EXPLORING THE IMPACT OF SOCIAL MEDIA ON SUPPLY CHAIN PERFORMANCE: A SENTIMENT ANALYSIS

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ABSTRACT

Drawing on social capital theory, this study uses a sentiment analysis approach to investigate the impact of social media usage by supply chain partners on supply chain performance. The findings suggest that higher usage of social media by supply chain partners result in better supply chain performance. The insight gained from this paper not only can help academicians understand how social media usage of supply chain partners can influence the outcome of a supply chain, but also can guide supply chain managers to adjust their supply chain strategies to have a sustainable competitive advantage.

Key words: Social media, Social capital, Supply chain performance, sentiment analysis

INTRODUCTION

Three major factors differentiate social media from the traditional media: magnitude of usage/reach, ease of use, and pace of transmission of information (Luo, Zhang, & Duan, 2013; Harris, Snider, & Mueller, 2013; Gallaugher & Ransbotham, 2010). With today’s consumers often relying on social media to conduct their information search for various decision making processes, social media has magnified the power of online communication by facilitating multi-way, real-time, convenient information sharing among a large number of companies, producers, consumers, and users with relative ease. Decision makers use social media for gathering information or opinions about products and services (Ramos & Young, 2009). Consumers consider the product and service related information sourced from social media to be more reliable than the corporate communication about those product and service through the traditional media (Mangold & Faulds, 2009).

Social media usage has experienced an enormous growth in recent years: nearly 500 million Facebook users in 2010; 50 million tweets in 2010; and average time spent on social networking sites rose by 82% in 2009 (HBR report, 2010). A recent review of social media usage estimated time taken for a message to be disseminated to 50 million people: 38 years for radio; 13 years for television; 4 years for the internet; 3 years for the iPod; and less than 3 months for Facebook (Harris, Snider, & Mueller, 2013). Social media is often viewed as a broad interdisciplinary concept having applications areas such as marketing (identifying new marketing channels, and increasing customer loyalty), supply chain management (improving product-service quality,
delivery, flexibility etc.), and information systems (gathering new sources of business intelligence) (Madison, 2012). Social media can also be used for information-sharing, relationship-building, and improving communication, coordination, and performance (Madison, 2012). Best Buy and Dell have successfully used social media to reduce costs, motivate employees, improve internal communications, and stimulate innovation (Shipilov, 2012). However, not much literature is found on exploring empirically how social media affects the communication and coordination among organizations (Aral, Dellarocas, & Godes, 2013; Dou, Niculescu, & Wu, 2013; Miller & Tucker, 2013; Madison, 2012). This issue is very relevant to the field of supply chain management where communication and coordination among partners is a key success factor in the supply chain performance.

Social media offers firms an opportunity to monitor and analyze consumer conversations and derive insights from that information to improve their performance. However, as HBR report (2010) indicated, three out of four companies were unaware of where their most valuable customers were talking about them, about one third of companies did not measure effectiveness of social media, and less than one fourth were using social media analytic tools. Less than one tenth of companies were able to integrate social media into their marketing activities and overall operations. This could be because the use of social media in organizational studies is a recent phenomenon and there is no established method to gauge its effectiveness, and integrate and align social media activities into their strategies to find an impact on company’s bottom line (HBR Report, 2010). Many companies started investing too much in social media and accumulated lots of uninstalled software in the process leading to wastage of resources (Baker 2009). Furthermore, Social media data are vast, noisy, distributed, unstructured, and dynamic in nature and collecting, mining, and deriving meaningful information from the huge available social media data remain a challenge (Cao, Wan, & Yiu, forthcoming; Gundecha and Liu, 2012; HBR report, 2010). This leaves a huge opportunity for companies to explore the untapped potential of social media in business activities. To the best of our knowledge, there is very little social media research in the supply chain management domain (Casemore, 2012; O’Leary (2011). Social media provides opportunity for building strong social capital through participation via online networks. This has huge potential of providing intelligence for improving supply chain performance. At the same time it is extremely important to justify the significant investments in social media, and to assess empirically social media’s financial value (Deans, 2011). Social media content is “a mixture of fact and opinion, impression and sentiment, founded and unfounded tidbits, experiences, and even rumor” (Blackshaw & Nazzaro, 2006, p. 4). In this study, we explore the relationship between social media and supply chain performance by empirically testing whether social media usage by supply chain partners in terms of frequency, volume, polarity, and content has significant impact on supply chain performance. Furthermore, most of the studies on social media are cross sectional and based on self-reported data which limits the objectivity of this stream of research (e.g. Grezel and Yoo, 2008). In this study, we analyze companies’ social media comments (data) on SCM collected from various social media outlet applying panel data analysis to explore our research question.

By examining social media usage by supply chain partners from various industries, we provide empirical evidence of the impact of social media use on supply chain performance. The findings
suggest that higher usage of social media by partners in supply chain result in better supply chain performance.

This study provides both theoretical and managerial contributions. Although previous studies have analyzed various supply chain functions through social capital theoretical perspective, ours is one of the first attempts exploring the impact of social media on supply chain performance through social capital angle. Additionally, as our findings suggest, by making social networking an integral of the company's interactions with employees and suppliers, managers can better manage the performance of the supply chain members and the supply chain performance as a whole. Our study provides managerial implications. Supply chain managers should consider the advantages of using social media networking to identify and track the relevant information to come up with appropriate solutions to improve the supply chain performance and to mitigate several issues such as supplier risk.

The remainder of the paper is organized as follows. In the following section, we review the literature on social media and supply chain. We then use social capital theory as the underpinning theoretical base to develop our research model and hypotheses. We describe our research methodology in the next section. The contributions and limitations of the study are included in the final section along with suggestions for future research.

**LITERATURE REVIEW**

**Social media**

Social media is a consumer-generated media in which a plethora of new sources of online information are created, initiated, circulated and used by consumers for educating each other about products, brands, services, personalities, and issues (Mangold & Faulds, 2009). Social media, in a broad sense, refers to a conversational, distributed mode of content creation, diffusion, and communication among groups. In a more specific way, Social Media can be defined as a group of internet-based applications built on Web 2.0 that allow the creation and exchange of user generated content (Kaplan & Haenlein, 2010). Social media encompasses a wide range of online, word-of-mouth forums such as blogs, chat rooms, product or service ratings websites, forums, and social networking websites.

By offering a whole new set of possibilities for and challenges before the organizations, social media have revolutionized almost all aspects of an organization's functions (Aral, Dellarocas, & Godes, 2013). For instance, besides offering market intelligence on consumer behavior and preferences (Trusov, Bodapati, & Bucklin, 2010), social media has played an important role in demand prediction (e.g. Bollen, Mao, & Zeng, 2011; Asur & Huberman 2010), crowd source novel ideas (Di Gangi & Wasko 2009). As Benbya & Van Alstyne (2010) and Zwass (2010) report, social media is capable of transforming the way of exchange of knowledge and expertise facilitating faster innovation and new product development. Furthermore, in the business context, social media is changing the way relationships are developed and maintained with geographically disperse talent (Archak, 2010). Social media has been found to be positively associated with sales processes and relationship sales performance (Rodriguez, Peterson, & Krishnan, 2012). In essence, all these studies demonstrate the potential uses and applications of
social media and its powerful influence on individual and societal performance highlighting the importance of study of the interaction of social media and an existing process or phenomenon. This opens up a huge opportunity of social media application in supply chain which has not reaped much of its potential benefits.

**Supply chain management**

Supply chain management refers to all types of planning and management of activities such as; sourcing, procurement, and logistics across the chain. It focuses on coordination and collaboration with the chain partners including: suppliers, intermediaries, and customers (Council of Supply Chain Management Professionals, 2012). In a supply chain context, managing social relations among the members can be crucial for sharing knowledge and creating value leading to a competitive advantage. Previous research has studied social relations in terms of social capital (Adler & Kwon, 2002), social networks (Granovetter, 1985), and relational embeddedness (Nahapiet & Ghoshal, 1998) and their impacts on creating value.

Supply chains are complex socio-technical systems where both technical and social factors play important roles. The technical factors are system dominated and deal with technological and supply chain structural issues such as logistics, information systems, and supply chain performance whereas social factors are human focused and deal with social relationships among various supply chain partners (Burgess, Singh, & Koroglu, 2006). While the technical factors are dealt with by formal mechanisms set up by organizations, the social factors such as reciprocity and mutual trust related to the social system of the supply chain. Social factors are as important as the technical factors in the context of supply chains (Burgess & Singh, 2012). Historically, the supply chain has emphasized on “hard” topics such as supply chain modeling and focused on keeping up with the latest technology. Snub & Stonebraker, (2009) argue that not enough attention has been given on analysis of “soft” human resource activities and organization variables, and their alignment with supply chain strategies and success. These soft constructs of supply chain management are “more vulnerable to misalignment, because they are more closely embedded in the socio-cultural context of the recipient culture” (Brannen, 2004, p. 597). Although many researchers stressed on the development of trust and collaboration within supply chains, the social aspects of SCM has not been investigated in depth (Burgess, Singh, & Koroglu, 2006). Moreover, with opportunities for improvement in supply chain performance via break through technical improvements on a decline, the focus on enhancing supply chain performance by improving relationships among supply chain partners is on the rise (Burgess & Singh, 2012). Therefore, exploring the relationship between the social media and various functions of supply chain is a potential area of research and study of impact of social media on supply chain performance in particular may unearth some interesting benefits of social media usage in supply chain context.

**Social media and Supply chain**

Noting that social media applications in supply chains lags behind other operational functions, Markova & Petkovska-Mirčevska (2013) describe supply chain research with reference to some concepts of social media such as social profiles, social applications, brand outposts and communities, and the social ecosystem. Among these, social ecosystem provides opportunity for
understanding and benefitting from the behaviors associated with collaborative social interaction within a network. They cite the work of Casemore (2012) to mention five key benefits of social media usage in supply chain: creating knowledge networks, balancing speed and contemplation, portable information vaults, replacing collaboration with community, and building a platform for innovation.

Social media has been largely used by business to customer (B2C) for brand promotion and marketing products (Markova & Petkovska-Mirčevska, 2013) and business to business (B2B) context (Rodriguez, Peterson, & Krishnan, 2012) for improving sales performance. Literature available related to social media usage in supply chain is not exhaustive. O’Leary (2011) investigated the impact of social media capabilities on the supply chain. Specifically, he examined the use of social media to capture the impact on supply chain events and developed a context for those events. He also tried to analyze the use of social media in the supply chain to build relationships among supply-chain participants. Our study is different from previous literature because of our supply chain performance focus.

Social issues such as product and human safety, welfare, reputation can potentially pose significant operational risks on the supply chain affecting its reliability and performance (Marcus & Goodman, 1991; Maloni & Brown, 2006; Roth, Tsay, Pullman, & Gray, 2008; Fombrun, Gardberg, & Barnett, 2000). Social factors such as relationships that the supply chain partners develop overtime through their formal and informal interactions are important in supply chain context. Burgess & Singh (2012) provide evidence of a large organization achieving significant improvement in its operating performance by effective use of its social system of its key supply chain. They find that instead of focusing excessively on formal governance and IT systems, firms can improve their operating performance in terms of cost and time frames by working through the existing social systems. All these reports highlight the importance of the social system, social issues, and social factors in a supply chain which have potentially significant impact on supply chain performance.

To summarize, social media presents a huge opportunity for improvement in performance of various business functions in companies. Culnan, McHugh, & Zubillaga (2010) highlight three factors responsible for firms gaining value from the social media usage: mindful adoption, community building, and absorptive capacity. Analyses of these three factors can help the firms develop appropriate social media strategies. In the same vein, understanding the relationship between social media usage and its impact on various supply chain functions is very important for designing appropriate supply chain systems and strategies. Although the extant literature presents some sporadic evidence of successful application of social media in supply chain context, there is a lack of in-depth analysis of how social media actually influences supply chain management process and its outcome. This study endeavors to investigate whether social media usage of various supply chain partners has an impact on supply chain performance.

**THEORETICAL BACKGROUND AND HYPOTHESES**

Social capital is the collective useful actual or potential relational resources embedded in personal ties of individuals in social organizations (Bourdieu, 1985; Adler & Kwon, 2002). Supply chain is an organization in itself as it has almost all the features of an organization such
as an overall vision and shared mission. The concept of social capital can very well be applied to supply chain and social capital of supply chain members or partners can be described as the network each member in the chain has and the potential and strength of that link or tie. Potential resource in this case can be seen as the knowledge exchanged or gained through interaction with specific members or partners.

Social capital of supply chain partners can influence supply chain performance and also can be a sustainable source of competitive advantage (Min, Kim, & Chen, 2008). Social capital in the supply chain play a key role in developing and managing buyer-supplier relationships (Bernardes, 2010) that can be a main source of value creation in a supply chain (Lawson, Tyler, & Cousins, 2008). Krause, Handfield, & Tyler (2007) present evidence of how three forms of social capital: structural, relational, and cognitive in a supply chain can bring about a partner’s performance improvements. Wei & Ju (2010) report that a partner’s social capital can enhance knowledge creation in supply chains. Yim & Leem (2013) demonstrate a case where supply chain social capital affects supply chain integration that significantly influences firm performance. These reports indicate significance of social capital on various aspects of supply chain performance. Because the social media helps a member create a profile within a network, articulate a list of other users for sharing a connection, and maintain that link or tie (Ellison, 2007), we can argue that social capital of a supply chain member can be increased by use of social media through strengthening of existing relationships (Shah, Nojin Kwak, & Lance, 2001), improving weak ties (Kenski & Stroud, 2006), as well as enabling collective action (Valenzuela, Park, & Kee, 2009). At the same time, better collaboration and communication resulting from the member ties or social capital of the member can improve the supply chain performance.

Recently, there has been a growing interest in understanding how WOM, particularly online WOM or eWOM (which is a form of social media), impacts sales, diffusion, and other business performance measures (e.g. Chevalier & Mayzlin, 2006; Godes & Mayzlin, 2004; Trusov, Bucklin & Pauwels, 2009; Villanueva, Yoo & Hanssens, 2008). For example, Godes & Mayzlin (2004) examine how online discussion forum activity affects television show ratings, Chevalier & Mayzlin (2006) show that user-generated online book reviews influence book sales, and Trusov, Bucklin, & Pauwels (2009) examine how referrals (invitations) to join an online social network affect website membership growth. Consistent with the findings on how WOM impacts performance, this literature generally finds social media can affect a product’s success in the marketplace. There are also reports of social media usage leading to greater product innovation and enhanced firm performance. Di Gangi & Wasko (2009) and Gallaugher & Ransbotham (2010) present evidence of successful use of social media by firms such as Dell and Starbucks for developing online communities to solicit and evaluate ideas from customers for product development. Luo, Zhang, & Duan (2013) argue that social media may be used to monitor and estimate customer feedback and brand buzz leading to improved firm performance. Rodriguez, Peterson, & Krishnan (2012) report a positive relationship between social media usage and sales processes and performance. As such, we posit hypothesis 1:

H1: The more social media is used by supply chain members, the better the supply chain performance is.
In this study, we examine two aspects of the usage of social media (e.g. frequency and volume) by the supply chain members.

WOM is a social phenomenon and degree of strength of social relations can influence WOM behavior (Brown & Reingen, 1987). In a network, social relations of a member with other members could range from a strong primary such as close contacts to weak secondary such as less contacted acquaintances (Granovetter, 1973). The members who have frequent interactions among themselves are found to have strong ties or relations with each other as they are more likely available to each other for information and resource sharing (Reingen, Foster, Brown, & Seidman, 1984). Also people tend to interact with other people who are similar to themselves (Laumann, 1966) and the stronger the tie through frequent interactions among the individuals, the more similar they are likely to be (Granovetter, 1973). The greater frequency of social contact among members with strong-ties can lead to more and better information flow among the members (Brown & Reingen, 1987). Peng & Luo (2000) report interpersonal ties of managers and top executives of firms improving firm performance. We expect a similar phenomenon in supply chain context in that stronger ties resulting from frequent interactions among supply chain members will lead to better supply chain performance. This is the basis of hypothesis H1a.

H1a: The higher is the frequency of social media usage by supply chain members, the better the supply chain performance is.

The volume of social media usage (eWOM) can be considered to be an indicator of the intensity of the eWOM effect (Duan, Gu, & Whinston, 2008). The product and firm performance have been reported to be positively correlated with the volume of usage of social media. Duan et al (2008) found the weekly movie box office sales to be significantly influenced by the volume of online posting, Ample amount of support for a positive relationship between the volume of eWOM and sales performance of firms can be found elsewhere (e.g. Liu, 2006; Godes & Mayzlin, 2004; McFadden & Train, 1996). Therefore, we hypothesize,

H1b: The higher is the volume of social media usage by supply chain members, the better the supply chain performance is.

A WOM can influence the purchase practice of a product or service in general and can have a significant impact on the first purchase of a product or service (Roshwalb, Katz, & Lazarsfeld, 1956). Dissatisfied customers are found to be engaged in greater WOM than the satisfied ones (Anderson, 1998) and on social media, users with extreme experiences (positive and negative) about a product or service are more likely to spread their eWOM than the users with moderate experiences. The perceived value of negative eWOM is likely to be higher in the morality including company values versus the ability such as product attributes domain (Park & Lee, 2009). The negative and extreme WOMs are more influential than the positive ones because of people's inherent assumptions concerning the relationships between behavioral cues and trait categories (Skowronski & Carlston, 1989; Agarwal et al, 2012). Specifically, negative effect of eWOM is more significant for experience goods and has greater purchase influence than positive eWOM (Park & Lee, 2009) and negative eWOM can have an adverse impact on firm performance (Hennig-Thurau et al, 2010). As the eWOM communication is perceived to be a
trustworthy source of information by customers and can directly benefit a company (Gruen, Osmonbekov, & Czaplewski, 2006; Agarwal et al, 2012), we argue that a spread of negative eWOM can be detrimental to a supply chain in terms of its performance and reputation. This leads to our next hypothesis:

H2: The more supply chain members talk positively about supply chain management, the better the supply chain performance is.

Information Sharing

Sharing of information among the supply chain partners on key supply chain processes including point of sales (POS) and adaptation of collaborative practices such as vendor managed inventory (VMI), and collaborative planning, forecasting and replenishment (CPFR), help in improving supply chain performance (Angulo, Nachtmann, & Waller, 2004; Aviv, 2001). Information sharing among chain partners can provide mutual competitive advantages both in terms of creating customer values and reducing supply chain costs. As Inderfurth, Sadrieh, & Voigt (2012) note, it can reduce the supply chain inefficiencies due to information asymmetry if there is a certain amount of trust among the supply chain members and information sharing can control non-cooperative behavior of supply chain members. Also information sharing is one of the essential factors for enhancing channel-wide collaboration across the supply chain (Ballou, Gilbert, & Mukherjee, 2000). On the other hand, consequences of asymmetric information which refers to different players in a supply chain having differing levels of specific information on various resources such as capacity, demand, and inventory status, related costs, supply chain operations and performance include: poor collaborative efforts, difficulty in dealing with market uncertainty, suboptimal decisions, and opportunistic behavior (Simatupang & Sridharan, 2006). These factors alone and/or in combination can significantly impact supply chain performance. Social media provides opportunity for real-time, convenient, quality information sharing among a wide range of supply chain partners because of its reach, ease of use, fast paced transmission of information (Luo, Zhang, & Duan, 2013) and we expect supply chain performance to improve if the supply chain partners share more information regarding supply chain management issues on social media. Therefore we hypothesize,

H3a: The more the supply chain partners discuss information sharing in social media, the higher the supply chain performance is.

Collaboration

Collaboration in the supply chain context refers to the sharing of supply chain information related to product design, product development, production processes, logistics and distribution strategies, and all forms of planning (Lejeune & Yakova, 2005; Balakrishnan & Geunes, 2004). Collaboration encompasses factors such as coordination, communication, relationship management, trust and structure (Lin et al, 2010). Successful collaboration among supply chain partners can result in improved supply chain performance such as: efficiency, effectiveness, profitability and a stronger and long-lasting relationship among the partners (Min et al, 2005). Supply chain management is a combination of approaches and efforts that support efficient collaboration of suppliers, producers, and customers with an ultimate aim to achieve customer
satisfaction (Simchi-Levi, Kaminsky, & Simchi-Levi, 2003). Advent of new internet technologies has enabled partners form diverse background and locations to collaborate effectively not only to improve their individual supply chain functions but also to coordinate their activities in the overall supply chain network. Social media can facilitate improving this collaboration by offering many convenient modes of communication, information sharing, developing relationships among partners.

Collaboration through delicate, complex social relations depends on a medium in which these relations work (Suchman, 1987). Socially related factors contributing to collaboration include: formal and informal communications, trust, motivation, and social ties (Kotlarsky & Oshri, 2005). Social media usage can influence successful online collaboration through social relations among supply chain partners. We expect that greater collaboration among supply chain partners on social media will lead to better supply chain performance. This leads to the following hypothesis.

H3b: The more the supply chain partners discuss collaboration in social media, the higher the supply chain performance is.

Trust

Trust and commitment are the two fundamental components of improving the relationship that leads to cooperation among partners (Morgan & Hunt, 1994). Trust is often developed on individual contact, recurrent exchanges of information, and socialization among groups and individuals (Child, 2001). Social media, social networking sites in particular, can strengthen weakening ties and promote collective action based on common interest, activities, and goals (Kenski & Stroud, 2006; Shah, Nojin Kwak, & Lance, 2001). Social capital of the user increases by increased participation in online and offline socialization (Kobayashi et al, 2006). Social media can help build social capital of a user through building of trusting relationships in the network. In the supply chain context, trust has been expressed as the degree to which supply chain partners have the intention and capacity to work for the improvement of overall supply chain performance (Morgan & Hunt 1994). Also trust is the degree of buyer’s confidence and reliance in supplier’s expertise that is required to perform an activity effectively (Ganeshan 1994). Online relationships and communications are positively associated with an individual’s social trust (Kavanaugh et al, 2005). Social media usage has been found to be strongly associated with maintaining or strengthening existing offline relationships of communities (Ellison, Steinfield, & Lampe, 2007). Therefore, we assume that more the supply chain partners talk about trust on social media, more likely they will develop greater mutual trust among themselves which will lead to better supply chain performance. This is stated in the following hypothesis.

H3c: The more the supply chain partners discuss trust in social media, the higher the supply chain performance is.

Commitment

Supply chain integration has been found to be associated with improved supply chain performance (Quesada et al, 2008; Yu, Yan, & Cheng, 2001). A strong relationship among
partners, in the form of mutual trust and collaboration may ensure integration of various supply chain functions such as design, purchasing, production, distribution (Chen & Paulraj, 2004) and as Wu et al (2004) find, commitment of supply chain partners can enhance the integration of supply chain management processes.

Allen & Meyer (1990) describe commitment from three aspects: affective commitment; normative commitment; and continuance commitment. While affective commitment refers to the feeling of belongingness and the sense of attachment to the firm, normative commitment is related to the obligation that members feel to remain with a certain firm and builds on generalized cultural expectations. Continuance commitment is perceived from lack of alternatives. In order to have mutual sharing goals and values, supply chain partners must have normative commitment that can increase coordination and integration (Brown, Lusch, & Nicholson, 1995). Identifying with others, gaining a sense of belongingness and insight into the circumstances of others are some of the major reasons for using the social networking sites. Social media, specifically several social networking sites can help create personal identity by providing multiple channels for relational feedback and peer acceptance (Valenzuela, Park, & Kee, 2009). In this way social media can facilitate development of affective and normative commitment of users and can promote trust and improve supply chain performance. We argue that if supply chain partners talk more about commitment of partners to supply chain goals and objectives on social media and in turn it can improve supply chain performance. This is the basis for our next hypothesis.

H3d: The more the supply chain partners discuss commitment in social media, the higher the supply chain performance is.

METHODOLOGY

Data Gathering

The sample firms (1040) for this study are randomly selected from six industries (i.e. pharmaceutical, retailing, software, financial, healthcare, and hospitality industries) using the stratified sampling method as subpopulations (i.e., industries) within an overall population vary in our case. We draw it from WRDS Data Base (Compustat). These six industries are chosen because social media is expected to have huge impact on them. We then gather information about these sample firms from social media on the daily basis for consecutive 9 months (July 1, 2011 – March 31, 2012). The social media source includes forums, blogs, and Twitter messages. Since various social media sources have their unique ramifications on firms (e.g., forums are more interactive than both blogs and Twitter messages are limited in length and content), we treat them separately. Various web crawler algorithms were designed to download media contents automatically.

We separate social media into three different categories including blog, forum, and micro blog due to the distinctive nature of each of them. For instance, forums are more interactive than both blogs and Twitter, and Twitter messages are also limited in length and content. For blog, we choose Google Blog Search, which provides fresh, relevant search results from millions of feed-enabled blogs. In other words, users can search for blogs or blog posts, and can narrow their
searches by dates and more. For forum, we use a forum search engine (a.k.a. Boardreader), which is developed to address the shortcomings of current search engine technology to accurately find and display information contained on web’s forums and message boards. Finally, Twitter, the most well-known micro blogs, is selected as the third social media type.

Four different web crawler algorithms were created to download relevant conventional media, blog, forum, and tweeter automatically due to the varying nature of the four data sources (e.g., different webpage layout, different formatting markup and different hidden advertisements, which are the main challenges for automatic text extraction.) A customized HTML parser based on Python was designed and imported as a “noise” filter to remove the noise information such as sidebars, headers, and footers and recognize useful text paragraphs from large chunks of HTML code. The filter uses information about the density of text vs. HTML code to work out if a line of text is worth of outputting. Different from the common html parser, the advantage of this filter is that it can be applied to an arbitrary html code but we do not have to know exactly the page layout or the noise tags used. For each blog, forum and conventional media, we obtained the title, date, author, source domain, and main content of article. For each tweeter content, we obtained Twitter identifier, the date-time of the submission (GMT+0), submission type, and the text content of the tweet which is limited to 140 characters by design. In order to avoid spam messages and other advertising tweets, we filtered tweets that included URLs.

**Sentiment Analysis**

For the past few years, sentiment analysis has greatly assisted decision makers in extracting opinions from unstructured human-authored documents (Pang and Lee, 2008). This type of technology reduces the need to have people read dozens or even hundreds of documents to extract business opinions on a variety of topics and for different purposes. As such it is a viable tool in analyzing the big data including social media.

To gain a better understanding of social media impact on supply chain management, we employ the sentiment analysis approach to extract opinions of supply chain partners on supply chain management content expressed in the social media. This approach provides a measure of supply chain management that can then be used to examine supply chain management practice and its relationship to SCM performance.

**Panel Data Analysis**

In order to examine the relationship between social media and firm performance, we used our panel data set that contains \( n \) firms (e.g. 350 firms), each of which includes \( T \) observations measured at 1 through \( t \) time periods (e.g. 9 months) to estimate a fixed effects regression model. A fixed group effect model examines group differences in intercepts, assuming the same slopes and constant variance across entities or subjects. Since a group (individual specific) effect is time invariant and considered a part of the intercept, \( u_i \) is allowed to be correlated to other regressors. Fixed effect models use least squares dummy variable and within effect estimation methods.
CONTRIBUTIONS, LIMITATIONS, AND FUTURE RESEARCH

By providing an investigative look into how social media may influence supply chain performance which is overall an understudied research question, the current study offers several potential academic and managerial contributions. First, although the social capital theory has found its applications in supply chain management research, it has not been studied in a social media domain. There are no investigative reports relating social media and supply chain management. To the best of our knowledge, the current study is the first attempt to investigate the effect of social media on supply chain performance. Second, our findings have implications for practitioners. Managers should consider the advantages of using social media networking to identify and track the relevant information to mitigate several issues such as supplier risk. Also by making social networking an integral of the company's interactions with employees and suppliers, managers can better manage the performance of the suppliers. Third, outsourcing is a common trend in today’s business. Use of social media can help the managers observe and determine changes in the global market trend to choose appropriate strategy for their firms. Social media can be used by sourcing professionals for branding themselves as industry leaders. Our study will test and confirm these propositions. This study has several limitations. We considered only a selected group of firms belonging to certain categories of industries for our study which may limit the generalizability of its findings. Also the research question for this study was broad and kind of exploratory in nature and any further research in these lines could investigate in depth how social media impacts specific issues in supply chain management. Furthermore, it will be interesting to explore the mediating and moderating effects between the variables presented in our models. Analyses of interaction effects of these variables might reveal some meaningful inferences that can help supply chain managers in developing appropriate competitive supply chain strategies.

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