



Digital Divide and Innovation in European Enterprises: A Multi-Method Analysis of Firm and Sectoral Dynamics

Luis Carlos Castillo

Supervisor: Prof. Francesco Vidoli
University of Urbino
Ph.D. Program in Global Studies

15 June 2023

Chapter 1



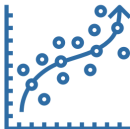
*Bibliometric Analysis of European Research on Digital Divide:
An Exploration of the Corporate Landscape*

Chapter 2



*Digital Divide in European Enterprises: A Clusterwise Linear
Regression Analysis of Digital Technology Usage*

Chapter 3



*Digital Technologies and Innovation in Europe: A Sectoral
Analysis Using Panel Data*



Bibliometric Analysis of European Research on Digital Divide: An Exploration of the Corporate Landscape



1. Digital Divide Overview
2. Motivation
3. Objectives and Research Questions
4. Data
5. Bibliometric Analysis



6. Performance Analysis

- 6.1 Publications Vs Citations
- 6.2 Authors
- 6.3 Articles
- 6.4 Journals
- 6.5 Affiliations/ Universities
- 6.6 Countries

7. Science Mapping

- 7.1 Citations Analysis
- 7.2 Similarity Measures
 - 7.2.1 Co-citations Analysis
 - 7.2.2 Bibliographic Coupling

8. Conclusions

1. The Digital Divide Overview I



- ▶ The digital divide is also known as the digital gap, inequalities, or disparities.
- ▶ The interaction with other existing gaps such as income, education, gender, age, and regional, among others ([Ragnedda, 2017](#)).
- ▶ The evolution of the concept has pointed out the phenomenon's complexity and the effects on the different layers of society and the economy ([van Dijk and Hacker, 2003](#); [Ragnedda, 2017](#); [Shakina et al., 2021](#)).

1. The Digital Divide Overview II



- ▶ Waves of Research
 - ▶ **The first wave:** Physical access to technology -> possession of computers and access to the internet (Norris, 2001; James, 2002; Castells, 2003).
 - ▶ **The second wave:** Usage of digital technologies and skills (Hargittai, 2002; van Dijk, 2005, 2006; van Deursen and van Dijk, 2011).
 - ▶ **The third wave:** The disparities in tangible outcomes arise from different forms of access to and usage of digital technologies, emphasizing the ability to benefit from these technologies in a data-driven market to enhance personal and professional aspects (Ragnedda, 2017; van Deursen and Helsper, 2015).

1. The digital divide overview III



The corporate landscape

- ▶ Digital revolution -> different aspects of daily activities -> how we conduct business.
- ▶ Disparity in digital capabilities and resources among businesses ([Shakina et al., 2021](#)).
- ▶ The corporate digital divide is a topic that remains under-explored ([Pejic Bach et al., 2013](#); [Shakina et al., 2021](#)).
- ▶ Understanding and addressing the divide, policymakers, and businesses owners can target their efforts to ensure inclusive digital transformation.

2. Motivation



- ▶ Investigating the transformative effects of digital technologies on society and economy, while highlighting both opportunities and challenges.
- ▶ Aligning with the Digital Europe program's vision by devising strategies to bridge the digital divide effectively.
- ▶ Diversifying bibliometric research by extending its application beyond health sciences, computer science, and technology to understand the digital divide.
- ▶ Harnessing the power of comprehensive data from three leading academic platforms to generate insightful and actionable findings on the digital divide.

3. Objectives and Research Questions I



Objectives

- ▶ Understand the intellectual structure within the domain of the digital divide.
- ▶ Examine the intellectual interactions, and thematic relationships of European research components.
- ▶ Explore the corporate digital divide among the collected corpus and identify trends and patterns within the literature.

3. Objectives and Research Questions II



Research Questions

- ▶ Q1: How have the main trends, focus shifts, and key themes in European research on the digital divide evolved over time, and how do they reflect the current state of knowledge in this field?
- ▶ Q2: What are the intellectual interactions and thematic relationships among European research components on the digital divide, and how do they contribute to the identification of core subtopics and literature clusters?
- ▶ Q3: How are European studies addressing the corporate digital divide, and which unexplored topics within this domain warrant further examination?

4. Data I



- ▶ Specific search within titles and author keywords on the “*digital divide*” merging data from the Web of Science, Scopus, and Dimensions platforms.
- ▶ Search criteria: “digital divide*” OR “digital inequalit*” OR “digital gap*”
- ▶ The sample includes articles, book chapters, conferences, and proceeding papers.
- ▶ Authors with European affiliations within the **business, management, economics, technology, and computer science** disciplines were included

4. Data II



- ▶ After conducting a thorough data cleaning, a total of 1609 unique documents from 2000 to 2022 were incorporated.
- ▶ Number of Documents by Database
 - ▶ WoS:946
 - ▶ Scopus: 254
 - ▶ Dimensions: 409
- ▶ To track the evolution of the digital divide literature, the data was divided into three periods: 2000-2007, 2008-2015, and 2016-2022.
- ▶ The R programming language environment.
- ▶ To ensure both replicability and reproducibility, a public repository named “dd_bibliometric_europe” has been established on GitHub.

5. Methodology I



Bibliometric Analysis

Following [Donthu et al. \(2021\)](#), [Aria and Cuccurullo \(2017\)](#), [Ellegaard and Wallin \(2015\)](#) and [Bornmann and Mutz \(2015\)](#)

bibliometric analysis:

- ▶ Is a methodology that applies quantitative techniques to bibliographic data and plays a vital role in evaluating research output.
- ▶ This technique allows researchers to uncover emerging trends identifying knowledge gaps in specific domains and analyze a significant quantity of documents .
- ▶ It offers three types of analysis: performance analysis, science mapping, and network analysis.

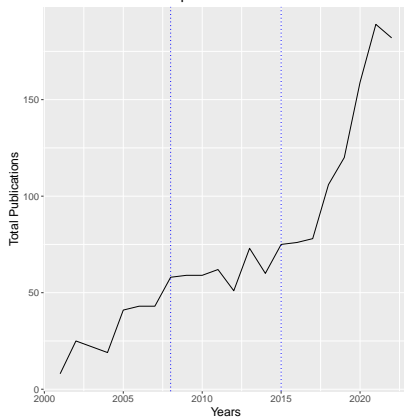
6. Performance Analysis I



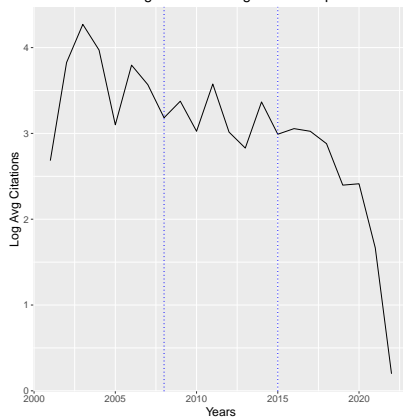
Is a descriptive interpretation of research constituents.

6.1. Publications vs Citations

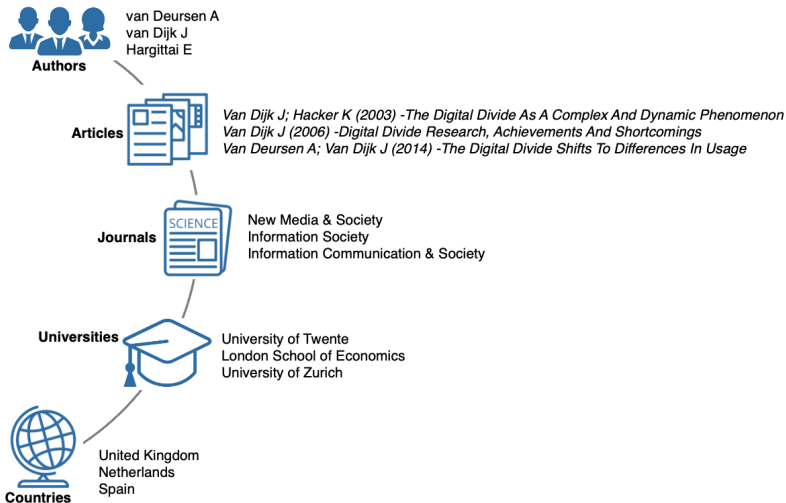
A. Total Publications per Year



B. Relative Change in the Average Citations per Year



6. Performance Analysis II

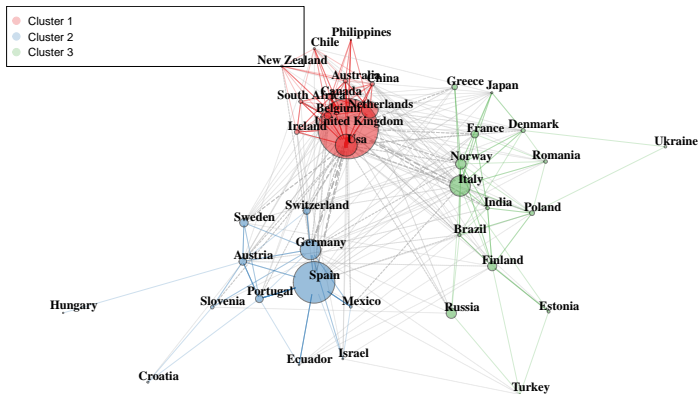


6. Performance Analysis III



6.6. Countries Collaboration Network

Country Collaboration Network



7. Science Mapping I

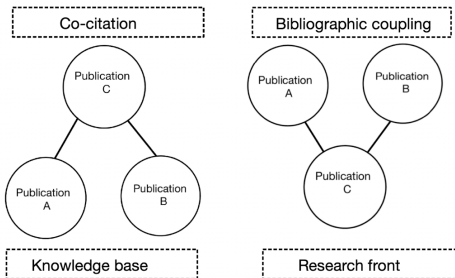
7.2. Similarity measures



Quantify similarity, connections and relationships among academic entities.

Following [Kammerer et al. \(2021\)](#)

- **Knowledge base:** cluster of academic publications in a research field that are considered fundamental to the development and understanding of the field.
- **Research front:** cluster of academic publications that refers to emerging active areas of research considering themselves with a similar unsolved research problem.

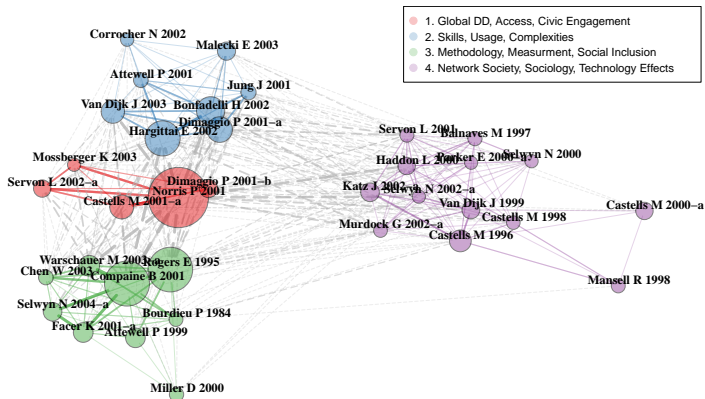


7. Science Mapping II



7.2.1. Co-citations Analysis

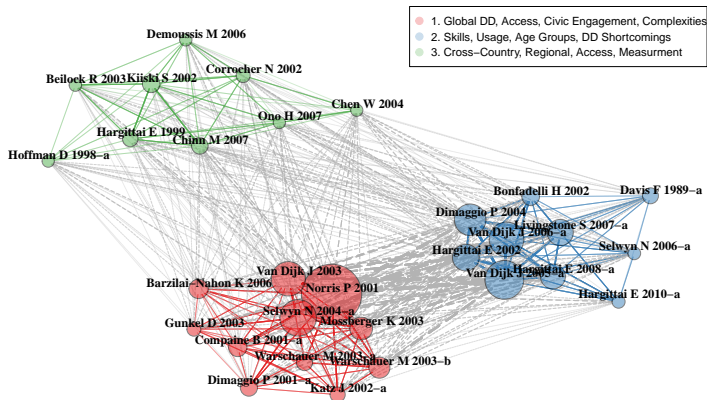
Co-Citation Network, 2000 – 2007



7. Science Mapping III



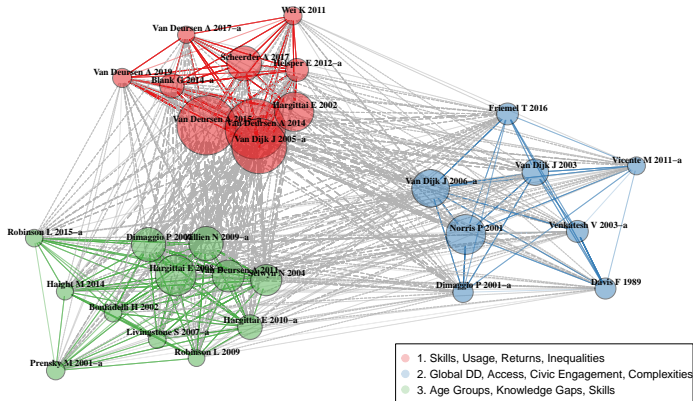
Co-Citation Network, 2008 – 2015



7. Science Mapping IV



Co-Citation Network, 2016 – 2022





Co-citation Networks Summary

This three networks highlighted:

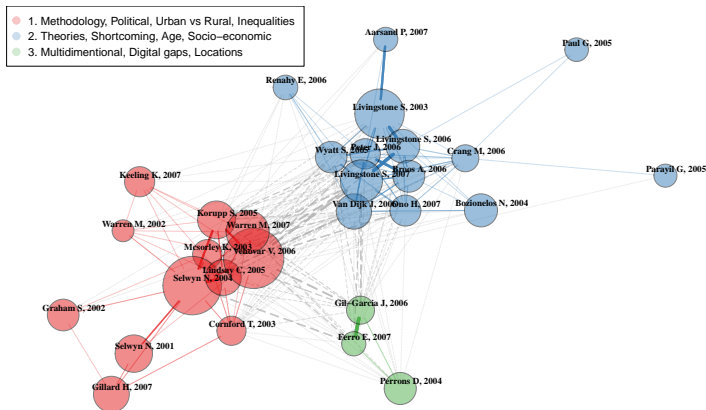
- ▶ **Evolution of research focus:** From internet access and methodological focus to the various facets of the digital divide.
- ▶ **Key publications and intellectual interactions:** Norris (2001), van Dijk (2005) Hargittai (2002) and van Deursen and van Dijk (2014) shape the discourse and the intellectual interactions.
- ▶ **Emerging trends and themes:** The third-level digital divide and its broader socio-economic ramifications. Uncovering a research gap remains unexplored concerning the corporate digital divide.

7. Science Mapping VI



7.2.2. Bibliographic Coupling Analysis

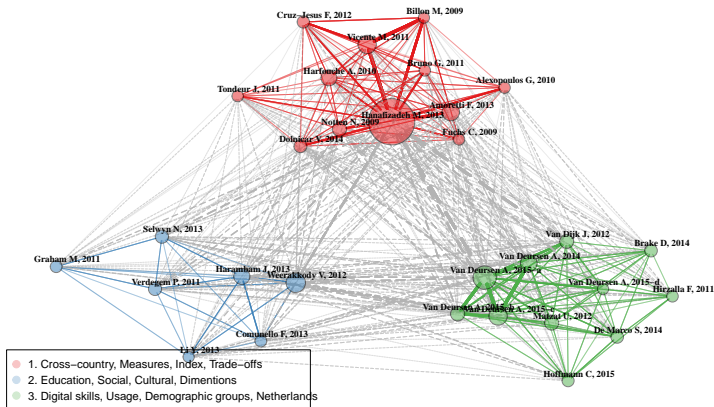
Bibliographic Coupling Network, 2000–2007



7. Science Mapping VII



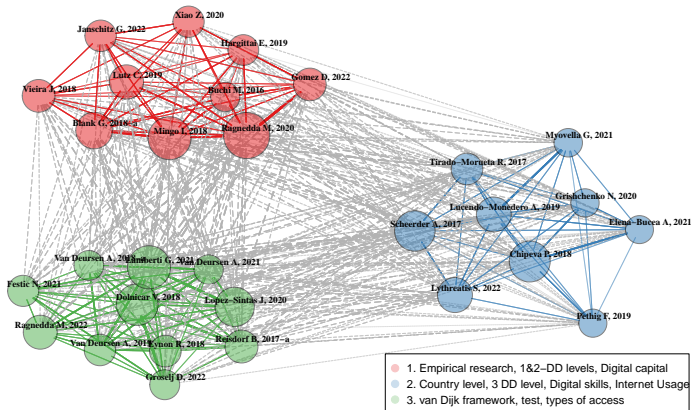
Bibliographic Coupling Network, 2008–2015



7. Science Mapping VIII



Bibliographic Coupling Network, 2016–2022





Bibliographic coupling Networks Summary

This three networks highlighted:

- ▶ **Evolution of unsolved research problems:** From political, methodological challenges, regional analysis to cross-country analysis, measurements shortcomings and testing the theory.
- ▶ **Emergence of key authors and publications:** Prominent publications by authors such as Van Dijk, van Deursen, and Livingstone, featured prominently across clusters, represent the intellectual interactions of the research front.
- ▶ **Growing complexities and specialization:** The diverse research themes in the networks reflect the expanding scope and depth of digital divide research. The last BC network illustrates the current state of research.

- ▶ The intellectual structure of the knowledge base and research front in the digital divide is evolving but it needs further development regarding the use of latest technologies.
- ▶ The networks showcase intellectual interactions among prominent authors and publications that consistently contribute in the field. The thematic relationships lead to the current state of research.
- ▶ European studies have not extensively addressed the corporate digital divide, leaving room for further examination. The corporate digital divide might be incorporated into other literature streams, such as digital transformation, technology adoption, and knowledge management.

Contact information



1506
UNIVERSITÀ
DEGLI STUDI
DI URBINO
CARLO BO

Luis Carlos Castillo-Tellez

PhD candidate in Global Studies

University of Urbino - Italy

email: l.castillotellez@campus.uniurb.it

- Aria, M. and Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, 11(4):959–975. Publisher: Elsevier Ltd.
- Bornmann, L. and Mutz, R. (2015). Growth rates of modern science: A bibliometric analysis based on the number of publications and cited references. *Journal of the Association for Information Science and Technology*, 66(11):2215–2222. Citation Key: Bornmann2015 Publisher: John Wiley and Sons Inc.
- Castells, M. (2003). *The Internet Galaxy: Reflections on the Internet, Business, and Society*. Oxford.
- Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., and Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research*, 133:285–296.
- Ellegaard, O. and Wallin, J. A. (2015). The bibliometric analysis of scholarly production: How great is the impact? *Scientometrics*, 105(3):1809–1831.
- Hargittai, E. (2002). Second-level digital divide: Differences in people's online skills. *First Monday*.
- James, J. (2002). Universal access to information technology in developing countries. *Regional Studies*, 36(9):1093–1097. Publisher: Routledge _eprint: <https://doi.org/10.1080/0034340022000024312>.

- Kammerer, K., Göster, M., Reichert, M., and Pryss, R. (2021). Ambalytics: A scalable and distributed system architecture concept for bibliometric network analyses. *Future Internet*, 13(8):1–29. Publisher: MDPI.
- Norris, P. (2001). *Digital Divide: Civic Engagement, Information Poverty, and the Internet Worldwide*. Communication, Society and Politics. Cambridge University Press, Cambridge. DOI: 10.1017/CBO9781139164887.
- Pejic Bach, M., Zoroja, J., and Vuksic, V. (2013). Review of corporate digital divide research: A decadal analysis (2003-2012). *International Journal of Information Systems and Project Management*, 1:41–55.
- Ragnedda, M. (2017). *The Third Digital Divide: A Weberian Approach to Digital Inequalities*. Routledge, 1st edition edition.
- Shakina, E., Parshakov, P., and Alsufiev, A. (2021). Rethinking the corporate digital divide: The complementarity of technologies and the demand for digital skills. *Technological Forecasting and Social Change*, 162:120405.
- van Deursen, A. and van Dijk, J. (2011). Internet skills and the digital divide. *New Media and Society*, 13(6):893–911. Publisher: SAGE Publications.
- van Deursen, A. J. A. M. and Helsper, E. J. (2015). *The Third-Level Digital Divide: Who Benefits Most from Being Online?*, volume 10 of *Studies in Media and Communications*, page 29–52. Emerald Group Publishing Limited. Citation Key: vandeursen2015 DOI: 10.1108/S2050-206020150000010002.



- van Dijk, J. (2005). *The Deepening Divide: Inequality in the Information Society*. Thousand Oaks, California. DOI: 10.4135/9781452229812.
- van Dijk, J. (2006). Digital divide research, achievements and shortcomings. *Poetics*, 34(4):221–235. Citation Key: vandijk2006.
- van Dijk, J. and Hacker, K. (2003). The Digital Divide as a Complex and Dynamic Phenomenon. *The Information Society*, 19(4):315–326. Publisher: Routledge
_eprint: <https://doi.org/10.1080/01972240309487>.