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Working title:

Development of a systematic approach for the identification of age-critical workplaces and their adaptation by technical assistance systems

25. Techno-Ökonomie-Kolloquium

24.05.2019

FFG Research project „EnableMe50+“

- EnableMe 50+: Methods and technologies to counteract occupational challenges of the demographic change

ENABLEME 50+

Project set-up	Public funded three year research project (FFG-Bridge program) Research focus: Work system design in times of digitalization and demographic change
Project partners	 JOHANNES KEPLER UNIVERSITÄT LINZ rosenbauer REWE GROUP

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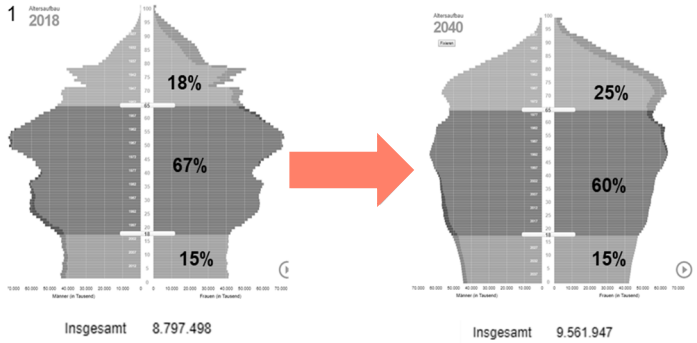
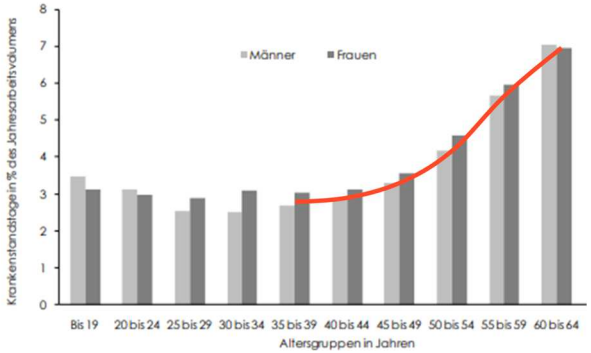
Problem statement

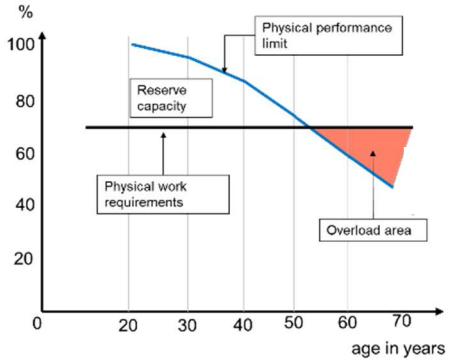
Significant ageing of working population is expected (in Austria **+200,000 people** in age group 50-65 between the years of 2017 and 2025)[1]



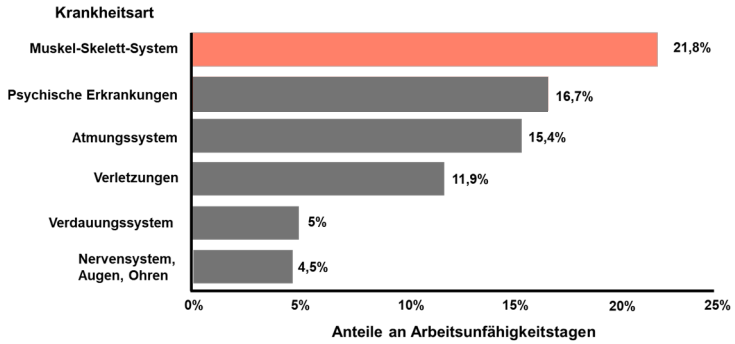
These overloads lead to **health problems**. This can be seen, for example in the fact that **sick days between the ages of 40-44 and 60-64 more than double.**[4]



As people age **human abilities change**, which can lead to **physical overload at constant physical workloads**.[2] This concept is known as **stress-strain-model.**[3]



The majority of this problems can be attributed to **musculo-skeletal disorders** and mental illnesses, which **account for almost half of all sick days**.[4]



[1] Statistik Austria Bevölkerungsprognose (2017); [2] Börner K. et al. (2017); [3] Rohmert W. 1984, [4] WIFO-Berechnungen (2017); [5] www.de.statista.com (2018)

Practical relevance economic impact

- Days of incapacity for work caused by MSD have a significant economic impact

	Days of incapacity for work		Production downtime costs		Loss of gross value added	
Diagnosis group	Million	%	Billion €	% GDP	Billion €	% GDP
Diseases of the musculoskeletal system	150,4	21,8	17,2	0,5	30,5	0,9
Psychological and mental disorders	107	16	12,2	0,4	21,7	0,7
Diseases of the respiratory system	92,9	13,9	10,6	0,3	18,8	0,6
Injuries, poisonings and accidents	70,2	10,5	8	0,2	14,2	0,4
Diseases of the circulatory system	34,1	5,1	3,9	0,1	6,9	0,2
Diseases of the digestive system	33,54	5	3,8	0,1	6,8	0,2
Other diseases	180,5	27	20,6	0,6	36,6	1,1
All diagnosis groups	668,64	100	76,3	2,2	135,5	4,1

Musculoskeletal disorders (MSD) account for:

- 21,8% of days of **incapacity for work**
- 17,2 billion € of production **downtime costs**
- 30,5 Billion € **loss of GDP**

BAUA 2017: Volkswirtschaftliche Kosten durch Arbeitsunfähigkeit 2017

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Research Need

- *Older workers whose **physical abilities do not meet job demands face increased injury risk** and work-related musculoskeletal disorders are more predominant in old workers. Further there **no cause and effect model or even a dose–response relationship model** between physical workloads and musculoskeletal disorders (MSD´s)*
  Klussmann F. et al. 2017, Fraade-Blanar F. et al. 2017

- *Present ergonomics standards concerning work process in principle are aimed at protecting an as wide as possible range of working population, **but in practice they are aimed mainly at protecting only the healthy adult working population***
  Colombinni D. & Occhipinti E. 2006
- ***"An ergonomic approach that considers influences of the age-related performance changes**, and relates them with strain and stress, **has not been found yet**"* Keil M. & Spanner-Ulmer B. 2011
- *"Due to age-related physical changes, an examination of the issue of age is required in relation to assessment procedures for physical stress. **A differentiated consideration of age-relevant factors, however, is not carried out in the procedures**, so that there is a **need for action especially with regard to the design of age-related workplaces"***
  Börner et al. 2017

- *"The measures pursued are usually aimed for isolated reduction of work stress. **A direct adaptation of the requirements at a workplace to the individual physical characteristics and abilities of employees does not take place**"*
  Wittemann P. 2017
- *„Digital and physical assisting systems **can lower physical work strain and therefore are very beneficial for older workers,** but there are only a few practical application examples in automotive industry for special work tasks. However **there is no structured approach for the planning or implementation of assisting systems related to the specific assistance need of the user**"*
  Spanner-Ulmer B. et al 2009, Brandl C. et al 2015
- *"The **ergonomic intervention process** is currently a **highly individual, knowledge-based process without a methodical procedure**. A methodical connection of the ergonomic analysis and the ergonomic intervention have not be established. Further **research seems to completely miss to address the ergonomic intervention process** and methodic assistance for the ergonomic intervention process or technological requirements detached from ergonomic assessment methods are essentially nonexistent in literature"*
  Brandl C. et al 2016

1. Increased work strain and **risk for older workers** but missing basic knowledge

2. Current ergonomic assessment methods do **not consider (age related) physical ability profiles** and are not capable to evaluate work strain

3. Current tools **focus on worker-workplace-fit.** The adaption of workplaces and ability based design **are not considered systematically.**

   Assisting systems can compensate for ability limitations but a structured ergonomic **intervention process is missing**

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Objective and derived research questions

Research objective

Enable the systematic identification of workplaces with age-critical work stress and minimize it by the use of assisting technologies

Research questions	Expected output
RQ1: How to **identify age-critical work places?**	▪ **Criteria for age-differentiated assessment** of workplaces ▪ Assessment method to identify age-critical work places ▪ Strain based **assistance need**
RQ2: What age-critical work strain can **be reduced by the use of assistance systems?**	▪ **Evaluation method** to identify suitable **assisting technologies** based on the assistance need
RQ3: How to conduct a **systematic identification and reduction** of age-critical physical work strain with assistance systems in industry?	▪ **Systematic procedure** to align assisting technologies to strain and workplace related stress ▪ Tool for industrial application

Expected result

A process model that …

…enables the assessment of work stress and strain and results in an assistance need

…offers a structured process to compensate the differences between requirements and worker abilities by the use of assistance system

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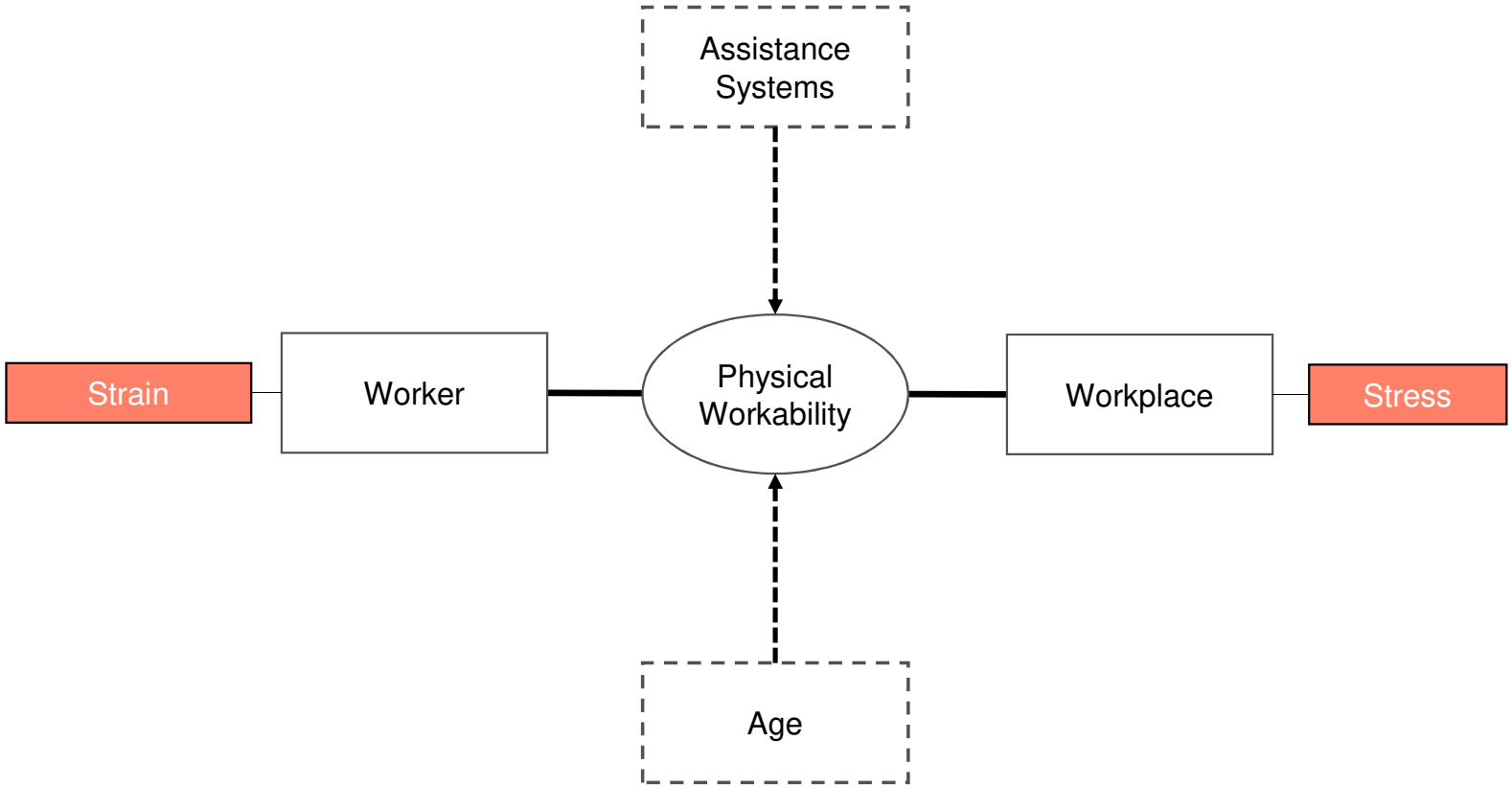
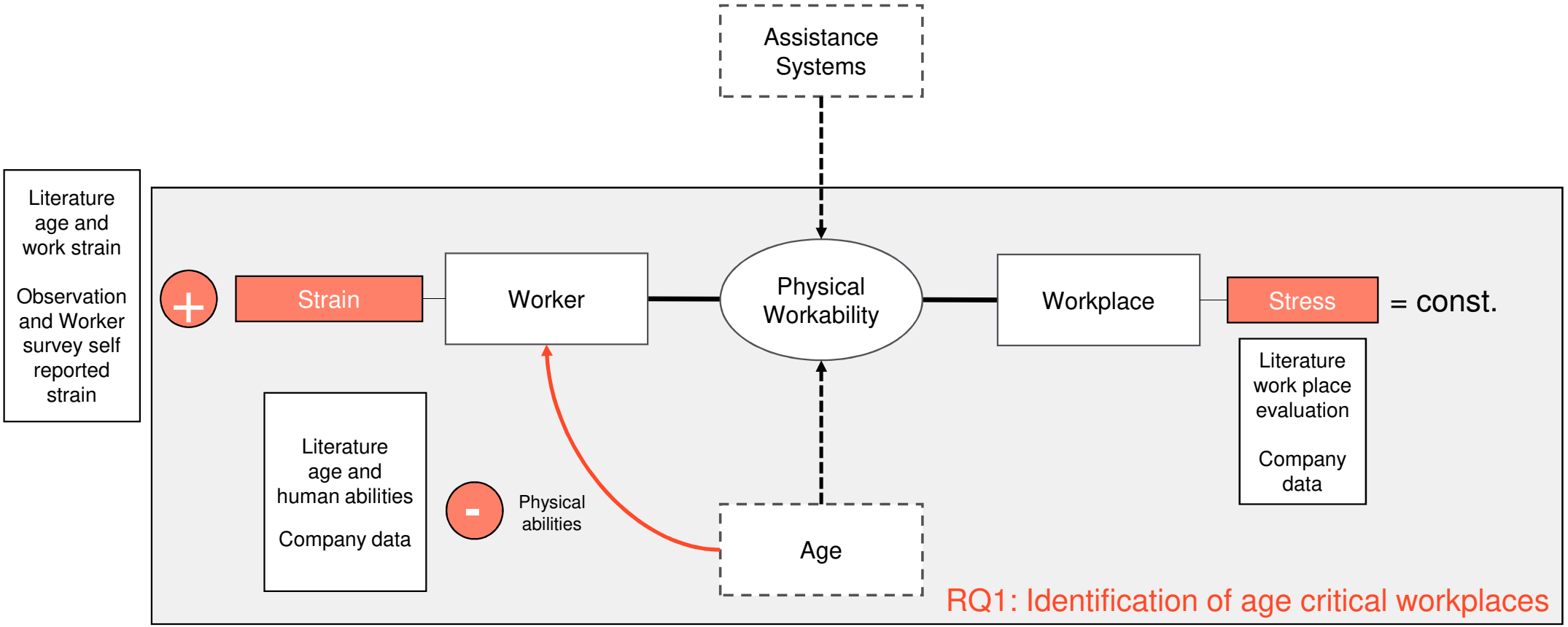
Research approach and framework

Applied research[1] with a inductive case study approach[3]

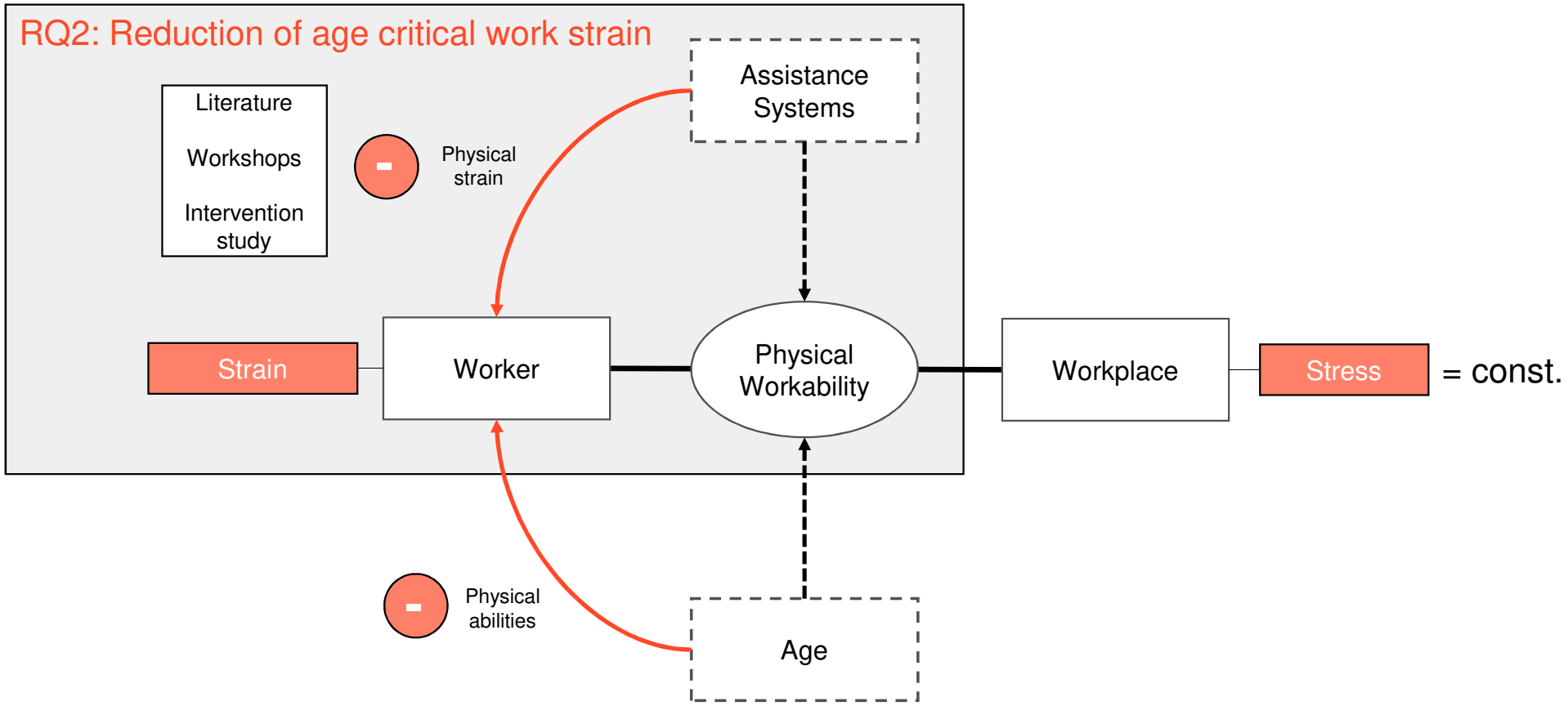


1 Ulrich 1981; 4 Voss 2016

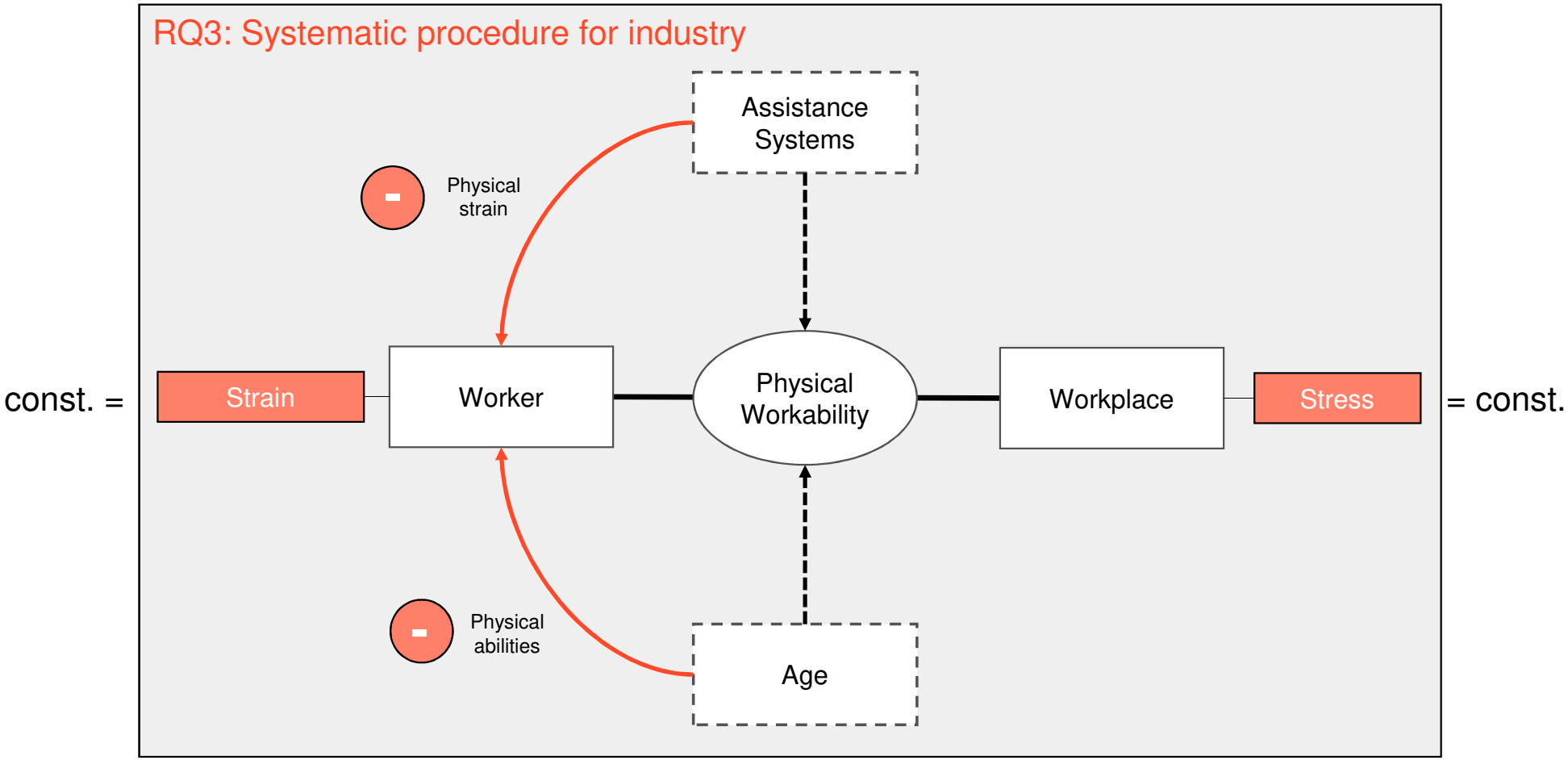
Research framework



Research framework



Research framework



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Research Streams

Ageing & Workability

Workability

Ilmarinen J. & Tempel J.: Working ability 2010 – What can we do so that you stay healthy?, Hamburg 2002

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Abilities

DeZwart et al.: Physical workload and the aging worker: a review of the literature. Int Arch Occup Environ Health, (68) 1995, 1–12.

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Shephard R: Age and physical work capacity. Exp Aging Res, 25(4) 1999, 331-343.

Industrial Engineering

Arbeitswissenschaft

Schlick C. et. al.: Arbeitswissen-schaft, Springer Berlin Heidel-berg, 2010

Rohmert W.: Belastungs-Beanspruchungs-Konzept ZfA, 4 1984, 193-200

Borg G.: Psychophysical bases of perceived exertion, Medicine and Science in Sports and Exercise, 14 1982, 377–381

Müglich D. et al.: Development of a database for capability-appropriate workplace design in the manufacturing industry, Occupational Ergonomics 12 2015, 109-118

Workplace assessment

Takala et al.: Systematic evaluation of observational methods assessing biomechanic exposures at work, Scand J Work Environ Health, 36(1) 2010, 3-24

Börner K. et al.: CheckAge Screening Verfahren für die Bewertung alter(n)sgerechter Arbeitsplätze. aw&I Report, Heft 2, Chemnitz 2017

Technical Assistance

Assistance Systems

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Human Factors

Age appropriate workplace (re)design

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THANK YOU

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