

HUMAN-DATA INTERACTION (HDI) TECHNICAL COMMITTEE

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Introduction

Human-Data Interaction (HDI) is a transformative research agenda that also represents a critical gap in current digital transformation efforts. Such transformation efforts have produced complex digital ecosystems that raise questions of, *e.g.*, trust, agency, and ethics, but the predominantly technocentric approaches tend to prioritise system performance over human-centric aspects. The Built Environment (BE) is data-rich but insufficiently human-centred in how data are accessed, interpreted, governed, and acted upon.

The HDI Committee, a permanent technical committee of the European Council on Computing in Construction (EC³), is dedicated to exploring the intricate relationship between humans and data in the BE. It investigates a wide range of topics, including user experience, change enablement, ethical data practices, and technological advancements that enhance our interaction with data. The Committee focuses on fostering dialogue and promoting leadership practices in HDI. It seeks to prioritise HDI-related research and educational initiatives, promoting practical applications across key areas.

Theoretical Foundations

As illustrated in Figure 1, throughout the Built Asset Lifecycle (BAL), humans serve as enablers, decision-makers, and users across various processes. The adoption of advanced digital technologies (*e.g.*, AI-based solutions, robotics, digital twins) has improved the efficiency and effectiveness of work processes while generating vast streams of digital data (Atuahene et al., 2023). In increasingly data-driven systems, it is not only the role of technology that matters, but the ways in which humans engage with the data these systems generate, transform, and act upon.

HDI addresses this gap by highlighting how users interact with digital data, focusing on access, interpretation, action, and ethical management in everyday tasks. Mortier et al.'s (2014) seminal paper identified the three foundational pillars of HDI (*legibility, agency, negotiability*) within the wider context of information systems. With the aim of adapting these pillars to the context of the BE's digitalisation, recent scholarly contributions (Li et al., 2024) have unpacked them to derive operational dimensions,

including *trust, human empowerment, safety, understanding, and privacy*. These dimensions, grounded in BE research, can be linked to these pillars to establish overarching principles for HDI tailored to digitalisation efforts across BAL. Taken together, this theoretical direction aims to reinforce HDI's relevance in settings where digital solutions are technically developed (*e.g.*, requirement gathering and analysis) and/or implemented to inform individual decisions and behaviours across BAL.

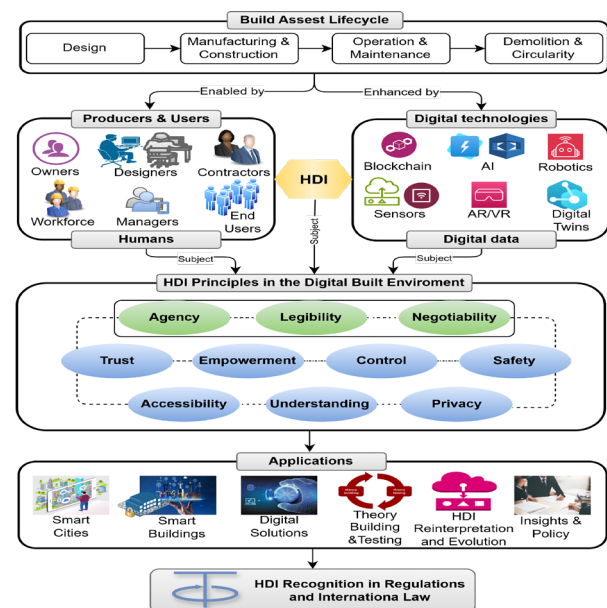


Figure 1: HDI Principles in the BE

From an enabler perspective, HDI emphasises that those managing change, through platform configurations, standards, and workflows, enhance data's findability, interoperability, and trustworthiness, shaping conditions for effective and responsible use. From a decision-maker perspective, HDI highlights the importance of timely, clear, and ethically governed data for evaluating trade-offs and making lifecycle decisions.

The overarching aim of HDI in the BE is to develop theoretical foundations while extending its applicability across diverse contexts. Contexts include smart cities, global policy development, and the reinterpretation of HDI principles in relation to cognition-driven intelligent systems like generative AI and autonomous DTW.

Committee's Contributions

HDI is a vital framework for understanding user-data relationships throughout the BAL within the context of computing in construction. Committee members contribute to knowledge dissemination through multiple scientific papers and outreach activities through engaging with and supporting all EC³ conferences, delivering knowledge through presentations, track sessions, and discussions on computing in construction.

In September 2024, the Committee launched its premier webinar introducing HDI in the BE, featuring presentations on HDI theory, generative AI, intelligent environments, and industry-academia collaboration. The Committee's White Paper (Kassem and Kifokeris, 2024) serves as a *Call to Action*, establishing HDI as a central research domain that unifies various interaction models under a human-centred approach. This *Call to Action* illustrates the shift from data as a neutral concept to understanding how data is constructed, interpreted and contested across stakeholders.

Committee members have collectively advanced theory and application through research. Li et al. (2024) developed an HDI theory for construction contexts incorporating trust, empowerment, safety, accessibility, and understanding, alongside the three pillars of HDI. Li et al. (2023) examined the implications of HDI for blockchain implementation, highlighting how stakeholder interactions shape immutability, transparency, and governance. Calvetti et al. (2023) proposed maturity levels for HDI in Digital Twins (DTw), also emphasising HDI's role in electronic performance monitoring at sensed construction sites, addressing data ownership and GDPR compliance (Calvetti et al., 2021, 2024). Rogage et al. (2025) highlighted the need for responsible data practices to manage the data carbon footprint in construction. Kifokeris (2025) explored HDI's potential to transform regenerative building production processes. Saif et al. (2025) advocated for sociotechnical approaches in DTw that balance technology with stakeholder engagement. Lastly, Munir et al. (2025) identified gaps in HDI strategies concerning sustainability and social good to drive purposeful digital implementations. Collectively, these contributions provide a foundation for future research to further integrate HDI into scalable, responsible, and human-centred digitalisation across the BE.

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