Social Media Discourse and Genetically Modified Organisms

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Abstract

The objective of this research was to analyze themes of the Genetically Modified Organism (GMO) debate to investigate if sentiment could be segregated by geography, and in the GMO debate contest, to recognize how individuals interact with each other to form online connections. In all datasets, sentiment surrounding GMOs was negative. Via Netlytic (a cloud-based social media and networks analyzer) Twitter data was collected in real time. Dataset collection periods ranged between 6 to twelve days in con-

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tinuous segments from November 2013 to February 2014. During this period, significant anti-GMO interactions were formed within networks, reinforcing the importance of social media in issue analysis.

The Genetically Modified Organism (GMO) debate impacts all individuals who are directly or indirectly involved in agriculture or the consumption of food, whether or not they support genetically modified products. It is important to study this debate as it can have future implications for the agriculture industry, policy makers, government, producers, feed businesses, seed companies, research institutions, and consumers.

Some have concerns that these organisms could have negative effects on the environment and human health in general (Daunert, Deo, Morin, & Roda, 2008). Others see the potential that by selecting and modifying genes of plants and organisms it may be possible to help people who are poor and possibly malnourished. The origins of the debate will be examined and the themes surrounding the debate will be analyzed using social media research tools, based on information related to GMOs posted by individuals in comments, blogs, and websites.

The main objective of this research is to analyze themes of the GMO debate using social media tools, to investigate if sentiment can be segregated by geography. A second purpose is to recognize how individuals interact with each other to form online relationships without meeting face to face. A third objective is to review how social media could potentially become a source of information for other online Twitter users.

Social media became a platform popular for Generation X (Gen X): those born between 1965 and 1984 (Kaplan & Haenlein, 2010). Although Gen-Xers began the social media movement, forms such as Twitter have been adopted by nearly all age groups. Twitter is a social networking website where users can send and read microblogs of 140 characters or less called tweets, as well as follow other individuals and groups (Kwak, Lee, Park, & Moon, 2010). Between 2007 and mid-2008, a 19% increase was noted for Internet users who reviewed blogs, added comments to reviewer websites, and joined social networking sites. Approximately 70% of Internet users use social media websites for information purposes, while 60% use it as a way to pass information along to family and friends (Fisher, 2009). The Internet has become an important marketing tool as well as a tool to analyze how individuals interact with each other.

Genetically Modified Organisms

The process for GMOs (altering the genetic material of the organism) was discovered in the 1970s. The result was highly improbable combinations unlikely to occur in nature through interactive recombination or mating (Ghisleri et al., 2009). Modern genetic engineering techniques facilitate simple gene transfer from one organism to a nonrelated species, for example, fish genetic material inserted into plants. This process has become progressive, each iteration building on the previous. The first generation crop offered natural resistance to pests providing opportunities for growers to choose this GMO crop rather than spray pesticides (Ghisleri et al., 2009). The second generation promised to provide opportunities for health

and nutritional benefits. This strategy was marketed to consumers by increasing ingredients or components, and prolonging shelf life of certain foods to entice them to try genetically modified foods. Between 2007 and 2008 the number of genetically engineered crops increased from 114.3 million to 125 million hectares.

When disconnect is present between what is considered acceptable in science and what is socially acceptable, the result is social magnification by the public group (Herrick, 2005). As individuals develop opinions, they may not align with their country's regulations. The political and cultural implications of GMOs also have been geographic – each side of the Atlantic has different labeling regulations for these products; these differences have led to anxiety. The debate over genetically modified foods, which started in the late 1990s between the European Union (EU) and the United States of America (USA), became a popular conversation topic for all political parties.

In the USA, the debate created anti-European sentiment due to negative European attitudes toward GMOs. Opposing views and policies caused this debate to become a significant political and cultural debate. Residents of the EU seem to have negative sentiment toward GMOs (Stephan, 2012). On the other hand some Americans see it as a practical approach to innovation. These differing views could explain why a trade war over labeling GMOs occurred (Herrick, 2005). In 2010, six nations were growing 95% of the world's genetically engineered crops. These nations included USA, Brazil, Argentina, India, Canada, and China. By way of comparison, the EU only dedicated 0.12% of agricultural land to GMOs.

Coexistence of GMOs within member states of the

EU is a complex issue. It is the member state's responsibility to self-regulate for the production of GMOs (Dobbs, 2011). Recent legislative procedures promised increased human and environmental health thorough a risk assessment procedure. An outright ban of GMOs was dismissed as illegal for member states meaning that co-existence has to be permitted over the opposition of individuals and groups. Their opposition has been promoted and discussed widely through social media.

Social Media

The Internet has evolved to become an online community, it which new relationships can be created from online groups and other communities because information is accessible and easy to find (Gruzd, 2009a). Relationships become easier to maintain with emails, web forums, chat rooms, instant messaging, Twitter, wiki pages, blogs, social media websites, virtual webpages, online courseware, and video blogs. Activity can be tracked from digital signatures once an individual posts, links, or replies online, thereby directly or indirectly connecting to another online individual. Social interactions are significant because they give researchers support, influence, exchange, and information sharing as well as shared knowledge construction. Name networks can be an alternative to collecting survey data, which can be time consuming and expensive in regards to public discourse. Twitter has become a convenient medium/alternative to posting information; it only takes one button to re-tweet a post or blog that can be seen in the user's network (Ignacio, 2012). Tweets about GMOs and how those tweets are shared may be a useful tool in examining the strength of support or opposition via

social networking.

Social networking sites allow individuals to: 1) construct a public profile in a bounded system; 2) articulate a list of users that share common interests; and 3) view and arrange their list of connections within the system (Boyd & Ellison, 2007). It allows individuals to share a connection and meet others, and gives an opportunity to create visible profiles that their online friends can see. Individuals who use social media sites are filling their need for a "third place" to go to occupy their time outside of work and home (Gruzd et al., 2011a). This online environment replaces or supplements coffee shops, bookstores or pubs, etc. Internet communities are attractive to some individuals. They can be support groups to help them deal with difficult situations; they can share leisure activities, provide connections to friends, loved ones, relatives, or can help in creating new relationships. The Internet has become ubiquitous.

Within the broader concept of the Internet, Twitter has millions of users and is constantly changing. It is publicly available and tweets can be easily accessed. Tweets can be spread and retweeted to other users very quickly, because tweets are posted in real time (Gruzd, Doiron, & Mai, 2011a). Twitter has been referred to as an "imagined community" based on lack of face-to-face interaction (Gruzd, Wellman, & Takheyev, 2011b). Twitter users do not necessarily know their audience, but they do have some awareness that users are present within their proximity/connection web of sources. Twitter allows a user to follow other tweeps (Twitter users), telling the world what they are doing, thereby creating a message to their own audience.

Social media, as compared to traditional online media, give users the ability to create, share and use material (Parker, Saundage, & Lee, 2011). Those examining online social interactions can explore and examine the conversations, and see how social structures are formed from groups, communities, organizations, and individuals themselves. Social media sites have become an important part of a scholar's professional life; social networking builds communication and work relationships between and among colleagues (Gruzd & Staves, 2011). Academics use sites such as LinkedIn to create professional contacts and use social media for research and communication of ideas. Scholars have relied on using social media sites, including wikis, blogs, and microblogging sites, for interaction and communication with colleagues and announcing information.

Quantitative analysis has been used in social media research by simply asking online users straightforward yes or no survey questions or through specific tools (Parker et al., 2011). Quantitative Content Analysis (QuantCA) includes statistical analysis along with hypothesis testing to derive conclusions. Unfortunately, QuantCA disregards an individual's thoughts, feelings, intentions, and attitudes, which provide the researcher with a deeper understanding of a topic or issue being discussed online. Social media discourse can be examined using grounded theory, discourse analysis, as well as QuantCA, thereby drawing on themes and patterns to arrive at conclusions that either support or refute an argument.

This extends social media research into qualitative research investigating the social structure and behavior, centering analysis on verbal and visual cues (thematic or

conceptual) to gather information from the individual's knowledge and viewpoints (Masue, Swai, & Anasel, 2013). This gives a descriptive picture of a particular question, such as order, structure and broad patterns and gives researchers a deeper understanding of historical, social, political and cultural influences affects society and their decision making that takes place. Qualitative researchers are starting to realize the usefulness of web archiving when analyzing social media and consumer behavior (Lomborg, 2012). Web archives allow researchers to collect data and discover information about places, objects, or groups of behavior over a period of time. They can make connections related to interactions between groups and individuals, and track behavior through Internet use, adopting methods that are not disruptive to users while data are collected. By incorporating social media research with web archives, communication patterns and social activity, researchers may answer questions related to how networks are formed.

Further evaluation of social media data allows researchers to build models of group behavior and individuals (DiGrazia, McKelvey, Bollen, & Rojas, 2013). One can extrapolate that social media provides researchers with a population sample that is not biased and is possibly a predictor of behavior offline. Interactions within an online group can be analyzed to identify users' priorities and interests. Node discovery takes place when names and email addresses are identified; Tie discovery determines whether or not there are social connections between people (Gruzd, 2009a). Social networks can be automated to collect the number of exchanges between individuals – the higher number of messages between users identifies a stronger

Tie. Tie Strength is correlated with a weight assigned to a Tie – increased weight determines a stronger relationship. Researchers count the number of overlapping words and phrases to find similarities in user profiles, or use a co-occurrence metric to calculate the number of times names occur in proximity within text.

Models can be built by collecting opinions of individuals or groups, learning behavior and then predicting future trends (real world outcomes) that may take place (Asur & Huberman, 2010). For example, Twitter has been used to predict outcomes of book and movie sales upon being released, by examining sentiment included in tweets posted. Social media research can be used as a tool to examine themes underlying sentiment surrounding the GMO debate. It is possible to predict the future origins of the debate by examining Tie strength and sentiment analysis. Society will continually need to make decisions regarding biotechnology research and new products entering the food system.

Methods
Netlytic

This research relies heavily on the developments at the Social Media Lab (SML) located at Dalhousie University in Halifax, Nova Scotia. The researchers of the SML have created a tool called Netlytic (http://netlytic.org). The Dalhousie team developed Netlytic to collect and analyze large text volumes from social media networks and websites such as Twitter to further examine text, name networks and chain networks. Networks are Ties that have been created from two individuals who are having a conversation and the strength of the Tie depends on the num-

ber of messages exchanged (Haythornthwaite, 2011).

Netlytic uses text-based analysis to present the information with social media networks; the most commonly used is Twitter analysis. The researcher uses a search term to collect posts for a period of time. Nodes, Ties, and Strength are used to determine how individuals interact with each other (Gruzd, 2009b). Ties are created when two people start a conversation. As the number of messages increases, the Tie between them becomes stronger. Nodes are the online users who have posted in relation to the selected search term. Nodes and Ties are used together to determine if there is a relationship between the two people.

Using Netlytic, a Twitter account was linked with the program to collect data in real time. Twitter was used quite extensively throughout this project because information is easily obtained and tweets are available to the general public. Each dataset was collected for a period of six to 12 days between November 2013 and February 2014. The initial search terms were general words related to GMOs; subsequently more detailed search terms were used. The initial searches were for GMO, GM, Genetically Modified, and Genetically; some produced conflicting results (GM is also an automobile company for example). The data gathered was evaluated for the number of interactions between Twitter users; traffic was analyzed to find which posting days were most popular to suggest if users were amateur or professional Twitter users. Those posting more material while they are not working may be considered amateur or not professional Twitter users (Gruzd, Black, Thi Ngoc, Yen Le, & Amos, 2012).

Netlytic also gives the researcher an indication of

any significant interactions taking place by mapping them into a name network where users may mention another user. This identifies similarities in posting material content by using Nodes and Ties between each user. Chain networks show which users are having a conversation together or mention a particular user when posting material on a certain topic. Each user that posts something within a search term is represented as a Node; the line connecting two Nodes together shows there is a connection between two users called a Tie. As more Ties are created, the connections and clusters form to create an online community (Gruzd et al., 2012).

One limitation of Netlytic is that although negative sentiment may be present within datasets on a certain topic, it does not give a numerical percentage of sentiment or feeling for content and material posted. Social Mention, a social media analysis tool, was also used throughout this research project to explain sentiment analysis (www.socialmention.com). By utilizing Social Mention and Netlytic together, sentiment was easier to analyze.

Social Mention

Social Mention is a search platform that brings together content from a variety of social media web sites and tools. These sites include such things as Facebook, YouTube, and Google+; more than 80 sites are included. This provides a broader base from which we can drill down into the Netlytic analysis. The dimensions of analysis are strength, sentiment, passion, and reach (terms defined below). In general, Social Mention is designed for corporate use to assess the attitude of the Internet toward a brand or product but it can provide useful directions for academic research. When a search term is entered, data retrieved

displays keywords, popular discussions, news stories, sentiment, and top users. Sentiment gives the researcher a numerical ratio score of posts that are positive to negative. This allows for the researcher to draw conclusions about how a particular topic is being discussed through social media. For this research, general search terms for GMOs were entered and this gave the researcher insight on the general opinion for a certain issue or topic.

Findings
Social Mention

Social Mention searches were used throughout data collection, using search terms similar to the Netlytic search terms. Table 1 is an example of a sentiment numerical analysis that was retrieved from Social Mention using the search term GMOs.

The sentiment ratio was recorded at 6:1 as positive posts compared to negative posts in this example. This means there were six times as many positive posts as for each one negative post. Passion is the probability that the term will be talked about repeatedly by different individuals; the example showed a passion level of 18%. Reach is a measure of influence, which is calculated from the number of different authors divided by the number of total posts, which totals 19% for this search term.

Each mention means the topic search is being referenced each time in the results. On average, every two minutes non-GMOs were being referenced by someone using social media. From this search term 95 different authors posted non-GMO related content. A retweet is when an author or online user decides to forward the content onto for others to see and read. In this result no online content

was reposted or forwarded onto another place or another online user.

Table 1

Social Mention for Search Term GMOs

Value	Result
Non-GMO sentiment search term - February 2014	4%
Strength	6:1
Sentiment	18%
Passion	19%
Reach	2 minutes average per mention
Recency	last mention 1 minute ago
Breadth	95 unique authors
Frequency	0 retweets
Sentiment	Those posts that are positive to negative

Netlytic

Once data were collected, Netlytic facilitated the researcher's analysis of search terms related to GMOs to explore how individuals interact with each other to determine if geography influences conversation around GMOs, and to identify any positive sentiment toward GMOs. Several different behaviors were noted during the data collection period. One of the more significant behaviors was that Twitter users seemed to post more content during time off, for example holidays, or close to the end of the workweek (Thursday and Friday). These results (shown in Figures 1

& 2) could indicate that these users are not professional social media users, meaning that they do not use Twitter for their work occupations or in their professional lives.

The lowest number of tweets occurred on Wednesday, Dec. 25 and Saturday Dec. 28, 2013. This could be due to it being the holiday season. A second example of posts over time is shown in Figure 2; the researcher used the general search term "GMO." Although this dataset was tracked during the holiday week of Dec. 22 to 27, interactions and conversations on Twitter were still occurring. On Friday, Dec. 27, 2013, the highest number of tweets was posted (8,274). On Christmas Day roughly 3,450 tweets were posted over 24 hours.

Even though Christmas Day is a holiday for many individuals when time is spent with loved ones, Figure 2 seems to indicate that Twitter users still found time to post content and get their message across about negative sentiment surrounding GMOs. This could be because Twitter users took the opportunity to promote the fight against GMOs by encouraging others not to purchase GMOs during the holiday season, encouraging instead free range turkeys or organic vegetables for holiday meals.

A few patterns are noted in Figure 3 using the search term "GM," genetically modified. Data were collected for a period of ten days from Jan. 14 to 24, 2014. The distribution of posts had high and low posting days: Thursday Jan.16 had 357 tweets; Saturday, Jan. 18 had 172 posts; Monday, Jan. 21 tweets increased to 245; and Wednesday, Jan. 23 showed a dramatic increase to 435 tweets.

During the time of data collection, three datasets included "Monsanto" search terms. Monsanto is an agricul-
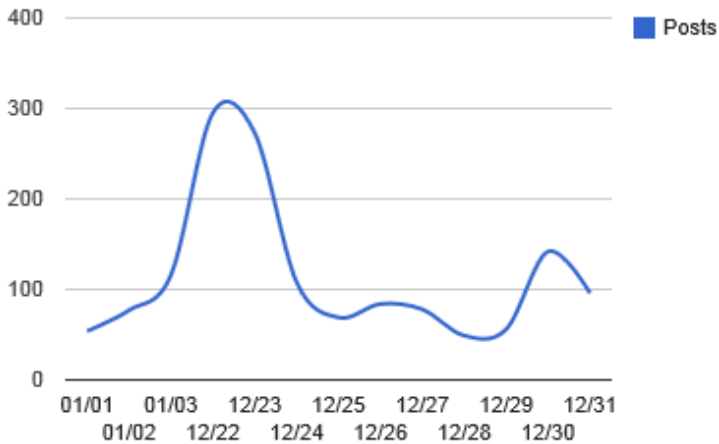
Figure 1. GMO labelling dataset-posts over time

ture-based company. All datasets showed negative senti-
ment toward the organization and also promoted action
such as encouraging other users to participate in protests,
sign petitions, and vote for different campaigns. Monsanto
has received negative press regarding lawsuits and what
some individuals consider vindictive business negotiations
between companies and producers. Marches were held to
boycott this organization. Communities and individuals
came together to create groups to promote petitions,
marches and protests. Examples of original tweets from
Monsanto datasets are included below from November,
December and January datasets.

> 2013-11-16 13:39:40: Monsanto wants a bill to
> expedite a #TPP trade deal protecting GMOs. Tell Con-
> gress to vote NO on Fast Track. http://t.co/klZ1CeU6wt
> (Original tweet from Monsanto November dataset-Nov
> 2013)
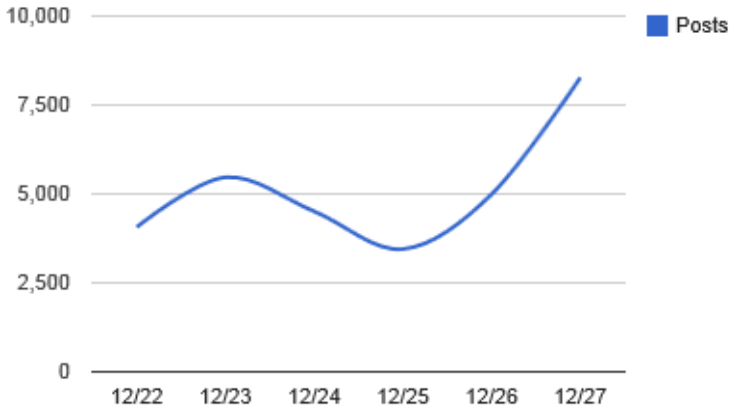
Figure 2. Posts over time-GMO-December dataset

2013-12-03 06:15:49: stop TPP Fast Track: the global Monsanto Protection Act on steroids! http://t.co/YO85ctmRTJ @food_democracy Please RT #LabelGMOs #stopTPP (Original tweet from Monsanto December dataset-Dec 2013)

2014-01-27 19:46:10: Protect Monarch Butterflies from Monsanto! PLEASE SIGN!! - Care2 News Network http://t.co/Znf7lScIY3 (Original tweet from different Monsanto dataset-Jan 2014)

2014-01-28 14:31:48: Fox Stl: Protesters march at Monsanto shareholder meeting over GMO labeling http://t.co/aOiMAR5vHi (Original Tweet from different Monsanto dataset-Jan 2014)

The Monsanto search term has created action and conversation among individuals and groups of individuals; chain and name networks were also analyzed in all data-
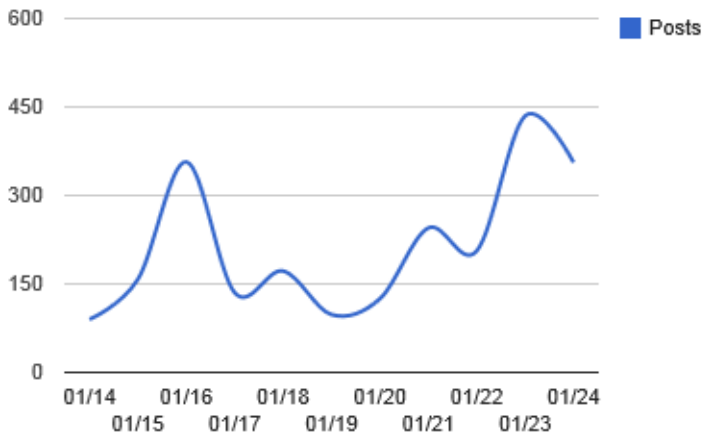
Figure 3. Posts over time-GM dataset

sets while using Netlytic. The chain and name networks for Monsanto datasets were very strong and created significant conversation between Twitter users. Both name and chain networks form connections between users — this is created in the form of Nodes (dots) and Ties connecting two Nodes (lines connecting two dots). Each Node is a different color to show each individual user; the Tie is the same color as the Node to show each connection that is formed. In a chain network, if Nodes and Ties are connected, two or more individual users are communicating between one another. When a Node becomes larger in size this means the user is becoming more connected within a network and the number of interactions and replies will also increase.

Figure 4 shows multiple Nodes, which represent individual Twitter users with several conversations taking place, as chain networks measure who is replying to whom
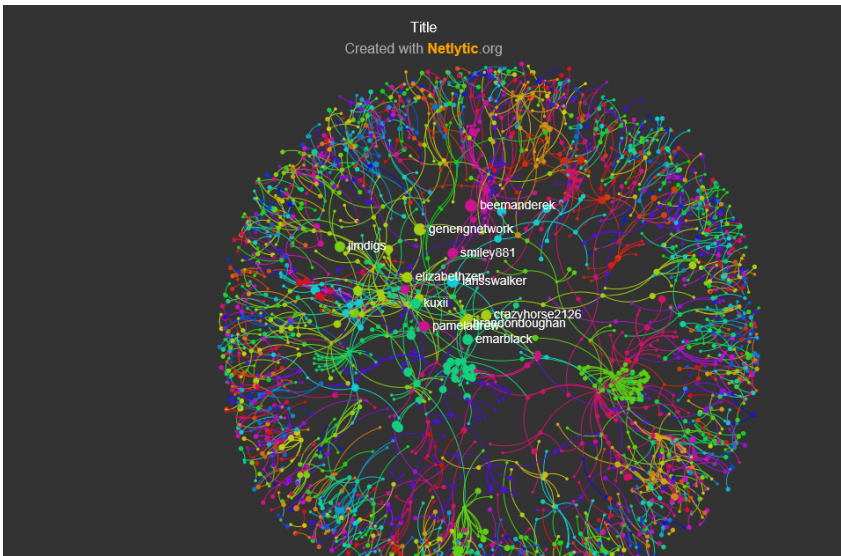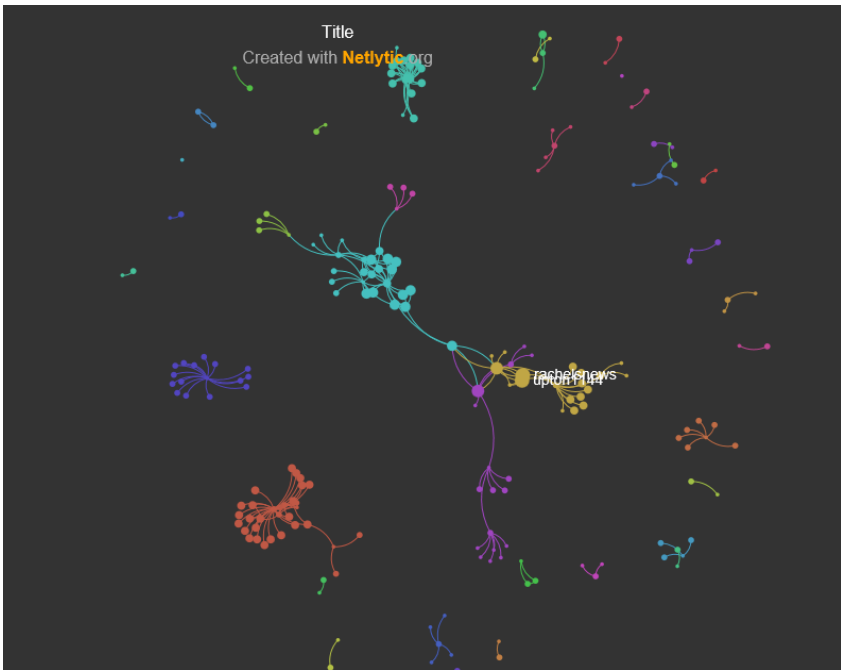
Figure 4. Chain network-Monsanto dataset – Jan 2014

in the online community of Twitter. The usernames are also displayed within the network to differentiate the stronger Nodes (users with more conversations).

Name networks were also evaluated in all Monsanto datasets with an example shown in Figure 5. Name networks represent which users are mentioned or acknowledged in conversation. The negative sentiment surrounding Monsanto has brought online users together around a common interest. In Figure 5, the interactions between individual users were closely knit, creating a wide array of connections. Thousands of Twitter users are mentioned in the name network depicted in Figure 5, attracted by the common negative sentiment toward Monsanto. The negative sentiment has brought these individuals together to form groups, with a goal of boycotting Monsanto and encouraging others by not supporting large organizations that are heavily involved with GMOs.

Figure 5. Name network for Monsanto dataset-Jan 2014

      Between Figure 4 and Figure 5 a large difference is noted in the number of users mentioned and connected. In Figure 4, the chain network showed hundreds of connected users and the name network showed thousands of mentioned users. The name network will have more individuals recognized if there is a common conversational theme. If a conversation involves several individuals who all have an interest in a topic and the users post content similar to others, more individuals are recognized and tagged/mentioned in the online post. The chain network does not pick up user names referenced when a new post about a topic is created; it does find connections when new users and new topics are created (Gruzd, 2009b).

      Datasets were collected in an attempt to find sentiment according to geography. For this research, search terms for "GMO Europe" and "GMO America" were used for comparison purposes. These two terms were chosen due to the contrasting viewpoints/attitudes between the

Figure 6. Name network – GMO Europe – Jan 2014

two continents regarding the marketing and research of GMOs. In terms of chain networks for those terms, a small amount of conversation occurred but nothing significant was present to make any conclusions about individual online behavior. In Figure 6, a few Twitter users were recognized. Some Nodes are larger, but not many networks have formed to create a close knit community of online users.

The same result was observed in a GMO America dataset: very few, very small chain networks. The name networks seemed to have more users mentioned than would be accounted for through replies to tweets. A few larger Nodes were identified in Figure 7, as compared to the GMO Europe name network. The users with the larger Nodes were mentioned more than users with smaller

Nodes. Once data were collected, it was noted that all sentiment was negative for GMOs. Original tweets indicated negative sentiment involving GMO-related search terms. Tweets relating to Monsanto were also found, the majority to blame the organization for negatively impacting producers financially from lawsuits causing some individuals to stop farming.

Below are a few examples of original tweets from the Monsanto and GM datasets:

2014-01-15 02:39:23: @CinderellaMan2 @Hariri_1987 poisoning your food by forcing GM agriculture and Monsanto products, supporting (indirectly) Assad regime (GM dataset)

2014-01-15 18:32:53: #Monsanto's GM "suicide seeds: It will increase poverty in farming community n deflat real cost of food. Future generations will suffer.(GM dataset)

2014-01-19 01:43:18: @MonsantoEurope @GM_JUDGE Civil society condemns #M2014-01-07 08:57:16: RT @Accradotalt: We can't pass a law @JDMahama that hands over our food production to companies like MONSANTO who have destroyed lives with… Monsanto's orchestrated invasion of toxic #GMO genetic contamination into our food supply (Monsanto dataset)

Discussion

Monsanto search related terms created significant reactions from online users promoting other individuals to not support large multinational corporations that are involved with research and marketing of GMOs. These online users would encourage others with the same atti-
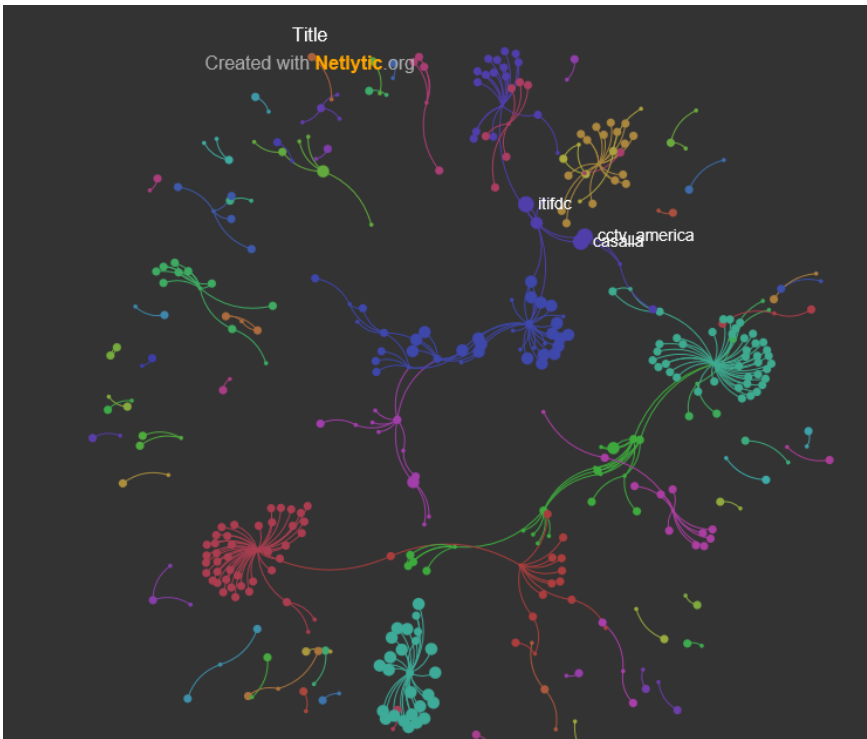
Figure 7. Name network – GMO America dataset – Feb 2014

tudes to participate in protests, petitions and marches in an attempt to take down the multinational corporation. Large name and chain networks are significant because each Node and Tie represents a connection (Gruzd et al., 2012). As the Nodes within Twitter become larger in size and increase in number, each who is acknowledged often by others and has more replies from other Twitter users becomes more connected (Gruzd et al., 2012). All Monsanto datasets are examples of large chain and name networks.

A 2013 survey of 100 Twitter users tracking Twitter data using a program called SentiStrength to measure sentiment, found that there was a strong correlation be-

tween the number of followers a user had and the positive as opposed to negative content posted. Approximately half the surveyed users reported that when composing tweets, they tended to edit them to be more appealing to their Twitter audience (Gruzd, 2013). Twitter users may have a wide range of followers, which may include family and friends, expert contacts, and individuals they do not know. Not surprisingly, more active Twitter users tended to have more followers.

It is possible for users within a network to be present, but not as connected as other individuals when it comes to posting and replying to tweets (Gruzd & Haythornthwaite, 2013). These individuals may be observing and gathering information about conversations that are created, and could potential become active Twitter users in the future. Users who stand out within a network generally are individuals who contribute to online conversations on a regular basis and are mentioned by others.

In the GMO Europe and GMO America search results, name networks were very small with few users mentioned and few replies between users, although both search terms had large text volumes. GMO America had 6,615 terms and GMO Europe had 3,081 terms found within Netlytic. When comparing this to research done in 2013 by Gruzd et al., it is possible the GMO Twitter users censored what they posted in order to appeal to their followers, or perhaps an event had not taken place to trigger users connecting to each other. When Twitter users censor and edit the content they post, retweeting may depend on the popularity of the user.

Thursdays and Fridays as well as holidays seemed to show increased tweets posted. This could suggest that

these users are not professional Twitter users. Depending on the content posted, if posting increases during time off or away from work, it could be interpreted that the user's followers are also non-professionals. Non-professional users post and reply to content they feel passionate about or to which they feel they can relate.

Conclusion

The GMO debate has been a controversial topic since the 1970s. This debate has created tension and trade wars between various countries and economic associations, including the EU and the USA. This could be due to differences in culture expressed in regulation. This debate is significant because it will have future effects on the agriculture industry and those involved within the industry. Since the popularization of social media in the late 2000s, this platform has become a locus modal of anti-GMO discussion. Although the broad analysis of Social Mention shows some supportive discussion of GMOs, the narrow analysis of the more egalitarian social media tool Twitter, demonstrates an almost unanimous negative attitude toward GMOs. This leads to a conclusion that Twitter users do not represent the broader difference in opinion found in other media.

Netlytic allowed for various aspects of GMO debate to be further analyzed for the themes surrounding the issue. In all datasets sentiment was negative; nothing was posted to promote the research or the marketing of GMOs. It is possible that those individuals who feel positive toward GMOs may choose not to participate in social media websites and may seek other sources to demonstrate GMOs as an innovative opportunity rather than a poten-

tial health hazard. Those individuals who oppose strongly to GMOs will continue to be active with social media websites such as Twitter because tweets are publicly available and information is spread quickly.

Social Network analysis allows researchers to further examine how online relationships are created. Organizations such as Monsanto that are heavily involved with GM research and market new products have become dynamic online topics. Social media have been demonstrated in research to produce real world effects. Cinematic releases which receive negative social media discussion have lower box office results. Governments and corporations have reacted time and time again to negative social media sentiment to change policies, procedures and products. The Netlytic research demonstrates clear anti-GMO sentiment in the Twitterverse. The Social Mention analysis agrees from the broader spectrum of Internet communities. Smart agricultural producers and suppliers should take notice of this and move toward non-GMO options.

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