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Cognitive Production Systems: A Mapping Study

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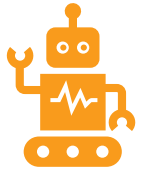
***Abstract*—In order to guarantee the quality and the productivity of a production system in a competitive marketplace, it is important to be able anticipate the changes in specifications of products and systems. The time limits in running productions, the complexity of manufacturing systems, and the diversification of components, are the challenges that human experts cannot handle**

Agenda

- Introduction
- Objectives and Research Questions
- Research Methodology
- Results
- Discussion
- Summery and Outlook
- Literature

Introduction

Problem

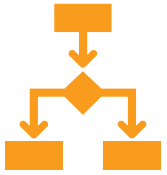


„from mass production to mass customization“[1]

Changes from inside and outside

Time to react

“cognitive capabilities such as perception, reasoning, learning, and cooperation”[1]



Use of cognitive skills to deal with unexpected events

[1]Tran, Park, Nguyen & Hoang, 2019

Motivation

- Provide an overview of the research area
- Represent the quantity and type of publications

- Identify research gaps and put a light on futhure research directions

Objectives and Research Questions

Research Questions

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RQ1: What types of concepts exist for Cognitive Production Systems (CPS)?

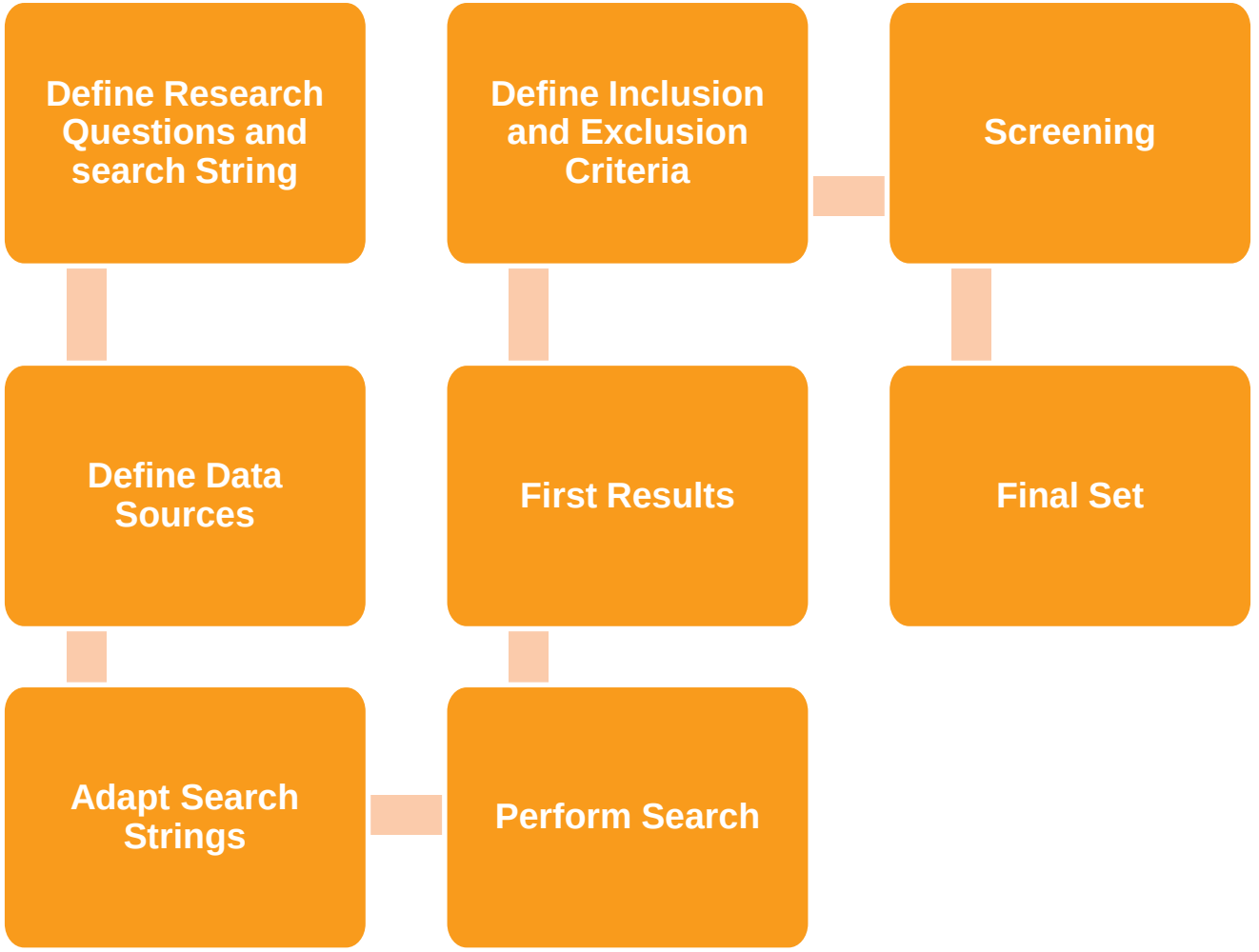
RQ2: Which types of existing concepts for CPS are used in practice?

RQ3: Which advantages do CPS have in production and which problems of traditional automated production do they really solve?

RQ4: What are the most relevant problems and barriers for CPS-prototypes?

Research Methodology

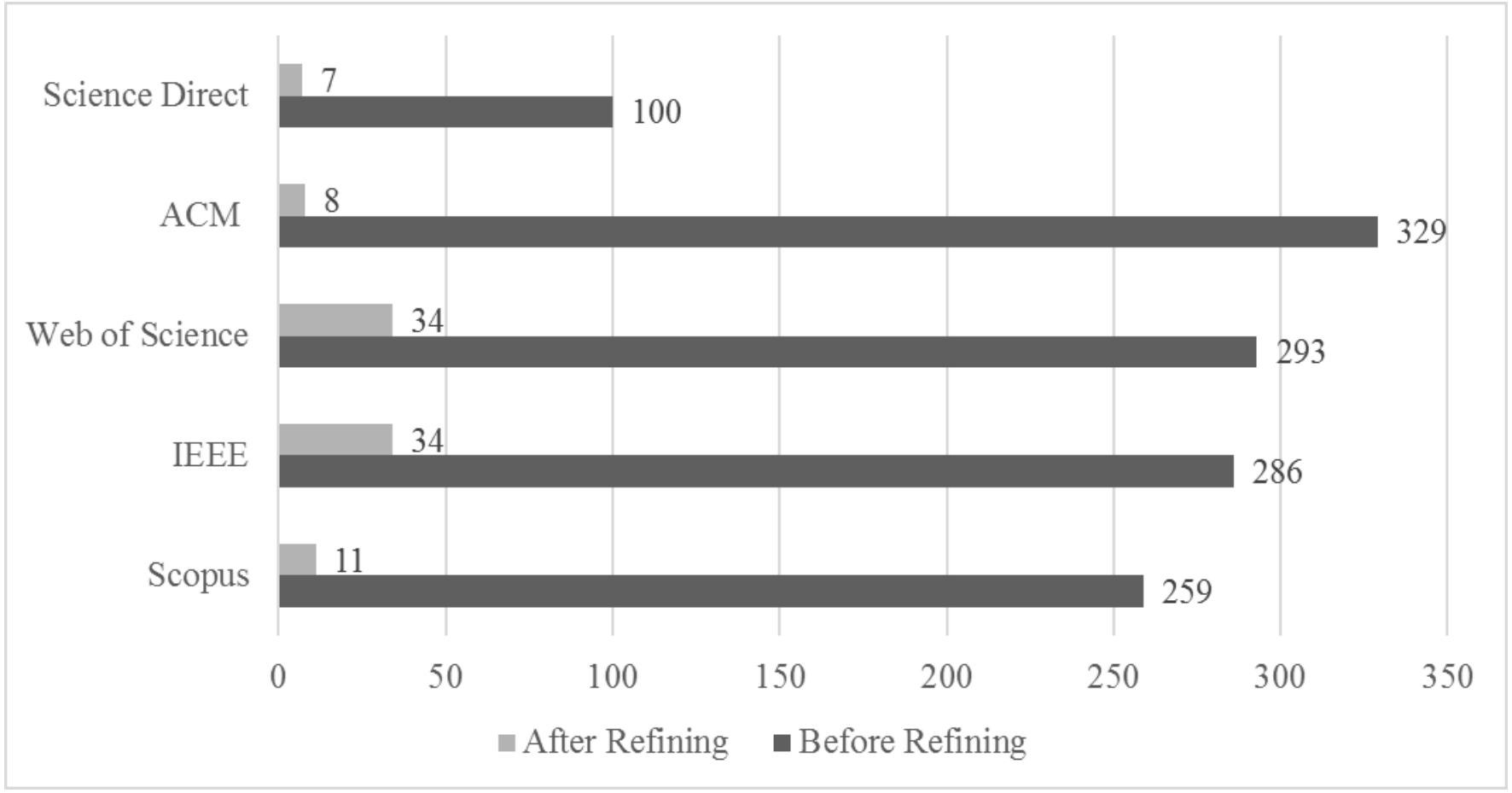
Conducting the Mapping Study



Search String

Keyword	Synonyms
Cognitive	intelligent smart artificial
Production	system production system manufacturing factory manufacturing system
Industry 4.0	industrial internet of things IIoT
Cyber Physical	industrial computer integrated computer aided

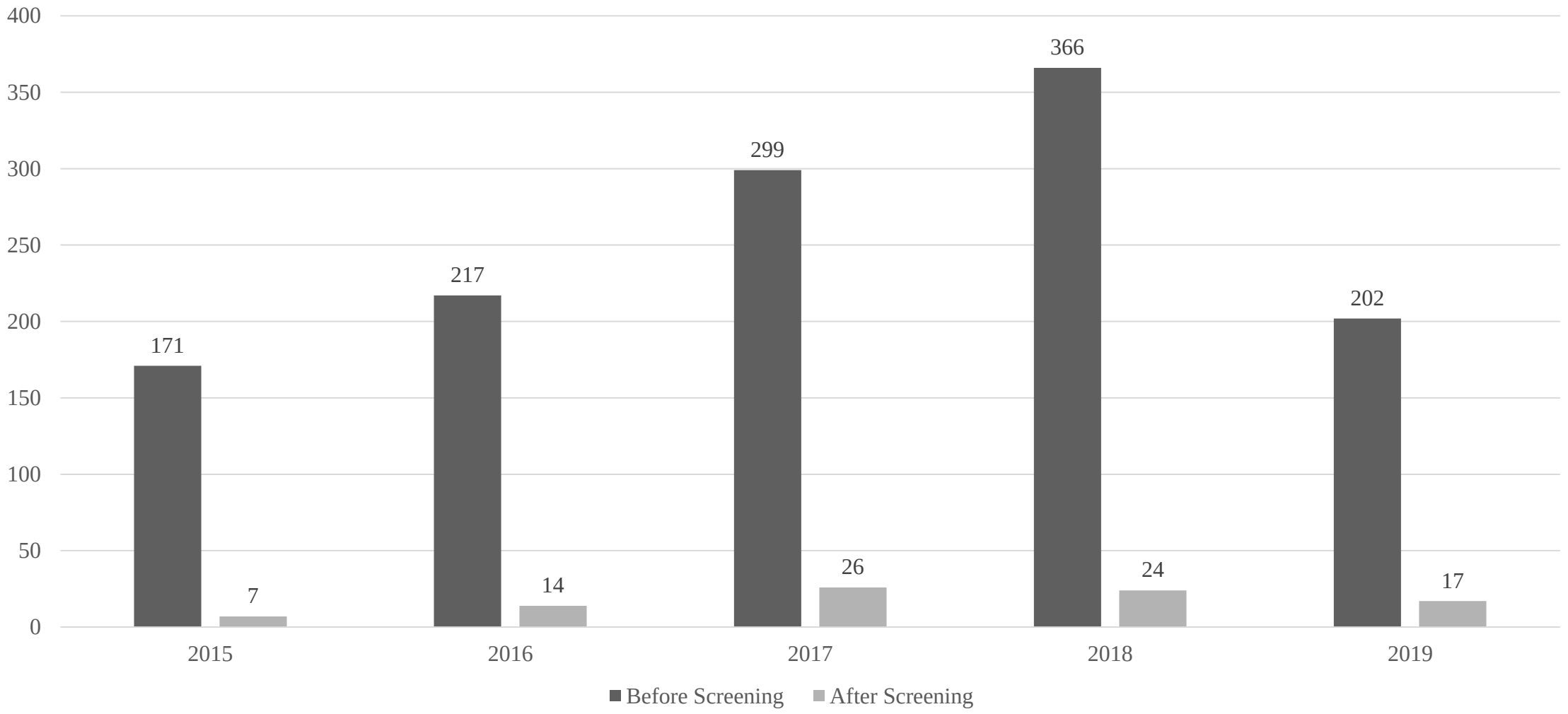
Finings with Regards to Dataset



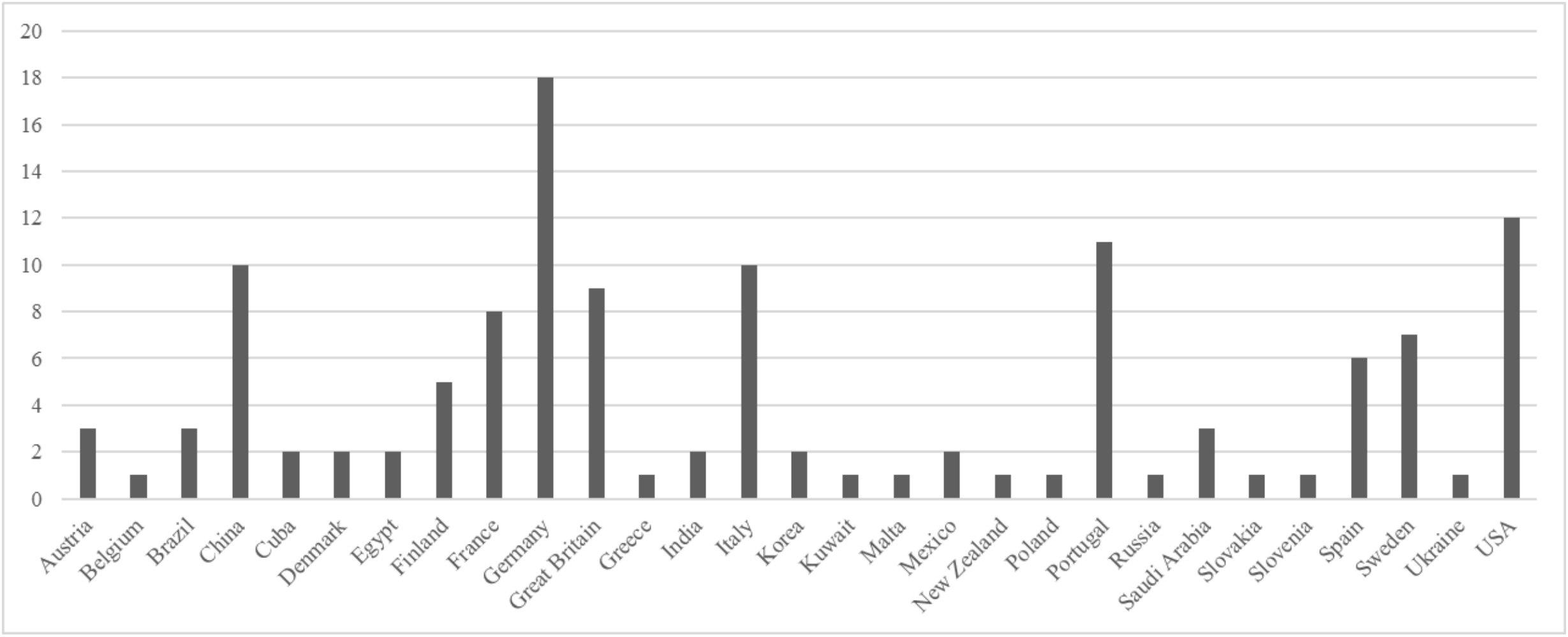
Before Screening: 1256

After Screening: 94

Papers with Regards to Year of Publication

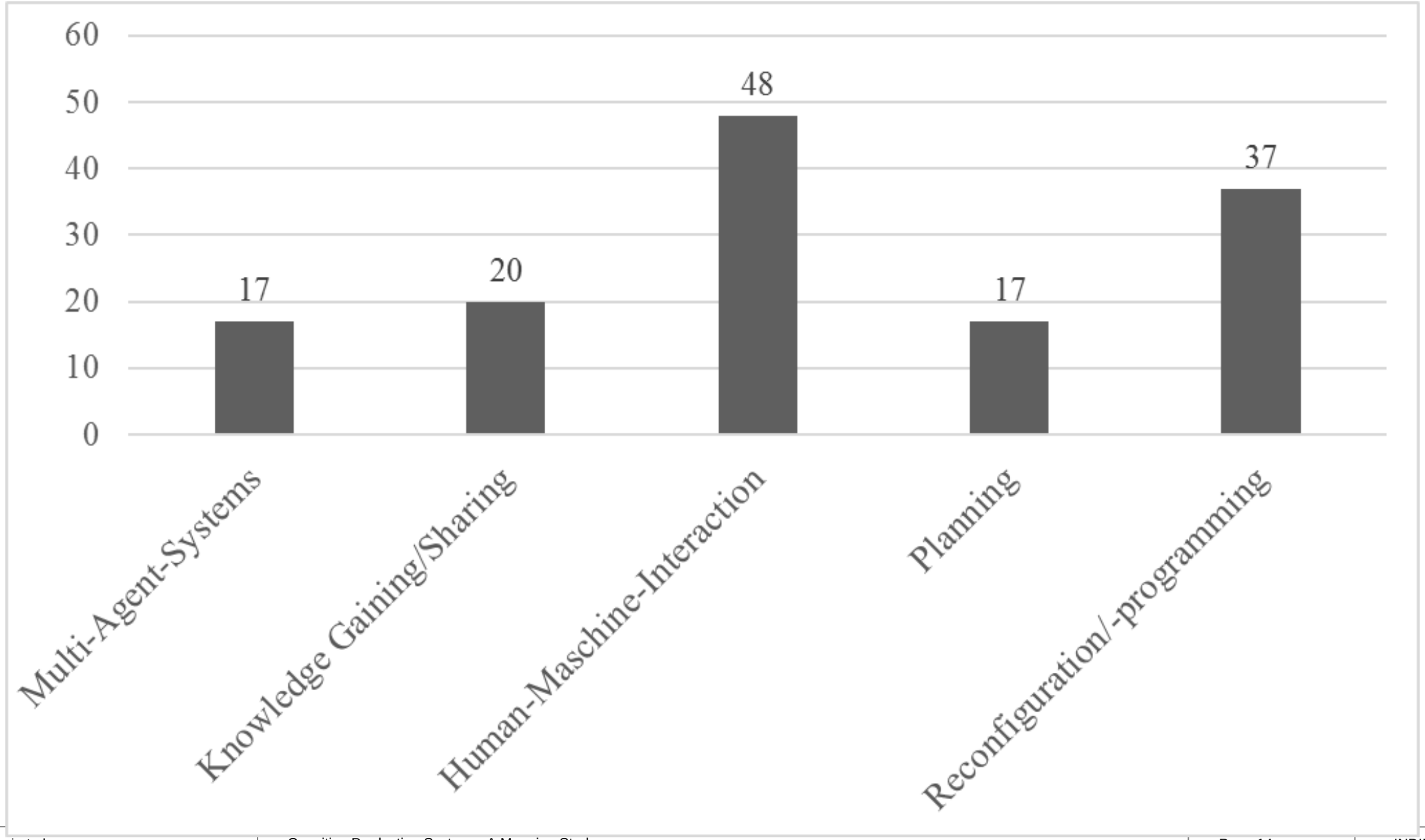


Papers with Regards to Country of Publication

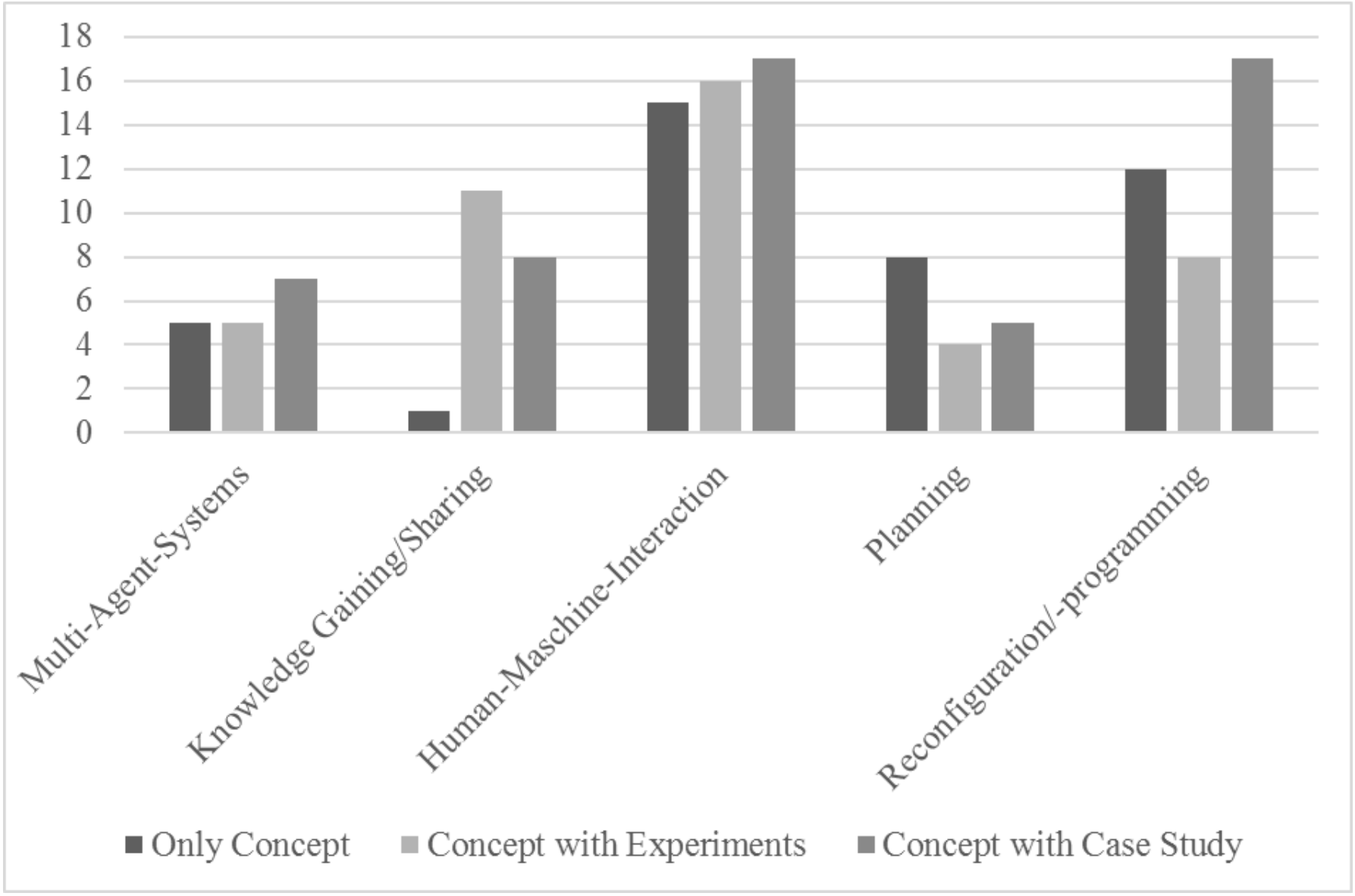


Results

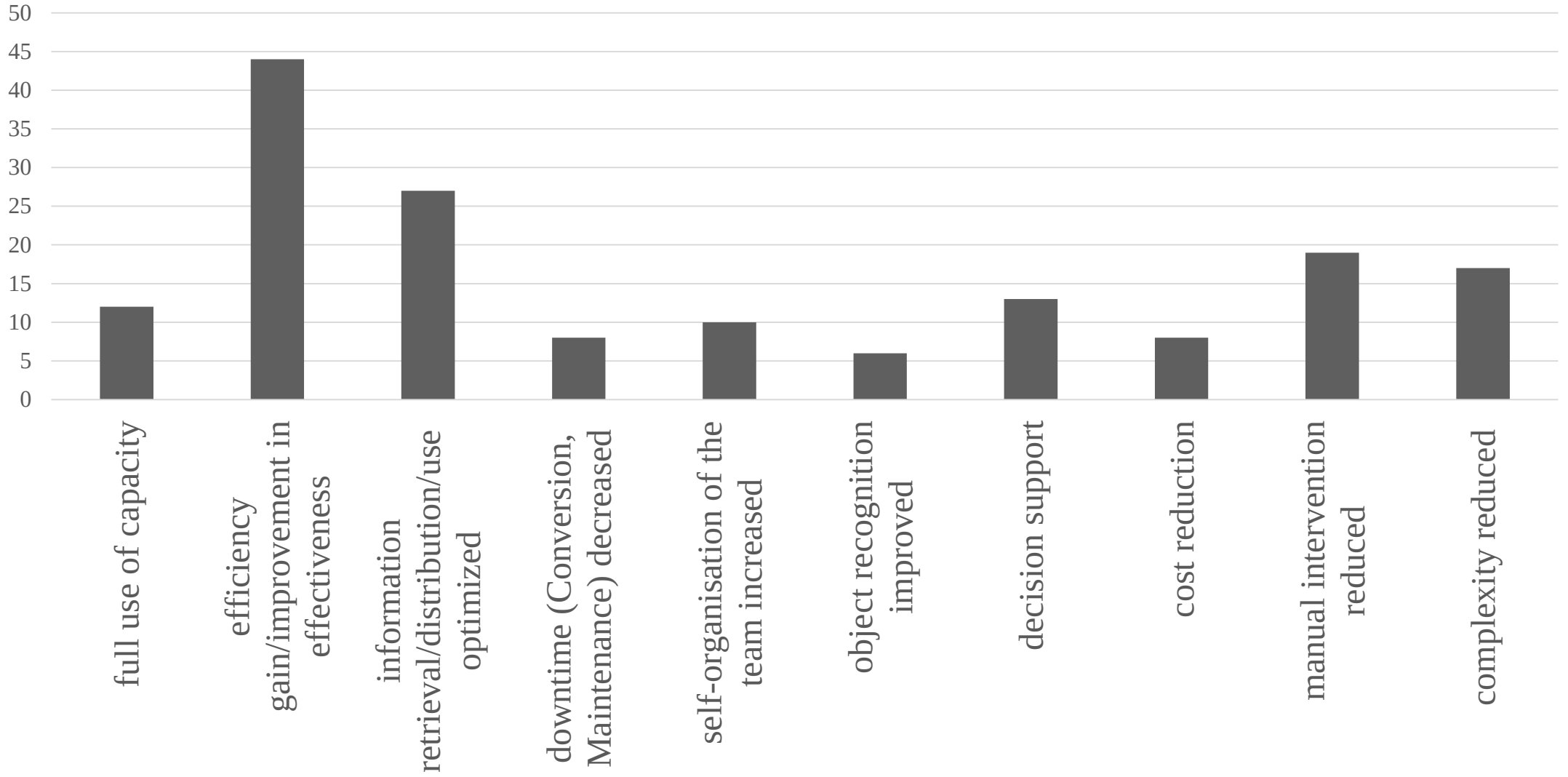
RQ1: What types of concepts exist for cognitive production systems?



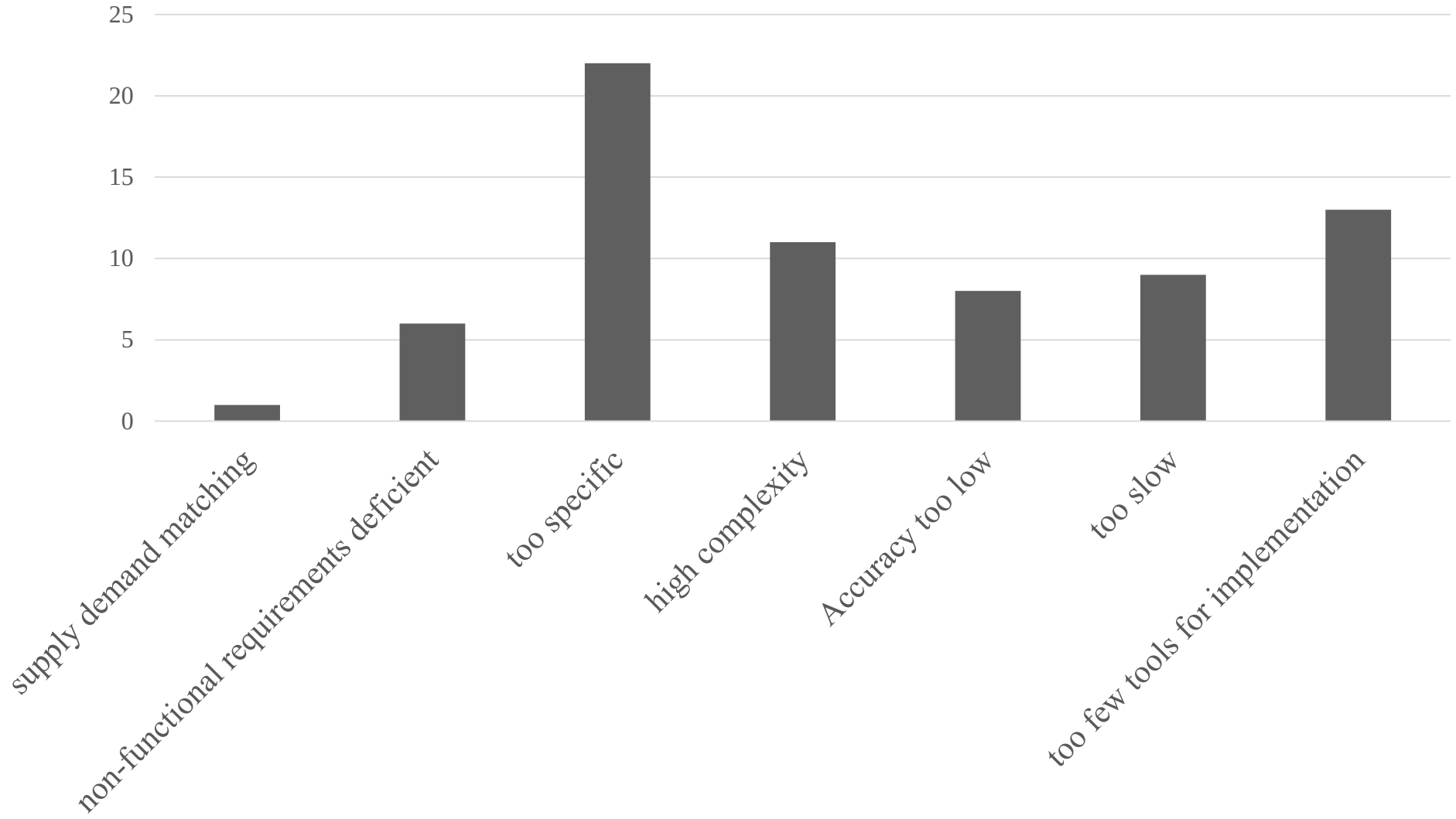
RQ2: which types of existing concepts for CPS are used in practice?



RQ3: Which advantages do they (CPS) have in production and which problems of traditional automated production do they really solve?



RQ4: What are problems and barriers for CPS prototypes?



Summary and Outlook

Summery and Outlook

Hype started since 2015

Human involvement is the focus of research

Research also with many practical results

Generalization of approaches is the most common problem

Optimized efficiency through cognitive production systems

Some Questions to be Answered

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Questions in the context of cognitive production systems:	
	Although people should be involved, the question is how?
	Can human involvement withstand the need for efficiency in the long term?
	Reconfiguration: Which approaches are successful?
	Would be standard AI solutions possible? or do the different approaches remain?
	Is the use of ontologies a method or just the help to implement other methods?

Links

- List of papers and their contribution in research questions
  - https://doi.org/10.6084/m9.figshare.12582632.v1
- Link to the Slides
  - https://tinyurl.com/indin2020cps
- Link to Smart Production Systems at HTW Dresden
  - https://www.htw-dresden.de/industrie40