

DIGITAL TECHNOLOGY AND FIRM DECARBONISATION

A case study of the construction value chain



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Research Objective

- ✓ Digital technologies raise a lot of hopes among academics and policy makers that they can contribute to decarbonisation (European Commission Joint Research Centre, 2022; Maher et al., 2022; Vidmar et al., 2021).
- ✓ Expectations are that if digital technologies are strategically deployed, a twin transition is possible where firms digitalise and decarbonise at the same time (George et al., 2020).
- ✓ However, using digital technologies do not necessarily lead to reduced carbon emission and scholars have advocated the need to unpack the mechanisms linking digital and sustainability (Xia et al., 2022)

Research question: How do firms use digital technologies to do their net-zero transition?

Conceptual framework

Functions of DT



- ✓ Information system literature emphasizes the importance of digital technologies (DT) in promoting sustainable business practices (Watson et al., 2021)
- ✓ DT do that by performing five functions which can contribute to decarbonisation (Pinkse and Bohnsack, 2024)
- ✓ Firms respond to climate change by engaging in carbon management activities (Lee, 2011): optimizing processes, designing low-carbon buildings, productivising (i.e. industrialize production); reporting carbon performance; incentivizing adoption of low carbon products.

We analyse how firm use DT for carbon management activities and what limits the capacity of firms to use DT to their full potential

Findings

Research method:
46 semi-structured interviews with material providers (ex. cement; wood), architecture firms, construction companies, renovation companies, digital service providers
Thematic coding

We analyse barriers at three levels:

- Digital technology (it is not seen as relevant)
- Firm level (the firm is unable to use digital functions for carbon management activities)
- Ecosystem level (the firm does not have full control over the digital control loop)

We find that barriers vary depending on the type of carbon management activities.

First order codes

Digital technology can only marginally help decrease CO ₂ emissions. It is not lack of DT that matters but that customers prioritise economic performance and speed
It is hard to trust the results generated with AI DT crash because of the large quantities of data that have to be processed
DT need a lot of data to learn from. This is difficult when projects are unique or use industrial processes that are really new and for which little data is available
Digital legacy; inertia; lack of digital knowledge in core competence; failed past projects
Employees lack expertise in low-carbon Carbon performance has a low strategic importance for the company
Digital tools do not allow to integrate carbon performance with other KPIs Firms are used to trace financial flows (euros) but not physical flows (which are needed to estimate CO ₂ emissions)
Difficulties to manage heterogeneous levels of digitalisation Too many bilateral transactions need to be organised Need to change work routine and understand the other's need
Data has not been standardised yet or the databases are not up to date Databases are based on industry averages and do not allow to differentiate low carbon offers

Second order codes

Limited decarbonisation potential
Uncertain reliability of DT
Limited ability to digitalise knowledge

Low level of digital maturity
Low level of decarbonisation maturity
Lack of alignment between digital and decarbonisation

Bilateral transactions
Centralised transactions

Aggregate dimensions

Digital technology perceived relevance

Barriers at the firm level

Barriers at the ecosystem level

Contributions

- ✓ We discuss the mechanisms through which carbon management activities and digital technologies articulate and explain what limits the use of DT for decarbonisation.
- ✓ We discuss tensions that firms face and how they limit their capacity to use DT to their full potential.
- ✓ We show that to understand the potential of DT to contribute to decarbonisation it is best take a systemic approach and considering how DT operate within digital control loops.

Policy and managerial recommendations:
Incentivise the development of libraries of digital building blocks
Align digitalisation strategy and decarbonisation strategy