

## **ABSTRACT**

This dissertation focuses on the creation of a paradigm shift in building innovation. Challenges in achieving building energy-efficiency at scale highlight the complexity of the building performance problem, which is embedded with social, cultural, physical, environmental, and economic factors. Traditional approaches to building design have difficulty accounting for these multi-faceted variables and related longitudinal barriers and intangible impacts. Firstly, key stakeholders and their economic constraints change throughout time, and this variability is not traditionally considered upfront or addressed throughout a building's operation. Secondly, buildings have social, cultural, environmental and economic implications that are difficult to quantify and evaluate against strictly functional design objectives. Therefore, current deeply technical and often system-specific building design strategies could benefit from whole-building solutions that account for this complexity and enable a paradigm shift in design toward human-centered outcomes (i.e., well-being, health, financial sustainability) and effective (i.e., equitable and sustainable) buildings.

To drive this shift, an impact-based innovation framework was employed to pursue system-level and ecosystem-level strategies to optimize longitudinal building value assessment and distribution. First, a grounded theory study was pursued which identified gaps in current design practice that miss underlying building subsystem interactions which influence building performance. A system-level taxonomy of the building was then defined, linking identified subsystem synergies to functional, emotional and social building benefits for inhabitants. Then, an exploratory mixed-methods study was pursued, yielding a longitudinal building value framework that helps characterize key stakeholders, building design choices, and shared efficacy metrics. Building on these inputs, a multi-stakeholder, longitudinal building value assessment model was

developed. The model was tested on two residential building development scenarios, highlighting its ability to capture the true impact of buildings on affected stakeholders over time in terms of tangible and intangible building costs and benefits. Finally, business model innovation concepts were employed to identify specific changes in stakeholder value delivery and capture strategies that could redistribute building costs and benefits over time, and thereby facilitate a shift in the paradigm of design and value capture in the residential building industry.