



Hochschule Karlsruhe
Technik und Wirtschaft
UNIVERSITY OF APPLIED SCIENCES



Industry 4.0, reshoring and skills in the German manufacturing industry

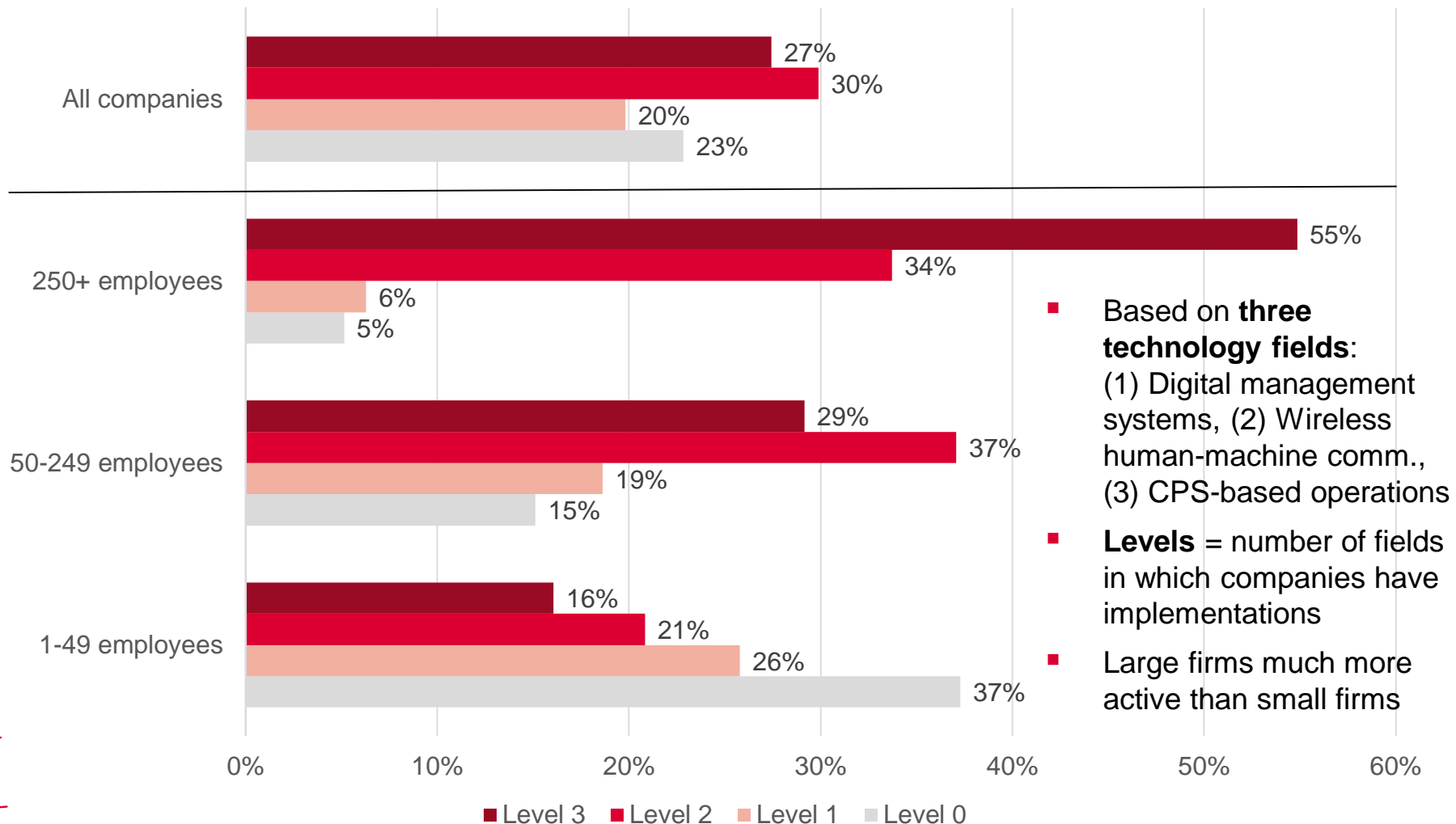
Steffen Kinkel

ILIN Institute for Learning and Innovation in Networks
Karlsruhe University of Applied Sciences

Brussels, May 17th 2019



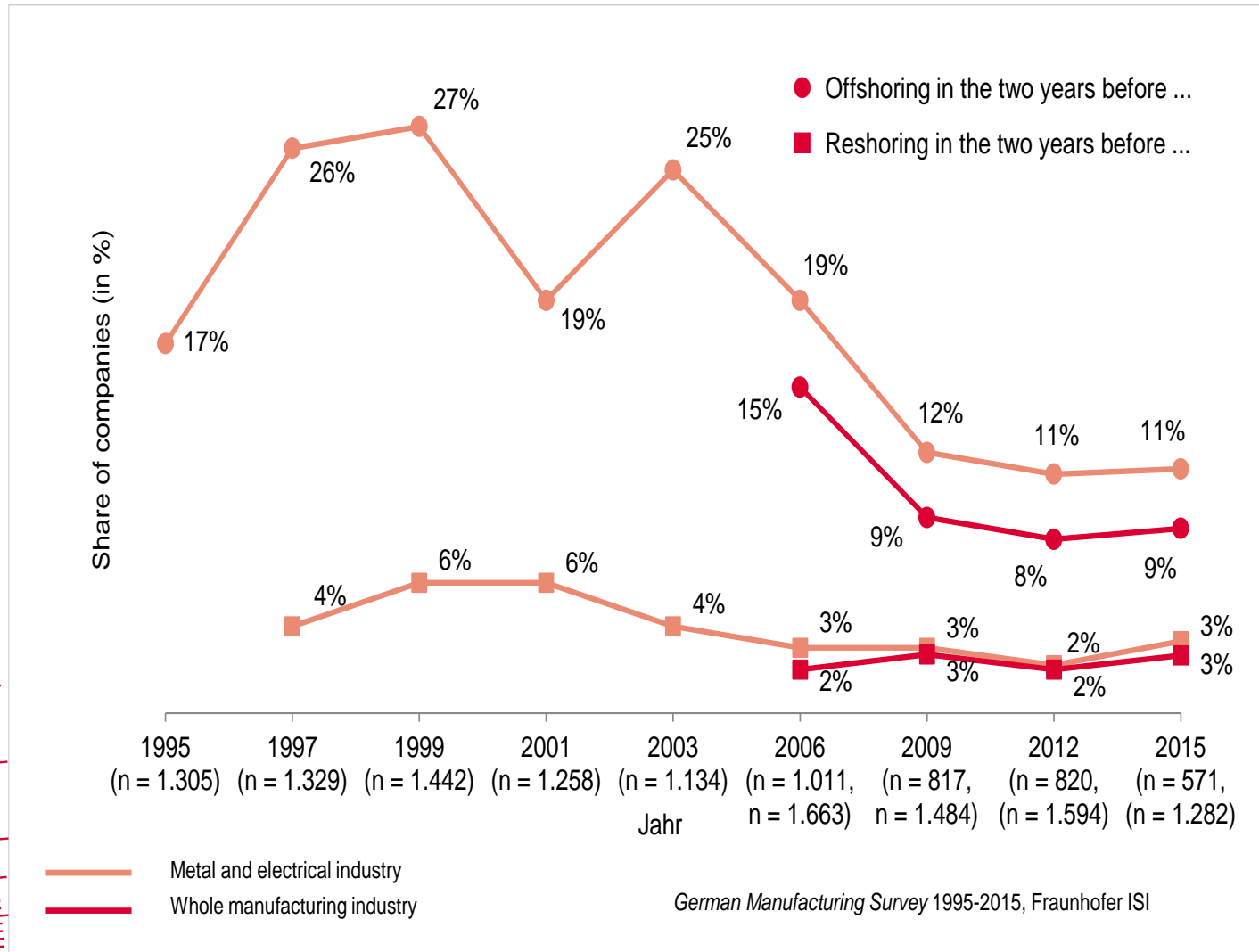
Industry 4.0 *enabling technologies* application levels – long ways to go



Source: Kinkel, S. and Jäger, A. (2017): *Auslandsverlagerungen, Rückverlagerungen und Digitalisierungsverhalten in der deutschen Industrie. Trends und Auswirkungen für den Produktionsstandort Deutschland*, Karlsruhe



German industry: Manufacturing offshoring and backshoring over time



- Offshoring stays on lowest level since mid 90s
- Backshoring stable (slightly upwards); for every 3rd offshoring company there is one backshoring
- Around 500 German manufacturing companies per year perform backshoring



Logit model for backshoring propensity of German companies

Cox & Snell: 0,055 Nagelkerkes: 0,230		Regression coefficient B	Sig.
Step 1	Ln #employees	,072	,673
	sec99_other manufacturing	-,038	,974
	sec24_metal & metal components	-,093	,938
	sec26_Data processing equipment, electronic and optical products	,691	,561
	sec27_electrical equipment	,439	,724
	sec28_machinery & equipment	-1,023	,415
	medium batch size	,329	,593
	large batch size	-,152	,850
	medium complex products	-,383	,532
	complex products	-,248	,730
	supplier company	-1,485	,004
	main competition factor: price/cost	,574	,310
	Ln import quota of inputs	-,143	,468
	Ln export quota of inputs	1,101	,004
	Ln share of unskilled workers	,137	,439
	I40-enabling-use-til-2013_level1	1,884	,095
	I40-enabling-use-til-2013_level2	1,932	,076
	I40-enabling-use-til-2013_level3	2,618	,016
	Constant	-8,946	,000

- Company size no factor for backshoring propensity
- Supplier companies are more reluctant to backshoring
- Export-intensive firms are more active in backshoring, to shorten their upstream value chains
- Positive and strong (!) effects of **use of Industry 4.0 enabling technologies** on backshoring propensity



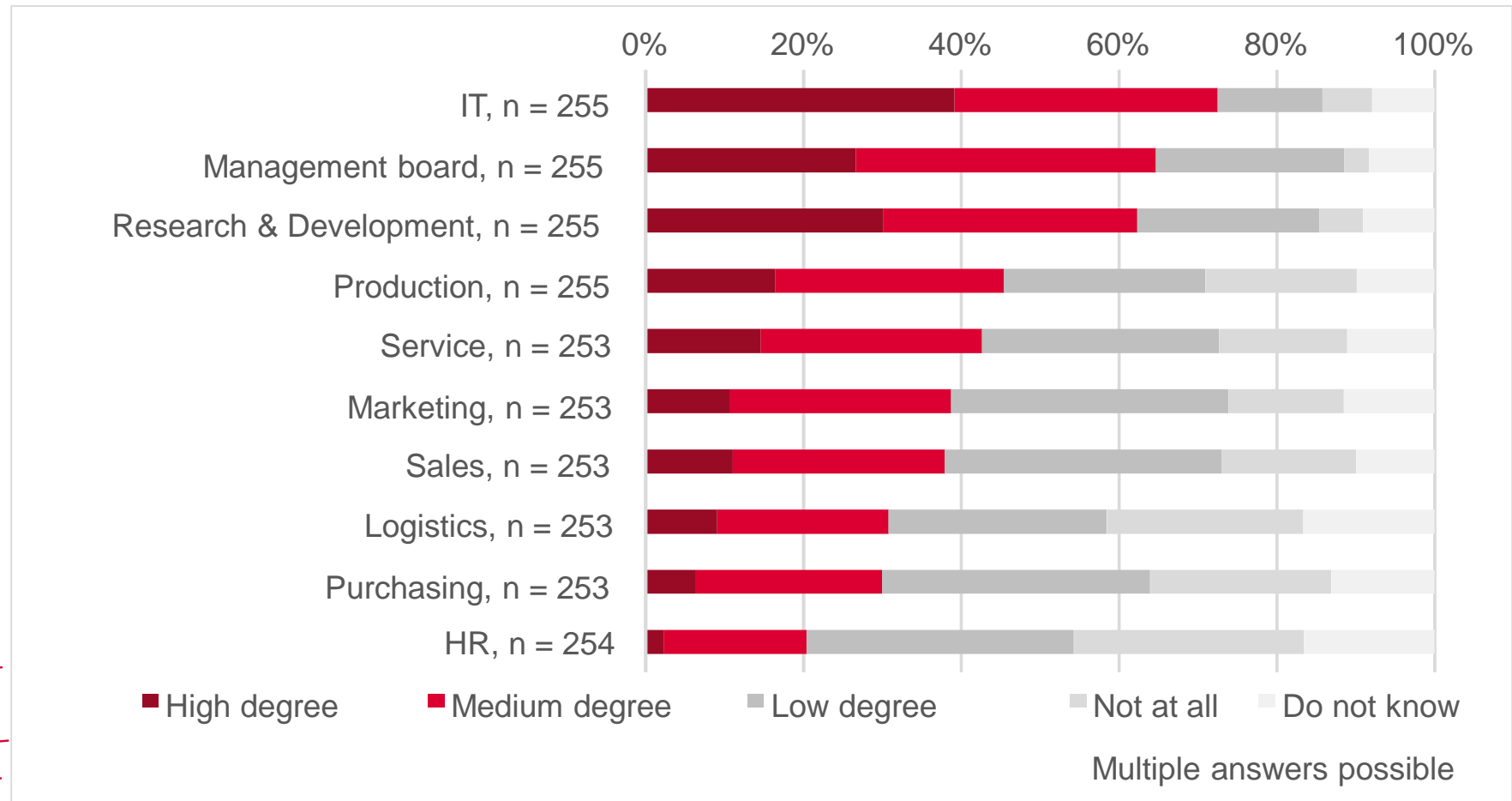
- “Advanced users” (level 3) of Industry 4.0 enabling technologies display on average a **10-times higher backshoring propensity** than “non-users” (level 0)

Two arguments:

1. Use of I4.0 enabling technologies facilitates **increased automation and productivity** of the German factory site, making labour arbitrage of low-cost countries (LCC) less appealing and **capacity utilization** (and economies of scale) more important
 2. Use of I4.0 enabling technologies facilitates **increased flexibility and efficient production of individualized solutions**, providing incentives for firms to keep/reshore production close to their European customers (→ local value chains).
- **Markets matter!** Local manufacturing will be localized where the customers are
 - **Employment effects**
 - limited with respect to jobs directly created at the home base, as “new production” is more automated
 - Indirect effects through local purchase of equipment and infrastructure and local sourcing of inputs and services



Which business units are involved in digitization strategy development and execution?



- IT, Management Board and R&D are deeply involved in digitization strategy development and execution
- But HR is only involved in every 5th company!



Technical key competences for the digital integration of mechanical engineering companies

- Software development, especially for modular apps and platforms
- Programming of machine and system controls
- IT and data security
- User-oriented IT design
- Analyse complex data
- **Interdisciplinary collaboration** different domains becomes vital:
“Engineers and computer scientists should work together in concrete projects in order to learn to understand the “different worlds”
- **Fast testing and learning:** Agile approach – early prototyping and testing – and positive error culture: “be brave and fail (and learn) fast“



Measures and activities to build up digitization competences

- A surprisingly high number (20%) of the surveyed companies do **spin-off own IT and software companies** – even small companies!
- The main reasons are
 - organizational separation to support the "two development speeds" of traditional mechanical engineering and agile software development,
 - overcome lock-in, better access to new industries and business models,
 - increased attractiveness of an independent, small software company for the recruitment of qualified IT staff.



Questions?

Prof. Dr. Steffen Kinkel

ILIN Institute for Learning and Innovation in Networks
(www.ilin.eu)

Karlsruhe University of Applied Sciences

Moltkestr. 30, 76133 Karlsruhe

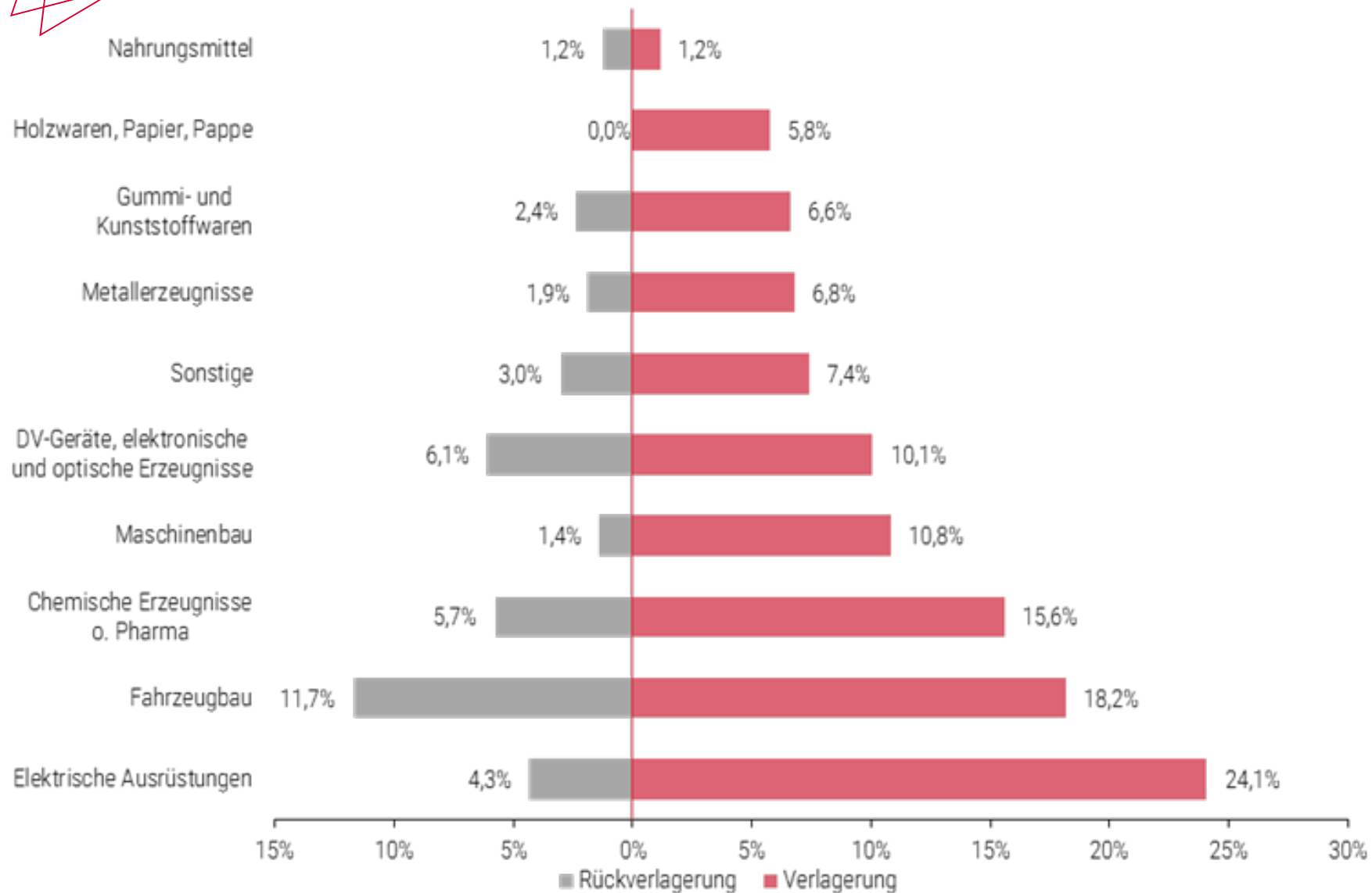
Tel.: +49 721 925-2915, Fax: -2965

steffen.kinkel@hs-karlsruhe.de





Sectoral offshoring and backshoring patterns





What policy can do

- Support regional clusters and local value chains
- Support local demand for innovative and more sustainable solutions (e.g. public procurement, “Made in” local value chains)
- Support development and adoption (!) of smart and agile production systems (e.g. Industry 4.0, flexible and individualized manufacturing, additive manufacturing)
- Support development of smart, data-driven services and business models
- Support education, qualification and competence development of skilled personnel, limit bottlenecks