# Media Coverage of US Wind Power Plants: Does it Generate Electricity?

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## ABSTRACT

This paper focuses on how media coverage influences innovation adoption. Specifically, we examine the effects of news media: (1) attention, (2) tenor (or affective content), (3) diversity of issues and (4) specific content areas on the likelihood and speed of adoption of wind power plants in the US. The theory developed in this paper suggests that news media both affects and reflects the cognitive appraisals of various primary stakeholders as they seek to make sense of the value of a proposed innovation. We add to the nascent infomediaries research literature in four important ways: providing additional empirical evidence for decreasing returns to media attention, examining the effect of specific content areas, providing further empirical evidence of the importance of tenor alone and in interaction with content, and demonstrating the effect of media on a new dependent variable not previously studied in media effects on market outcomes research. This study adds to the innovation literature by highlighting an important non-market actor, the media, on the diffusion of innovations, and to the managerial and organizational cognition literature by suggesting that affective content (emotions) and specific aspects of content (cognition) on the part of third party infomediaries is associated with innovation diffusion.

## INTRODUCTION

Recent research has begun to highlight the importance of information intermediaries (*infomediaries*, Deephouse & Heugens, 2009; Hagel & Singer, 1999) such as the media, financial analysts, regulators, and consumer advocacy groups, in shaping primary stakeholders' knowledge, opinions and actions relating to organizations and industries (Deephouse, 2000; Elsbach, 1994; Pollock & Rindova, 2003). Based on this nascent stream of research, it seems logical that the legitimation and diffusion process of innovations is influenced by infomediaries; however, little is known of what characteristics of media coverage impact the likelihood of innovation adoption.

Industry emergence and innovation diffusion are important research areas among organizational scholars (e.g., Russo, 2001; Russo, 2003; Sine & David, 2003; Sine, Haveman & Tolbert, 2005; Sine & Lee, 2009). This stream of research has provided important insights into how innovations and processes diffuse (Kennedy & Fiss, 2008; Rogers, 1962, 1995; Russo, 2001) and become legitimate (see also Hargadon & Douglas, 2001; Higgins and Gulati, 2006; Kennedy, 2008; Rosa, Porac, Runser-Spanjol & Saxon, 1999). The process of innovation diffusion and legitimacy requires potential adopters to gain a shared understanding of the innovation by engaging in the cognitive processes of information gathering and sensemaking in order to form opinions and an understanding about the novel technology (Deephouse, 1999; Rogers, 1995; Suchman, 1995; Rosch & Lloyd, 1978; Weick, 1995). While theorists have suggested that media is a likely source for information about innovations (Pollock & Rindova, 2003; Rogers, 1995), neither innovation scholars nor media researchers have empirically examined the role of media in the innovation diffusion process.

We address these issues and extend the media effects in markets literature by evaluating the content of media coverage. In particular, this research delves deeper into a fundamental question: What characteristics of media coverage have material impact on innovation diffusion? We are particularly interested in how the media influence how stakeholders conceive novel technologies, such as green technologies, proposed to be introduced into their community. In examining the effects of the media on adoption, we develop and test theory of relating to the influence of: 1) *attention,* 2) *tenor, 3) issue diversity, 4) contextual issue coverage* and *5)* address the relative importance of tenor of coverage compared *to mere discussion of particular contextually important issues* on the likelihood and speed of adoption of the innovation.

## THEORY DEVELOPMENT

An infomediary is a formal organization that acts as a mediator providing information to the public (Deephouse & Heugens, 2009; Shoemaker & Reese, 1996). The extant research on infomediaries has shown that the media is an active participant that affects the sensemaking process of other stakeholders and influences evaluations (Deephouse, 2000; Deephouse & Heugens, 2009; Fombrum & Shanley, 1990; Pollock & Rindova, 2003). These studies highlight the importance of the media not only as a source of information, but also "performing its function of informing, highlighting and framing, the media presents market participants with information that affects impression formation and the legitimation of firms" (Pollock & Rindova, 2003, p. 632).

While modern theories of the role of media in the social construction of markets differ in particulars, all current theories suggest that news media provides information to audiences about

a novel technology. Thus, the more news media cover the technology, the easier it is for various stakeholders to become familiar and comfortable with it—ambiguity or uncertainty is reduced. However, only a few studies in organizational studies have begun to examine a few specific aspects of media coverage. Specifically, prior work has focused on media attention and tenor.

**Aspects of Media Accounts**

***Media Attention.*** Prior research has shown that increasing exposure of media-provided information facilitates favorable impression formation and legitimation (e.g. Deephouse 2003; Jonnson & Buhr, 2011; McCombs, 1972; Pollock & Rindova, 2003). These studies have shown that simply providing coverage will impact how audiences make sense of a new concept, organization, or process. Exposure creates familiarity with the new technology, which helps to create cognitive legitimacy of the category (Aldrich & Fiol, 1994). Applying this argument to innovation adoption, we expect a greater media attention will facilitate familiarity with the innovation, thereby shortening the time that it takes for stakeholders to understand and accept an innovation. We propose that the greater the volume of coverage presented about a new technology, the easier it is for various stakeholds to accept the project as legitimate and should increase the probability and reduce the time it takes for innovation adoption.

*Hypothesis 1: Greater media attention increases speed of adoption.*

While repeated exposure increases acceptance, reduces risk and establishes legitimacy, cognitive limitations suggest that this process proceeds in a non-monotonic fashion (Pollock & Rindova, 2003). The paradigm of information load refers to the finite limits to absorb and process information during a period of time. As reasoned by Herbert Simon (1957), individuals suffer from bounded rationality; experiencing cognitive limitations when there is an inadequacy of scientific knowledge to predict the relevant phenomena (Eatwell, Milgate & Newman, 1987).

Therefore, when an innovation is new, it will garner higher levels of sensemaking from potential stakeholders (Fiske & Taylor, 1991). As stakeholders begin to form impressions about an innovation, each additional piece of media coverage will include elements of redundancy and thus is expected to have a reduced effect on acceptance. This redundancy will result in less attention being given to later pieces of information resulting in a declining effect of media attention on innovation perception formation. In addition to redundancy, the presence of too much information can cause cognitive overload and may signal controversy or conflict—instead of reducing ambiguity and uncertainty, too much coverage might actually signal that ambiguity and uncertainty are high. We propose that these processes, taken together, will facilitate the likelihood of adoption but at a diminishing rate, except at very high rates of media coverage, which may actually hinder the likelihood of adoption. Stated more formally:

*Hypothesis H2: Too much media attention slows speed of adoption.*

***Media tenor.*** Informational content that the audience is exposed to is not simply codified on paper but is a method of influence (Krippendorff, 2004). The framing of social issues by media provide audiences with visible expressions of approval or disapproval (Elsbach, 1994; Rindova & Pollock, 2003). In other words, media provides evaluation, not just information, and this evaluation is not just cold, calculated cognition appraisal, but also includes affectively infused "warm" or "hot" cognition, usually called tenor in organizational studies (also called tone in media studies). Tenor has been conceptually defined as the positive or negative framing of a particular issue, organization or industry (Rindova & Pollock, 2003) and is usually measured by the affective content of a corpus of texts. A growing body of research across several disciplines (political science, media studies, sociology and organizational studies) has begun to provide a convincing case that the tenor of media coverage—the positive affective content—has

important impacts on a variety of audiences. For example, political research has found that media influence perceptions of candidates through the tenor of their coverage (McCombs, Llamas, Lopez-Escobar and Rey, 1997; Mullen, 1984). These findings indicate a positive correlation between the tenor of media coverage and the approval of political figures. In the organizational literature, Gameson and colleagues (1992) argue that the forum of media coverage allows stakeholders to identify what constitutes a good firm by interpreting how media frame evaluations of the firm. Following Rindova and colleagues, we argue that the media's status as expert, objective information providers is the reason stakeholders place high emphasis on the media as a reliable institutional source of information. Because audiences expect news media to be objective, the overriding tenor of news stories influences stakeholder impressions of the desirability of a technological innovation more than persuasive arguments made directly be interested parties. We propose that when the media frame an innovation with favorable coverage, stakeholders will be persuaded and the innovation will be adopted at a faster pace than in markets where the media offer neutral or negative framing. We therefore hypothesize that:

*Hypothesis H3: Positive tenor increases speed of adoption.*

***Issue diversity.*** The decision to adopt a technology requires knowledge and understanding of the impact the innovation will have on the factors that matter most to the audience (Dewar & Dutton, 1986; Rogers, 1995). Adoption decisions that possess ambiguity are characterized by multiple conflicting frames which create a poor understanding of a situation (McCaskey, 1982). This ambiguity could create conflicting interpretations of the innovation and restrict the coalescence of a unified understanding by stakeholders. As more issues are raised in the media concerning the innovation, confusion and competing frames ensue (Kraft & Clary, 1991; Smith & Marquez, 2000). Thus, the diversity of issues raised in media coverage cause

confusion and uncertainty (Chi, Glaser & Rees, 1982). Diversity of issues in media coverage also may cause or be a reflection of competing frames and conflict concerning the project. As more issues are raised by the media, stakeholders' ability to cognitively evaluate the potential of the emerging innovation is jeopardized resulting in reduced likelihood of adoption. The diversity of issues can thus slow down the cognitive processes and innovation-decision making process in the market. Stated more formally:

*Hypothesis 4: Issue diversity slows speed of adoption.*

While examining characteristics of media coverage on innovation adoption in terms of attention, tenor, and issue diversity provides significant insights not currently in the literature, there have been calls for researchers to examine not only abstract characteristics, but also to examine the impact of specific contextually important content (Duriau, Reger & Pfarrer, 2007; Short, et. al, 2010). Prior media in markets research also has called for greater focus on the specific content of media coverage. Thus, in addition to examining the effect of issue diversity, which is a new variable in our research, we also develop theory about why specific contextual content might be expected to impact innovation adoption separate from the volume or tenor of coverage. In particular, psychological research suggests that mere mention of certain words can trigger strongly negative affective responses. While the source of the content may not provide negative tenor, the audience responds to the ostensibly neutral words negatively because the words evoke past negative associations.

*Hypothesis 5: Coverage of context-specific issues that have the potential to evoke negative responses decreases speed of adoption.*

In addition to these main effects, we expect that specific content areas may interact with tenor of media coverage. For example, if a news story is overwhelmingly positive in its

coverage, the audience might remember the positive tenor of the coverage and be unable to recall coverage of specific issues. Because we expect these interactions to be context specific, we develop these hypotheses after we discuss our research context.

## METHODOLOGY

### Research Setting: US Wind Energy Industry

Management and strategy scholars have recently examined the earliest phase of the emergence of wind energy industry as a research context for investigating emerging industries and entrepreneurship (Russo, 2003, Sine & David, 2003; Sine, Haveman & Tolbert, 2005; Sine & Lee, 2009). Our study examines a slightly later time frame than these prior studies. Rather than examining a new innovation, we examine the time period (to date) of greatest diffusion of wind power plants. During our study period, the amount of U.S. electricity generated by wind power went from less than 1 percent to over 3% nationally, with as much as 20% being generated in a couple of states where wind power achieved extremely high penetration, to lows of zero in states of particularly low penetration. The relative newness of this industry means that stakeholders will seek information from news media about proposed wind power projects in their area, providing an ideal context to study the impact of infomediaries on the diffusion process (Aldrich & Fiol, 1994; Pollock & Rindova, 2003). Furthermore, scholars studying environmental initiatives have identified a strong social construction of markets element involving green technologies (Bansal & Roth, 2000; Russo, 2003; Samdahl & Robertson, 1989). For these reasons, the U.S. wind energy industry is an ideal context for studying how media affects how local communities of stakeholders form impressions about proposed wind projects.

***Sample.*** We assembled data from multiple sources of information provided by the American Wind Energy Association (AWEA), the Department of Energy, U.S. Census Bureau,

Database of State Incentives for Renewable Energy and Lexis/Nexus. AWEA, a non-profit organization which promotes wind energy as a clean source of electricity, tracks up-to-date information on proposed and operation wind farms. This study focuses on commercial wind projects. Referring to AWEA's definition of Wind Power Plant, commercial wind farms can generate in excess of 20 MW of electricity (AWEA, 2009).[1] After removing small wind farms producing less than 20MW of electricity annually, we charted those wind farms which had received coverage by the media. This yielded a final sample size that included 224 operational commercial grade wind farms. The American Wind Energy Association also provides up-to-date information about proposed wind projects in the United States. They implement a variety of research methods to locate project announcements, track permit applications, zoning changes, conditional variances being granted and connection into the commercial power grid. This database included a total of 389 proposals for the sample period. The sample is displayed in figure 1.

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Insert Figure 1 about here

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**Dependent Variable**

***Innovation adoption.*** This is a dichotomous variable which receives a coding of "1" on the date when a project first provides commercial electricity into the electrical grid. Otherwise, proposals and in-development projects are coded "0". This variable was gathered using two methods. First, AWEA tracks the quarter in which each wind farm becomes commercially operational. We confirmed this quarterly estimate by reviewing the press releases issued by the wind farm developer, which identifies the exact date of commercial operation. These measures

[1] Proposed projects with less than 20 MW account for 517.51MW of the total proposed 62135.87 MW (.00833).

had perfect correlation, giving credence to the reliability of AWEA data. In order to track the time component necessary for the Cox proportional hazard model, we created a variable called *date of announcement*. This date was calculated as the quarter and year of the first article published concerning the specific project.

**Independent Variables**

Using the Lexis/Nexis database to identify news articles written about a specific project, we collected local/regional and national newspaper coverage about each wind project. For instance, in studying wind projects in Oregon, Lexis/Nexis will query *The Clatskanie Chief* (Oregon), *Daily Journal of Commerce* (Portland, OR), *Lewiston Morning Tribune* and the *McKenzie River Reflections* (McKenzie Bridge, OR). Local statewide news coverage has an impact on the adoption of locally proposed wind farms. However, the advent of internet based news allows for the possibility of coverage in national newspapers to affect how local communities interpret large-scale wind projects. Accordingly, we use Lexis/Nexis to also query national coverage by project. This query draws from 531 major news sources such as *The New York Post*, *The Baltimore Sun* and *The New York Times.* Arguably, most of these sources will not include information concerning wind developments in Oregon; however, the advent of internet news reading suggests testing national coverage as well as local is an appropriate comprehensive technique, and in a few instances, a local project did receive some national coverage.

***Media attention.*** We followed existing research for the measure of media attention (Pollock & Rindova, 2003). We counted the total number of articles about each wind project written during the period from when it was first announced through when the project became

commercially adopted. In situations where projects had not yet become adopted, we counted articles until December 2009, the end of our sample. We squared the number of articles in order to test the diminishing rate suggested in hypothesis 2.

***Positivity of tenor.*** Extant research on media and intangible assets from other strategic studies has operationalized tenor as affective content (e.g. Deephouse, 2003; Jonnson & Buhr, 2011; Pfarrer, Pollock, & Rindova, 2010; Pollock & Rindova, 2003). Using existing techniques, we developed a measure of tenor for each quarter over the course of the projects history. To measure the tenor of each article, we used Linguistic Inquiry and Word Count (LIWC) software to conduct a content analysis of the gathered articles about each project. LIWC is a computer-aided textual analysis (CATA) program designed to facilitate the process of analyzing textual data (Pennebaker, Booth & Francis, 2007; Pfarrer, Pollock, & Rindova, 2010). This software identifies the total number of positive affect words in each article as well as the total number of affect words in each article. We generated this variable by creating a positive affect to total affect percent.

Additionally, we randomly sample 10% of the total articles of this study for hand-coding by one of the coauthors and a trained doctoral degree holder. We conducted an inter-rater reliability analysis between the hand-coded articles and the LIWC results and resulted in a Cohen's Kappa coefficient of 0.82, which is an acceptable value.

***Issue diversity.*** A reading of a random sample of articles in our sample yeilded a diverse set of issues that were raised in media reporting ranging from job creation, economic benefits, environmental issues, aesthetic degradation of the landscape, potential harm to humans and wildlife. We conducted an in-depth analysis of current wind related articles published in the energy and management literature (e.g. Kraft & Clary, 1991; Krohn & Damborg, 1999; Russo,

2000; Smith & Marquez, 2000; Wolsink 2000) and a comprehensive case study on the Cape Wind Project (for a detailed list see Vietor, 2008) in order to ascertain which issues are relevant to our context of large scale infrastructure projects. Using a random sample of 5% or 130 articles from the sample of total articles, one of the coauthors and a trained graduate student identified a series of issues related to the adoption of commercial wind projects which had a recurring theme throughout the media coverage. From this combination inductive and deductive approach, we created a typology of 8 categories representing the major issues. The list of issues identified includes: aesthetic, economic, environmental, wildlife, community disturbance, health concerns, legal and military. This list corresponded with those identified by Vietor (2008) in his case study of Cape Wind. Following the protocol advocated by Short and colleagues (2010), we created custom dictionaries of terms related to each issue. These custom dictionaries were used in conjunction with LIWC software to count words related to each individual issue.

Next, each wind project was coded for the number of categories of issues covered by the media. Projects could range from having no issues identified in any of the media coverage through some displaying coverage of all 8 issues. This variable is operationalized on a scale from 0 to 8 and the variable issue diversity represents the total number of issues raised about a particular project over the course of the month.

**Context-specific issues.** To examine hypothesis 5, that certain context-specific issues are expected to slow the adoption of innovations more than other issues, we conducted over thirty interviews with informants familiar with the wind power industry including project developers, turbine manufacturers and government regulators, attended AWEA conference sessions on overcoming community objections to wind power, and consulted the land development literature relating to other major infrastructure projects. Based on this in-depth

investigation, we concluded that issues relating to aesthetics and economics of wind power plants are likely to be two issues whose mere mention may evoke negative association in audiences' minds regardless of the media's coverage of the issue in a particular article.

Aesthetics. Aesthetic issues, those relating to the view and visual and sound pollution are particularly important in this context. Aesthetics are impactful in the study of large scale infrastructure projects such as roads, railroads, power plants, bridges and other public projects. Specific to the context of wind energy, opponents have largely rejected the adoption of this technology based on the phenomenon known as NIMBY – "not in my back yard" (Cupchik, 1995; Gipe, 1995; Kaldellis, 2005; Krohn & Damborg, 1999; Wolsink, 2000). The NIMBY syndrome has commonly been associated with the siting of major infrastructure facilities (e.g., hazardous, nuclear and conventional waste facilities, tunnels, railroads, interstates and airports) and has been responsible for reducing the likelihood of adoption. This phenomenon refers to situations where stakeholders publically support the adoption of infrastructure facilities; however, when they learn the effect these projects will have upon them individually, they shift their support away from the project. The publics' negative perception of these projects stems from a series of aesthetic issues which are well documented in the NIMBY research (e.g. Kraft & Clary, 1991; Krohn & Damborg, 1999; Smith & Marquez, 2000; Wolsink 2000).

Large-scale infrastructure projects such as nuclear power plants, high capacity electrical transmission lines, and waste water treatment plants are typically viewed as disamenities to local communities. A disamenity is a feature of a property or area that reduces the desirability and value of the property. These disamenities are created through market externalities which require stakeholders to sacrifice the desirability of their property for the benefit of others who live farther away from the infrastructure. In evaluated the issues raised in energy policy research, the

top two causes of residential property owners attempting to keep various types of facilities out of their neighborhoods are the "threat of noise pollution and the spoiling of scenery" (Krohn & Damborg, 1999 p. 956 & Wolsink, 2000 p. 50). Therefore, communities faced with the adoption of infrastructure projects, which by definition will inherently create disamenities for stakeholders, will generally view them unfavorably. An interesting aspect of our context is that many studies of community perceptions before a project is built have found that community members believe wind projects will be a disamenity that will lower their property values but most studies conducted after a project has been built has found either no effect or a positive effect on property values.

We propose that information provided by the media that mentions aspects associated with aesthetic concerns for large-scale infrastructure projects will raise a red flag in the collective minds of stakeholders and reduce the rate by which the innovation will be adopted. Formally stated,

*Hypothesis 6. Wind projects that receive more coverage of aesthetic issues are less likely to be adopted.*

Aesthetics is a subsample category from the issue diversity variable. This category includes only those words that are related to perceptual concerns. This category has been created using a variety of perceptual issues raised in the NIMBY research (e.g. Kraft & Clary, 1991; Krohn & Damborg, 1999; Smith & Marquez, 2000; Wolsink 2000). We evaluated the issues raised in these articles, cases and other energy policy publications. Using this information, we created a typology of NIMBY issues. This list includes the senses of sight, sound, hearing, and touch.[2] Again, by analyzing 130 articles manually for recurring themes, we created a custom

[2] LIWC includes a variety of categories. Related to aesthetic issues, the dictionary for perceptual processes includes 273 words: This category includes the dictionary for see includes 72 words (ie. View, saw, seen) the

dictionary of words associated with aesthetic issues in accordance with the Short et al, 2010 protocol. These dictionaries were fed into LIWC for large scale content analysis. A continuous variable was created to measure the percentage of "aesthetic words" to total words of each article over the course of the each project/quarter.

***Economics.*** Similar to the construction of the aesthetics category, we constructed a category called *economics.* This category is also a subset of the issue diversity variable. In this category, we measure the impact that information concerning financial implications for wind power projects will have on the likelihood that it will be adopted in the community. This category included words that consistently appeared in the sample articles related to money, wealth, jobs, economy, finance, etc. We followed the same protocol for custom dictionaries described above.

Innovation research has successfully shown the importance of economic advantages and functional utility in the adoption of an innovation (e.g. Rogers, 1962, 1995; Tushman & Anderson, 1986). This research investigates how a new technology must be able to provide a price-performance advantage in order to destroy the incumbent firms' competencies (e.g. Henderson & Clark, 1990; Tushman & Anderson, 1986). Relative economic advantage and functional utility play a key part in the process of creative destruction and innovation adoption (Rogers, 1995). Understanding the importance of economic implications requires stakeholders to have exposure to the financial and economic implications of an innovation before they are willing to be persuaded to adopt the innovation. Again, the public looks to mass communications and the media to fill this need for economic evaluation.

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dictionary for hear includes 51 words (ie. Listen, hearing), and the dictionary for feel includes 75 words (ie. feels, touch).

*Hypothesis 7. Wind projects that receive more coverage of economic issues are more likely to become adopted by the market.*

**Interaction Effects.** Having argued for the main effect of context specific issues to evoke past negative associations that slow the diffusion of innovations, there may be circumstances where the coverage of the issue is infused and surrounded by significant positive affect such that the past negative associations can be neutralized. For instance, Hargadon & Douglas (2001) found that firms capable of replacing existing dominant forms with aesthetically like formed models can facilitate the process of innovation adoption. While aesthetic issues can facilitate adoption when replacing the existing institutional norm with an aesthetically similar product, these issues are emotionally and powerfully charged when radical, disruptive or discontinuous innovations are being introduced. Thus, while simply covering aesthetic issues is relevant to the introduction of large scale energy projects, how the media frames these aesthetic issues and the tenor that is used plays a pivotal role in how public perceptions are formed (Deephouse, 2000; Pollock & Rindova, 2003). Similar arguments can be made for economic issues.

Therefore,

*Hypotheses 8 and 9. Positivity of tenor will positively moderate the effects of coverage of aesthetic/economic issues in the media on the likelihood that the project will be adopted.*

**Controls**

***Regulatory***. The regulatory environment has been shown to have an effect on entrepreneurial activity within the renewable energy sector (Sine & Lee, 2009). Regulatory legitimacy has been shown to facilitate civil service reforms and would be a viable alternative explanation for innovation adoption (Tolbert & Zucker, 1983). We isolated the policies that

were in place that were state specific to renewable energy in order to control for any regulatory policies that might uniquely influence the adoption in the marketplace. The renewable portfolio standard (RPS) is a state policy that requires electricity providers to obtain a minimum percentage of their power from renewable energy resources by a certain date (US DOE, 2010). Each state has the option to include a renewable portfolio standard in their state policies. These policies are in place at the state level for several purposes. State policy for renewable energy should apply pressure on community governance which should hasten the current zoning and permitting procedures in order to facilitate renewable growth. We controlled for state specific policies by including a dichotomous indicator variable for states with renewable portfolio standard, coding those states with this policy as RPS=1, otherwise RPS=0.

***Population.*** In an attempt to control for the heterogeneity among stakeholders in different locations we focused on local marketplace characteristics (Kassinis & Vafeas, 2006). *Population* density and county characteristics often affect the location of both pollution creating energy plants (Kassinis & Vafeas, 2006) and wind farms (Russo, 2003; Sine, Haveman & Tolbert, 2005; Sine & Lee, 2009). We used the same method employed by Russo (2003) using data from the US Census Bureau for 2000 and 2009.

***Market substitutes***. The existence of substitutable electricity creates a threat to the adoption of wind power as a source of electricity (Porter, 1980). Accordingly, the economic perspective dictates that areas where the price of substitutable electricity is lower should delay or eliminate the adoption of wind power. The local electricity economy has also been linked with the siting decisions of wind farms (Sine, Haveman & Tolbert, 2005; Sine & Lee, 2009). The price of substitutable electricity will impact the concentration of suppliers (Porter, 1980) and subsequently the motivation of the market to adopt this new technology. We controlled for the

prices of available substitutes using Sine & Lee (2009) variable avoided costs for the production of electricity using coal. In 2009, coal provided 45.9% of the net generation of electricity in the United States.[3] Therefore, we gathered the information of the average coal price for each state between the years 2000-2009 (US EIA)[4].

***Political.*** The adoption of a new technology can be heavily influenced by the political ideology of the residents of each individual state. Democratic majorities in the state legislature are significant antecedents of the state-level renewable portfolio standards being enacted (Yin & Powers, 2010). Democratic majorities possess political views concerning environmental and financial policies which influence the adoption of a sensitive innovation such as renewable energy. Therefore, it is important to control for these political ideologies in this study. The process for accepting a proposed wind farm to be constructed is heavily influenced by community input. Zoning and hearing appeals are filed following numerous interactions with community members, activists and representatives. It is imperative to control for the political ideology of the citizens as much as it is to control for the democratic majorities. Using the Berry and colleagues (1998) measure for *citizen political ideology*, we controlled for political heterogeneity among citizen groups in the community. This measure tracks the liberal-conservative nature of the constituents in a congressional district in regards to electing officials and voting on local referendums using a scale from 0 to 100.

***Proposed county wind power plants.*** With the goal of evaluating the impact of media upon the release of new innovation, it was imperative that we control for communities that have already been exposed to wind power proposals. For each county with a proposed project, we

[3] Source: Energy Information Administration, Form EIA-923, "Power Plant Operations Report". Other sector generation included Nuclear (20.9%), Hydro (7%), Gas (22.1%) and Petroleum/Other (4.2%).
[4] Source: Energy Information Administration, http://www.eia.doe.gov/emeu/states/_seds.html ; see documentation at: http://www.eia.doe.gov/emeu/states/_seds_tech_notes.html

created a continuous variable which measured how many wind power proposals the community has been exposed to prior to the subject project being introduced to that community.

***Experience of wind farm developers.*** The experience of how many prior wind projects the developer has constructed is expected to have an impact on how quickly the subject project becomes adopted. More experienced developers could become more familiar with the zoning and variance process as well as the filings with both local and state authorities. For this reason, we controlled for the number of wind power project that each developer has installed prior to the subject project being announced.

**Estimation Procedure**

This is a panel study consisting of pooled time series data. Our theory predicts that various media-provided information characteristics will impact the probability of the event happening and the time it takes for an innovation to become adopted. This requires the use of a time-to-event analysis enabling us to investigate the likelihood that the wind project will be adopted and how a series of covariates will affect the duration of time it takes for the project to become operational. We ran a Cox proportional hazard model (see Cox, 1972) to test the covariates.

This model is effective as it accounts for not only the probability of an innovation becoming adopted but also the timing of the event (Tuma & Hannan, 1984). This model makes no assumptions about hazard shape over time (Cleves, Gould, Gutierrez, 2004). The model is also ideal as it makes quality estimates with samples that are censored, as is the case with several wind proposal observations in our sample (Tuma & Hannan, 1984). The specifications of the Cox proportion hazard model is as follows:

$$\lambda_i(t) = \lambda_0(t)e^{Xi(t)\beta}$$

where $\lambda_i(t)$ is the hazard rate of wind project i, $\lambda_0(t)$ is the baseline hazard rate and $Xi(t)\beta$ are the media characteristic covariates and regression parameters.

## RESULTS

Descriptive statistics and correlations on the variables included in the analysis are presented in Table 1. While an examination of the bivariate correlations revealed in Table 1 do not indicate any major issues of collinearity, we conducted variance inflation factor analysis and found no evidence of multicollinearity.

Regarding predictions of our hypotheses, the results of the tests are revealed in Tables 2 and 3. Hypothesis 1 evaluates the effects of the media attention (volume of media coverage) on the adoption of the innovation. Models 2 and 3 investigate the probability of a wind farm becoming adopted as it relates to volume of coverage. These models show that there is a positive relationship between media attention and adoption and support the hypotheses that attention affects the probability of the adoption, but at a diminishing rate. Hypotheses 1 and 2 are supported. Hypothesis 3 predicts that the positivity of media tenor will impact the probability of adoption of the innovation. These results reveal several interesting findings. First, as hypothesized, the positivity of tenor is indeed a significant predictor of project adoption. Second, our findings from model 2 concerning the effects of media attention are fully mediated by the positivity of tenor. This indicates that mere volume of coverage, by itself, is a crude measure in media analysis and much can be learned by shifting focus to include tenor and the study of other aspects of content.

Table 2 continues to investigate the main effects of issue diversity and contextually important issues on the adoption of innovation. Hypothesis 4 suggested that media coverage

could potentially confuse audiences by introducing too much issue diversity. The negative and significant coefficient for issue diversity revealed in Model 5 shows that a larger number of issues raised in the media reduces the likelihood of innovation adoption. In continuing to refine this measure to more contextually relevant issues, Model 6 investigates hypotheses 5 and 6 concerning aesthetic and economic issues. Hypothesis 5 predicted that aesthetic issues will slow down the probability of project adoption. The coefficient of aesthetics is negative and significant, indicating that the adoption rate of projects that received coverage of NIMBY topics was lower. Interestingly, we predicted that economic coverage would hasten the time and increase the probability of adoption of these projects. Not only do we not find support for this hypothesis, but we see significance for this variable in the opposite direction. While we hypothesized that there was a need for supplying economic issues to the public for their interpretation, these results further emphasize the role the media plays in framing economic issues.

Table 3 reports the results for a series on interactions between the contextual issues variables and the positivity of tenor. Hypothesis 7 predicted that the positivity of media tenor would positively moderate the effects of aesthetic coverage. The change in sign of the coefficient and its significance displayed in Model 7 indicate that the media can indeed influence our acceptance of an innovation by covering controversial issues in a positive light. Therefore, this hypothesis is supported. Finally, we investigated if the positivity of coverage would moderate the effects of economic coverage. While the sign did change as the interaction was introduced, it is not significant, thus no significant interaction is found for tenor and economic issues.

**Robustness Checks**

Because there are a series of nuances with content analysis and the use of linguistic inquiry software, we ran a series of robustness checks to ensure proper measurement of the variables of interest. First, regarding tenor, following prior research by Pfarrer, Pollock & Rindova (2010), we tested the percentage of coverage as a dichotomous variable using a variety of tenor ratio coefficient of imbalance at the 55% / 45% and 75% / 25% levels. The results held at each level. In order to check the robustness of the assumption that learning about an innovation may not happen instantaneously, we created time lags of $t + 1$ month and reran the results. The results of all robustness checks support the findings reported here; the results remained substantively unchanged.

Since we were first to introduce these contextual categories to the strategic management literature, we spent a significant amount of time developing these custom dictionaries. As a robustness check of our economic category, we used a well vetted measure of a category called "money" from the psychology literature (see Pennebaker, Booth & Francis, 2007; Pennebaker & Francis, 1996; Tausczik. & Pennebaker, 2009). We tested our sample using the dictionary for money and found robustness for our variable across all models.

## DISCUSSION

Research suggests that infomediaries play a key role in the cognitive processes of information gathering and sensemaking. This research adds to our understanding of the social structure of markets and how the stakeholders acquire and interpret information (Aldrich & Fiol, 1994). Explanations of how markets gather and interpret information and apply it to innovation decision adoption processes are central to innovation and strategic scholars. By applying social

construction concepts with innovation adoption decision, we get a deeper understanding of the perception formation and ultimate adoption of new technology. To our knowledge, this is the first study to link social cognitive concepts of media influenced schema formation and innovation adoption.

As noted by both Deephouse (2000) and Pollock & Rindova (2003), little research has linked mass communication and organizational studies. As a field, we are just beginning to understand the power of influence that third party informediaries can have on various strategy issues. The advent of computer-aided textual analysis software is making the application of content analysis more applicable across management disciplines. This study adds to this stream of research by introducing and empirically testing the idea that aspects of media coverage can have an impact on the adoption of new technology and ultimately on the performance of the firm. News media acts as institutional actors capable of shaping the entrepreneurial landscape through its coverage of innovations. The media not only acts as purveyors of information capable of influencing the process by which the stakeholders develop an understanding about innovations, but also as a source of legitimacy to innovations. In this research, we applied the existing tenets that all media attention is beneficial for familiarity to innovation (Hypothesis 1) and extended it to include a non-monotonic relationship (Hypothesis 2). We revealed the crude nature of this variable by showing how positivity of tenor mediates the effect of attention (Hypothesis 3) and that an increase in the diversity of issues covered may increase rather than reduce the ambiguity and uncertainty inherent in innovation diffusion, and thus slow its adoption (Hypothesis 4).

We dug deeper into the content of coverage by further unpacking the issue diversity variable to reveal the importance of specific issues, and also the interaction of specific content

with the tenor of media coverage issues such as aesthetics. We found that when dealing with large scale alternative energy projects that create market externalities, audience have a higher degree of sensitivity to aesthetic related issues than economic issues. But interestingly, the tenor of media coverage interacts with aesthetic issues such that the positive affective content of an article can attenuate the negative effect of the mere mention of aesthetic issues. This study is one of the first large-scale empirical tests of the NIMBY hypotheses presented in the organizational studies domain.

This research has practical implications as well. We suggest that news media play an important role in the adoption of innovations, and suggests that developers could employ nonmarket strategies that may influence the media (Zavyalova, Pfarrer, Reger, and Shapiro, forthcoming *AMJ*). These strategies may include issuing information subsidies such as press releases and offering media access to information and sources that may encourage positive coverage of their projects.

**Directions for Future Research and Limitations**

This research serves as a building block for nonmarket strategies. We have shown that news media have an impact on innovation adoption. We recommend that future research should investigate what actions the firm can take in order to influence nonmarket actors such as media. Nonmarket strategies have been acknowledged as having an impact on the market process but little is known about how firms can impact this process (Baron, 1996, 2004). This study begins to unpack which aspects of influence attempts are most likely to impact news media. Specifically, our study suggests that attempts to influence the tenor are most important, and that some media attention is advantageous, but excessive media attention should not be sought. Our

results suggest that firms should seek simple coverage of few issues rather than complex coverage of many issues. In addition, context-specific "hot" negative issues should be avoided, but if coverage of these issues are unavoidable, efforts to influence the affective content of media coverage might mitigate the negative effect of the mere mention of these "hot" negative issues. Numerous nonmarket actors influence the process of innovation adoption at the community level and this research could provide solid footing for further investigation into the adoption of nonmarket strategies. This stream of research could be expanded to include how firms influence the media and other nonmarket actors such as the government.

Certainly, this study suffers from the limitations of generalizing the findings from a single industry to other industries. We intentionally focus on the US wind energy but fully acknowledge the limitations this creates. Next, being the first to introduce new constructs of study, we acknowledge the limitations of the issue diversity and contextual issues variables. While much can be learned by investigating media content, this first attempt is limited by the liability of its newness and will only continue to develop over time. Future work will need to explore more nuances of these measures.

## CONTRIBUTIONS

This research contributes to our understanding of innovation adoption by examining the effects of third party infomediaries on the framing, legitimacy and diffusion of an emergent innovation by examining the effect of media coverage on a project-by-project basis. First, this paper adds to our understanding of how innovations become adopted in the marketplace. By investigating the speed of adoption in the U.S. wind energy sector, this paper extends our knowledge of adoption to include how nonmarket actors, such as the media, influence the speed by which an innovation becomes adopted. These findings have strategic implications for firms

trying to introduce a new innovation. Next, this paper builds on the nascent infomediary stream of research as it relates to innovation adoption. External factors affecting legitimacy have been studied in both industrial and organizational contexts (Rao, 1994; Suchman, 1995). This paper extends this research to include third party infomediaries and their effects upon innovation adoption. The paper also draws on the cognitive processes of information framing and sensemaking to explain the market adoption of new industries. We contribute to sociocognitive research concerning innovation adoption (Rindova & Petkova, 2007; Rosa, Porac, Runser-Spanjol, & Saxon, 1999) by evaluating the effect of third party infomediaries on sensemaking in the market. Our research provides theory and empirical evidence that news media play an important role in legitimating the construction and adoption of a diffusing industry.

**FIGURE 1**

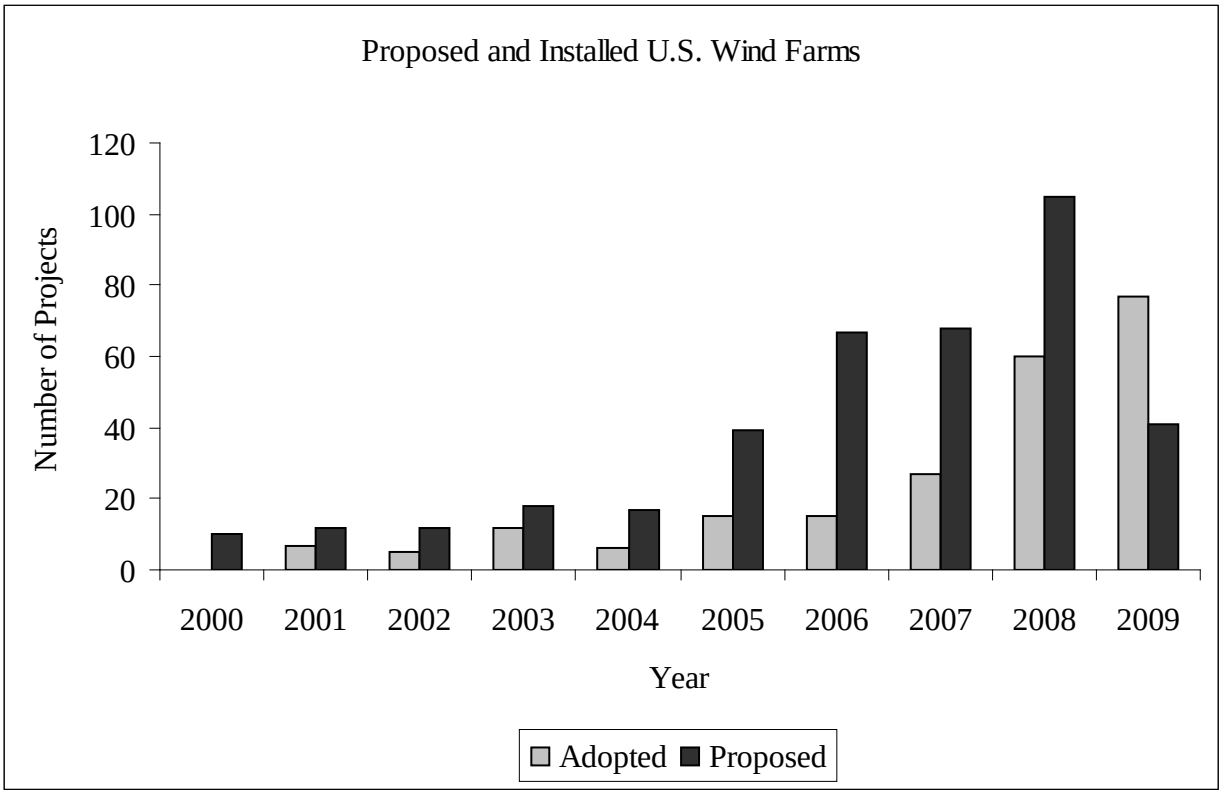
Proposed and Installed U.S. Wind Farms
Number of Projects
120
100
80
60
40
20
0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
Year
Adopted
Proposed

**TABLE 1**

**Descriptive Statistics [a]**

| Variable | Mean | s.d. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1. Innovation Adoption** | 0.07 | 0.25 | 1.00 | | | | | | | | | | | |
| **2. Exposure** | 0.78 | 1.96 | 0.07 | 1.00 | | | | | | | | | | |
| **3. Positivity of tenor** | 0.49 | 0.56 | 0.18 | 0.57 | 1.00 | | | | | | | | | |
| **4. Issue Diversity** | 1.72 | 2.92 | 0.07 | 0.70 | 0.78 | 1.00 | | | | | | | | |
| **5. Aesthetics** | 0.08 | 0.21 | 0.01 | 0.38 | 0.47 | 0.64 | 1.00 | | | | | | | |
| **6. Economics** | 0.57 | 1.12 | 0.06 | 0.52 | 0.67 | 0.76 | 0.39 | 1.00 | | | | | | |
| **7. Regulatory** | 0.76 | 0.43 | 0.01 | -0.02 | 0.00 | -0.02 | -0.02 | 0.01 | 1.00 | | | | | |
| **8. Population (in 000's)** | 159.49 | 416.41 | -0.02 | -0.07 | -0.11 | -0.07 | -0.04 | -0.06 | -0.21 | 1.00 | | | | |
| **9. Political** | 60.56 | 14.69 | -0.04 | 0.02 | 0.06 | 0.04 | 0.06 | 0.00 | 0.39 | 0.03 | 1.00 | | | |
| **10. Market Substitutes** | 1.70 | 0.58 | -0.01 | 0.06 | 0.08 | 0.06 | 0.09 | -0.01 | 0.24 | 0.12 | 0.56 | 1.00 | | |
| **11. Number of proposals in county** | 1.61 | 1.40 | 0.01 | -0.01 | -0.02 | 0.00 | 0.01 | 0.00 | 0.10 | 0.10 | 0.22 | 0.21 | 1.00 | |
| **12. Projects installed by developer** | 3.66 | 3.89 | 0.09 | 0.03 | 0.07 | 0.06 | 0.01 | 0.09 | 0.15 | -0.07 | 0.11 | 0.01 | 0.16 | 1.00 |

**[a] n = 3426. All correlations above |.05| are significant at the .05 level.**

**TABLE 2**

**Results of Cox Proportional Hazard Rate Analysis for Operational Wind Farms**[a]

| Variables | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 |
|---|---|---|---|---|---|---|
| **Regulatory** | 1.21 (0.26) | 1.32 (0.27) | 1.32 (0.27) | 1.36 (0.27) | 1.34 (0.27) | 1.39 (0.28) |
| **Population** | 1.08 (0.08) | 1.01 (0.08) | 1.00 (0.08) | 1.08 (0.08) | 1.08 (0.08) | 1.09 (0.08) |
| **Political** | -0.98 ** (0.00) | -0.98 ** (0.01) | -0.98 ** (0.01) | -0.98 ** (0.01) | -0.98 ** (0.01) | -0.98 ** (0.01) |
| **Market substitutes** | -0.78 (0.12) | -0.80 (0.13) | -0.81 (0.13) | -0.77 † (0.12) | -0.81 (0.13) | -0.78 (0.12) |
| **Number of proposals in county** | -0.99 (0.05) | 1.01 (0.05) | 1.00 (0.05) | -0.99 (0.05) | -0.99 (0.05) | -0.99 (0.05) |
| **Projects installed by developer** | 1.08 ** (0.02) | 1.08 ** (0.02) | 1.08 ** (0.02) | 1.08 ** (0.02) | 1.08 ** (0.02) | 1.08 ** (0.02) |
| **Exposure** | | 1.11 ** (0.02) | 1.28 ** (0.07) | 1.00 (0.00) | 1.10 (0.09) | 1.01 (0.07) |
| **Exposure squared** | | | -0.99 * (0.00) | -0.93 (0.06) | -0.99 (0.00) | 1.00 (0.00) |
| **Positivity of tenor** | | | | 1.74 ** (0.13) | 2.07 ** (0.19) | 1.99 ** (0.17) |
| **Issue Diversity** | | | | | -0.86 ** (0.04) | |
| **Aesthetics** | | | | | | -0.83 † (0.08) |
| **Economics** | | | | | | -0.80 * (0.08) |
| **Year fixed effects** | Yes | Yes | Yes | Yes | Yes | Yes |
| $\chi^2$ | 64.50 | 81.54 | 91.31 | 140.02 | 150.11 | 150.84 |
| **Log-likelihood** | -1053.37 | -1087.80 | -1082.91 | -1058.56 | -1053.52 | -1053.15 |

[a] n = 3015. Standard errors are in parentheses.

† $p < .10$

* $p < .05$

** $p < .01$

**TABLE 3**

**Results of Cox Proportional Hazard Rate Analysis for Operational Wind Farms[a]**

| Variables | Model 7 | Model 8 | Model 9 |
|---|---|---|---|
| **Regulatory** | 1.37 (0.27) | 1.38 (0.28) | 1.40 † (0.28) |
| **County population** | 1.08 (0.08) | 1.08 (0.08) | 1.00 (0.08) |
| **Political** | -0.98 ** (0.01) | -0.98 ** (0.01) | -0.98 ** (0.00) |
| **Market substitutes** | -0.78 (0.12) | -0.76 † (0.12) | -0.76 † (0.12) |
| **Number of proposals in county** | -0.99 (0.05) | -0.99 (0.05) | -0.99 (0.05) |
| **Projects installed by developer** | 1.08 ** (0.02) | 1.08 ** (0.02) | 1.08 ** (0.02) |
| **Exposure** | -0.98 (0.07) | -0.98 (0.07) | 1.02 (0.07) |
| **Exposure squared** | 1.00 (0.00) | 1.00 (0.00) | 1.00 (0.00) |
| **Positivity of tenor** | 1.85 ** (0.15) | 1.93 ** (0.16) | 1.99 ** (0.17) |
| **Aesthetics** | -0.55 ** (0.11) | | -0.59 * (0.13) |
| **Aesthetics x Positivity of tenor** | 1.26 * (0.12) | | 1.22 * (0.12) |
| **Economics** | | -0.70 * (0.12) | -0.86 (0.15) |
| **Economics x Positivity of tenor** | | 1.09 (0.10) | -0.98 (0.09) |
| **Year fixed effects** | Yes | Yes | Yes |
| $\chi^2$ | 150.67 | 147.75 | 154.79 |
| **Log-likelihood** | -1053.23 | -1054.69 | -1051.17 |

[a] n = 3015. Standard errors are in parentheses.

† $p < .10$

*$p < .05$

**$p < .01$

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