Industry 4.0
Mapping the Structure and Evolution of an Emerging Field

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Outline

• Introduction to Industry 4.0
• Research Question and Method
• Findings
• Conclusions
Four Stages of Industrial Revolution

1. Industrial revolution follows introduction of water- and steam-powered mechanical manufacturing

First mechanical loom, 1784

First production line, Cincinnati slaughterhouses, 1870

1. Industrial revolution follows introduction of water- and steam-powered mechanical manufacturing

End of 18th century

Start of 20th century

Start of 1970s

Today

Source: Kagermann et al., 2013, p. 13
“Industry 4.0”/ “Industrie 4.0” vs. “Industrial Internet”

Source: https://www.google.com/trends/explore?q=%22industry%204.0%22,%22industrial%20Internet%22,%22industrie%204.0%22 (Oct. 11, 2016)
“Industry 4.0” on Carrot Search

Source: http://search.carrot2.org/ (Oct. 11, 2016)
Industry 4.0 and smart factories as part of the Internet of Things and Services

Source: Kagermann et al., 2013, p. 19
Industry 4.0 keywords and concepts

• CPS, IoT, SF
• Smart grids, smart products, smart buildings, smart logistics, smart mobility, smart factories
• Intelligent technical systems, cloud-based design, big data analytics, cloud computing, predictive manufacturing
Research Question and Method

• Emergence of a new field: Industry 4.0
• Its intellectual structure and interactions with other disciplines
• Data: Thomson Reuters’ Web of Science (1945-2015)
• Search query:
  ti=“(industry 4.0)” or ts=“(industry 4.0)” or ti=“(industrie 4.0)” or ts=“(industrie 4.0)” or ti=“(4th industrial revolution)” or ts=“(4th industrial revolution)” or ti=“(fourth industrial revolution)” or ts=“(fourth industrial revolution)”
• Bibliometric analysis of 89 records using CiteSpace
Findings
Document types

Conference paper: 58%
Journal article: 24%
Editorial: 17%
News item: 1%

IMCW 2016
Use of the term ‘4th Industrial Revolution’

• 1978, L. Steipe
• 1984, D. Hague
• 1986, W. W. Rostow
• 1999, D. A. Smith
• 2012, Hofmann et al.
• 2014-2015 (84% of 89 papers)
Role of Germany

• Leader of the 4th Industrial Revolution
• ‘High-Tech Strategy 2020 for Germany’
• 59 papers from Germany
• All prolific authors but one affiliated with German institutions
• Most prolific authors: Schuh (6), Toro (4), Jasperneite, Potente and Thoben (3 each)
Citations

• 29 citations (incl. 14 self-citations) mostly (24) from 2014 papers

• Most cited papers:
  • *Scalability of OPC-UA down to the chip level enables ‘Internet of Things’* (5)
  • *Industrie 4.0: Hit or hype* (4)
  • *Service innovation and smart analytics for Industry 4.0 and big data environment* (4)
  • *Cyber-physical production systems: Roots, expectations and R&D challenges* (4)

• Most cited authors: Schuh G (5), Jasperneite J (5) and Imtiaz J (5)
Co-citation network (N=157)
Subject categories
Noun phrases
Conclusions

• Industry 4.0: An emerging interdisciplinary field
• Related fields: Engineering, Computer Science, Telecommunications
• Main components: cyber-physical production systems, Internet of Things and Services, Smart Factories
• Leading role of Germany
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