

PUBLIC POLICY AND IMPACTS ON ADOPTION OF SUSTAINABLE BUILT ENVIRONMENTS: LEARNING FROM THE CONSTRUCTION INDUSTRY PLAYMAKERS

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ABSTRACT

Sustainable practices in the built environment are becoming a more common phenomena as market penetration of green buildings grow. Despite the reported benefits of green buildings, barriers to sustainability still exist. To motivate wider adoption of sustainable built environments, this research studies public policy and its impacts. The study aims to understand the links between public policy, construction playmakers' (e.g., organizations', institutions', business owners', and developers') motivation to build green, and growth of sustainable built environments in the United States. As a step forward in this direction, this paper focuses on the case of Michigan and explores construction playmakers' motivations to build and/or occupy sustainable buildings and how effective current public policy in Michigan is at addressing these motivations. There is little research on the links among legislation, construction playmakers' motivation to build green, and the growth of sustainable built environment in the United States. This article's findings show that: 1) green building costs are still the most frequently-reported barrier to green building, 2) property developers are significantly less likely to utilize green building practices than other construction playmakers, 3) single-family residential buildings were the least likely building type to receive green certifications, and 4) construction playmakers report low levels of green policy awareness and use despite the presence of relevant public policies. These findings will provide direction for policy makers and advocates in creating policy that will effectively promote green building construction.

KEYWORDS

sustainability; green; building; construction; policy; incentives; barriers

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INTRODUCTION

Green building practices are expected to become more commonplace as our society, driven by both market demands and policy regulations, continues to explore ways to become more energy efficient and reduce reliance on fossil fuels (Smart Market Report, 2007; Christopher & Jelier, 2009). Great opportunities exist for economic growth across the United States with the adoption of green buildings. Aside from efficient use of resources, such as energy and water (Magent et al., 2009), and improvements to public health, productivity, and well-being (Singh et al., 2010), a significant number of new 'green' jobs will be created, most of which will be associated with energy efficiency and the construction industry (Michigan Department of Energy, Labor & Economic Growth, 2009; Christopher & Jelier, 2009).

The number of buildings certified by United States Green Building Council's sustainable building project assessment system, Leadership in Energy and Environmental Design (LEED), has at present reached 35,287 buildings in the United States and over 42,000 buildings worldwide (US Green Building Council, 2013). While construction rates have fallen throughout the United States due to a shrinking economy (US Department of Commerce, 2011), sustainable structures remain an important and growing segment of the construction industry. For example, LEED certification has continued to increase every year since 2001 despite the slowing construction market. In 2009 alone, 1,812 buildings were certified by the US Greenbuilding Council (USGBC); 2010 saw an additional 2,483 buildings, and 2,685 more were constructed in 2011 (US Green Building Council, 2013).

Despite the promise of growing market penetration (Simons, Choi, & Simons, 2009; Konotokosta, 2011; Christopher & Jelier, 2009), barriers to utilizing green building practices still exist; one of which is high building premiums. However, research shows that budgets of conventional buildings do not significantly differ from ones seeking any level of sustainable certification (Kats 2003, Matthiessen and Morris 2004, Hoffman and Henn 2008), especially with the use of integrative design practices (7 Group, 2009). The barriers to adoption of green buildings therefore seem organizational and psychological (Richardson & Lynes, 2007; Hoffman & Henn, 2008; Gauthrie & Wooldridge, 2012). Construction playmakers' motivation to build sustainably, therefore, becomes a key argument to further encourage the construction of green buildings.

Korkmaz (2007) observed that building owners and developers across the United States build sustainably-designed and/or green certified buildings (e.g., LEED, Green Globes certified) for several reasons. One of the most influential reasons for building green are incentives provided by financial institutions or local governments. Reinforcing public policy can additionally help playmakers to overcome the psychological barriers of building green.

To move forward with this goal of reinforcing public policy, this paper studies how current public policy in Michigan supports and motivates adoption of sustainable built environments. Through a content analysis of public policy in the past fifteen years and a survey of construction playmakers in Michigan, the study explores: a) motivations for construction playmakers to build and/or occupy sustainable buildings in Michigan, and b) the effectiveness of current public policy in Michigan at addressing these motivations. Findings will serve as an important foundation for recommending how new policies can be designed so that they are easily interpreted and adopted more often by construction playmakers as a means to encourage construction of sustainable built environments.

Background

The cost of green buildings has been declining due to more common use of integrative design practices (7 Group, 2009). As the cost of green building components continue to decline, green buildings will only become more affordable (Kats, 2003; Matthiessen & Morris, 2004; Hoffman & Henn, 2008). Through a review of 33 buildings, Kats (2003) noted the widespread public misconception that green buildings are prohibitively more expensive. He noted that the majority of the additional cost of green buildings is not in “hard” costs (i.e., costs associated with green component installation and materials) but is instead in “soft” costs (i.e., costs associated with experts’ additional time for planning, design, and construction to build green). As a result, the earlier green building features are incorporated into the design process, the lower the cost (Kats, 2003; Matthiessen & Morris, 2004; Hoffman & Henn, 2008). Matthiessen and Morris (2004) also found no statistically-significant difference between the budgets of conventional buildings and those seeking any level of sustainable certification.

Despite there being a convincing financial case for building green, organizational and psychological barriers to green building still persist (Richardson & Lynes, 2007; Hoffman & Henn, 2008; Gauthrie & Wooldridge, 2012). Hoffman and Henn (2008, 391) agreed “obstacles faced by green building movements are no longer primarily technological and economic. Instead, they are social and psychological.” They divided those barriers into three main categories: individual, organizational, and institutional perspectives. They suggest that incremental changes can help overcome biases against green construction in “benign individuals” (Hoffman and Henn, 2008). Richardson and Lynes (2007) similarly concluded that a lack of internal leadership among university officials with decision-making power and an institutional structure that does not reward buildings with lower energy cost were barriers to constructing green buildings.

Gauthrie and Wooldridge (2012) report that LEED adoption is driven by imitating other competing firms and provide empirical evidence that ‘efficient-choice’ influences are significant in explaining a firm’s decision to build green buildings. While the United States federal government has played an important role in promoting green building practices and products (e.g., the Build America (U.S. Department of Energy, 2013), and ENERGY STAR (U.S. Environmental Protection Agency, 2013) programs), much of the ‘push’ for building green comes from state legislatures. Legislators from states around the United States have adopted policies that incentivize and/or mandate green building practices. Korkmaz (2007) observed that building owners and developers across the United States build sustainably and/or green certified buildings (e.g., LEED, Green Globes certified) due to one of the reasons below:

- *Incentives provided by financial institutions or local governments for building sustainably:* These include additional financing credits, allowance for additional construction square foot per area, and tax breaks.
- *Strict local codes and regulations:* In states like California and Washington, developers report that they do not take extra measures to receive sustainability certificates for their buildings, as they already build according to highly strict codes regarding energy, recycling, and site selection.
- *Marketing benefits to developers through direct sales or lease of facilities:* Raising sustainability awareness in public and government (as the major customer for buildings in some markets) can motivate developers to build sustainably. For

example: government agencies such as the Department of Energy (DOE) and the Environmental Protection Agency (EPA) require LEED Silver certification at minimum for any buildings they occupy. In fact, government-built or occupied buildings constitute 27% of all LEED certified facilities (US Green Building Council, 2013).

- *Life cycle cost savings*: When the project owner is to occupy the building, they are more likely to consider: a) energy savings in the long run, and look for ways to include energy efficient technologies and renewable energy resources (e.g., photovoltaics, wind turbines) into their projects and b) improving indoor environmental quality of buildings for investing in occupant productivity, health, and well-being.
- *Doing the right thing*: Business owners, non-profit organizations, and educational institutions that are the innovators of the sustainability market build green to 'do the right thing' for the public and lead the market. Their vision for building sustainably is to reduce carbon emissions, contribute to energy efficiency, and educate the public about sustainable building technologies and practices.

In summary, perceived higher costs continues to be a psychological barrier for construction playmakers to build sustainably. Public policy can act as a motivator to overcome this challenge. However, it is important for policymakers to accurately understand the influences felt by construction playmakers in order to draft effective policies. Konotokosta (2011) provided evidence that more innovative cities and early adopters of green building policies have typically evaluated their cities' needs and set green goals, allowing the cities to take advantage of new building policies from the state and federal levels more quickly and efficiently. Those same innovative cities have lower carbon emissions per capita, suggesting that there is a link between public policy, building sustainably, and carbon emissions.

State and local green building policies include financial incentives, executive orders and directives, and building guidelines and regulations (Simons, Choi, and Simons 2009), and can have social, economic, and environmental impacts (Pearce, Dubose, and Bosch 2007). Among all green policies, 'lead by example' initiatives were observed to be the most common form of enacted public policy (Simons, Choi, and Simons 2009). Interestingly, Gauthrie and Wooldridge (2012) found no empirical evidence that such policies influence private firms to utilize green building practices. Nellen and Miles (2007) provide a checklist to properly utilize tax incentives when considering building green. Despite this literature, a rigorous analysis of the links among legislation, construction playmakers' motivation to build green, and growth of sustainable built environments in the United States is missing.

THE CASE OF MICHIGAN AND STUDY METHODS

This paper focuses specifically on the state of Michigan. Michigan is not generally perceived as an innovator in public policy areas among many states. However, Michigan consistently ranks within the top-20 states with regards to the number of certified green buildings: 380 LEED certified buildings and 224 ENERGY STAR certified buildings as of February 2013 (US Green Building Council, 2013; ENERGY STAR, 2013). Similarly, Michigan ranks 12th in the top-20 of the American Council for an Energy-Efficient Economy (ACEEE) policy scorecard (American Council for an Energy-Efficient Economy, 2012). Michigan has begun to take

serious steps towards implementing and encouraging green building practices and building greener infrastructure (Acuff, Harris, Larson, Magnus, & Pumpbrey, 2005). As a result, the number of green buildings has been increasing every year (with the exception of 2011) despite the overall decline in construction across the state (US Green Building Council, 2013; US Department of Commerce, 2011).

To understand the links between public policy and construction playmakers' decisions to build green in Michigan, the researchers first identified existing public policy relating to sustainable building practices and then conducted a survey of construction playmakers.

Public policy across any state is always a moving target- policies are constantly moving in and out of effect over time. Additionally, local municipalities may also have their own policies that pertain to the same issues as the state policies. Therefore, the policy landscape is not consistent temporally or geographically in any given state on most issues, which makes creating a policy inventory and content analysis very challenging.

To conduct a content analysis of green public policy in Michigan, researchers first searched the timeline for the most recently-enacted and active public policies. Based on this information, the researchers searched for Michigan green building policies that existed between the years of 2000 and 2013. Researchers utilized the United States Department of Energy's Database of State Incentives for Renewable Energy (DSIRE) and the ACEEE's website (American Council for an Energy-Efficient Economy, 2013; US Department of Energy, 2013) to identify specific Michigan public policy. The DSIRE database provides a list of policies specific to energy efficiency with summaries and links to the policies activating legislation. The ACEEE's website summarizes the various types of energy efficiency and green building policies as they exist in Michigan and provides a convenient mechanism for comparing policies of different US states. Researchers were then able to identify relevant Michigan policies.

The researchers then identified a target population of building professionals (i.e., also called "construction playmakers" in this report) in Michigan, including project managers, designers, contractors, developers, land banks, institutions, and building owners. The database of construction playmakers was compiled by referring to the US Green Building Council's Member Directory for Michigan (US Green Building Council, 2012), which was then enhanced using the publicly-available online member directory on Green Built Michigan (Green Built Michigan, 2012), as well as Michigan land banks, institutions of higher education, and other construction playmakers involved in other green building projects (i.e., Society of Environmentally Responsible Facilities' certification program). The researchers ultimately identified 238 potential survey respondents.

To reach this population, survey team members first contacted each potential survey participant in the database by telephone. All investigators underwent basic training on human subject research protections under the terms of Michigan State University's Institutional Review Board. After establishing initial contact with the potential survey participants, the proper contact email address was obtained and willing participants were sent an email containing a link to the survey, which was created through a web-based survey application tool (SurveyMonkey, 2012). The survey consisted of 36 questions broken into three main sections designed to understand following:

1. Respondents' experience and role in the construction industry; their opinions regarding the green building movement in Michigan, and their companies' experiences with green buildings.

2. The specific conditions and characteristics of the most recent green building project they were involved in Michigan, if any. Key hypotheses tested via responses to this section include:
 - a. Hypothesis (H) #1: The motivation for building green is influenced by the type of project (e.g., office, industrial).
 - b. H #2: The type of playmaker who initiated the green building process on the respondent's last project is related to the level of LEED certification achieved on that project.
 - c. H #3: Project type (e.g., office, industrial) is related to the level of LEED certification achieved on that project.
 - d. H #4: Owner type (e.g., public, private) is correlated with public policy use, and
3. Respondents' experience and position on public policies and programs related to green building practices within Michigan. The key research question asked within this section was: "Is the awareness of public policy a predictor of green building project involvement?"

It is important to note that, not all survey respondents pursued certification for their most recent green building (i.e., due to the cost associated with certification). On the other hand, all respondents who reported that a recent project they worked on received some green certification also reported that LEED certification was pursued in these projects. Therefore, study results report only on responses related to LEED certification, where green certification is considered. Considering that LEED is the predominant certification system in the US and other certification systems have reached relatively smaller populations (Kats, 2003; May & Koski, 2007; Gauthrie & Wooldridge, 2012); the sample reached via this study shows similar characteristics with the industry trends. While many of the respondents were not LEED accredited professionals, it is possible that the survey is biased in favor of respondents with more green building experience than the field in general.

Collected data were downloaded from SurveyMonkey and coded in Microsoft Excel (SurveyMonkey, 2012; Microsoft Corporation, 2012). The researchers first ran exploratory data analysis to collapse study variables to meaningful categories. The variables addressed in this paper are either binary or ordinal. The researchers used regressions and ordered logistic regressions with robust standard errors to examine the data. Data analysis was done in STATA 12 (StataCorp, 2013). Marginal effects were determined by using difference-in-difference estimation. Standard errors for the marginal effects are delta-method standard errors.

Finally, the results of the content analysis and hypothesis testing were cross-referenced to understand the links between adoption of green building practices and existing Michigan green policy.

FINDINGS

Content Analysis Results

The research revealed that public policy in Michigan exists in the form of regulatory policy, policy incentives, and lead-by-example initiatives. Regulatory policy in Michigan either targets playmakers or utility services. The Michigan Uniform Energy Code (The Michigan Department of Energy, Labor, and Growth, 2010), for example, was adopted in 2009 to upgrade the existing code to meet mandatory minimum federal requirements. Incentives, on the other

hand, are voluntary and either reduce the cost associated with green building or provide an additional benefit (i.e., certifications and awards). Michigan enacted the *Michigan Energy Efficiency & Renewable Energy Tax Credit* (P.A. 287 of 2008) and the *Customer Choice & Electricity Reliability Act* (P.A. 141 of 2000), which provided grants to non-profit organizations, governments, and government agencies that support sustainable buildings, until the 2011 tax-year (The State of Michigan, 2000; The State of Michigan, 2008). At present, Michigan has the *Michigan Energy Efficiency and Renewable Energy Revolving Loan Program* (P.A. 242 of 2009), which provides low-interest loans to parties utilizing energy-efficient building components and renewable energy installations (The State of Michigan, 2010). Lastly, Michigan has a lead-by-example initiative, which mandates that all state-owned buildings meet certain sustainability goals (i.e., Gov Granholm's "Reduction of Energy Usage" directive requires all state buildings to reduce energy use by 10% statewide by 2008) (The State of Michigan, 2007). Table 1 below presents recent green building policies in Michigan. These policies were included in the survey of green building playmakers for the second part of the study.

Michigan has had a total of nine recent public policies addressing green building and energy-efficiency in buildings since 2007. Of those nine, four have been discontinued, including the Low-Income and Energy-Efficiency Fund (LIEEF), which provided grants to non-profit organizations promoting energy-efficiency for low-income households, and the Michigan Energy Efficiency Tax Credit. Two private sector incentives still exist: PA 295, which requires utilities to provide affordable net-metering to customers, and PA 242, which authorized the Michigan Energy Efficiency Revolving Loan Fund to provide low interest loans for renewable energy and energy efficiency projects. The remaining policies target state buildings' energy use. As Michigan continues to develop public policy encouraging green building, it becomes important to know the type and visibility of effective policy incentives to influence construction playmakers in the adoption of green building practices.

Survey Results

Sample Characteristics

In total, 80 surveys were completed between July 1 and October 31, 2012, resulting in an acceptable (Kongsved, Basnov, Holm-Christensen, & Hjollund, 2007) 34 percent response rate. The respondents consisted of a diverse group of playmakers within the construction industry, with no cohort achieving more than 16 percent of respondents. Other than the largest cohort, consisting of project and construction managers, the distribution between cohorts is fairly even. Land banks returned the lowest number of responses, at three, despite including all 32 land banks in the Michigan Department of Treasury Land Bank Database. Table 2 presents respondent characteristics.

Figure 1 illustrates the geographical distribution of the respondents and the general population density throughout Michigan. Respondents are spread across the state of Michigan with relatively dense clusters in the Detroit, Grand Rapids, and Lansing metropolitan areas, (see Figure 1). Figure 1 shows that the Detroit metropolitan area is the highest sampled geographical area in this survey, which is unsurprising given that the combined Detroit metropolitan area consists of over 52% of the population of Michigan (US Census Bureau 2013). The Grand Rapids metropolitan area is the next most heavily sampled area in the survey and has the next largest combined metropolitan population, consisting of 14% of the state's total population (US Census Bureau 2013). The Upper Peninsula and northeast region of the lower

TABLE 1. Recent Policies in Michigan Related to Green Building Practices.

ID	Name	Years Passed/ Discontinued	Target Population	Programs Granted—Summary
Public Act (PA) 141	Customer Choice & Electricity Reliability Act	2000–2012	Established the Low-Income Energy Efficiency Fund (LIEFF) / Targeted primarily low-income families	Michigan Saves, Inc., Better Buildings for Michigan, The Michigan Community Action Association, and the Department of Human Services
PA 295	Clean, Renewable, and Efficient Energy Act	2008– ...	Targets energy utilities	Net-Metering, Utility-Run Optimization Policy, Detroit Edison Solar Currents (DTE) Program
PA 287	Michigan Energy Efficiency / Renewable Energy Tax Credit	2008–2012	Targeted low income households	Established tax credit for installation of energy-efficient appliances and home improvements.
ED 2005-4	Energy Efficiency in State Facilities and Operations	2005–2007	Targeted state of MI government agencies	Established target of 10 percent reduction in energy use by 12/31/2008 for all state buildings under the Executive Branch's purview.
ED 2007-6	Reduction of Energy Usage	2007–2007	Targeted state of MI government agencies	Established a target of an additional reduction in energy usage of at least 10 percent from the level of energy usage during the fiscal year ending September 30, 2006.
ED 2007-22	Enhanced Energy Efficiency and Conservation by State Departments and Agencies	2007– ...	Targets state of MI government agencies	Multiple energy-efficiency measures, including requiring all new state buildings to be LEED certified.
Executive Order (EO) 2007-42	Michigan Climate Action Council	2007– ...	Targets state and local governments and general public	Established the Michigan Climate Action Council, not active since 2009.
PA 242 – 2009	Michigan Energy Efficiency and Renewable Energy Revolving Loan Program	2009– ...	Targets public and private entities - Facilitates participation in PA 245	Provides low-interest loans to public or private entities for energy efficiency and renewable energy projects
ED 2009-4	Implementation of Recommendations of the Michigan Climate Action Council	2009– ...	Targets state agencies	Implements policy measures in the Michigan Climate Action Council's final report.

TABLE 2. Respondent Characteristics.

Respondent Types			Respondents' most recent green building project		
	<i>Freq.</i>	<i>% in the Sample</i>		<i>Freq.</i>	<i>% in the Sample</i>
Developer	10	12.50%	Residential single Family	14	16%
Contractor	14	16%	Residential multi-family	3	4%
Higher Education	14	16%	Municipal	4	6%
Designer	6	8%	Commercial Office Space	16	23%
Public Owner	7	9%	Commercial Retail	0	n/a
Private Owner	14	16%	Industrial	3	4%
Land Bank	3	4%	Educational (K–12)	5	7%
Project Manager	15	19%	Higher Ed.	12	17%
Other	10	12.50%	Other	13	18.50%
Respondents' experience in construction					
	<i>Freq.</i>	<i>% in the Sample</i>		<i>Freq.</i>	<i>% in the Sample</i>
<1 years	5	9%	6–12 years	9	16%
1 – 2 years	0	n/a	>12 years	37	66%
3 – 5 years	5	9%			

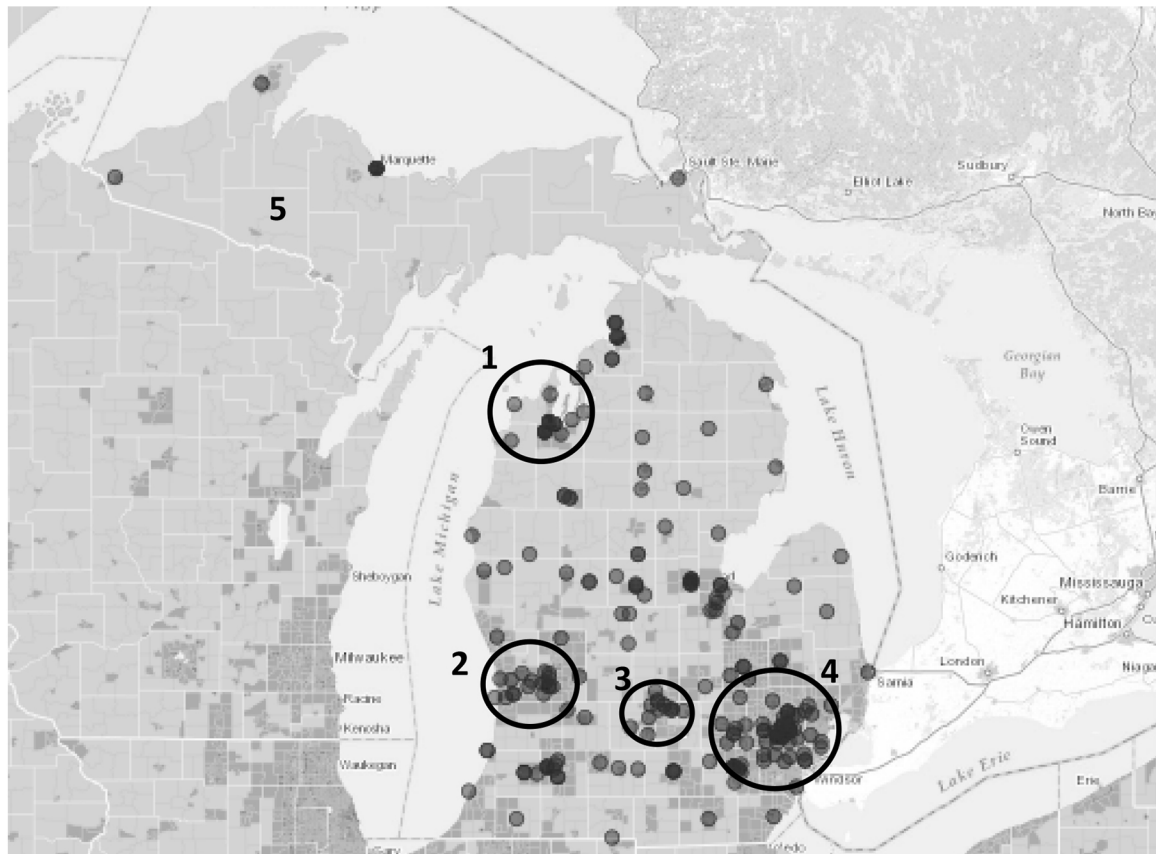
peninsula have relatively fewer respondents than are present elsewhere in the state but the general population densities of those areas are much lower. Figure 1 illustrates that researchers were able to reach a geographically representative sample of respondents.

Figure 2 illustrates building permit figures in Michigan from 1996 through 2011 (US Department of Commerce, 2011), along with the number of sustainable buildings initiated by our survey respondents. The number of green buildings built by survey respondents follows a similar pattern of rise and decline over time as all buildings built in Michigan in total over that same period of time. This indicates that the survey respondents were subject to the same economic trends over time as all construction playmakers, and that the survey respondents are representative of construction playmakers throughout Michigan. The decline in total buildings constructed is slightly more extreme from 2007–2010 than our survey sample, however, this is likely the result of the increasing popularity of green buildings specifically during that same period of time (US Green Building Council, 2013).

Insights to Green Building Market and Construction Playmakers: Descriptive Statistics

To determine barriers to and influences on deciding to build green, the survey asked respondents to rank the following barriers: unfamiliarity with construction materials, lack of design integration, customer preferences, increased labor costs, and increased material costs. The increased cost associated with green practices was consistently ranked as the most critical barrier (Table 3). The second most important barrier to building green was reported to be the clients themselves: 12 out of 54 respondents indicated that clients' resistance (i.e., project owner) was the most critical barrier to sustainable construction (Table 3).

FIGURE 1. Respondent Distribution and Population Density Across Michigan.



● - Respondent Location

- 1 – Traverse City Metropolitan Area (Population Density: 85/sq mi)
- 2 – Grand Rapids Metropolitan Area (267.81/sq mi)
- 3 – Lansing Metropolitan Area (1,714.6/sq mi)
- 4 – Detroit Metropolitan Area (1,104.8/sq mi)
- 5 – Upper Peninsula (19/sq mi)

Source: (US Census Bureau 2013)

39 percent of respondents claimed that company vision or values was the major motivation to build or occupy sustainably designed structures, while 21 percent of respondents indicated that their leading motivation was decreased life-cycle energy costs associated with green buildings (Table 4). Owners were reported to have initiated green building process much more than other types of stakeholders that (e.g., occupants, contractors, developers, clients, and designers).

Hypothesis Testing Results on Respondents' Most Recent Green Building Projects

Over seventy percent of respondents (n=46/64) reported to have followed sustainability guidelines (e.g., LEED, ENERGYSTAR) or achieved certifications in their most recent green

FIGURE 2. Building Permits Issued in Michigan between years 1996 and 2011 & Number of Green Buildings Built by Study Respondents.

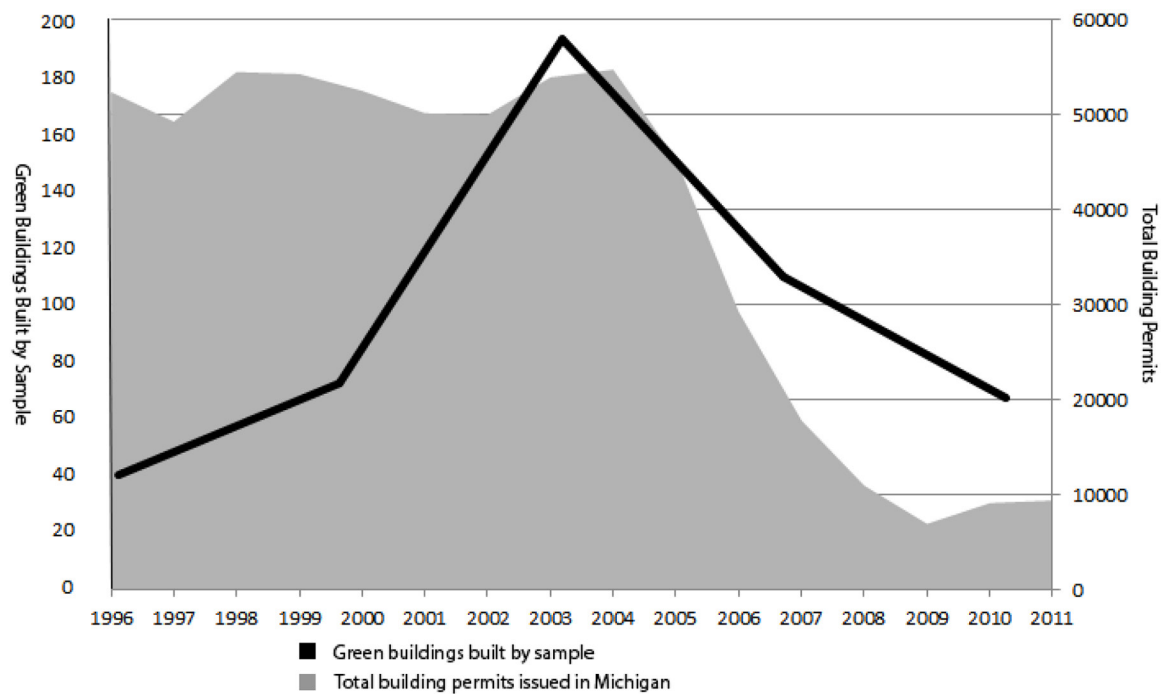


TABLE 3. Statistics for Respondents' Most Recent Green Building Project.

The party that Initiated Green Building Process			Level of LEED Certification Achieved		
	<i>Freq.</i>	<i>% in the Sample</i>		<i>Freq.</i>	<i>% in the Sample</i>
Owner	41	50%	none	26	40%
Occupant	5	6%	Certified	6	9%
Client	12	15%	Silver	16	25%
Developer	12	15%	Gold	16	25%
Designer	11	13.50%	Platinum	1	1.50%
Occupancy Status					
	<i>Freq.</i>	<i>% in the Sample</i>		<i>Freq.</i>	<i>% in the Sample</i>
Occupied	43	66%	Sold	8	12%
Rented	3	5%	Vacant	2	3%
Leased	6	9%	Other	3	5%

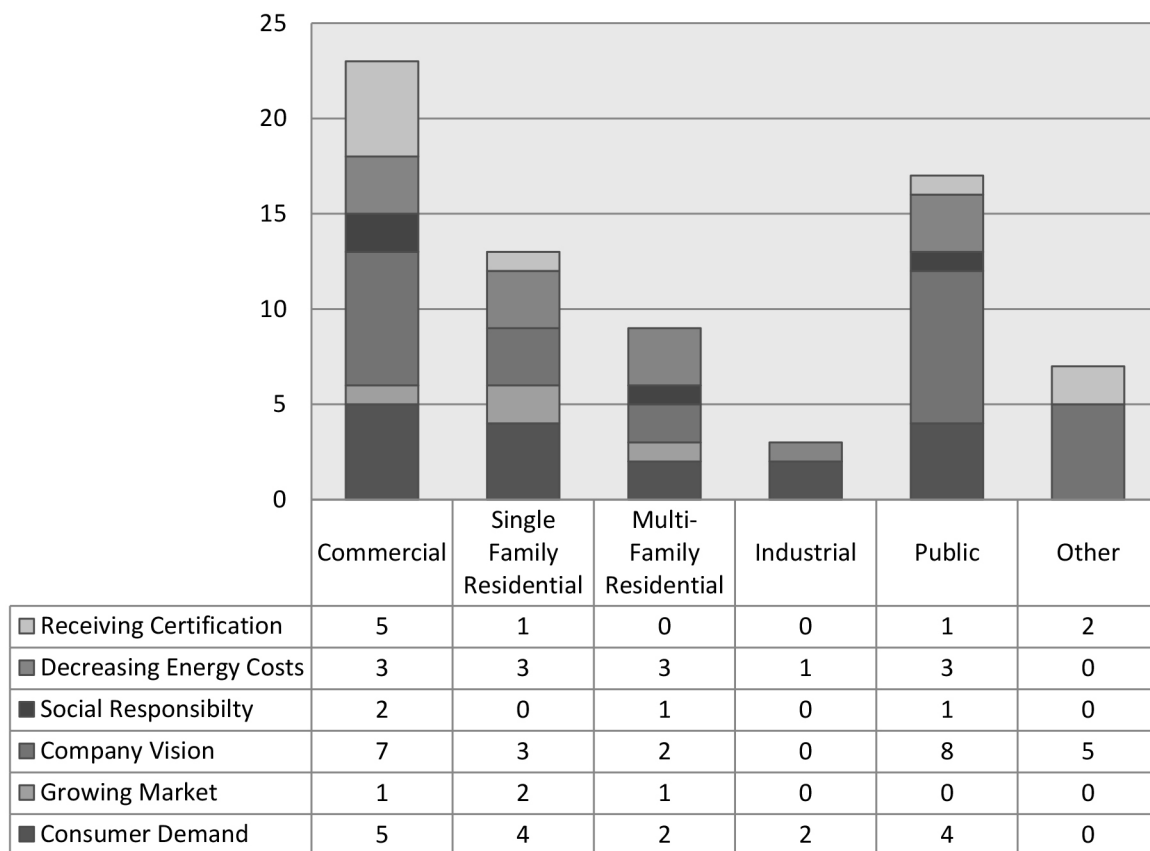
building project. LEED Gold and Silver certifications were achieved in projects where 41 percent of the respondents were involved, while Certified and Platinum buildings were far less common (15 and three percent respectively). Below, hypothesis testing results are reported based on the data collected from respondents regarding their most recent green building projects.

TABLE 4. Barriers and Motivations to Build Green for Michigan Construction Playmakers.

Barriers to Building Green			Motivations to Building Green		
	<i>Freq.</i>	<i>% in the Sample</i>		<i>Freq.</i>	<i>% in the Sample</i>
Material Cost	30	55.50%	Company Vision/ Values	20	39%
Client	12	22%	Lower Energy Costs	11	21%
Lack of Design Integration	5	9%	Consumer demand	7	14%
Labor Cost	4	7%	Receiving Certification	6	12%
Unfamiliar w/ Green Materials	3	5.50%	Social Responsibility	5	10%
			Un-tapped, Growing Market	2	4%
			To compete with other developers	0	n/a
Opportunities to Increase Adoption of Green Buildings					
	<i>Freq.</i>	<i>% in the Sample</i>		<i>Freq.</i>	<i>% in the Sample</i>
Increased incentives	37	74%	Decreased construction and material cost	33	66%
Increased consumer demand	28	56%	More familiarity with green practices	14	28%
More competitive construction industry	14	28%			

Hypothesis #1—The motivation for building green is influenced by the type of project (e.g., office, industrial). The data for this hypothesis included seven binary dependent variables. Researchers ran seven logistic regressions with robust standard errors to determine whether the type of construction project is significant in explaining any of the motivations for building green. As shown in Figure 3 and Table 5, *company vision* is the most frequently-reported ‘main motivation’ to build green.

Commercial office buildings were not significantly different from other building types in any regression, therefore, was selected to serve as the comparison basis. Researchers found that *consumer demand*, *company vision*, *decreasing energy costs*, and *receiving green certifications* were all motivations with significant relationships to recent green building projects for commercial retail, single family residential, municipal, and educational building types. For example, construction playmakers who reported recent participation in commercial retail building projects were significantly more likely to report that receiving certifications and awards was the most important motivation they observed for building green. Meanwhile, construction playmakers who reported recent participation in *single family residential* and *educational* building projects were significantly more likely to report that *consumer demand* was the most important

FIGURE 3. Respondents' perceived "main-motivation" by recent project types.

motivation for building green. *Company vision* and *decreasing energy costs* were also significant motivations. The motivation "to compete with other developers" had no variation and could not be tested. Some of the variables were omitted due to colinearity as reported in Table 5. In Table 5, the marginal effects are the first figure reported in each cell and the standard-error is the figure reported below it in parentheses.

Hypothesis #2—The type of playmaker who initiated the green building process on the respondent's last project is related to the level of LEED certification achieved on that project. LEED certification, the dependent variable in this hypothesis, is ordinal. The researchers ran ordered logistic regressions to observe the effects of the independent variables. However, the sample lacked a variety of responses among some categories at some levels of certification. As a result, researchers found it necessary to collapse the LEED-certification-achieved variable down one level from Platinum (i.e., which had only one observation) to Gold, and then ran additional regressions with the level of LEED collapsed further to the Silver level. By collapsing the dependent variable, any issue regarding lack of variability among Gold and Platinum levels of certification are addressed.

Figure 4 graphs the mean levels of LEED certification and standard errors by the various types of initiating playmakers. Standard errors were calculated in Excel (Microsoft Corporation, 2012) using standard deviations and sample sizes reported in cross-tables in STATA

TABLE 5. Marginal-effects of respondents reported “main motivation” vs. project types respondents have recently been involved with.

	Consumer Demand	Company Vision	Decreasing Energy Costs	Certifications and Awards
Commercial Retail	0.8767 (0.0784)	0.0035 (0.1537)	0.0291 (0.3292)	0.2280 (0.1147)*
Industrial	0.8758 (0.2638)*	Omitted †	Omitted ‡	Omitted †
Single Family Res.	1.5910 (0.5307)*	0.0709 (0.1152)	0.0501 (0.1475)	0.0032 (0.0705)
Multi-Family Res.	0.02895 (0.0626)	-0.0742 (0.1419)	0.1440 (0.1634)	Omitted †
Municipal	0.0642 (0.0737)	0.3085 (0.1306)*	Omitted †	0.1032 (0.0740)
Educational	1.5549 (0.5018)*	0.1424 (0.1364)	0.2162 (0.1231)	0.0178 (0.0653)
Other	Omitted †	0.3467 (0.1043)*	Omitted †	0.1513 (0.0834)
Pseudo R ² =	0.5895	0.2000	0.1006	0.3051
N=	68	69	59	67

*= significant at the 95% confidence interval

†= predicts failure

‡= predicts success

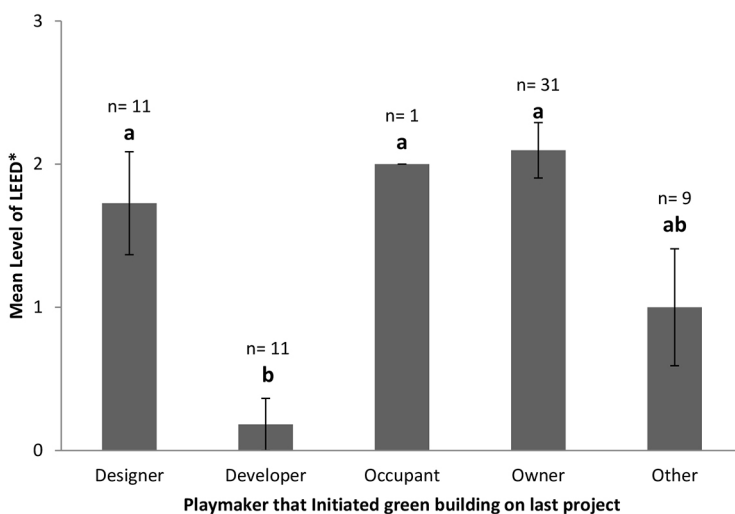


FIGURE 4. Mean level of LEED by initiator type.

* 0= no LEED, 1= certified, 2= silver, 3= Gold and above

* a is significantly different than b; ab is significantly different than neither a or b

(StataCorp, 2013). *Developers* on average receive significantly lower levels of LEED certification for their buildings than other initiating playmakers. Researchers ran ordinal logistic regressions of initiator type on the level of LEED achieved, with LEED certified project categories at and higher than: (a) Gold, collapsed to the same level in one regression; and (b) Silver to the same level in another. In both regressions, the construction playmaker type

developer was significant at the 99% confidence interval and negatively correlated with the level of LEED certification achieved. With a marginal effect of 0.678 in the first regression, and a marginal effect of 0.645 in the second regression, *developers* responsible for initiating the green building process were observed on average to achieve one level of LEED certification lower than other types of construction playmakers.

Occupants who were responsible for initiating the green building process were found to be significant at the 99% confidence interval when the level of LEED was collapsed to the Silver level. Occupants were found to have a positive relationship with the level of LEED certification achieved (i.e., with a coefficient of 13.704), however the delta method marginal effect associated with occupant was relatively small (−0.26) suggesting that an average of 26% of occupant-initiated green building processes result in a single additional level of LEED certification.

Hypothesis #3—Most recent project type (e.g., office, industrial) is related to the level of LEED certification achieved on that project. Similar to the exploratory data analysis procedure explained in the previous hypothesis testing, in this analysis, projects with LEED Gold and Platinum certification observations were collapsed into the same category. Researchers ran a cross-table of the level of LEED certification achieved on respondents' last project and the type of building project they last worked on (Figure 5).

FIGURE 5. Level of LEED achieved by project type.

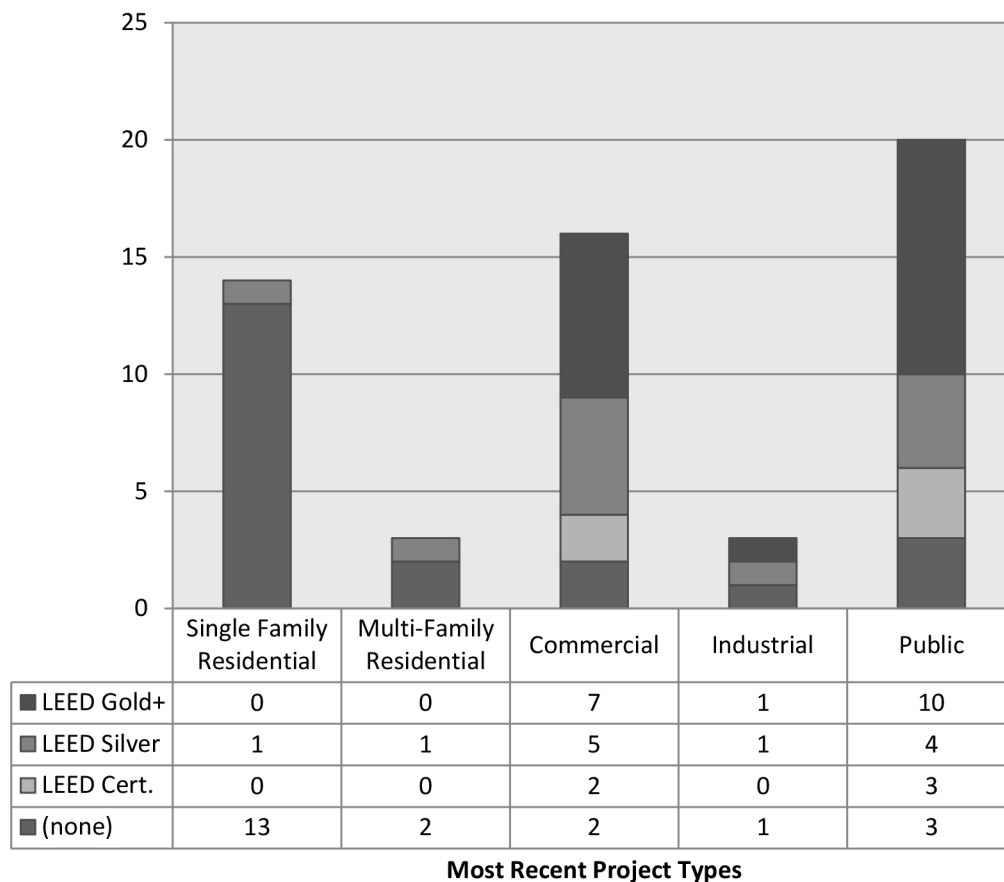
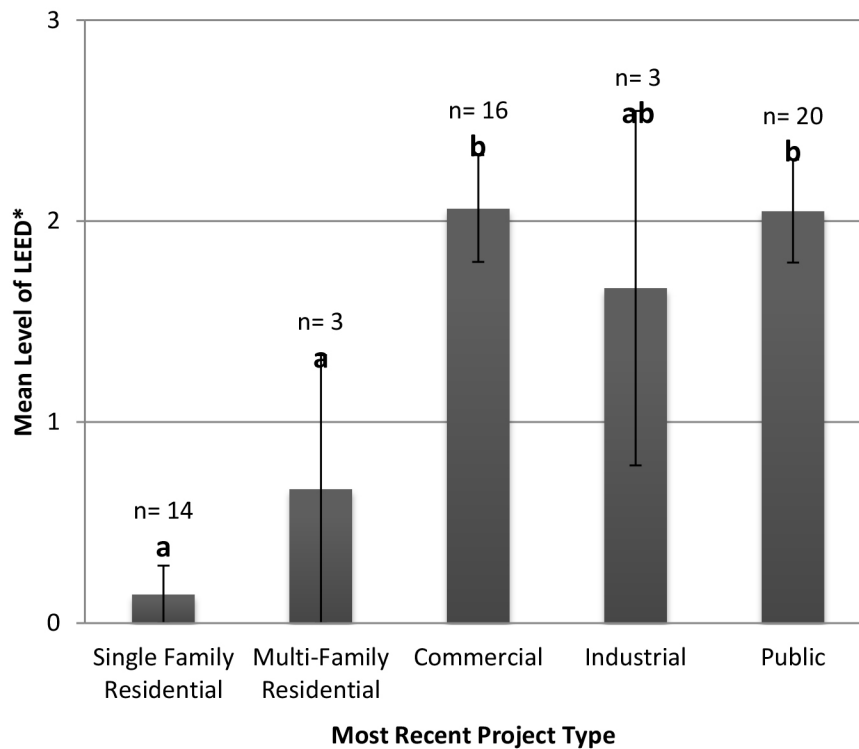


FIGURE 6. Mean level of LEED achieved by project type.



* 0= no LEED, 1= certified, 2= silver, 3= Gold and above

* a is significantly different than b; ab is significantly different than neither a or b

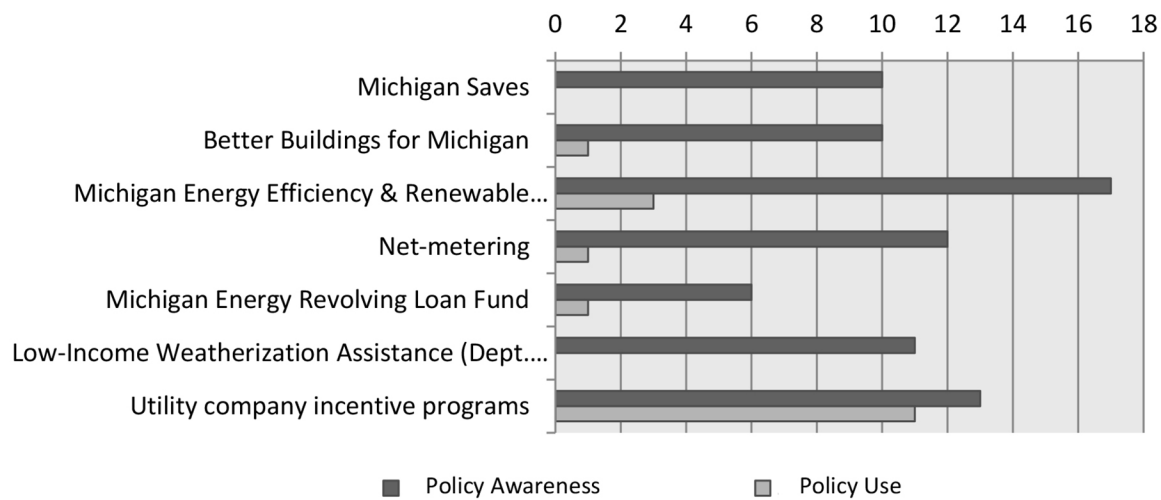
Results show that, *single-family residential projects* are significantly (i.e., at 99% confidence interval) less likely to receive LEED certification of any level. *Commercial* and *public* projects on average receive LEED Silver certification; and *multi-family residential and industrial* buildings had a relatively low sample size, preventing meaningful analysis of those variables (Figure 6).

Hypothesis #4—Owner type is correlated with whether the project received certification or not. Single-family residential structures are considerably less likely to receive certification. Second, public building owners were reported to use state policy/programs more than others; approximately 50% of respondents whose last project was a public project reported that project as having received some level of certification. Only about 30% of commercial projects received certification. *Residential* owners were 47% less likely to pursue certification than *public* building owners.

Green Policy Awareness and Use in Michigan

In the final section of the survey, respondents were asked a variety of questions based on their experience and position on public policies and programs related to green building practices within Michigan. When asked if they were aware of any sustainable building programs, 24 of 64 respondents indicated they were. Of 49 respondents that were asked if they had utilized any program, 24 responded that they had. This results in a policy-use rate of 21 percent in our sample. Respondents had the highest levels of awareness for the Michigan Energy Efficiency

FIGURE 7. Respondents' Awareness and Use of Specific Policies in Michigan.



and Renewable Energy credit, with 17 respondents reporting that they were aware of the policy. The Net-Metering program also had high levels of awareness among respondents (i.e., 12 positive responses).

The survey also asked what specific policies in Michigan the respondents were aware of and had participated in. As shown in Figure 7, The Michigan Energy Efficiency and Renewable Energy Tax Credit is overwhelmingly the most visible public policy in Michigan, although respondents reported taking advantage of energy efficiency programs instituted by private utility companies in Michigan more frequently. This suggests that private utilities are doing a more effective job at reaching construction playmakers in Michigan. Meanwhile, non-profit programs, such as Michigan Saves and Better Buildings for Michigan, created with grants from the LIEEF fund (Table 1), saw moderate awareness but little participation with regards to the study sample. This could be due to the programs being relatively new.

To understand *if the awareness of public policy is a predictor of green building project involvement*, a logistic regression with robust standard errors was run. Results show that respondents who reported being aware of at least one policy were approximately 33% more likely to have utilized or participated in a public policy or program in Michigan.

Summary

While green building policy in Michigan is relatively diverse compared to other states (American Council for an Energy-Efficient Economy, 2012), Michigan has had an even more robust portfolio of green building policies in recent history. Michigan has not had policies with comparably large incentives or as strict of regulations as the US's green building leader states, such as Massachusetts. Michigan, as of 2013, offers only two public policies targeting the private sector: one requiring utilities to provide low-cost net-metering for electric utility customers and another that provides low-interest loans for green building components. Michigan's remaining policy initiatives target public sector buildings and likely have little impact on the private sector. Net-metering and other financial incentives, such as Michigan's low interest revolving loan program and now defunct tax credit, began to address the issue of perceived cost as a barrier to green building. However, policy awareness is generally low regarding

Michigan's private sector incentives; there are no incentives available to developers or sufficient incentives for single-family residential units. Both the latter groups in Michigan were observed to be significantly less likely to build green buildings.

DISCUSSIONS AND POLICY IMPLICATIONS

As of 2013, Michigan has a relatively robust portfolio currently active with regards to the kinds of green building policies. According to the ACEEE, Michigan offers virtually all the same types of policies as Massachusetts (i.e., whom the ACEEE reports as being the greenest state in the US) with only a few exceptions- appliance standards and output-based emissions regulations. Otherwise, Michigan offers a similar portfolio of policies. That being said, the biggest difference between Michigan and green leader Massachusetts is in the strictness of regulations and incentives. For example, Michigan adopted an energy-efficiency resource standard in 2008 with the *Clean, Renewable, and Efficient Energy Act*, which required energy utilities to meet an annual 0.3% savings by 2009, a 1% savings by 2010, an additional 0.75% annual savings in 2011, and 1% annually after that. Massachusetts similarly enacted an energy efficiency resources standard. However, that act called for a higher annual saving of 1.4% in 2010, 2% in 2011, and an annual savings of 2.5% from 2013-15. For the state of Michigan to encourage more widespread adoption of green building practices and become greener relative to other states, there is a need to focus on adopting regulations and policy incentives with greater goals (American Council for an Energy-Efficient Economy, 2013; American Council for an Energy-Efficient Economy, 2013).

Polymakers in Michigan should consider programs that provide economic incentives for building green, promote programs that increase the economic literacy associated with green buildings, and promote policy awareness, particularly with regard to policies that provide economic incentives for building green, such as tax incentives, certification and award opportunities, and public funding opportunities. Michigan presently provides one low interest loan and no tax incentives. Increasing public awareness of the Michigan Revolving Loan Fund and creating policies that provide tax credits for construction playmakers who build sustainable residential and commercial buildings can promote policy use and increase green building practices statewide. Simons, Choi, and Simons (2009) suggest that financial incentive policies should only target new buildings and additionally suggest that governments provide support for non-profit and private organizations that play a role in sustainability education and outreach. Michigan did support non-profit organizations as recently as 2011 with the LIEEF fund. That fund, however, lost its ability to collect revenue in 2011 following a decision by the Michigan Supreme Court (Michigan Public Service Commission, December 20, 2011).

Advisory councils, such as Michigan's Climate Action Council, are similar to public endorsements of green buildings in that they are politically inexpensive to implement since they require only an executive action to be implemented and not legislative consensus. Advisory councils that provide assessments and perform the necessary analyses to recommend standards can position states and cities to act efficiently and take advantage of opportunities to develop sustainably (Konotokosta, 2011). However, enacting the recommendations and standards developed by advisory councils as regulation is politically difficult and may not always be feasible.

Public endorsements of green buildings, such as Michigan's lead-by-example initiative, an executive directive requiring existing state buildings to meet energy efficiency standards

and new buildings to meet LEED standards (May & Koski, 2007), may be very limited with regards to influencing private entities to adopt green building practices on their construction project (Gauthrie & Wooldridge, 2012). A motivator for wider adoption of green buildings in private sector, that also can help overcome the initial increased cost perception of building green, can be tax incentives: In 2012, Michigan had four green building-related bills before the state legislature (House Bill 4286, 2011; House Bill 4485, 2011; House Bill 4049, 2011), all of which were tax incentives, two of which were sponsored by legislators at the time. Nellen and Miles (2007) concluded that the US is just beginning to explore tax incentives for green building and that such incentives have great potential for generating green building funding. Additionally, this work found that financial incentives (i.e., such as tax credits) are desirable for green building playmakers and should be an effective influence (Hoffman & Henn, 2008).

CONCLUSIONS

Via the case of Michigan, this study explored construction playmakers' motivations to build and/or occupy sustainable buildings and public policy's role in adoption of green buildings. Findings present insights for crafting more effective public policies that can further encourage market penetration of green buildings in Michigan and other states in the US. Policy makers should reinstate the energy-efficiency tax-credit and LIEEF fund and possibly expand their scope with more ambitious goals similar to green building leader states such as Massachusetts.

The study showed low policy awareness, even among construction playmakers that are generally perceived as building experts. Policymakers and interested non-profit organizations should devote additional effort to increase green building policy awareness and overcome general misconceptions related to the green building process, specifically those affiliated with first and life-cycle cost.

While the survey of green building playmakers yielded some significant results, the survey lacked some data potentially of interest such as respondents' company size and project budget. Additionally, no readily available data was available to compare these figures to other states or within Michigan over any period of time. Further research can help establish typical policy awareness and utilization figures to guide legislative measures. Lastly, the use of green building related publicly available websites such as USGBC leads to a recognized sampling bias to this study. However, this research will serve as an example for how future research on the influence of public policy on green building playmakers could be conducted, and should inform policy makers and advocates seeking to promote green building practices in Michigan and other states by way of public policy.

ACKNOWLEDGMENTS

This study is funded by the Institute of Public Policy and Social Research (IPPSR) at Michigan State University. The paper does not reflect any opinions of the IPPSR. The authors would also like to thank Dr.s Schneider and Saptioichne for their insightful comments on this study.

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