

The Role of AI for Industrial Innovation: Results from a Representative Sample of German Firms

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**OECD International conference on AI in Work, Innovation,
Productivity and Skills**

Session: „AI diffusion in firms – what do we know and what does it mean for policy”

February 3rd, 2021



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Content

- **Measuring AI diffusion in German firms**
 - Question in the German Innovation Survey (CIS 2018)
 - Follow-up telephone survey of AI using firms
- **AI contribution to innovation and firm performance**
 - Part of innovation output of AI using firms that can be attributed to the use of AI
 - Extrapolation to arrive at economy-wide figures
- **Skill demand for AI**
 - Open positions by required qualification
 - Positions that could not be filled

Measuring AI Diffusion in Firms

- Short, simple definition
- One question among many (no bias from satisficing)
- Methods/application areas, AI development, year of first use

12.4 Does your enterprise use Artificial Intelligence methods?

Artificial Intelligence (AI): A method of information processing that allows computers to autonomously solve problems.

Yes ₁ No ₂

→ Please continue with Question 12.7.

AI Method:

	Area of AI application:				
	<u>Products</u> <u>Services</u>	<u>Automation</u> <u>of processes</u>	<u>Interaction</u> <u>with clients</u>	<u>Data</u> <u>analytics</u>	<u>Other</u> <u>areas</u>
<u>Language/text</u> understanding	<input type="checkbox"/> ₁	<input type="checkbox"/> ₁	<input type="checkbox"/> ₁	<input type="checkbox"/> ₁	<input type="checkbox"/> ₁
<u>Image/pattern</u> recognition	<input type="checkbox"/> ₁	<input type="checkbox"/> ₁	<input type="checkbox"/> ₁	<input type="checkbox"/> ₁	<input type="checkbox"/> ₁
<u>Machine Learning</u>	<input type="checkbox"/> ₁	<input type="checkbox"/> ₁	<input type="checkbox"/> ₁	<input type="checkbox"/> ₁	<input type="checkbox"/> ₁
<u>Knowledge/expert</u> systems	<input type="checkbox"/> ₁	<input type="checkbox"/> ₁	<input type="checkbox"/> ₁	<input type="checkbox"/> ₁	<input type="checkbox"/> ₁
Others: <input style="width: 300px; height: 40px;" type="text"/>	<input type="checkbox"/> ₁				

12.5 Were the Artificial Intelligence methods used in your enterprise developed in-house or by others?

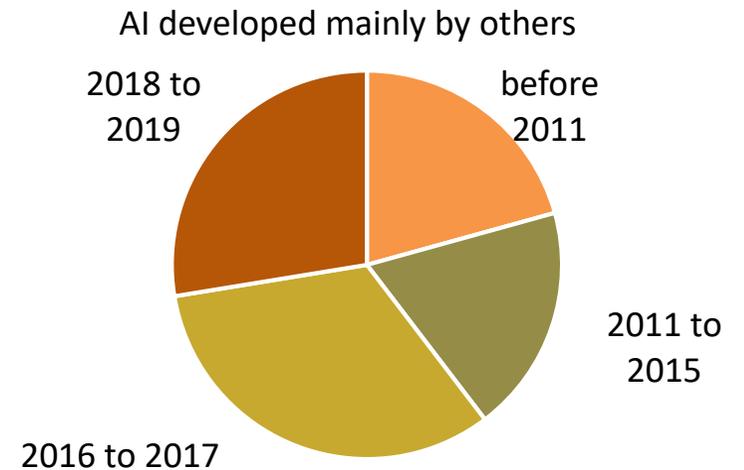
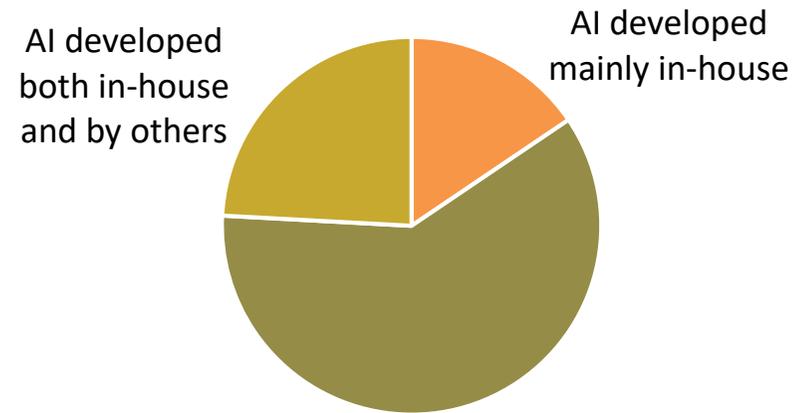
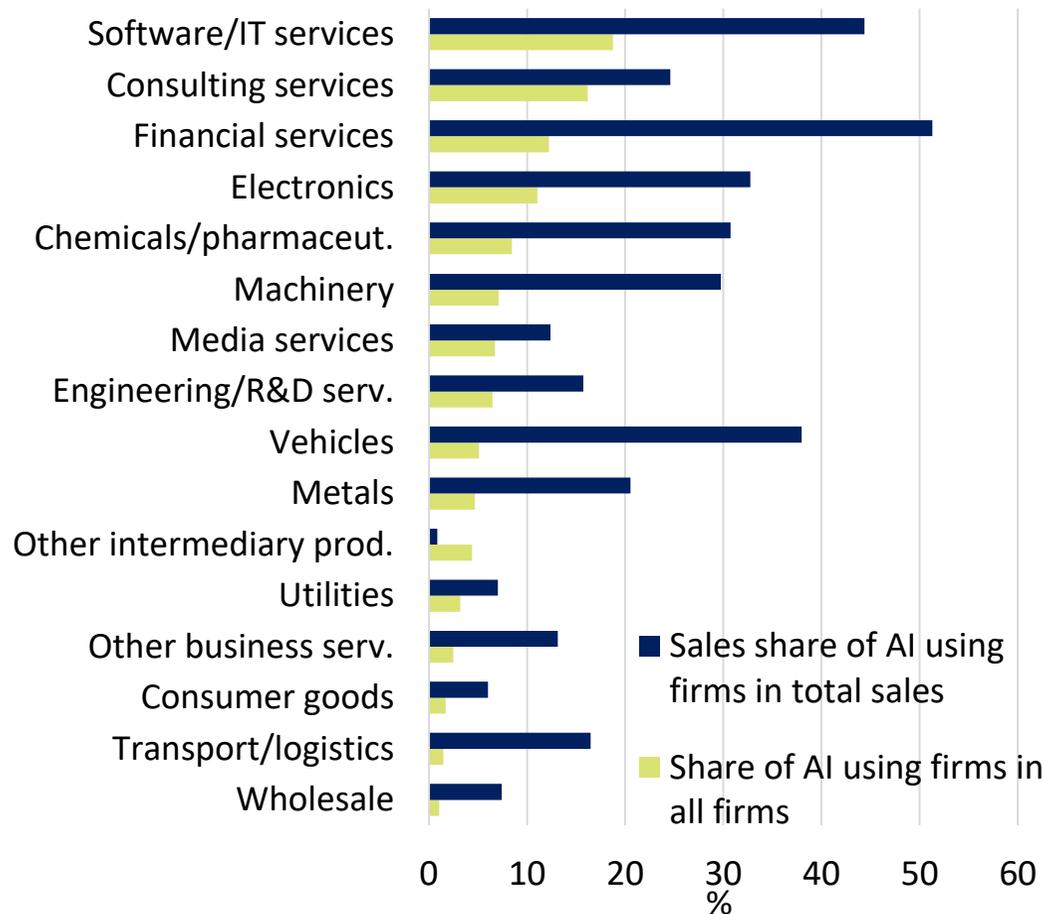
₁ mainly developed in-house ₂ mainly developed by others ₃ both in-house and by others

12.6 Since when is your enterprise using Artificial Intelligence methods?

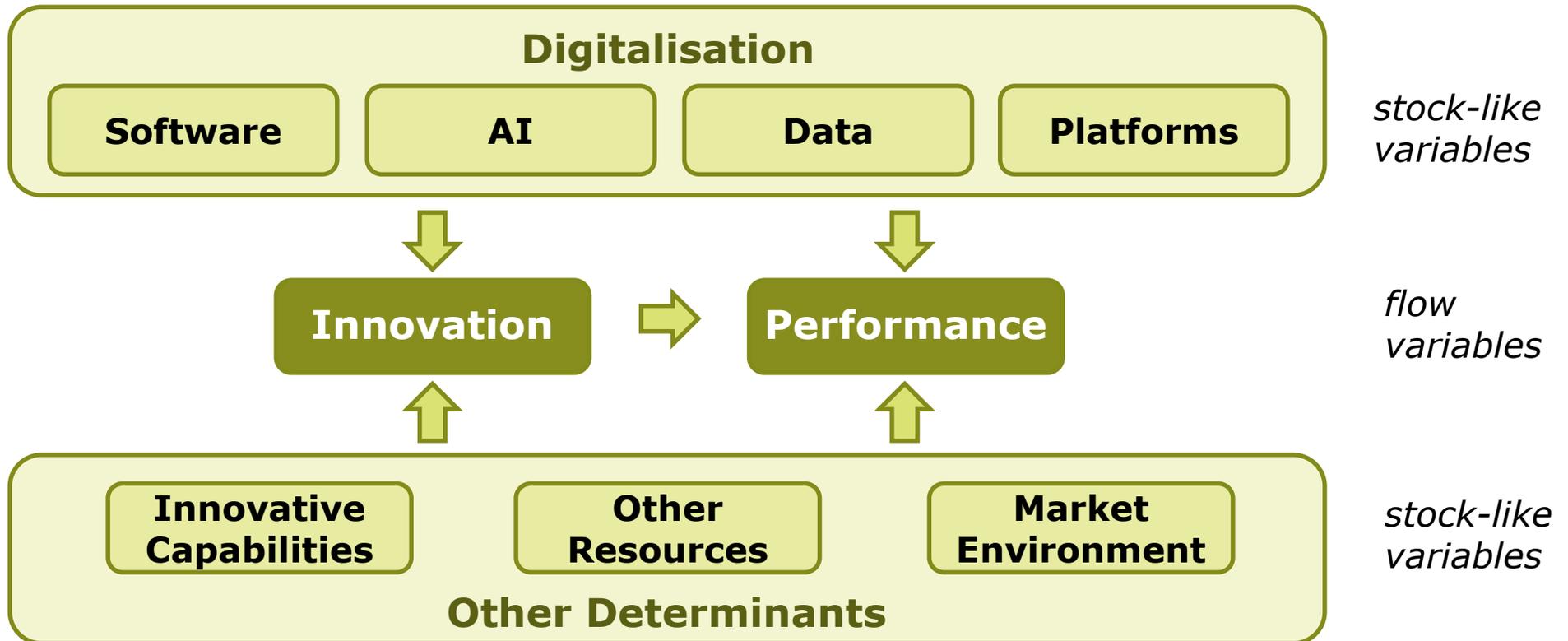
Year of the first use of artificial intelligence in your enterprise (*please provide an estimate*)

Share of AI Using Firms in Germany 2019

- 5.8% of firms use AI (+5 employees, manufacturing and business services)
- Representing 23.5% of total sales



Contribution of AI to Innovation and Firm Performance



Measuring AI Contribution to Innovation

	#	Share (%)	
Firms using AI	17,500	100.0	
Firms using AI that have introduced world-first innovations	1,950	11.1	100.0
Firms using AI that have introduced world-first innovations that can be attributed to the use of AI	470	2.7	24.3
Total number of firms in Germany (CIS target population)	299,600	100.0	
Firms in Germany with world-first innovations	12,900	4.2	100.0
AI contribution to world-first innovations	470	0.2	3.7

estimated

results of CIS

Main findings

Product innovation

- Significant contribution to more ambitious/novel innovation
- 3.7% of all world-first innovations in German firms linked to AI
- 8.9% of total sales with world-first innovations linked to AI

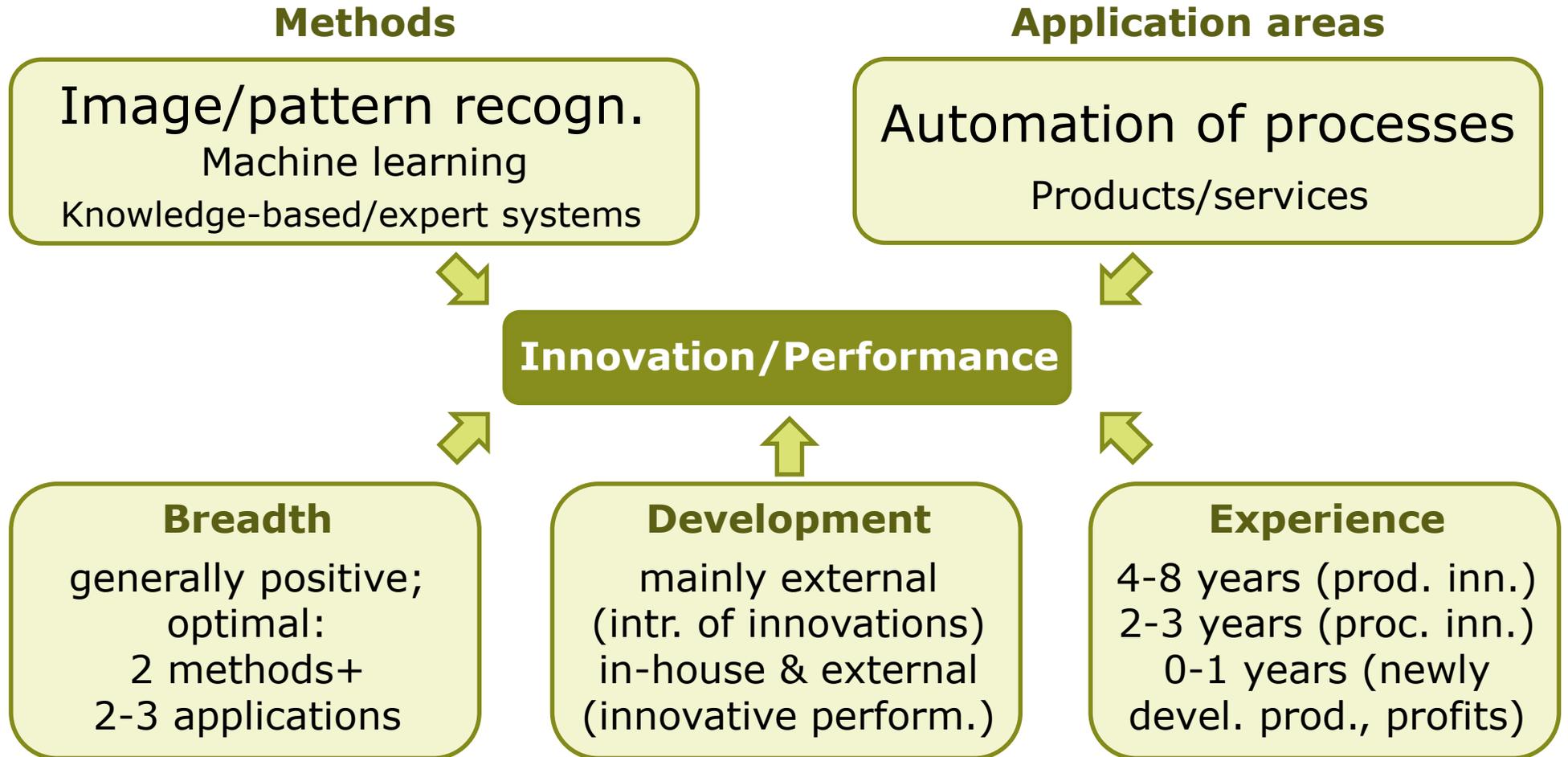
Process innovation

- Highest contribution to logistics and production methods (~3%)
- Only very small contribution to cost savings

Economic performance

- Positive net employment effect in AI using firms (1/3 of total employment growth 2016-2018)
- Substantially higher profitability (+1.3 PP, 20% of total profits of AI using firms)

Type of AI



AI Contribution in Absolute Figures

Innovative Sales (2018)

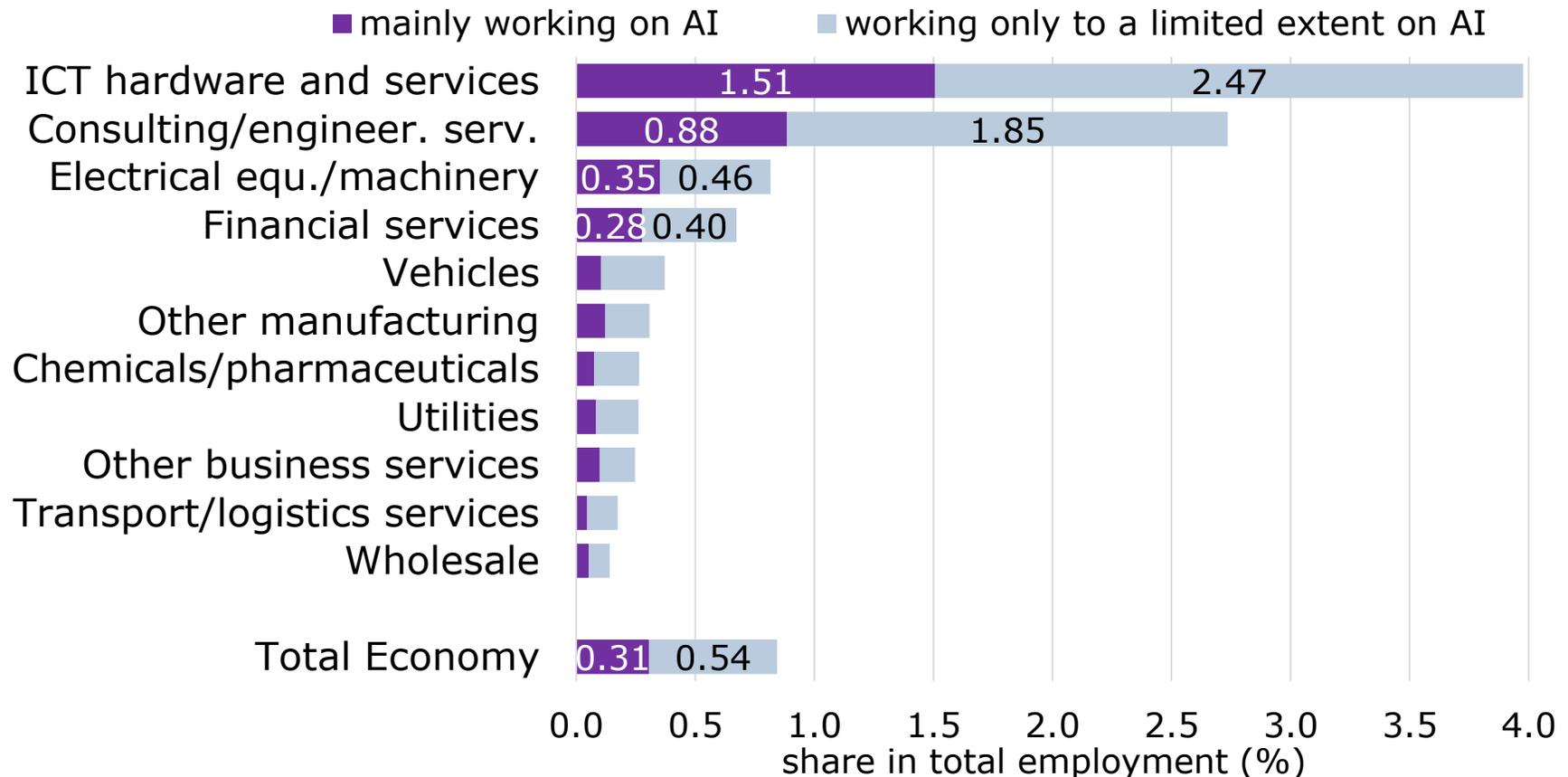
- **World first:** € 7.6 billion (SMEs: € 2.3 billion)
- **New-to-market total:** € 11.0 billion (SMEs: 3.1 billion)
- *Compare: **Expenditure on AI** (2019): € 4.8 billion
(return on investment at an average profit margin: ca. 15%)*

Profits (2018): € 15 billion

Additional Employment (change from 2016 to 2018): 48,000
(in SMEs and mid-range companies)

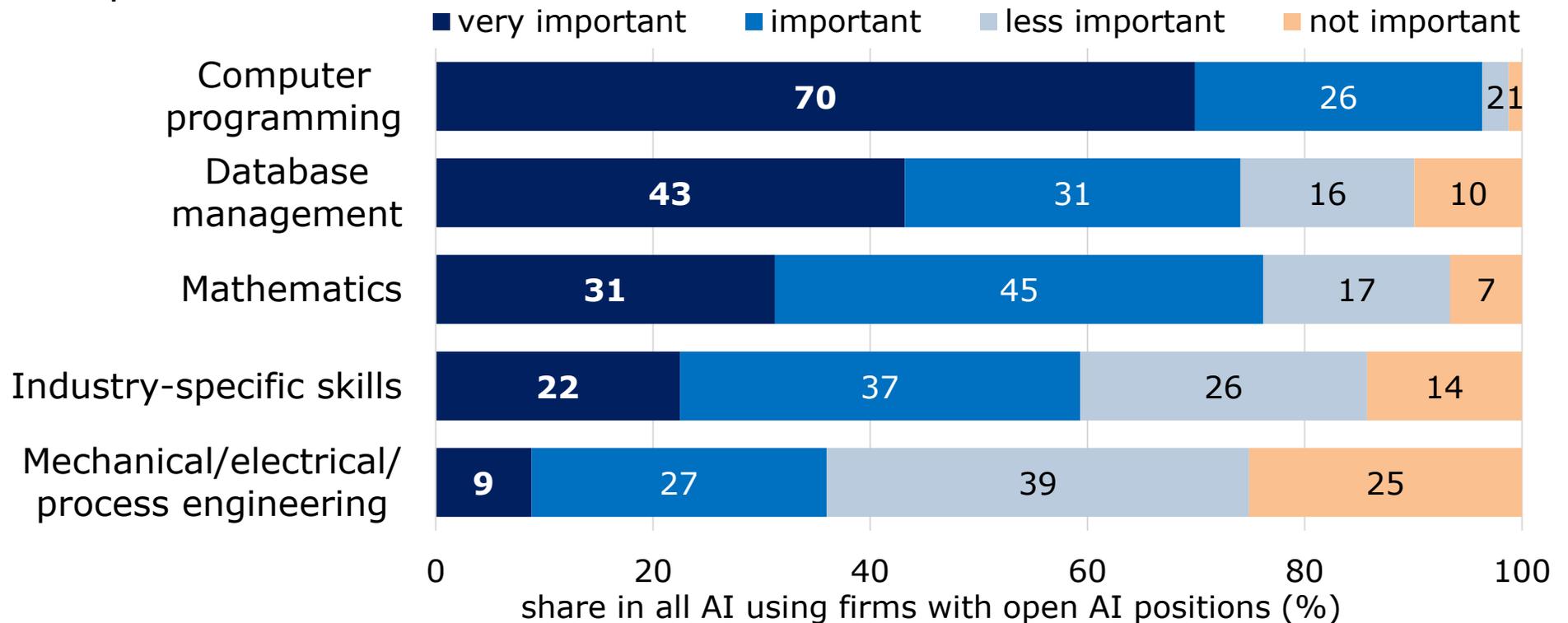
Skills for AI

- In 2019, 139,000 employees worked mainly of partly on AI
- 0.85 percent of all employees in surveyed sectors/size classes
- Major sector differences:



Open Positions for AI

- In 2019, 22,500 AI-related positions to be filled in AI using firms
- Corresponds to 0.14% of all employees, 45% of main AI employees
- 43% of open positions remained unfilled by the end of 2019, 11% filled late or not with the desired skills
- Required skills:



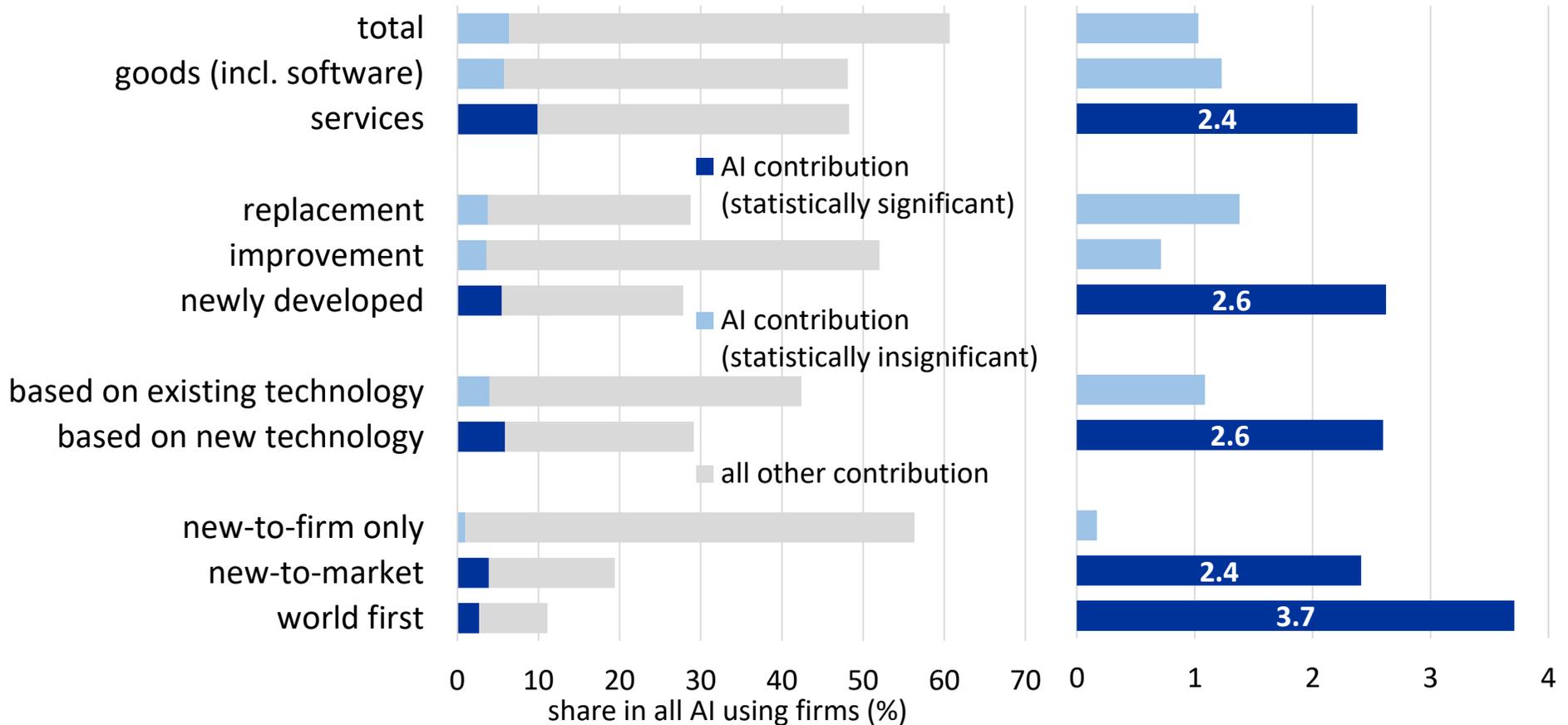
Thank you for your attention!

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AI Contribution to Innovation

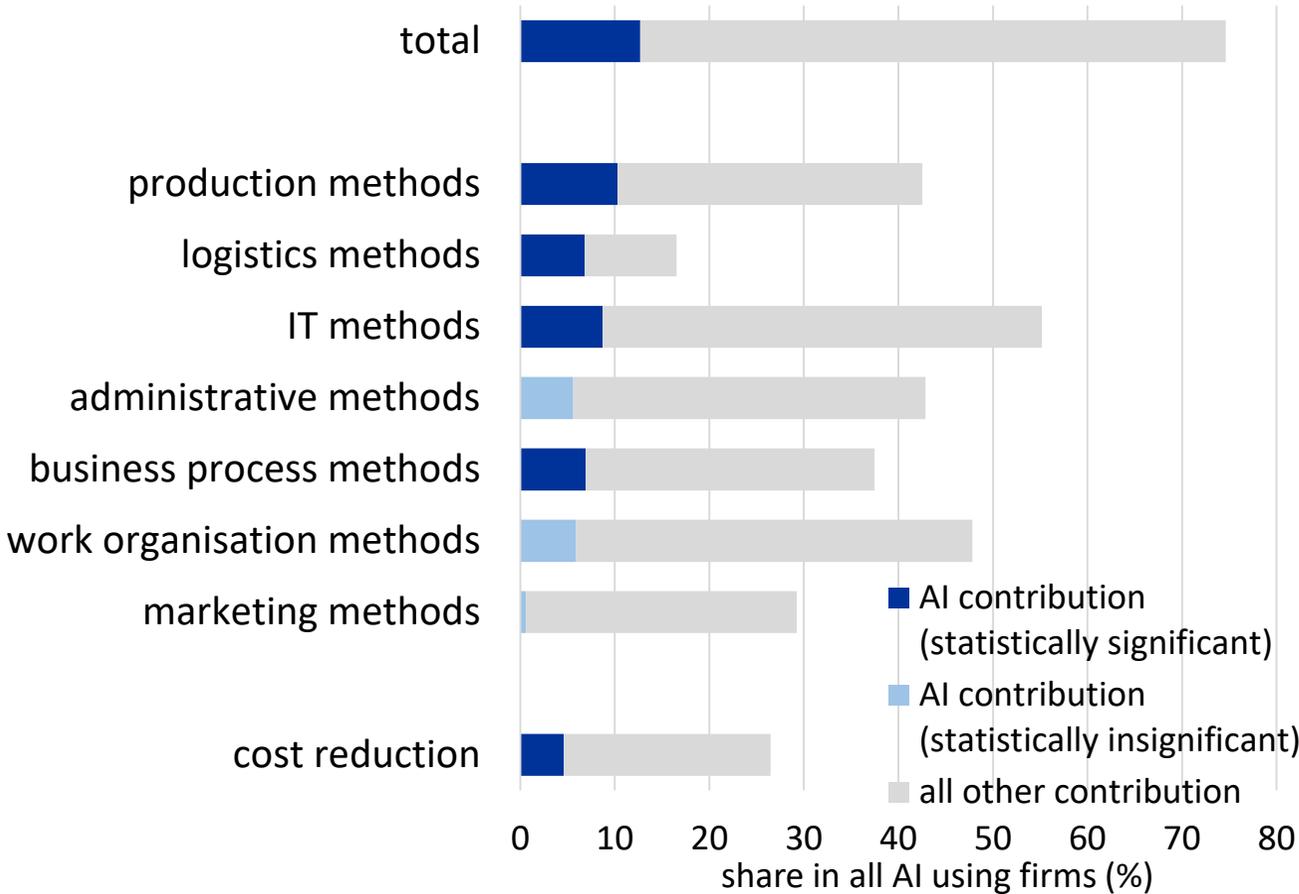
Product innovation in AI using firms

Total-economy contribution (%)

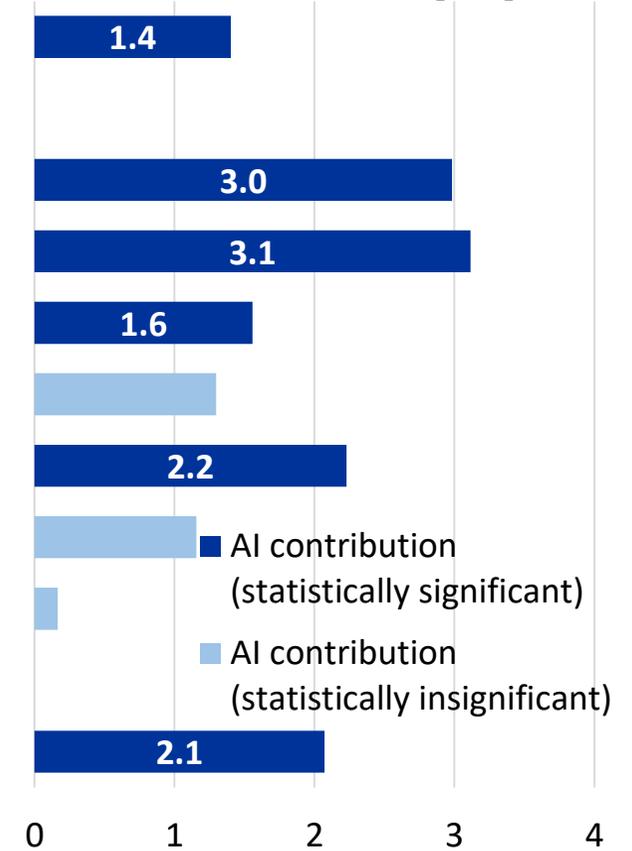


AI Contribution to Process Innovation

Process innovation in AI using firms

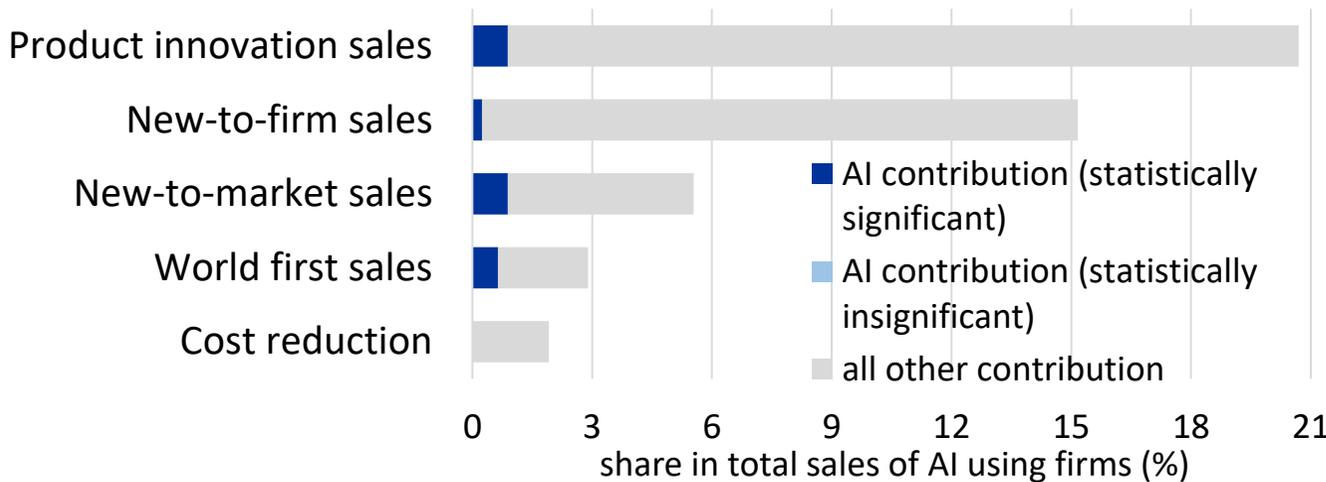


Total-economy contribution (%)

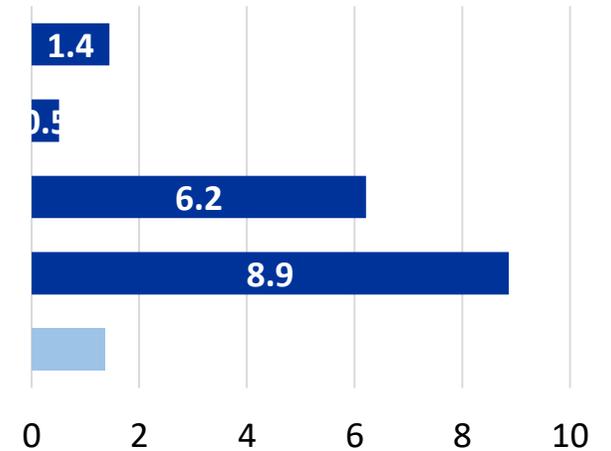


AI Contribution to Performance

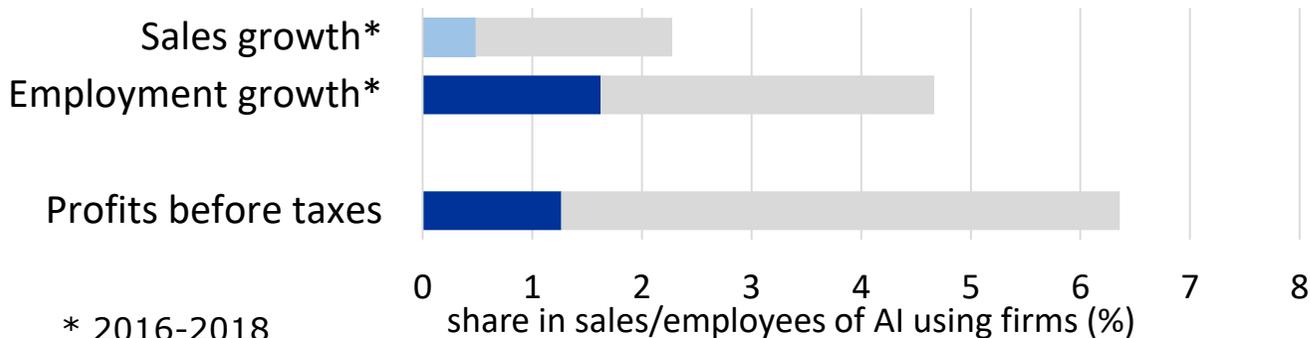
Innovative sales / cost reduction of AI using firms



Total-economy contribution (%)



Economic performance of AI using firms



* 2016-2018