Infrastructural Disruption. Ole was right all along — it's the infrastructure, stupid!

Carsten Sørensen
Copenhagen Business School, Denmark, London School of Economics & Political Science, UK, Linnaeus University, Sweden, cso.digi@cbs.dk

Follow this and additional works at: https://aisel.aisnet.org/sjis

Reflection note

Infrastructural Disruption

Ole was right all along—it's the infrastructure, stupid!

Carsten Sørensen
Copenhagen Business School, Denmark
London School of Economics & Political Science, UK
Linnaeus University, Sweden
cso.digi@cbs.dk

1   Introduction

Thirty years ago, at the beginning of my academic career, I was part of The Internet Project, a research effort led by Bo Dahlbom from Gothenburg University. Here, I met Ole Hanseth, who was finishing up his PhD with Bo as the supervisor. The Internet Project was a collection of research themes and infrastructure formed one of these, which early on in my research career sensitised me to understanding infrastructural aspects of socio-technical arrangements. Up to that point, like most others, I overwhelmingly considered information systems within an organisational context. Ole, however, along with Eric Monteiro and others, was concerned with infrastructures, standards, and other aspects beyond our normal IS gaze. Some of this research showed infrastructures as unwieldy polycentric beasts intertwining wires, protocols, and work processes. When studying Internet standards, it could become open to elegant redefinitions with rapid twists and turns (Hanseth & Monteiro, 1996; Hanseth, 1997). Ole and others' attention to infrastructures was a distinct IS minority, perhaps best illustrated by the late Susan Leigh Star's proclaimed chairpersonship of *The International Association of People Who Study Really Boring Things.* (Bowker et al, 2010). It is hard to overstate the importance of being exposed to such a novel perspective. While the organisation indeed remained the primary "laboratory" for the coming decades of IS research (Braa, 1999), being exposed to an infrastructural perspective turned out to be of incredible value for

my own research in the following decades. This essay is my personal reflections on the role of an infrastructural perspective and why it is more important now than ever.

2 Focus on information infrastructures

During the Clinton administration from 1993 to 2001, Vice-President Al Gore formulated the need for an Information Super-Highway; an infrastructure that, as a digital road network, would fuel innovation, productivity, and growth. Within the European Union, the so-called Bangemann Report made similar claims about the need for an European information infrastructure (Bangemann, 1994). While it may be a gross simplification that these two political discussions kick-started the interest in information infrastructures see, for example, (Abbate, 1999; Naughton, 2000), they were, nonetheless, critical in focusing the political attention on information infrastructures as a distinct societal phenomenon. Much of the discussion related to the impact of information technology was still frequently framed in terms of the economist Robert Solow's (1987) famous one-line quote from a New York Times Book Review less than a decade previously: "*You can see the computer age everywhere but in the productivity statistics.*" In a sense, the public debate on information infrastructures did not mature much a decade after Gore's initial framing of the issue as Carr (2004) asserted that any information technology available to everyone did not represent much in the way of competitive power. However, the world around us is increasingly dominated by infrastructural transformations based on Internet protocols and a growing public debate is concerned with the societal and commercial impact of these disruptions.

3 Infrastructures in information systems

Within IS research and broader, a few highly notable exceptions proved the rule that infrastructures were not deemed interesting. At the 2010 HICSS Conference, a senior scholar even remarked at the presentation of (Tilson et al, 2010) that the infrastructure construct was "a Shibboleth" — a made-up term for something already assigned a widely accepted term of inter-organizational systems. Joanne Yates (1989) showed how various information systems shaped and were shaped by the management of highly distributed organisations. One of the core citations in the study of information infrastructures is Star & Ruhleder's (1996) work formulating an infrastructural perspective, as well as Star's later work with Bowker on standards as infrastructures for distributed action (Bowker & Star, 1999). Ole Hanseth has, through his scholarly work, played a key role in formulating an Information Systems perspective on information infrastruc-

tures, for example, through his work with Claudio Ciborra and others studying the corporate infrastructures supporting large global companies (Ciborra and Associates, 2000), and through the study of public sector infrastructures (Hanseth, 2006).

A host of efforts further beyond IS explore various infrastructure aspects, such as their general social value (Frischmann, 2012); the complex development leading to the Internet infrastructure (Abbate, 1999; Blum, 2012; Naughton, 2000); the various challenges of control over a globally distributed Internet (Goldsmith & Wu, 2006); the changes resulting from diverse actors reshaping it to their needs (Yoo, 2012); the innovation risks of vertically integrated corporate control (Lessig, 2002), and the potentially greater consequences of seeking to exercise broader control (Zittrain, 2008).

The information systems field, generally, has an uneasy relationship with socio-technical arrangements beyond the firm (Sørensen, 2016). While the advent of cloud computing, digital platforms, and a general interest in digital transformation could have led to increased interest in infrastructures, this has not come to fruition. Calls to action in 2010 proposing treating digital infrastructures as a distinct IS artifact received much attention over the years from IS researchers (Tilson et al, 2010; Hanseth & Lyytinen, 2010). However, this interest is overwhelmingly related to non-infrastructural discourses and reflects the emerging research IS discussion of digital transformation in general and -platforms in particular. Of the approximately 400 papers citing Tilson et al. (2010) and Hanseth and Lyytinen (2010), only a very small fraction adopts an infrastructural perspective (Pujadas et al, 2024a). Cloud services and digital platformisation are predominantly seen through a monocentric perspective with nods to the fact that there are distributed aspects of these arrangements. However, green shoots are emerging, considering polycentric perspectives (Mindel et al, 2018; Benfeldt, 2020).

4   The privatisation of the open Internet

I would argue that there is an emerging and urgent need to understand contemporary developments from an infrastructural perspective. The early decentralisation of web servers during the late 1990s and early 2000s has now been replaced by increasing centralisation where large global digital platform firms in effect have privatised the open Internet and command it from behind platform walled gardens (Dixon, 2024; Sørensen et al, 2024). This has resulted in complex relationships between consumer privacy and the platform business arrangements (Zuboff, 2019) as well as between the platforms and the firms contributing to value creation on the platforms (The Economist, 2022).

Distinguishing between the platform as a means of capturing value (through a 'platform tax') and the infrastructure as a means of delivering said value (Kazan et al, 2018),

we can characterise the rise of the platform economy as the capturing of value by the platform and delivered through the publicly available Internet. In this sense, the rise of global digital platforms is a disruptive innovation founded on re-appropriating the open Internet to function as a mere value-transportation infrastructure for business activities. The open Internet, for example, facilitated the breakdown of existing vertical integration within the music industry and the rebuilding of new integration with the digital platforms in control (Tilson et al, 2013; Tilson et al, 2021). As an incumbent, a global chain of hotels can partly protect itself against new entrants through capital investments in desirable hotel assets. Airbnb has established a large installed base to matchmake across property owners and room-seeking customers; it uses the open Internet as a disruptive value-delivery infrastructure. As the global digital platforms seek to expand their sphere of interest, they establish infrastructural services, for example, ecosystems of resource exchanges (Lindskow, 2016) through Application Programming Interface (API) ecosystems (Pujadas et al, 2024b).

5 Infrastructural disruption

Contemporary industry developments seek to combine a range of technological innovations, going beyond the now-common combination of smartphones operating as entry points to supply-demand matchmaking across the sides of digital platforms or to access various corporate and public services. These new technological configurations can be characterised by the following five main categories: 1) 5G telecommunications and the Internet of Things; 2) Artificial Intelligence; 3) Device autonomy; 4) Digital-physical hybridity; and 5) Distributed ledger technology (Brodie et al, 2019). In this reshaping of social organisation and emergence of new social categories facilitated by digitality, interconnectivity, and materiality, infrastructures are a necessary practical concern (The Economist, 2024). The open public Internet in the 2000s formed the basis for the current dominant digital platforms by allowing for the addition of new bespoke protocol layers using the open Internet as a disruptive delivery infrastructure.

As the combinations of these technologies take on infrastructural characteristics, we will need to critically appreciate how this represents new disruptive possibilities. Some of these configurations may solidify the power of global platform firms, such as Microsoft's business interests in OpenAI, or of telecommunications firms through the upgrade of their infrastructures to 5G. Other developments could support new entrants as global platform firms, such as OpenAI and other new AI companies, or the possible transformation of General Electric, Siemens, Nokia, or others through increased importance of infrastructural control points embedded in the Internet of Things and

device autonomy. However, the infrastructural disruption through distributed ledger technologies (DLT) possibly holds the greatest potential. DLT supports the transformation of an open Internet of data packages to an infrastructural layer transforming data into property — an Internet of claims against collectives (Dixon, 2024; Sørensen et al, 2024). Such tokenisation of assets, information, obligations and much more, supported by consensus processes resolving the double-spend problem holds both the promise and threat of radically reorganising how firms and individuals relate to each other in new arrangements.

The emerging academic debate on this novel infrastructuring and the consequences is still in its infancy in general, and within Information Systems in particular, even if a number of important contributions already has been made, for example, on: Understanding DLT (DuPont, 2019; Lacity, 2020; Rossi & Sørensen, 2019); its governance (Beck et al, 2018; Goldsby, 2022); relation to the law (De Filippi, 2018); smart contracts (Halaburda, 2024); and an IS research agenda for DLT (Rossi, 2019). The industry developments have also already seen significant DLT failures, most prominently financial mismanagement and fraud cases (FTX, Celcius, Luna and many others), but also the breakdown of industry consortia, most prominently TradeLens (Goldsby, 2024; Jovanovic et al, 2022; Sarker et al, 2021). As the Internet has taken us from Vint Cerf and Bob Kahn driving around San Francisco connecting lab computers to the humble web server, complex middle-ware layers, dot-com startups, mobile phones, and global platform dominance, it is critical to understand the duality of rapid developments and slow processes of infrastructural development (Hanseth, 2022), resulting in unexpected twists and turns in the journey. Having spent a significant amount of time over the past three years actively participating in the governance of the Hedera Layer-1 DLT project, I have first-hand seen the effort that goes into the slow and steady growth of a new digital infrastructure.

6   Final remarks

In order for the IS field to make significant contributions to our understanding of socio-technical dynamics, the field will need to embrace an infrastructural perspective on innovation and development. Ole Hanseth pointed this out in his doctoral thesis nearly three decades ago (Hanseth, 1996) and has, through his life work, provided scholarly leadership in this debate. When the open Internet provided a disruptive infrastructure supporting digital platforms implementing multi-sided markets,, the IS field responded with a significant research interest (Constantinides, 2018; Pujadas, 2024a). If new socio-technical developments will fuel subsequent disruption, the IS field should finally

take the challenge seriously and respond with energy and resolve by taking infrastructures seriously.

This would be a highly fitting legacy for Ole!

Acknowledgements

Bibliography

Abbate, J. (1999). *Inventing the Internet*. MIT Press.

Bangemann, M. (1994). Report on Europe and the Global Information Society: Recommendations of the High-Level Group on the Information Society to the Corfu European Council. *Bulletin of the European Union, 2*(94), 5-39.

Beck, R., Müller-Bloch, C., & King, J. L. (2018). Governance in the Blockchain Economy: A Framework and Research Agenda, *Journal of the Association for Information Systems*, *19*(10), 1020-1034.

Benfeldt, O. (2020). *Polycentric Governance of Organizational Data Ventures: An Organizing Logic for Data Governance in the Digital Era*. Doctoral Dissertation. Aalborg University. Aalborg Universitetsforlag.

Blum, A. (2012). Tubes: A Journey to the Center of the Internet. HarperCollins.

Bowker, G., & Star, S. L. (1999). *Sorting Things Out: Classification and Its Consequences*. MIT Press.

Bowker, G. C., Becker, H. S., Latour, B., Busch, L., Arvanitis, R., Trompette, P., & Vinck, D. (2010). Hommage À Susan Leigh Star, *Revue d'Anthropologie des Connaissances*, *4*(4-1), 8-10.

Braa, K., & Vidgen, R. (1999). Interpretation, Intervention and Reduction in the Organizational Laboratory: A Framework for in-Context Information Systems Research, *Accounting, Management and Information Technologies, 9*(1), 25-47.

Brodie, A., Brennan, D. E., & Sørensen, C. (2019). *Tides of Disruption: How to Navigate Business Transformation*, Gowling WLG & LSE Consulting, London. http://stuff.carstensorensen.com/TidesOfDisruption2019.pdf

Carr, N. G. (2004). *Does IT Matter? Information Technology and the Corrosion of Competitive Advantage*. Harvard Business Review Press.

Ciborra, C.U., & Associates (2000). *From Control to Drift*. Oxford University Press.

Constantinides, P., Henfridsson, O., & Parker, G. G. (2018). Special Issue Introduction: Platforms and Infrastructures in the Digital Age, *Information Systems Research, 29*(2), 381-400.

De Filippi, P. (2018). *Blockchain and the Law: The Rule of Code*. Harvard University Press.

Dixon, C. (2024). *Read, Write, Own: Building the Next Era of the Internet*. Random House.

DuPont, Q. (2019). *Cryptocurrencies and Blockchains*. John Wiley & Sons.

Frischmann, B. M. (2012). *Infrastructure: The Social Value of Shared Resources*. OUP USA.

Goldsby, C. (2024). *Demystifying Digital Governance: Exploring the Mechanisms and Structures of Blockchains for Organizations*. Unpublished PhD Thesis. Erasmus University Rotterdam.

Goldsby, C., & Hanisch, M. (2022). The Boon and Bane of Blockchain: Getting the Governance Right, *California Management Review 64*(3), 141-168.

Goldsmith, J. L., & Wu, T. (2006). *Who Controls the Internet?: Illusions of a Borderless World*. Oxford University Press.

Halaburda, H., Levina, N., & Min, S. (2024). Digitization of Transaction Terms as a Shift Parameter within Tce: Strong Smart Contract as a New Mode of Transaction Governance, *MIS Quarterly. Forthcoming.*

Hanseth, O. (1996). *Information Technology as Infrastructure*. PhD Thesis, Göteborg University.

Hanseth, O. (2022). When Stars Align. The Interactions and Transformations of E-Health Infrastructure Regimes, *Historical Social Research/Historische Sozialforschung*, *47*(3), 40-80.

Hanseth, O., Jacucci, E., Grisot, M., & Aanestad, M. (2006). Reflexive Standardization: Side Effects and Complexity in Standard Making, *MIS Quarterly*, *30*, 563-581.

Hanseth, O., & Lyytinen, K. 2010. Design Theory for Dynamic Complexity in Information Infrastructures: The Case of Building Internet, *Journal of Information Technology, 25*(1), 1-19.

Hanseth, O., & Monteiro, E. (1997). Inscribing Behavior in Information Infrastructure Standards, *Accounting, Management and Information Technologies, 7*(4), 183-211.

Hanseth, O., Monteiro, E., & Hatling, M. (1996). Developing Information Infrastructure: The Tension between Standardization and Flexibility, *Science, Technology, and Human Values*, *2*(4), 407-426.

Jovanovic, M., Kostić, N., Sebastian, I. M., & Sedej, T. (2022). Managing a Blockchain-Based Platform Ecosystem for Industry-Wide Adoption: The Case of Tradelens, *Technological Forecasting & Social Change,* 184, 121981.

Kazan, E., Tan, C.-W., Lim, E. T. K., Sørensen, C., & Damsgaard, J. (2018). Disentangling Digital Platform Competition: The Case of Uk Mobile Payment Platforms, *Journal of Management Information Systems — special issue on Financial IS, Underlying Technologies, and the FinTech Revolution, 35*(1), 180-219.

Lacity, M. C. (2020). *Blockchain Foundations for the Internet of Value*. Epic Books.

Lessig, L. (2002). *The Future of Ideas: The Fate of the Commons in a Connected World*. Vintage Books.

Lindskow, K. (2016). *Exploring Digital News Publishing Business Models, Unpublished Doctoral Dissertation*. Copenhagen Business School.

Mindel, V., Mathiassen, L., & Rai, A. (2018). The Sustainability of Polycentric Information Commons, *MIS Quarterly*, *42*(2), 607-631.

Naughton, J. (2000). *A Brief History of the Future: The Origins of the Internet*. Phoenix.

Pujadas, R., Tilson, D., Lyytinen, K., Sørensen, C., & Venters, W. (2024)a. Digital Infrastructures in the Roaring Twenties: Taking Stock and Moving Forward. In A. Baiyere, M.-K. Stein & R.D. Galliers (Eds.), *The Routledge Companion to Management Information Systems*.

Pujadas, R., Valderrama, E., & Venters, W. (2024)b. The Value and Structuring Role of Web Apis in Digital Innovation Ecosystems: The Case of the Online Travel Ecosystem, *Research Policy 53*(2), 104931.

Rossi, E., & Sørensen, C. (2019). *Towards a Theory of Digital Network De/Centralization: Platform-Infrastructure Lessons Drawn from Blockchain.* https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3503609.

Rossi, M., Mueller-Bloch, C., Thatcher, J. B., & Beck, R. (2019). Blockchain Research in Information Systems: Current Trends and an Inclusive Future Research Agenda, *Journal of the Association for Information Systems*, *20*(9), 1390-1405.

Sarker, S., Henningsson, S., Jensen, T., & Hedman, J. (2021). The Use of Blockchain as a Resource for Combating Corruption in Global Shipping: An Interpretive Case Study, *Journal of Management Information Systems*, *38*(2), 338-373.

Solow, R. M. (1987). We'd Better Watch Out, *New York Times Book Review* (36).

Sørensen, C. (2016). The Curse of the Smart Machine? Digitalisation and the Children of the Mainframe, *Scandinavian Journal of Information Systems*, *28*(2), 57-68.

Sørensen, C., Viguerie, C., Giraldo Mora, J. C., & Ahmed, T. (2024). Tokenization: A Foundation for Digitized Inter-Organizational Relationships. In: A. Baiyere, M.-K. Stein & R.D. Galliers (Eds.). *The Routledge Companion to Management Information Systems.*

Star, S. L., & Ruhleder, K. (1996). Steps toward an Ecology of Infrastructure: Design and Access for Large Information Spaces, *Information Systems Research*, *7*(1), 111-134.

The Economist (2022). What Went Wrong with Snap, Netflix and Uber?, *The Economist*. Oct. 31.

The Economist (2024). Technology Quarterly: The Foundations of the Cloud, *The Economist*. Feb. 2.

Tilson, D., Lyytinen, K., & Sørensen, C. (2010). Digital Infrastructures: The Missing Is Research Agenda, *Information Systems Research, 21*(5), 748–759.

Tilson, D., Sørensen, C., & Lyytinen, K. (2013). Platform Complexity: Lessons from the Music Industry, *46th Hawaii International Conference on System Science (HICSS 46)*. Maui, HI.

Tilson, D., Sørensen, C., & Lyytinen, K. (2021). Digitally Induced Industry Paradoxes: Disruptive Innovations of Taxiwork and Music Streaming Beyond Organizational Boundaries. In: R. Bednarek, M.P. Cunha, J. Schad & W.K. Smith (Eds.), *Interdisciplinary Dialogues on Organizational Paradox*. Emerald Publishing Limited (pp. 171-192).

Yates, J. (1989). *Control through Communication: The Rise of System in American Management*. The Johns Hopkins University Press.

Yoo, C. (2012). The Dynamic Internet: How Technology, Users, and Businesses Are Transforming the Network. AEI Press.

Zittrain, J. (2008). *The Future of the Internet: And How to Stop It*. Allen Lane.

Zuboff, S. (2019). *The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power*. Profile Books.

Sørensen:
Infrastructural Disruption

10