

# Transformation of Work through Digitalization

Key findings from the project »TransWork«



SPONSORED BY THE



Federal Ministry  
of Education  
and Research

MANAGED BY



**PTKA**  
Project Management Agency Karlsruhe  
Karlsruhe Institute of Technology



Fördereschwerpunkt  
Arbeit in der  
digitalisierten Welt

  
TransWork

# Joint Research Project Overview

## Project term and partners

- Project term: July 2016 – June 2020
- Funded by the German Federal Ministry of Education and Research (BMBF)
- Project consortium:



**Vereinte  
Dienstleistungs-  
gewerkschaft**

# Project background



- High-Tech Strategy of German Federal Government
- Framework Research Programme of German Federal Ministry of Education and Research (BMBF) on Innovation for Tomorrow's Production, Services and Work («Innovationen für die Produktion, Dienstleistung und Arbeit von morgen«)
- TransWork is the accompanying project within the funding priority on Work in the Digitalized World («Arbeit in der digitalisierten Welt«)

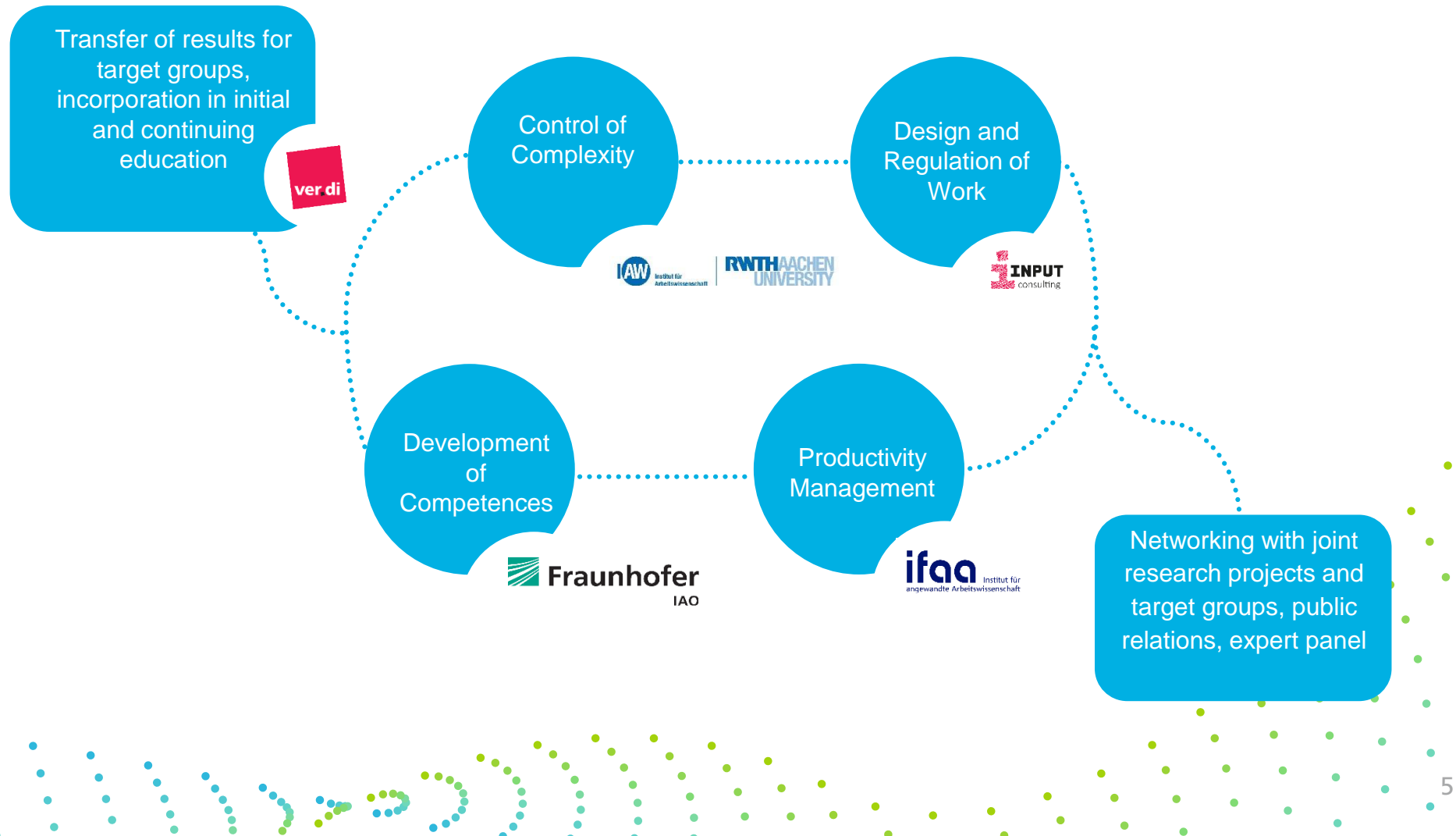
# Overall Objective of TransWork



- Analysis and assessment of digitalization effects on work in the following central fields of research
  - Competences
  - Managing Complexity
  - Productivity Management
  - Regulation
- Development of accessible solution approaches and transfer to those involved into regulatory standard setting
- Identifying research gaps and fostering further cooperative development of the funding priority



# Project structure



# Exploration of perspectives of development of digitalized work

## Assessment from TransWork expert interviews

Unternehmen	Branche	Größe
1	Automobilzulieferer	> 5.000 MA
2	Maschinenbau/Sonderfahrzeugbau	50-249 MA
3	Automobil- und Maschinenbauzulieferer/Metallverarbeitung	> 5.000 MA
4	Maschinenbau/Fördertechnik	> 5.000 MA
5	Mischkonzern/Mobility Services	> 5.000 MA
6	Versicherungswesen	> 5.000 MA
7	Versicherungswesen/Öffentlicher Dienst	> 5.000 MA
8	Beratungsagentur Industrie 4.0 bezogen auf ein Unternehmen der Branche Steuerungs- und Automatisierungstechnik	> 5.000 MA
9	Maschinenbau	> 5.000 MA

## Selection of theses

Lack of competences in dealing with uncertainty and data volumes

Model function of managers with regard to the acquisition and application of „digital know how“

High potential of social media and mobile technologies

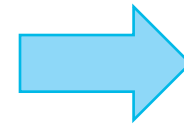
Ambivalent tendencies: Culture of openness vs. decrease of co-determination at company level

...

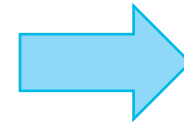
# Competence Development 4.0

- **System competence** by understanding connected, intelligent systems
- **Understanding processes** for physical and digital processes in cyber-physical systems (CPS)
- **Interdisciplinary/cross-functional working and learning**, in particular IT, electrical engineering and mechanics
- **Generic competences** for cooperation, communication and organisation in CPS
- **Strengthening decision-making** by autonomy versus intelligent systems

Challenge: Designing Industry 4.0 applications beneficial for learning and focussed on competence development!



Digital and work-integrated learning



Learning factories 4.0



E-Learning



Lernvideos



Serious Games & HoloLens



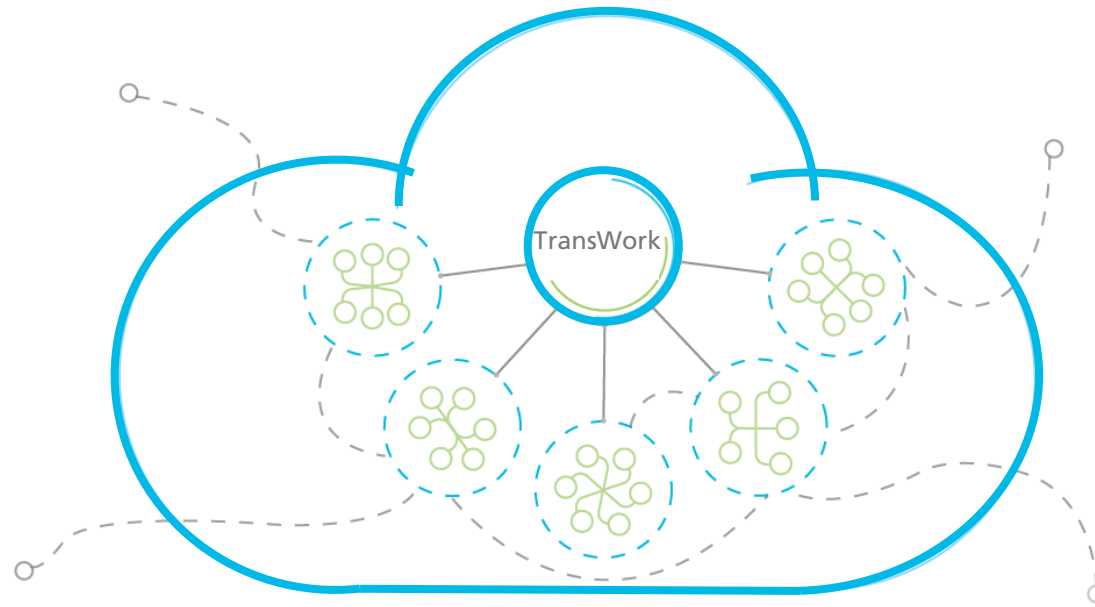
Assistant systems as Learning systems





# Funding Priority „Work in the Digitalized World“

## Structural Context



Fördereschwerpunkt  
Arbeit in der  
digitalisierten Welt



Focus Group



Joint Research  
Project



Funding  
Priority



Projects/partners in  
unfunded space



# Joint Research Projects

## Work in the Digitalized World („Arbeit in der digitalisierten Welt“)

Assistance Systems &  
Competence  
Development

Project Work and  
Teamwork in the  
Digitalized World  
of Work

Productivity  
Management

Design of  
interconnected-  
flexible work

Work Design in the  
Digital Change  
Process

IAO	IAW	ifaa	INPUT	ver.di
APRODI	CollaboTeam	InAsPro	EdA	AKTIV-kommunal
ArdiAS	diGAP	IntAKom	Hierda	DigiRAB
FachWerk	GADIAM	IviPep	ICU	DigiTrain 4.0
KODIMA	KAMiiSo	MONTEXAS 4.0	SANDRA	GAMOR
StahlAssist	SOdA	SiTRA4.0	SB:Digital	KoLeGe
TeamWork4	vLead	SynDiQuAss		Pro-DigiLog

# Focus Group

## Assistance Systems & Competence Development



### BACKGROUND

- Design of assistance systems and effects on division of work and work organization
- Possibilities of competences development in digital change

### QUESTION

- How can assistance systems be designed to promote health, learning and competence in response to the demands of digital transformation?



www.transwork.de



Förderschwerpunkt  
Arbeit in der  
digitalisierten Welt



Bundesministerium  
für Bildung  
und Forschung

# Healthy mobile work with digital assistant systems in the technical service [ArdiAS]

## Objectives

- Digitally assisted work in the technical service (changing places of action)
- Human-oriented development of mobile assistant systems by participation of users
- Stress reducing and healthy work



IFF

User-oriented development of assisting functions and coordination



MENSCH | TECHNIK  
ORGANISATION | PLANUNG

Human and process-oriented aspects of design of mobile applications



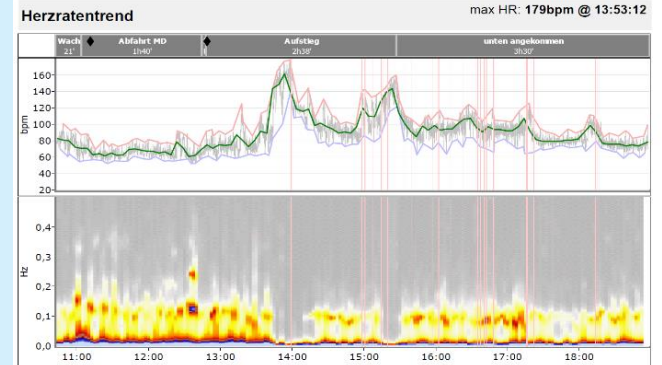
OTTO VON GUERICKE  
UNIVERSITÄT  
MAGDEBURG



MEDIZINISCHE  
FAKULTÄT

Identification of reactions of the organism by measurement (occupational medicine)

- **Subjective** (Psychology)  
-> z.B. Questionnaire
- **Objective** (Physiology)  
-> z.B. Vital parameters (ECG)



# Focus Group

## Project Work and Teamwork in the Digitalized World of Work



Schwerpunktgruppe  
Projekt- und Teamarbeit in der digitalisierten Arbeitswelt

Leitung der Schwerpunktgruppe  
Dr. Philipp Przytycz | Prof. Dr. Susanne Mölze-NewGörner | Lehrstuhl und Institut für Arbeitswissenschaft der RWTH Aachen (IAW)  
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IAW

CollaboTeam

diGAP

GADIAM

KAMiiSo

SOdA

vLead

### BACKGROUND

- The impact of digitization on project work and teamwork
- Derivation and formulation of design recommendations to ensure "good" - human and effective - working conditions in digitalized work systems



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Förderschwerpunkt  
Arbeiten in der  
digitalisierten Welt



Bundesministerium  
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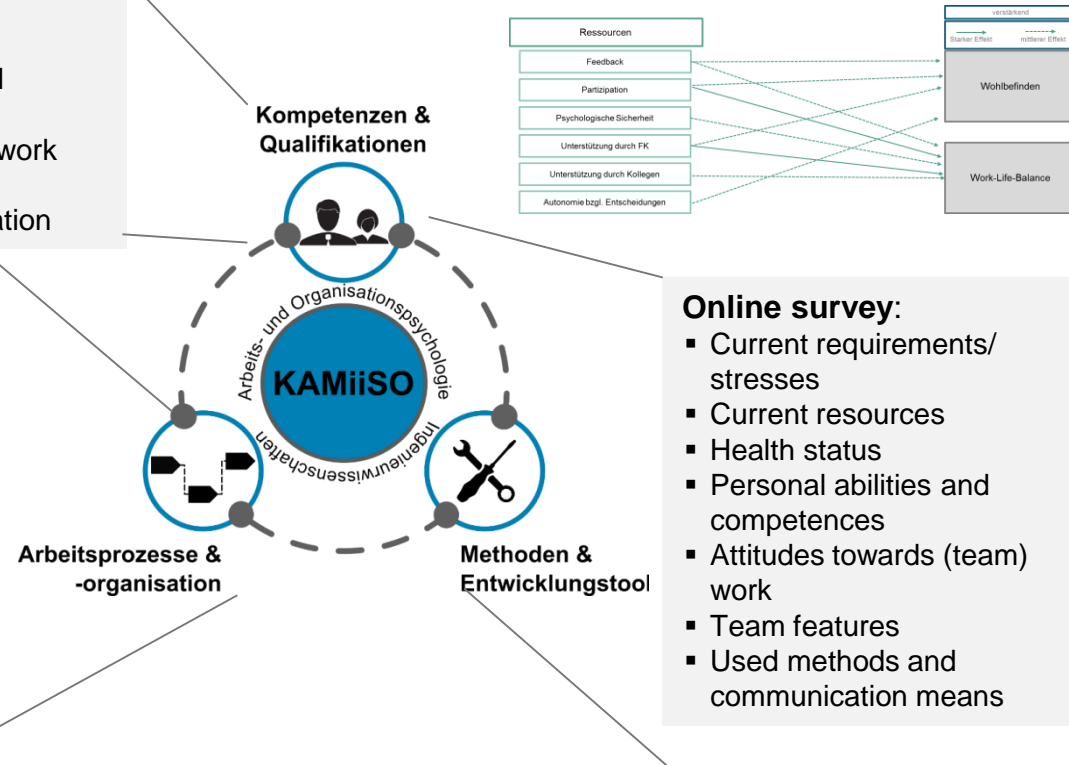
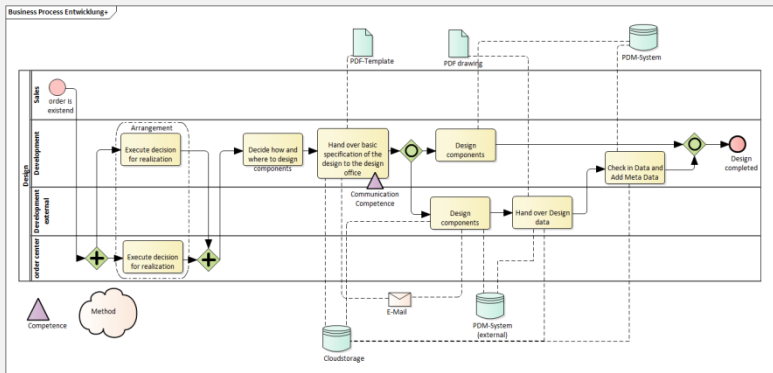
## KAMiiSo – Recent results

### Interviews with experts in the companies:

- Knowledge and abilities of the employees
- Barriers and catalyzers of und Katalysatoren of distributed collaboration
- Communication in distributed collaboration and linkage to work processes
- Technical and methodical support of (distributed) collaboration

## Process modelling:

- Actual processes modelled in the companies
- Target processes depicted in work scenarios



# Focus Group

## Productivity Management



Schwerpunktgruppe  
Produktivitätsmanagement

Leitung der Schwerpunktgruppe  
Dr. Tim Jasko | ifaa – Institut für angewandte Arbeitswissenschaft e. V.  
Uerdinger Straße 56 | 40474 Düsseldorf | Telefon +49 (0) 211 542263-24 | t.jasko@ifaa-mail.de

**ifaa**

- InAsPro
- IntAKom
- IviPep
- MONTEXAS 4.0
- SiTRA4.0
- SynDiQuAss

### BACKGROUND

- Systematical design of new possibilities for management and for increasing productivity in order to fully exploit potentials
- Strategic, long-term orientation of the approach to design measures to influence productivity
- Alignment of productivity management with future requirements, whereby individual framework conditions and requirements must be taken into account



# SynDiQuAss: Assistant Systems for Production

## What is going to create added value and is accepted?



Testing different assistant systems

Projections, Display, Headset, Gesture control...

Early participation of users



# Focus Group

## Design of interconnected flexible work



### BACKGROUND

- Research into the characteristics of digitalized work
- Development of design approaches for the realization of good, human work under conditions of networked, temporally and spatially flexible work

## Problem:

- Permanent, technical availability by widespread distribution of smartphones
- Delimitation of work, lack of phases of regeneration

## Solution:

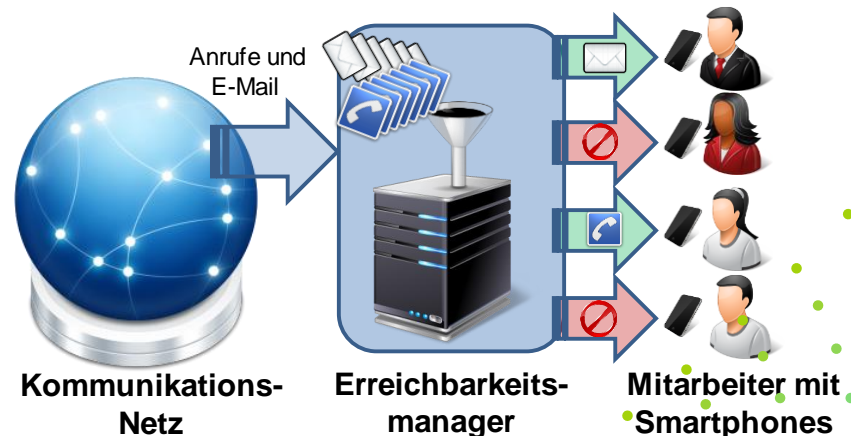
- Organisational approaches and availability assistant for smartphones, which delays e-mails, blocks calls in an intelligent way

## Status of the project:

- First version of the availability assistant in two application companies piloted
- Continued further development and testing of the availability assistant and organisational measures.

## Intelligent Delay and Blocking:

- Usage of meta data and additional information (e.g. vacation plan, calendar, localization)
- Content-based assessments by NLP-method (Machine Learning)



# Focus Group

## Work Design in the Digital Change Process

**Schwerpunktgruppe**  
**Arbeitsgestaltung im digitalen Veränderungsprozess**

Leitung der Schwerpunktgruppe  
Karl-Heinz Brand | ver.di Bundesverwaltung, Bereich Innovation und Gute Arbeit  
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**ver.di**

AKTIV-kommunal

DigiRAB

DigiTrain 4.0

GAMOR

KoLeGe

Pro-DigiLog

### BACKGROUND

- Development of concepts and solutions for the implementation of digital change processes
- Implementation of spatially and locally flexible, mobile work models, leadership concepts, innovative forms of cooperation and participation and preventive measures in occupational health and safety

### Objective

The Atlas gives an overview on relevant dimensions of the digital world of work and corresponding changes.

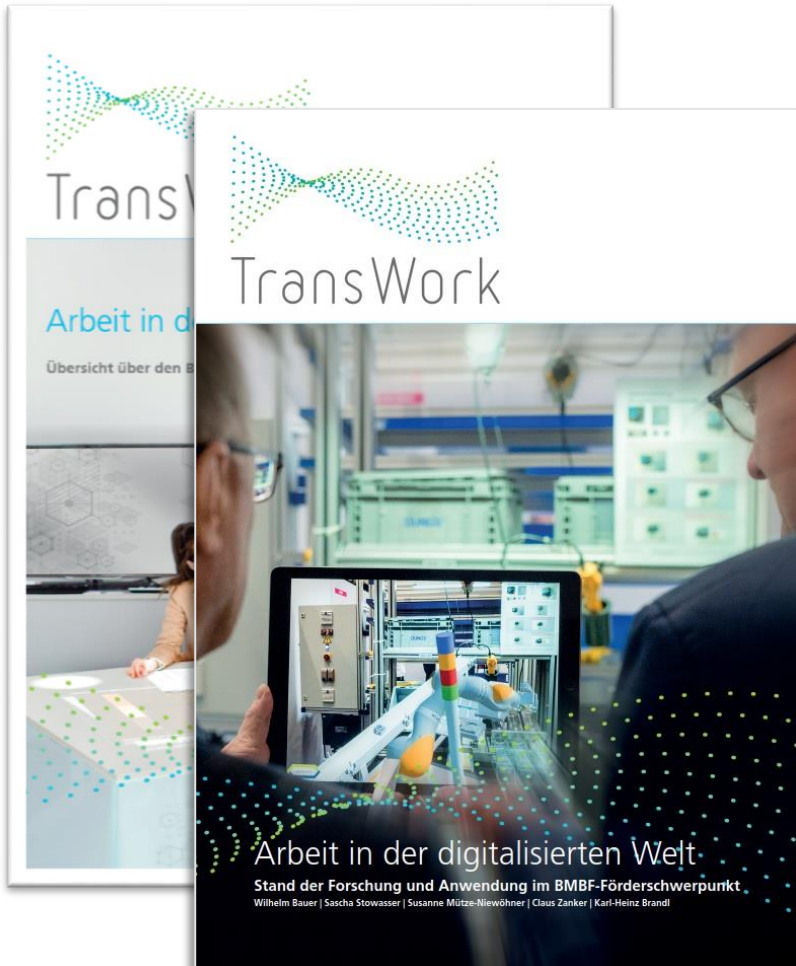


### At a glance

- The world of work can be specified and detailed along **organisational, interactional and individual core dimensions** in a multidimensional way.
- The project focuses both on the dimensions and their **interaction and interplay**.
- In total changes as well as opportunities and threats in **10 dimensions** have been identified coining the digital world of work.
- The Atlas serves as 1) **Orientation** for companies looking for an overview on digitalization of the world of work and as 2) **Basis** for further (measuring) instruments of the application-oriented research project DigiTrain 4.0
- Further information:  
[www.digitrain40.de/atlas/](http://www.digitrain40.de/atlas/)

# Public Relations

## Brochures



- Arbeit in der digitalisierten Welt – Übersicht über den BMBF-Förderschwerpunkt (2018)
- Arbeit in der digitalisierten Welt – Stand der Forschung und Anwendung im BMBF-Förderschwerpunkt (2019)

Work in the Digitalized World - Overview of the Federal Ministry of Education and Research (BMBF) funding priority

Work in the Digitalized World - Status of research and application in the Federal Ministry of Education and Research (BMBF) funding priority

➤ [www.transwork.de](http://www.transwork.de)

# Contact



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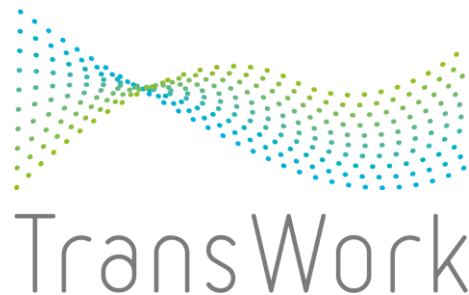
**Fraunhofer Institute for Industrial Engineering IAO**

**Nobelstr. 12**

**70569 Stuttgart**

**Germany**

The research results presented have been developed within the research project “TransWork”, which is funded by the German Federal Ministry of Education and Research [Bundesministerium für Bildung und Forschung – BMBF] in the funding measures “Arbeit in der Digitalisierten Welt” [Work in the digitalized world] (grant no. 02L15A164).



TransWork



# Research focus Fraunhofer IAO

»Analysis and Design of future Competences«

Overall Project Management, Work Package 1, 5-7, 8



## The Organisation

The interdisciplinary teams of **Fraunhofer Institute for Industrial Engineering IAO**, located in Stuttgart, bring colleagues from a range of specialist fields, including business management and economics, computer science, engineering, natural sciences, and social science together. They take a wide-ranging, holistic approach to analyse key issues in order to pinpoint the most practical and feasible solutions.

## The Objective

- Exploration of development prospects of digital work
- Deriving competence and qualification requirements
- Analysis and design of future learning organisation
- Design of digital tools and assistance systems for the development of competences
- Development and activation of an expert panel



# Research focus Fraunhofer IAO

## »Analysis and Design of future Competences«

### Overall Project Management, Work Package 1, 5-7, 8



#### In the project Fraunhofer IAO aims at...

- an expert-based exploration of development prospects of digital work.
- the derivation of qualification and competence requirements.
- the analysis and design of future learning organisation.
- the development of a design quality check of digital tools and assistance systems for competence development.
- the development of recommended actions for an assessment of digital tools and assistance systems.
- the networking within the research focus on Work in the Digitalized World (»Arbeit in der digitalisierten Welt«)
- the further development of the research field.
- the identification and closing of research and development gaps.



# Research focus

## Institute of Industrial Engineering and Ergonomics at RWTH Aachen University (IAW)

### »Control of Complexity« Work Package 2 and 6



#### The Organisation

The main research focus of the **Institute of Industrial Engineering and Ergonomics (IAW)** is the design and optimization of work systems and work processes in development, production and service. This complex task is performed by an interdisciplinary team of mechanical and industrial engineers as well as computer and social scientists.

#### The Objective

- Exploration of complexity drivers in digital working systems
- Identification of changes in groups and teamwork through digital technologies
- Quantitative evaluation of the complexity of work systems
- Development and practical test of a TeamTracker for self-organization



# Research focus

## Institute of Industrial Engineering and Ergonomics at RWTH Aachen University (IAW)

### »Control of Complexity« Work Package 2 and 6

In the project IAW aims at...

- a definition of complexity.
- a operationalisation based on the development of complexity-metric for cooperative types of work.
- the exploration of complexity drivers in digital working systems.
- the identification of changes in groups and teamwork through digital technologies.
- the quantitative evaluation of the complexity of work systems.
- the derivation of potential for reduction and control of complexity.
- Development and practical test of a assistance system (TeamTracker) used for self-organization distributed and inter-connected teams.
- the transfer of results through publications of the IAW publication series and the joint research project.



# Research focus Institut fuer angewandte Arbeitswissenschaft (ifaa)

## »Productivity Management« Work Package 3, 5, 6



### The Organisation

The **Institut fuer angewandte Arbeitswissenschaft (ifaa)** is the research institute of the German metal- and electrical industry for designing the working world. ifaa supports the employers' associations and their member companies as a pioneer, crosslinker and mediator in disciplines of industrial engineering, ergonomics and business organization. Ifaa's applied research is closely linked to the practice of companies and is primarily aimed at strengthening the competitiveness of the German economy in order to safeguarding jobs.



### The Objective

- Framework for systematic design of productivity strategies for workplaces 4.0
- Structured overview of productivity strategies and their potential within an integrated productivity management
- Compilation of good practices for productivity strategies in a digitalized and connected working environment
- Guidelines for design and implementation of digitalization-adequate productivity strategies

# Research focus Institut fuer angewandte Arbeitswissenschaft (ifaa)

## »Productivity Management« Work Package 3, 5, 6



### In the project ifaa aims at...

- conceptual development of a framework for systematic design of productivity strategies in a digitalized and connected working environment.
- systematic identification, classification and potential analysis of strategies for an integrated productivity management based on participation of joint research projects and other advanced users, e.g. corporations.
- transfer of identified potentials for designing an integrated productivity management.
- identification of evaluated good practices for productivity strategies with regard to effectivity and efficiency within a digitalized and connected working environment.
- development of a guideline for designing and implementing of digitalization-adequate productivity strategies.



Ludmila Parsyak, ©Fraunhofer IAO



# Research focus Input Consulting

## »Design and Regulation of Work« Work Package 4, 6



### The Organisation

**Input Consulting**, seated in Stuttgart, is a consulting and social research institute. Main subjects, amongst others, are the development of markets, companies, employment, working conditions and representation of interests. The development of (services) work and technology are considered in this context. Furthermore, Input Consulting carries out projects and studies on the subject of digitalization.

### The Objective

- Analysis of objectives and instruments of work design and regulation within the context of digitalization
- Identification of factors for success and good practice for designing and regulating new forms of work
- Development of subject-specific design and regulation solutions for digitally networked types of work





# Research focus Input Consulting

## »Design and Regulation of Work« Work Package 4, 6



### In the project Input Consulting aims at...

- the analysis of objectives and tools for work design and regulation in the digital context.
- the development of a typology of digitized work with regard to work design and regulation.
- the identification of factors for success and good practice for designing and regulating new forms of work.
- the development of subject-specific design and regulation solutions for digitally networked types of work in potentially problematic areas while taking the existing legislative framework into account.
- the development of a guideline for subject-specific design and regulation approaches of digitized/ networked work.
- the formulation of requirements for a good work design and regulation.

# Research focus ver.di - United Services Trade Union

## »Integration and Transfer of Design Approaches to target groups« Work Package 4, 5, 6



**Vereinte  
Dienstleistungs-  
gewerkschaft**

### The Organisation

The name ver.di stands for Vereinte Dienstleistungsgewerkschaft – United Services Trade Union. Our members are employees, freelancers, civil servants and students drawn from over 1,000 different occupations, all of them working in services or related industries. With a membership of over 2 millions we work to achieve humane working conditions and preserve jobs, carrying out collective bargaining, advising works councils and pursuing political lobbying at national and international level.



### The Objective

- Development of success factors for the transfer of all partners' research results
- Concrete transfer by target group-specific work material
- Dissemination and sustainable utilization of results by means of qualification modules and training concepts.

# Research focus ver.di - United Services Trade Union

## »Integration and Transfer of Design Approaches to target groups« Work Package 4, 5, 6



**Vereinte  
Dienstleistungs-  
gewerkschaft**



Ludmilla Parsyak, ©Fraunhofer IAO

### In the project ver.di aims at...

- the development of success factors for the transfer of all partners' research results.
- the concrete transfer by target-group-specific work material.
- the dissemination and sustainable utilization of results by means of qualification modules and training concepts.

For this purpose, there are the following objectives:

- Overview of success factors and good practice.
- Compilation of transfer activity approaches.
- Guideline for appropriate procedure models with strategic recommendations.
- Target group-specific publications.
- Creation of internet-based support services.
- Initiation and monitoring of pilot projects.