Are Electricity Prosumers More Engaged? An Analysis of Brand-Follower Engagement on Twitter

Completed Research

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Abstract

By leveraging new information systems and technologies, social media and the smart grid are transforming the company-customer relationship and providing opportunities for co-creation of value. In the smart grid, individuals will be able to participate in distributed renewable energy generation, for instance by installing rooftop solar panels. In effect, many customers will become electricity ‘prosumers’. As a result, there will be a need for greater shared understanding of environmental and renewable energy concerns between utilities and their customers. Although the current use of social media by electric utilities is limited, it could represent an important media choice for creating engagement with their customers. In this research, we analyzed 7180 tweets of 31 U.S. utilities over a five-month period. We found that utilities with more prosumers are more active and have higher follower engagement on renewable energy tweets. Practical implications and directions for future research are presented.

Keywords

Social media, brand engagement, co-creation, prosumers, smart grid.

Introduction

This research is situated at the intersection of two important trends in information systems: social media and the smart grid. By leveraging advanced information technologies and systems (IS), both of these trends are creating dramatic changes in the company-customer relationship. Customers are becoming more active and engaging in co-production and the co-creation of value (Piccinini, Gregory and Kolbe, 2015). This has led to the emergence of the ‘prosumer’, a party that both produces and consumes a particular good or service (Bitner, Faranda, Hubbert and Zeithaml, 1997). It is estimated there are 2.8 billion active worldwide users of social media (Hutchinson, 2017) and the continuing growth of social media has motivated many organizations to seek the online engagement of their customers. High customer engagement can contribute to improved sales, reduced costs, higher brand referrals, more meaningful customer collaborations, and enhanced co-creation experiences (Munoz-Exposito, Oviedo-Garcia and Castellanos-Verdugo, 2017).

In the context of the electricity sector, co-creation also occurs when customers install solar panels and begin generating electricity for their own use or for resale. This transition to a more distributed electricity supply system is part of the IS-enabled ‘smart grid’ (Ramchurn, Vytelingum, Rogers and Jennings, 2012). We speculate that social media can enhance utilities’ co-creation efforts by providing a means to disseminate information and offering a platform by which prosumers can ask questions, make suggestions, evaluate or critique existing distributed generation programs. Benefits of co-creation for utilities include greening the electricity supply, increasing energy efficiency savings from demand management programs (Corbett, 2013), enhancing customer relationships, and improving innovation.
Given the potential benefits of co-creation, a key question is how to enhance prosumer engagement. Organizations should recognize that the prosumer is now part of value creation process and thus requires different methods of engagement (Prugl and Schreier, 2006). They must attract and work with prosumers through engaging experiences and develop the right communication tools (Izvercianu, Seran and Buciuman, 2012). Electric utilities, typically risk-adverse when it comes to new technologies, have been slow to adopt social media (Nicholson, 2014). Still, social media could become an important part of utilities’ media mix (Munoz-Exposito et al. 2017) by providing opportunities to enhance the conversation with customers, provide new managerial insights, and encourage their customers to enrol in energy efficiency programs and renewable energy generation (Nicholson, 2014).

Our research seeks to shed light on the relationship between social media engagement and co-creation in the electricity sector. It is guided by two main research questions: First, do utilities with more prosumers differ in the use of their social media as compared to utilities with fewer prosumers? This question explores whether utilities demonstrate similar co-creation strategies for electricity production and social media activities. Second, do utilities with more prosumers have higher social media engagement on the topic of renewable energy? This question draws attention to the potential of social media to attract and engage prosumers who are interested in renewable energy. To answer these questions, we empirically examined the use of Twitter by 31 U.S. utilities. Among current social media platforms, Twitter is one of the most popular, being used by 83% of the Fortune 500 companies (Barnes and Lescault, 2014). Through Twitter, companies can increase brand awareness, foster relationships, and create leads and customer engagement events (Munoz-Exposito et al., 2017). Our findings reveal significant differences in the use of social media and the brand-follower engagement of utilities depending on the extent of prosumers within their customer base. At a practical level, this research could help utilities improve their use of social media to increase engagement and motivate customers to participate in co-creation initiatives, such as distributed energy generation programs.

The rest of the paper is structured as follows. In the next section, we provide theoretical background that helps to inform our research. Then, we present the research methodology. This is followed by the presentation of our results and a discussion of the implications of our findings. We conclude with a brief presentation of the limits and contribution of this research and future directions for scholars.

**Theoretical Background**

**Co-Creation of Value and Social Media**

Broadly speaking, co-creation is “the joint, collaborative, concurrent, peer-like process of producing new value, both materially and symbolically” (Galvagno and Dalli, 2014, p. 644). The advent of internet-based technologies has created a range of new, cost-effective opportunities for organizations to engage and empower their customers (Füller, Mühlbacher, Matzler and Jawecki, 2009; Peeroo, Samy and Jones, 2017). Customers can participate in co-creation processes in a number of ways, from simply requesting information and consuming products to suggesting new product ideas, challenging product concepts, and evaluating proposed offerings (Füller et al., 2009; Peeroo et al., 2017). To date, IS research has examined co-creation primarily from the perspectives of customer relationship management, open innovation, collaboration, and platforms for customer engagement (Galvagno and Dalli, 2014). With respect to the latter, the extant research suggests that choice of platform influences customers’ engagement (Sorensen, Andrews and Drennan, 2017) and their involvement in the co-creation experience (Füller et al., 2009). Specifically, the more an IS supports customers - by providing the necessary information to understand the product and a mechanism for articulating their ideas - the more customers feel empowered, enjoy the experience, and participate more actively in co-creation activities (Füller et al., 2009).

Among the different internet tools being used for value co-creation are social media. Research suggests that, whether in response to a company-initiated message or their own volition, customers are willing to make suggestions regarding products and services, effectively transforming from passive consumers to co-creators of value (Peeroo et al., 2017). To extract maximum benefit from social media activities in the context of co-creation of value, organizations need to understand how and why customers engage on social media platforms (Peeroo et al., 2017). This is not a simple equation as value co-creation and customer engagement are linked through a variety of factors including the selection of platform, the
Social Media Engagement

The motivation behind social media is to create a social relationship with others and the availability of these tools is making it easier for organizations (i.e., brands) to initiate conversations and rapidly gather feedback from a large number of participants (Carlson, Rahman, Voola and de Vries, 2018) at a relatively low cost. Engagement has become an important indicator of the nature and strength of these relationships. However, social media engagement research is still in its very early stages (2018) and there is still some debate around exactly what engagement means. Kooohikamali and Gerhart (2018) suggest that social media engagement is the emotional investment that is made when one reacts to a post or message rather than simply viewing it. Offering a more comprehensive view, Munoz-Expositio and colleagues define social media engagement as “the manifestation of commitment, through the intensity of interactions and their implications, toward the offers and activities of a brand, product, or firm, regardless of whether it is initiated by the individual or by the firm” (2017, p. 1128). For some, customer engagement on social media is the result of the co-creation of the customer experience (Peeroo et al., 2017).

Various streams of research have begun to emerge around social media engagement. Some researchers have investigated factors that contribute to social media engagement (e.g., Islam et al., 2018), while others have focused on the outcomes that social media engagement can produce. Social media engagement has been shown to enhance brand loyalty (Islam et al., 2018). It also influences customers’ participation within the online community, commitment and trust. Engagement can also lead to a significant increase in consumer purchases (Goh, Heng and Lin, 2013) and an engaged customer is more likely to participate actively in idea generation, knowledge sharing, giving feedback, and engaging in collaboration to support the brand (Carlson et al., 2018).

Another emerging stream of research investigates how different organizations use social media. This research suggests customers and brands play different roles on social media sites and use social media to achieve different purposes. For instance, consumers have been found to influence the purchases of one another through both informative and persuasive communications, whereas the brands tend to influence consumers purchases solely through content valence in the form of persuasive communication (Goh et al., 2013). However, open questions remain about how different roles may play out in the context of value co-creation, implying a need to look more carefully at how brands and their prosumers interact through social media.

Research Methodology

Selection of Sample and Collection of Data

The first choice we made in implementing this research was the selection of the sample, specifically which utilities (i.e., brands) to include. As our research objective is to compare whether differences existed between utilities with more and less prosumers, we identified two groups of utilities based on data from U.S. Energy Information Administration (EIA) which provides comprehensive data on U.S. electricity utilities. From this data, we identified the top 25 utilities in terms of number of net metering customers. When customers install solar panels (and become prosumers), they are generally required to install a new, ‘net’ meter, that is capable of capturing both the demand load (use) and supply (generation) of electricity. Therefore, we used the number of residential net metering customers to represent the number of prosumers. Next, we created a comparison group by finding a utility with no or few net metering customers that otherwise matched each of the first 25 utilities. The matching was based on the number of residential customers, revenue from residential customers, and ownership type. We also tried to match by state of operation where this was possible. Based on these criteria, we were able to find reasonable matches for 24 of the 25 top utilities (Wu, Asio and Corbett, 2017). Following the identification of these 49 utilities, we verified manually whether they were present on Twitter and confirmed Twitter handle they used. Of the two groups with 25 and 24 utilities respectively, only 16 (Group 1) and 15 (Group 2) were active on Twitter (i.e., had tweets either from the utility or its followers). Table 1 presents a summary profile of these two groups. From this information we observe that, on average, the two groups of utilities...
had similar proportions of Twitter followers (2%) when compared to the total number of residential customers despite a large difference in the number of prosumers (i.e., net metering customers).

<table>
<thead>
<tr>
<th></th>
<th>Residential Customers</th>
<th>Net Metering Customers</th>
<th>Twitter Followers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>780 852</td>
<td>22 640</td>
<td>14 296</td>
</tr>
<tr>
<td>Group 2</td>
<td>593 621</td>
<td>250</td>
<td>12 808</td>
</tr>
</tbody>
</table>

Table 1. Customers and Twitter Followers per Utility Group

Once the Twitter handles were identified, tweets posted by the 31 utilities and their followers were collected using a Java program that connected to the Twitter’s standard search API\(^1\). The API provides a sample of tweets in the last seven days, and this API has been used in prior works (Hill, Benton and den Bulte, 2013; Ibrahim, Wang and Bourne, 2017). Our program connected to the API every fifteen minutes and the resulting tweets were aggregated. We collected a total of 63352 unique tweets between 11\(^{th}\) July 2017 and 4\(^{th}\) November 2017 (over about 5 months).

**Coding of Tweets**

The most common form of electricity prosumers are customers that have installed solar panels on their homes. Besides the financial advantages they receive from offsetting their electricity consumption or selling excess electricity back to the grid, these prosumers are motivated by environmental concerns. Thus, we decided to concentrate our exploration on two categories of tweets: those related to the environment and those related more specifically to renewable energy. To do so, we needed to determine a way of separating these tweets from others. Our process involved four main iterative steps: manual coding, keyword formulation, automatic coding, and keyword refinement. Unlike other research, we developed a custom tool to identify the environment-related messages from the collected tweets rather than using a ready-made application for the same purpose (Koohikamali and Gerhart, 2018; Stowe, Paul, Palmer, Palen and Anderson, 2016).

For the manual coding, a small sample of 8984 tweets was analysed by two students. Passing through those tweets one by one, each tweet was categorized according to its contents. In this coding, we allowed for the possibility of a single tweet to be classified under one or more categories. To ensure the reliability of the coding, the analysis was done sequentially and independently by the two students. Then, the results obtained by the two students were compared to evaluate the degree of matching between them. ‘Matching’ here was declared when a single tweet had an identical categorization by the two students. The inter-coder matching obtained by the two human coders was 85.3%.

Following the manual coding, a list of keywords was prepared to allow automatic detection and categorization of environment-related tweets and renewable energy tweets (which were also considered part of environment-related tweets). For each category an exclusive key word set was defined. An initial list of keywords was defined by the two student coders. It was then reviewed and adjusted by one of the authors. In defining this list, we required that a single keyword, or a combination of more than one word, could not belong to more than one category. However, a single tweet could be classified under more than one category if it contained keywords belonging to different categories.

<table>
<thead>
<tr>
<th>Category</th>
<th>Manual coding</th>
<th>Automatic coding</th>
<th>Agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>All environment-related messages</td>
<td>1210</td>
<td>940</td>
<td>77.7%</td>
</tr>
<tr>
<td>Renewable energy</td>
<td>465</td>
<td>399</td>
<td>85.8%</td>
</tr>
</tbody>
</table>

Table 2. Evaluation of Coding Performance over Sample of 8984 Tweets

Following the definition of the initial set of key words, an R program was developed to detect contents of tweets and to classify them accordingly. The program was run against the small sample. Results obtained

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1 https://developer.twitter.com/en/docs/tweets/search/overview
by the program were refined against those obtained by manual coding carried out by the students. In this step, a substantial number of false positive tweets (i.e. tweets classified as environment-related when they were actually not) was found. That was due to the presence of several simplistic keywords that are commonly used such as ‘tree’, ‘sun’, ‘energy’. By taking the results of human coding as the reference baseline, the keyword set was refined to obtain more accurate results. The refinement process was carried out iteratively through refinement and testing against the small sample until reaching a level of accuracy that we deemed acceptable: 77.7% in the case of environment-related messages and 85.8% for messages related to renewable energy as shown in Table 2. We observed that the matching rate was higher for renewable energy because this subject is more precise than the other environment-related messages. The final list was confirmed with the agreement among all three authors. Afterwards, the automatic detection program was executed over the large sample, 63352 tweets, for the next stage of research.

**Analyses of Coded Tweets**

Based on automatic coding of tweets, out of a total of 63352 tweets we identified 7180 tweets (11.3%) that contained environment-related messages. Of these 7180 tweets, 1788 (25%) were related to renewable energy. Once we had identified the tweet cohorts (total environmental-related tweets and renewable energy tweets), we performed a number of statistical analyses to investigate the two research questions we posed. For both these questions, we investigated six variables that may help distinguish the two groups. The first variable, the number of messages posted by a brand quantifies the amount of environmental or renewable energy information posted by the utility. The second variable, the number of follower messages captures the engagement of followers with the information posted by the utilities. The third variable is the sum of the two afore-mentioned variables reflects the two-way discussions had by the utility and the followers. The fourth variable, the sum of likes for brand tweets signal follower engagement on messages posted by the brands. The fifth variable, the sum of retweets for brands tweets also signal follower engagement on messages posted by brands. The sixth variable, the sum of likes and retweets signal the follower engagement on brand tweets. Several other works have utilized measures such as likes, retweets, number of replies and counts of brand tweets and follower tweets in their investigations (Bruns and Stieglitz, 2013; Hoffman and Fodor, 2010; Smith, Fischer and Yongjian, 2012). However, these metrics have not been used in the context of distinguishing two groups of utilities based on net metering customers as we do in this study.

The six variables were normalized based on total number of Twitter followers for each brand, a standardized procedure for reducing bias. The normalization for the last three variables (likes, retweets, likes + retweets), corresponds to the engagement rate metric defined by other works (Hwong, Oliver, Van Kranendonk, Sammut and Seroussi, 2017; Semiz and Berger, 2017). Mann-Whitney U tests were conducted to test whether the null hypothesis that the median values for the two groups are identical is rejected. Mann-Whitney U test was chosen because it is more conservative (i.e., does not assume normality).

**Results**

**RQ1: Differences in the Use of Social Media between Utilities**

The first research question investigates whether utilities having more prosumers (Group 1) differ from those with fewer prosumers (Group 2) in terms of using social media. To evaluate this question we evaluated the six variables for all environment-related tweets. As shown in Table 3, in our dataset, we observed that Group 2 posted less than a third of the tweets posted by Group 1 (ratio of utility tweets for Group 2 to Group 1 was 0.33). The responses for Group 2 were about two-thirds that of Group 1, with the ratio of 0.69. Also, the likes and retweets for Group 2’s followers were less than a third of the likes and retweets for Group 1, with the ratio of 0.29 and 0.29 respectively.

To systematically test for differences between the two groups of utilities, we scrutinized the six variables. The results for the six tests conducted are presented in Table 4. Results for tests 1 and 2 show that there is significant difference between the two groups in the amount of environment-related tweets (median counts) exchanged between the utilities (p<0.01) and the followers (p<0.05) respectively. Test 3 results show that the utilities that have more prosumers (Group 1) tend to attract significantly (p<0.01) more environmentally-related messages (i.e., sum of brand posts and follower posts), than utilities having fewer...
prosumers (Group 2). Conversely, results for tests 3-6 show no statistically significant difference between the two groups based on likes and retweets of followers for the posted brand tweets containing environmental-related themes. The combined effect for like and tweets (test 6), was also insignificant.

<table>
<thead>
<tr>
<th>Test number</th>
<th>Variables considered</th>
<th>Outcomes of Mann-Whitney U tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Brand tweet counts</td>
<td>Significant** (p = 0.003, U-value = 45, Z-Score = 2.94)</td>
</tr>
<tr>
<td>2</td>
<td>Follower tweet counts</td>
<td>Significant* (p = 0.028, U-value = 64 Z-Score = 2.19)</td>
</tr>
<tr>
<td>3</td>
<td>Brand and follower tweet counts</td>
<td>Significant** (p = 0.008, U-value = 53, Z-Score = 2.62)</td>
</tr>
<tr>
<td>4</td>
<td>Sum of likes for brand tweets</td>
<td>Not significant (p = 0.093, U-value = 77, Z-Score = 1.68)</td>
</tr>
<tr>
<td>5</td>
<td>Sum of retweets for brand tweets</td>
<td>Not significant (p = 0.294, U-value = 93, Z-Score = 1.05)</td>
</tr>
<tr>
<td>6</td>
<td>Sum of likes and retweets for brand tweets</td>
<td>Not significant (p = 0.200, U-value = 87, Z-Score = 1.28)</td>
</tr>
</tbody>
</table>

** => p < 0.01, * => p < 0.05

Table 4. Outcomes of Statistical Tests Related to Environment-Related Tweets

**RQ2: Differences in Social Media Engagement on Renewable Energy Tweets**

The second research question investigated whether there is a statistically significant difference in brand-follower engagement on the topic of renewable energy. In the main sample renewable energy tweets represented approximately 25% of the total environment-related tweets. The same six variables considered for RQ1 were considered for this question. The average numbers of tweets are shown in Table 5 and the test results are shown in Table 6.

The result for the first test in Table 6 shows a significant difference in the median values between the two groups for brand tweets (p<0.05). We observed that utilities in Group 1 produced more renewable energy related tweets (average of 15 tweets per brand, Table 5) than Group 2 utilities (average of 5.5 tweets per brand, Table 5). This shows that utilities with higher number of prosumers focused on conveying renewable energy related messages. However, no statistically significant difference was observed for the customer tweets or brand plus follower tweets (tests 2 and 3). The ratio of average number of brand tweets between top and bottom utilities was 2.72 and that of follower tweets was 1.76. The reduction in the ratio of the follower tweets by about a value of 0.96 (i.e. from 2.72 to 1.76) is because there were relatively more follower tweets for the Group 2 utilities when compared to Group 1. Some followers of utilities in Group 2 generated renewable energy tweets even when the brand did not even post a single renewable energy tweet. This was observed in four utilities where customers in their own initiative tweeted renewable energy messages (1, 3, 17 and 44 tweets respectively). Of these 65 tweets 54 were from distinct customers (i.e., 83%). This is noteworthy because it appears followers of Group 2 utilities (those with few or no prosumers) seed renewable energy discussions voluntarily, thus increasing the number of tweets. This increase contributed to a non-significant difference between the two groups on follower tweet counts (test 2). The combined effect of brand and follower tweet counts (test 3) was also not significant.
An Analysis of Electricity Prosumers' Engagement on Twitter

Twenty-fourth Americas Conference on Information Systems, New Orleans, 2018

<table>
<thead>
<tr>
<th></th>
<th>Utility tweets</th>
<th>Follower tweets</th>
<th>Utility + Follower tweets</th>
<th>Likes</th>
<th>Retweets</th>
<th>Likes + Retweets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>15</td>
<td>97</td>
<td>112</td>
<td>78</td>
<td>57</td>
<td>135</td>
</tr>
<tr>
<td>Group 2</td>
<td>5.5</td>
<td>55</td>
<td>60</td>
<td>21</td>
<td>21</td>
<td>41</td>
</tr>
</tbody>
</table>

**Table 5. Average Number of Tweets per Group for Renewable Energy Tweets**

The results for tests 4 and 5 show that there are significant differences between the median values for the two groups in the likes (p<0.01) and retweets (p<0.05) respectively for tweets posted by utilities on renewable energy. The average number of likes attracted by Group 1 and Group 2 tweets was 78 and 21 respectively (Table 5). The average number of retweets attracted by Group 1 and Group 2 tweets was 57 and 21 respectively (Table 5). The results show that the engagement of followers (in the form of likes and retweets for the brand tweets) is more than two times higher for Group 1 utilities than Group 2 utilities. Finally, the result for test 6 (i.e. combined effect of likes and retweets shown in tests 4 and 5) was also significant (p<0.01).

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</tr>
</thead>
<tbody>
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<td>Brand tweet counts</td>
<td>Significant* (p-value = 0.01, U-value = 54, Z-Score = 2.59)</td>
</tr>
<tr>
<td>2</td>
<td>Follower tweet counts</td>
<td>Not significant (p-value = 0.211, U-value = 88 Z-Score = 1.24)</td>
</tr>
<tr>
<td>3</td>
<td>Brand and follower tweet counts</td>
<td>Not significant (p-value = 0.119, U-value = 80, Z-Score = 1.56)</td>
</tr>
<tr>
<td>4</td>
<td>Sum of likes for brand tweets</td>
<td>Significant** (p-value = 0.001, U-value = 38, Z-Score = 3.22)</td>
</tr>
<tr>
<td>5</td>
<td>Sum of retweets for brand tweets</td>
<td>Significant* (p-value = 0.043, U-value = 68.5, Z-Score = 2.02)</td>
</tr>
<tr>
<td>6</td>
<td>Sum of likes and retweets for brand tweets</td>
<td>Significant** (p-value = 0.003, U-value = 45, Z-Score = 2.94)</td>
</tr>
</tbody>
</table>

** => p < 0.01, * => p < 0.05

**Table 6. Outcomes of Statistical Tests Related to Renewable Energy Tweets**

**Discussion**

Our findings present some interesting implications for utilities and their use of social media. First, our results for RQ1 show statistically significant differences between the two groups of utilities in terms of the volume of environment-related tweets by the utility and their followers. In effect, utilities with more prosumers do indeed harness the power of social media to convey environmental information for discussion and this information appears to be received positively by their customers as evident through follower responses. This result aligns with previous research suggesting that effective platforms for value co-creation must allow for both the dissemination of relevant information (i.e., utility tweets) to help customers understand the new product context as well as providing opportunities for customers to share their ideas (i.e., follower tweets) (Füller et al., 2009). However, the fact that there were no significant differences between the two groups based on likes and retweets suggests that perhaps shared understanding has not been entirely achieved between the utility and its customers. In terms of engagement, this may reflect shallow engagement with respect to environment-related issues. In other words, concerns for the environment are relatively generic such that individuals may like and retweet environment-related messages regardless of what brand they follow.
Second, our results for RQ2 show that the two groups of utilities differentiate themselves in terms of brand tweets on renewable energy. Utilities with higher numbers of prosumers are more active in transmitting information to their followers on renewable energy. From the perspective of value co-creation, this might suggest that these utilities are supporting distributed energy programs with social media communication strategies. However, the results show no significant difference in the followers’ tweet patterns in the two groups. We speculate that this can be attributed to the fact that followers of Group 2 post renewable energy messages even when the brands they are following do not post renewable energy messages. Thus, there is evidence that followers are ready to take lead and are pushing utilities to engage in renewable energy discussions. The implication of practice is that utilities from Group 2 (i.e., those with few prosumers) may be missing an opportunity to engage in co-creation with their followers. By posting renewable energy messages, these utilities could create a shared understanding in this topic, which could in turn create new business opportunities for these utilities to promote distributed renewable energy generation among their customer base.

Third, our results for RQ2 reveal significant differences between the two groups of utilities for likes and retweets for renewable energy. In some respects, this result is not surprising as we could reasonably expect that utilities with more prosumers (i.e., customers engaged in renewable energy generation) also have higher brand-follower engagement related to renewable energy on social media. Our data does not allow us to examine causality, thus we cannot say whether social media engagement leads to more prosumers, or whether prosumers, who have already made the financial investment in installing solar panels continue to be engaged through social media discussions. This could be an interesting avenue for future research.

Finally, our results suggest that social media engagement may depend to some extent on the specificity of the social media content. When comparing brand-follower engagement between environment-related tweets and renewable energy tweets for Group 1, we note that in the first case, the results are insignificant, while in the second case they are significant. As we alluded to above, environment-related messages are less specific or more diverse than tweets related to renewable energy. Thus, to achieve higher levels of engagement, it is essential that utilities communicate messages that resonate with the interests of their followers in some concrete fashion in order to achieve deeper levels of engagement.

**Conclusion**

**Contributions**

This research makes three main contributions. First, from a theoretical perspective, our research extends the literature related to IS-enabled co-creation of value by examining how social media, and Twitter in particular, are used to support information dissemination by utilities and the engagement of their customers. Beyond providing evidence for value co-creation in Twittersphere between brands and followers, our work demonstrates that these interactions may not necessarily lead to deep engagement and enhanced value co-creation. Second, our research contributes to practice by shedding light on how the increase in prosumers can influence companies’ social media behaviors. For both RQ1 and RQ2, we found that utilities with more prosumers were more active on social media, attempting to use this as a way to communicate and engage with customers. Third, methodologically, we advance work in social media analytics by highlighting some of the challenges related to understanding the content of social media messages and developing routines to automatically categorize them. Coupling manual and automatic detection of environment-related messages to achieve a satisfactory level of accuracy and the development of a custom tool for that purpose extend previously used approaches based on automatic classification using off-the-shelf applications. In addition, in this research, we added a new dimension which was to compare social media activity and engagement between two groups in the same sector. Other researchers and practitioners can draw on these approaches in order to bring a higher level of sophistication to their own social media analyses.

**Limitations and Future Research**

A number of limits should also be noted. First, there are limitations concerning the collection of data. In most, if not all social media analysis, researchers are constrained by what can be retrieved from the social media providers. We acknowledge that our dataset does not represent 100% of all brand and follower
tweets. We have tried to mitigate this concern by collecting data over a 5-month period. Still, some caution is necessary when interpreting results and making conclusions. Second, we limited our investigation to Twitter. In terms of a social media platform, Twitter is relatively mature with new players are coming into the market daily (Barnes and Lescault, 2014). In addition, research suggests organizations use different platforms for different purposes, with Twitter being used most often for public information messages and Facebook being used to create more two-way discussion and collaborative conversations (Manetti, Bellucci and Bagnoli, 2017). Future research could examine the same or similar research questions across different platforms.

In terms of future research, our work could be extended by investigating the three dimensions of engagement proposed by 3-M framework: brand-to-customer, customer-to-brand, and customer-to-customer (Gallaugher and Ransotham, 2010). Our current results are aligned with brand-to-customer and customer to both brand and customers. Future research could consider the latter two dimensions of the framework more explicitly. This may provide insights on the nature of environmental and renewable energy discussions between the customer and the brand and also between customers and could extend our understanding of the different roles played by brands and their followers (Goh et al., 2013). A second avenue for future work could probe into shallow vs. deep engagement, where shallow engagement refers to cognitively less-demanding engagement activities such as likes and retweets and deep engagement refers to more demanding activities such as writing a response from scratch, asking questions and providing suggestions. Investigating the impact of engagement levels across different groups of utilities could extend our understanding of co-creation processes. Finally, sentiment analysis may be another fruitful direction for research. The preservation of the natural environment, climate change, and renewable energy can be emotion-charged topics. In our analysis, we considered the number of tweets, likes and retweets, without considering whether these were favorable, unfavorable or neutral. Yet these sentiments may provide a different image of what people are feeling about the subject (Kooohikamali and Gerhart, 2018) and allow utilities (as well as policy makers and other stakeholder) to evaluate the emotional state, judgement or evaluation of renewable energy.

Co-creation has become an important emerging strategy for many companies. This research investigated whether utilities differ in the use of their social media based on their number of prosumer customers. Electric utilities with more prosumers tend to engage their followers more in the social media domain. In this respect, other utilities may be missing an opportunity to transform their relationships with customers with a view to creating even greater levels of business value.

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