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EXPLORING THE POTENTIAL INFLUENCE OF OPINION LEADERS IN DIFFUSION OF ENERGY CONSERVATION PRACTICES

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ABSTRACT

Increases in global energy consumption rates are substantially driven by human activities. Influencing individuals to adopt energy-saving practices in their daily routines is fundamental to every energy-conserving intervention. Studies have shown that widespread diffusion of practices in a population requires reinforcements from influentials, in particular opinion leaders. However, the level of influence of opinion leaders in large scale diffusions of energy conservation practices is unknown. To address this gap, we developed an agent-based simulation model based on empirical communication data on energy conservation from Twitter. Using global sensitivity analysis, we explored the patterns of information diffusion—and, by extension, the flow of influence—in large networks, and identified the key attributes that dominate the opinion leaders' influence. We found interventions that focus on these attributes can increase the level of influence from opinion leaders, which can lead to faster and wider dissemination of energy conservation practices in large online networks.

1 PROBLEM STATEMENT

World energy consumption is projected to increase 56% by 2040 (EIA 2013). Due to its substantial environmental, social, and economic impacts, developing effective energy conservation strategies is one of the most essential challenges of this century. Greater than 80% of U.S. energy use and its related CO_2 emissions are estimated to be driven by individuals' consumption activities (Bin and Dowlatabadi 2005). Thus, it is critical that energy conservation practices diffuse to individuals in order to shape public opinion to make well-informed energy choices in the future.

A growing body of literature has suggested ways to inform the public on energy saving routines and strategies that will lead to reductions in energy consumption. These methods have exhibited between 2.0 to 60.0 percent of energy savings in small social networks (Chen et al. 2012, Allcott 2011). However, the extent to which public opinion on energy conservation in larger social networks can be influenced, which is synonymous to innovation diffusion (Rogers 2010), has received little attention. Although a recent study has examined the diffusion of energy saving practices in large online networks (Wang and Taylor 2014), we lack knowledge of what entities are most influential in forming public energy conservation opinion, and by what means their roles can be most effective. A central idea in marketing research is that opinion leaders' role is critical in achieving widespread diffusion and the formation of public opinion. In particular, the two-step flow of communication model (Lazarsfeld et al. 1944) is widely accepted to be effective in opinion formation. We examined this model of public opinion formation on energy conservation practice diffusion through a series of simulations.

2 METHODOLOGY

To examine the level of influence of different entities and the role of opinion leaders in a two-step flow model, we studied interpersonal diffusion of energy conservation practices in a large online social network

(Twitter). Our data included energy-related communications (tweets) between different entities over the course of 28 days. We then used the empirical data to develop an agent-based model to evaluate different attributes of entities in the communication netwrok evolved by sharing energy-saving information and practices. The model incorporates different types of communicators (entities), and multiple attributes that potentially contribute to each agent's level of influence. Each entity, i.e. an organization, opinion leader, or individual, was modeled as an agent. Each agent had multiple attributes including the type of node, the number of followers, followees, general tweets, energy re-tweets from other entities, the frequency of energy tweets, and credentials. The model also incorporated a scale-free network to represent the social structure among all the agents. When running the model, an organization would generate a piece of information, i.e. tweet. The tweet then propagated to opinion leaders and individuals thereafter through social connections. We observed the flows of information and evaluated the level of influence and roles played by opinion leaders. We conducted multiple simulation experiments to test the effectiveness of the two-step flow of communication model, and examined whether this model can improve effectiveness when the attributes of different entities, particularly opinion leaders, were altered.

3 FINDINGS

Although the concept of opinion leadership and public opinion formation is an established marketing approach, there is a lack of research to reveal the underlying mechanisms of the diffusion of energy saving practices in large online networks. Our empirical study discovered insignificant levels of influence among opinion leaders in a two step-flow model. In fact, a greater flow of information —and thereby influence—was observed from organizations to individuals. Our simulation explored the potential influence of opinion leaders, and identified the attributes that contributed most to their levels of influence in dissemination of energy conservation information and practices.

4 IMPLICATIONS

The results from this study improved our understanding of how opinion leaders in a large online network may contribute more effectively in the diffusion process of energy conservation practices and, thus, public opinion formation related to energy conservation. Further, our findings illustrate how the two-step flow model can be applied in the diffusion of energy conservation practices more persuasively by effective employment of opinion leaders. The study will help in designing more effective energy conservation interventions through forming public opinion on energy conservation and influencing individuals' energy consumption routines, which in aggregate may contribute to the global CO_2 mitigation goals.

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