**Objectives & Theoretical Perspectives**

Analysis of eco-label and voluntary environmental program effectiveness have shown ambiguous results. While some have studied the differences in voluntary program outcomes among early and late adopters, I apply the theory behind institutional isomorphism to a new case of green buildings, with the advantage that the rich dataset can differentiate many practices, rather than relying on binary outcome measures. This paper extends existing theory to directly compare contradictory expectations of voluntary certification program outcomes. Late certification adopters, increasingly searching for legitimacy by conforming to the practices of lead adopters, draw on more symbolic environmental strategies when choosing how to certify through Leadership in Energy and Environmental Design (LEED) for green buildings. Organizations increasingly rely on cost-cutting strategies that reduce resource consumption, as opposed to other strategies that are especially convenient, or that increase visibility.

**Hypotheses & Application to Green Buildings**

I use a proprietary dataset containing information on each LEED certified building registered under LEED for New Construction version 2.2. This is the first version of LEED for which complete data are available, including building use, location (including coordinates, address, an ordinal measure of development density, and climate zone), owner information (name, sector), and certification information (date of registration and certification, certification tier and score, as well as complete qualitative data on each LEED credit obtained toward certification). This level of detail enables analysis of certification pathways, answering key questions regarding the motivations to certify green, and how they evolve over time.

Two key expectations emerge from theory: first, that pathways will converge over time; and second, that pathways will become increasingly symbolic as later adopters seek to gain legitimacy by mimicking the practices of their early adopting peers. I operationalize these into five falsifiable hypotheses regarding firm behavior. One, variance across certification paths decreases over time. Two, certification paths are increasingly selected for convenience, rather than long-term benefit. Hypotheses three and four describe increases in alternative symbolic pathways to certification: three, organizations rely more on highly visible strategies that do not normally require certification; and four, organizations utilize strategies that provide greater private benefit, rather than public good provision. Finally, it is expected that for-profit firms will demonstrate greater propensity to shift behavior over time, and that these trends will be more pronounced in the for-profit sector, compared to government and non-profit owners.

**Methods & Results**

To observe whether conformity of certification pathways emerges as expected by institutional isomorphism, building observations are aggregated into monthly groups, many of which have over a hundred buildings. Heterogeneity of the certification strategies is empirically derived through the Blau index, a measure of entropy, and the normalized forms of these measures. Though both indices are shown to decrease over time in support of Hypothesis 1, the effect is extremely pronounced for entropy.

Second, I identify key trends in the use of particular environmental strategies by correlating them with time. Tests of statistical significance reveal that select subsets appear more common over time. In the multivariate case, logistic regression models are constructed predicting the use of environmental strategies linked to key hypotheses: the use of FSC certified wood, addition of bike racks and changing rooms, deployment of on-site renewable energy, and enhanced commissioning for energy efficiency represent strategies related to the convenience, visibility, and private profitability the available environmental strategies. After controlling for geographic and sector differences, I show that private profitability plays a major role in determining certification pathways. This evidence supports Hypothesis 4, but partially refutes Hypotheses 2 and 3.

 Finally, I construct a Cox proportional hazard model is used to evaluate the “risk” of a firm adopting a particular environmental strategy towards certification over time with maximum likelihood estimation. This enables investigation on whether adoption of emerging strategies is accelerated in firms, or in other subsets of our data, as expected in Hypothesis 5. I find evidence that differences exist between market sectors, and that firms become more likely to innovate towards these symbolic adoption strategies, unlike what was seen in previous models. Statistically significant results indicate that firms are more prone to adopting convenient strategies as time progresses, despite the overall decline of these strategies in the overall data.

**Conclusions**

This work has implications for both policymakers and program managers. The flexibility of many eco-labels encourages broader program adoption, but risks unclear signals sent to consumers of the labeled products. Results here demonstrate that dominant certification pathways quickly emerge as firms learn about cost-effective strategies. The evolving motivations to participate are shown to drive conformity in adoption, but late adopters are not observed to, subverting the value of the market signal. The environmental impact of later certified LEED buildings appears as strong as that of early adopters, but with a greater share of benefits absorbed by the firm itself. Combined with greater rental premiums for LEED certified buildings, the balance of benefits is tipped in favor of late adopting firms who maximize private gains through their certification pathway.

For a label to remain credible through these transitions, standards must be enforced to maintain a least common denominator across certified firms or products. This is particularly true for many environmental strategies that cannot be directly experienced by the user. Credence good eco-labels for some improvements such as sustainable material sourcing require monitoring, with the aim of ensuring that each certified product follows a certain, higher standard, regardless of the choice of improvements made toward certification. Monitoring is an important part of numerous eco-labeling programs, including ISO 14001 firm certification, Leadership in Energy and Environmental Design (LEED) building certification, organic food labels, and forestry certifications, among others. For flexible programs like ISO 14001 and LEED, this monitoring eases consumer uncertainty about the meaning of the product label. Despite inherent signal noise, flexible certification programs may still accrue premiums for firms by lowering information asymmetries.

The observed trends towards resource efficiency have implications for how policymakers address the energy efficiency paradox. Adopters of LEED certification are incentivized to pursue increasingly higher levels of efficiency, in spite of high upfront costs, high discount rates, and short time horizons. LEED may function to extend time horizons for investors in the real estate industry. Because hundreds of policies have been crafted to promote LEED adoption at various levels of governance, future work should explore the impacts of policy coercion for certification on the environmental strategies selected and the emergent certification pathways that result.