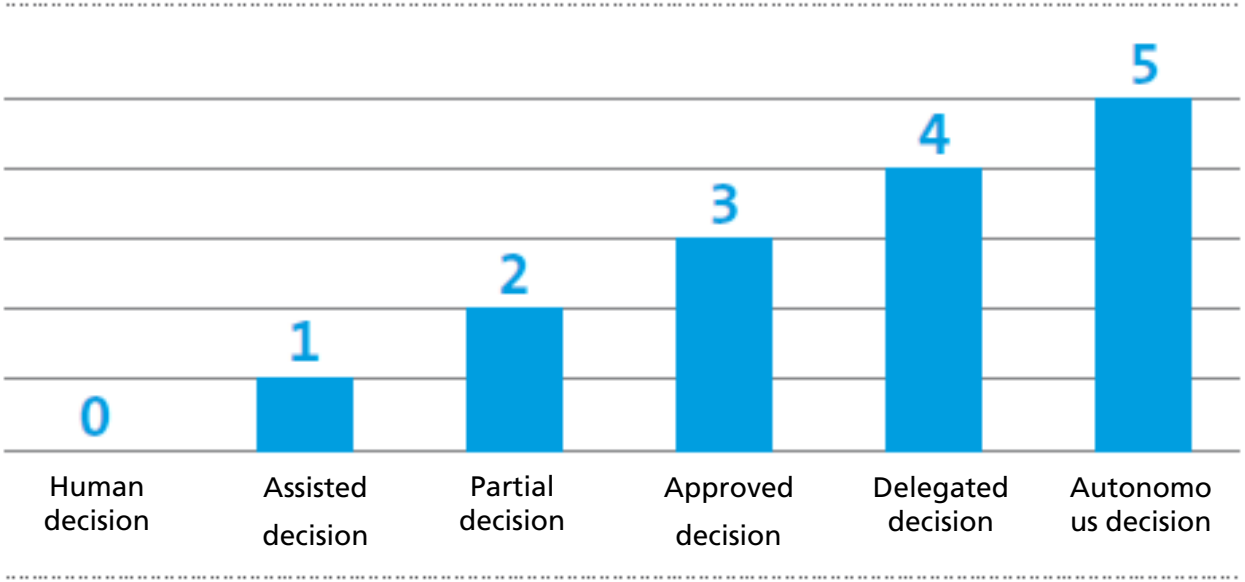
5-Level Model of Automation of Decision-Making



Source: Bitkom (editor) 2017; Künstliche Intelligenz verstehen als Automation des Entscheidens. Leitfaden, p. 14.

Where Artificial Intelligence Can Help

From the Issue to the Solution

Example: *Customer inquiry*

Issue: Customers do not receive answers to inquiries by mail, e-mail, ... promptly enough.

Cause:

- Classification and forwarding to the competent contact persons is complex.
- Extraction of relevant technical data is time-consuming.
- Pattern recognition by humans is difficult in case of large amounts of data.

Solution: Generate suggestion for answer automatically and forward it to appropriate contact person.

Example: *Payment for purchases*

Issue: Trivial decisions take much time and effort, e.g. whether a minor purchase should be paid directly or needs to be released for payment by an executive.

Cause:

- Each purchase is scrutinized individually.
- Time-consuming detection of irregularities.

Solution: All purchases less than x euros without irregularity detected are automatically passed to accounting; everything else is submitted to the functional officer with information about the purchase.

Digitization and digital revolution

… the basics

Digitization

- Classical term for the **conversion** of analog values into digital formats.
- Today's importance: to **store** information digitally and make it **available** for electronic data processing.
- Digitization and the digital revolution are **two different things** that have to do with each other.

This »revolution« can have two forms for your business

- **Internal**: employees, processes, information
- **External**: products, services