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The University of San Francisco

THE RELATIONSHIP BETWEEN INTERACTION PATTERNS ON AN ONLINE
IDEA GENERATION COMMUNITY AND THE IMPLEMENTATION OF IDEAS

A Dissertation Presented
to
The Faculty of the School of Education
Department of Leadership Studies
Organization and Leadership Program

In Partial Fulfillment
of the Requirements for the Degree
Doctor of Education

by
Michael D. Jacobson
San Francisco
May 2012

THE UNIVERSITY OF SAN FRANCISCO

Dissertation Abstract

The Relationship Between Interaction Patterns on an Online Idea Generation Community
and the Implementation of Ideas

The purpose of the study was to investigate a socially-networked online idea-generation community. Specifically, the study examined the specific interaction patterns on an online social network and the emergence of ideas. Using social-network analysis, the interaction among the network participants was studied. This analysis included examining the relationships among the network participants in the generation and implementation of ideas. Comparisons were made between networks with ideas that were implemented and those that were not. The findings revealed that activities on the community can be expressed from a network perspective and that insights were found about participant relationships and positions in the networks. Differences among participants with respect to idea implementability were found between the networks. Also, the idea networks were consistent with the behavior of a complex adaptive entity. Based on the findings, practical implications for action for professional and academic disciplines were presented.

This dissertation, written under the direction of the candidate's dissertation committee and approved by the members of the committee, has been presented to and accepted by the Faculty of the School of Education in partial fulfillment of the requirements for the degree of Doctor of Education. The content and research methodologies presented in this work represent the work of the candidate alone.

Michael D. Jacobson
Candidate

April 19, 2012

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April 19, 2012

Dr. Richard Stackman

April 19, 2012

DEDICATION

This work is dedicated to the memory of my loving grandmother, Hazel Bernice
Jardine.

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There are many people that I would like to thank that helped me through this journey. First, my two dissertation chairs, Dr. Deborah Bloch, who helped me through the proposal stage, and Dr. Patricia Mitchell, whose wise guidance helped me finish. Both were not only excellent dissertation coaches, but also wonderful teachers. I would also like to thank my committee chairs, Dr. Richard Stackman and Dr. Xornam Apedoe, for their helpful advice. Finally, I would like to thank my friends and family who were patient with me throughout my graduate studies.

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CHAPTER I: THE RESEARCH PROBLEM

Statement of the Problem

To stay competitive, organizations are seeking creative ways to innovate and generate ideas to improve their products and services. Executives at Netflix, a large online movie-rental business, offered \$1 million to anyone in the world who could come up with the best idea to improve their movie-recommendation system (Denne, 2009). A small group of researchers, among 14,000 teams from 186 countries, took the prize by developing an algorithm that realized the 10% improvement goal. Traditionally, idea generation has been associated with the suggestion box, slips of paper placed on a bulletin board, or through focus groups and e-mails. With the Internet and the proliferation of social-networking technologies, however, more tools have emerged to create opportunities that open and enhance the ideation process. Organizations are increasingly using this technology to generate innovative ideas from their customers and employees.

Starbucks, for example, has implemented My Starbucks Idea (2011) on their public website. Interested customers can share ideas, vote on the ones they like best, and engage in online discussions about the ideas. Over 86,000 ideas have been submitted thus far, and Starbucks employees actively engage with the community. During the transition period before President Barack Obama was inaugurated, the Office of the President-Elect implemented similar technology on its public website named the Citizen's Briefing Book (Obama, 2009). The intent of the tool was to elicit ideas from citizens around the world, thereby informing the new administration of policy recommendations. Over 70,000

people entered thousands of ideas that were subsequently compiled and presented to President Obama after he took office.

A common thread in these examples is that there are no specific directions given to the participants in the kinds of ideas that should be shared. Ideas simply emerged from those who volunteered to participate. Through the voting and discussion process, the community as a whole decided which ideas were popular and which potentially had merit.

A journalist for *The Economist* (Vaitheeswaran, 2007) reported that organizational innovation, once confined to research and development laboratories, has become a communal process. Globalization and the ongoing advent of new technologies are forcing leaders to scramble to bring fresh thinking into their organizations. Vaitheeswaran (2007) described a new paradigm in how creative ideas are reaching decision makers as “more democratic, even joyously anarchic” (p. 57). Innovation enables companies to keep up the evolution of their marketplaces more quickly than their competition (Damanpour, 1995). A key aspect of innovation management is ideation, the process of generating new ideas. Idea generation is a critical source of competitive advantage (Girotra, Terwiesch, & Ulrich, 2008).

The research literature on innovation is vast. Theoretical frameworks and empirical studies have focused on areas such as idea generation, creativity, user involvement, Internet-based collaboration, and innovative knowledge communities. Despite this considerable amount of literature, what remained to be explored was the role online social-networking platforms play in stimulating ideas. The present study aimed to fill this gap.

Purpose of the Study

The purpose of the study was to investigate a socially networked online idea-generation community. Specifically, the study examined the specific interaction patterns on an online social network and the emergence of ideas. Using social-network analysis, the interaction among the network participants was studied. This analysis included examining the relationships among network participants on the generation and the implementation of the ideas. Network participants were those who shared and commented on ideas posted on IdeaStorm (2010), a public online community of Dell customers. Data were collected from a sample of the output from the network participants including the ideas, comments on those ideas, and Dell's assessment of the quality of the ideas.

Background and Need for the Study

The background and need for the present study originates in the following themes: (a) the importance that innovation, specifically idea generation, plays in the competitive business context; (b) the ways in which ideas are generated and how companies respond to those creative inputs; (c) the growing trend of organizations to open their ideation process to include customer and other external constituents; and (d) the use of online social networks as a medium to foster and harvest implementable ideas. Finally, this section demonstrates that, as the use of online social networks continues to be prolific, there is an ongoing need for research to determine whether these communities play a critical role in an organization's innovation process.

Innovation is an important strategy for establishing and maintaining a competitive edge. Demand is growing for new and improved products and services (Rhodes, 2002).

There are competitive pressures on organizations to decrease the time new products and services reach the market (Fedorowicz, Laso-Ballesteros, & Padilla-Meléndez, 2008).

Mariello (2007) defined five distinct stages to innovation: (a) generating ideas, (b) evaluating the potential success of the ideas, (c) shaping the ideas into customer-focused solutions, (d) verifying that solutions have potential commercial success, and (e) gaining acceptance and implementing the ideas. The present study focuses on the initial stage, idea generation. Most organizations focus on the later stages (Awazu et al., 2009; Mariello, 2007).

Innovation enables companies to increase their sales and profit by creating unique products and reaching their marketplace more quickly than their competition (Damanpour, 1995; Hansen & Birkinshaw, 2007). Companies can realize a competitive advantage if they direct their human resources, operation, and marketing efforts collectively toward innovation (Singuaw, Simpson, & Enz, 2006).

The literature on idea generation covers a number of areas. Ideas emerge from a number of different sources and methodologies. Group brainstorming (Girotra et al., 2008), for example, is an effective technique to generate good ideas. In contrast, Paulus (2000) found that individuals are better at idea generation than groups. Ideas can come from employees, customers, and partners (Hansen & Birkenshaw, 2007). It is possible that the best ideas may be those that are made up of smaller ideas that come together to form a new idea. This happens when contributors both in and outside the organization contribute to the idea to improve on it.

Creativity studies are another line of research connected to idea generation. Sosa and Gero (2005) developed cognitive models that determine how individual creativity

can spark good ideas. Similarly, Perttula and Liikkanen (2005) studied cue-based memory probes: a process that searches long-term memory to inspire ideas and creative thinking. Bereiter and Scardamalia (2003) connected creativity and idea generation with group-knowledge building. Ideas in this context can be continually improved through the exchange of information and knowledge. As discussed in the present study, technology can provide an area where knowledge is shared, viewed, and expanded.

A. Wood (2003) found that companies with good innovative practices act quickly on ideas, have established evaluation methods, implement the ideas, and provide incentives and rewards to those who participate. According to A. Wood, an idea-generation system needs the following components: be open, be decentralized, be publicized, have management support, and be accepted as part of the organizational culture. Ideas are immediately implemented when possible. Other ideas need to be worked through the management of the organization quickly.

To enhance the proliferation of better ideas, companies have been expanding their innovative processes by turning to their customers for help (Rigby & Zook, 2002). Firms have gathered ideas from their customers and enabled them to be a part of their innovative process by tapping into networks. Communities of practice, which are groups of individuals who are connected through a shared purpose or interest, have been studied as to their contribution to innovation (Wenger, 2000; Zhang & Watts, 2008). For example, open-source communities, which are globally dispersed software developers who have free access to source code, have been found to establish new ideas and promote collective knowledge for the firms that allow access to their software-development process (Hemetsberger & Reinhardt, 2006; von Hippel, 2007).

Grabher, Ibert, and Flohr (2008) empirically examined codevelopment, which is the interaction between those who build products and services and those who use them. Through their research, they were able to classify different user communities that participate in the codevelopment process. Codevelopment communities represent consumers, product users, and interest groups; all can contribute to the innovative capacity of a firm. Füller, Matzler, and Hoppe (2008) investigated brand communities as a source of innovation for an organization. Customers who have strong relationships to a company's brand were found to be attracted to participating in the innovative process.

Computers and the Internet have enabled networks and have made it easier for firms to access customers (Sawhney, Verona, & Prandelli, 2005; von Hippel, 2007; Wellman, 2004). Studies have shown that ideas can be improved by the use of technology (Bereiter & Scardamalia, 2003; Fink, 2007). With respect to computing and idea generation, tools such as information-communication technologies have been used to support distributed and open innovation (Awazu et al., 2009; Barba-Sánchez, Martínez-Ruiz, & Jiménez-Zarco, 2007). Researchers have also examined e-collaboration tools as a specific way of reaching their customers through technology-enhanced networks that facilitate creativity and innovation (Farooq, Carroll, & Ganoe, 2008; Fedorowicz et al., 2008; Fink, 2007).

Technology can enhance innovation through the use of online social networks. New knowledge and ideas are created through collective actions among community members (Brown & Duguid, 2001; Lave & Wenger, 1991; Sawhney et al., 2005; Wenger, 2000). Software can be helpful to manage ideas. A well-designed online idea-

management system can help sort out repeated ideas, provide transparency, and enable the participants to build and improve on the ideas. (A. Wood, 2003).

There is a proliferation of organizations that are beginning to leverage online social networks to fuel innovative thinking (Mohannak, 2007). Although there is varied research across many disciplines regarding the effectiveness of these communities, there is little research that demonstrates whether online idea-generating communities are an effective way of collecting ideas. The present study focused on examining that connection.

Theoretical Foundations

The research framework applied in this study was divided into two perspectives: theory that explains behavior in a social network and theory that serves as a basis for idea evaluation. Complexity science provided the theoretical lens to understand how ideas are generated in the context of an online social network. Complexity science describes the nature of interconnectivity and the dynamics of networks. Constructs identified in the innovation and creativity literatures served as a framework to evaluate ideas.

Complex Adaptive Entities

To grasp how complexity theory applies to idea generation, it is important to understand its connection with emergent behavior. Complexity science is a language that describes interactive, self-organizing systems that are connected through nonlinear networks (van Uden, Richardson, & Cilliers, 2001). According to Cilliers (1998), a complex adaptive entity (CAE) has the following characteristics: adaptive to changes in the environment; nonlinear; open; emergent, but follows a general sense of local rules; lacks equilibrium; contains feedback loops; and operates as a whole, although the

individual parts are not aware of the behavior of the entire system. The behavior of ant colonies, flocks of birds, and slime mold are often used as examples of CAEs because they are examples of organized systems that share a common purpose.

CAEs have been used as metaphors for organizational behavior (Lissack, 1999). In this context, CAEs provide a lens that helps explain the uncertainty that surrounds the dynamic behavior of organizations. Organizations are comprised of individuals who continually have to adapt to changes in the environment. In a sense, organizations operate in an endless state of oscillation between stability and instability.

With respect to innovation, Carlisle and McMillian (2006) prepared a framework that describes the ideal situation in which innovation occurs called the zone of emergent complexity. It is in this stage that an organization is in the center of the continuum between highly unstable and highly stable. This point describes an organization as interactive, networked, and internally interdependent. Their model predicts that an organization in the zone of emergent complexity has the most flexibility to accept new innovations and be adaptive to change. Similarly, Coleman (1999) anticipated that an organization that is somewhat unstable and engages with a diversity of interconnected learning communities possesses the ideal composition for innovation and idea generation.

Social Networks

As part of the roots of social-network theory, Milgram (1967) conducted one of the first empirically based investigations examining social behavior. The researcher was trying to determine through how many acquaintances two people chosen at random are connected. Milgram designed an experiment, asking a sample of people from Kansas to serve as starting points in getting a message to a target person in Massachusetts. They

were each given a set of rules: if they didn't know the target person, they were to then send the message to the person they know who most likely did know the person. The result of the study found, surprisingly, that the message got to the target person through an average of only five intermediary people. The implications from the study revealed that communication structures, specifically considering connections and links between individuals, are powerful mechanisms in understanding human behavior.

Watts (2003) expounded on social-network theory with respect to innovation and idea generation and suggested that companies innovate when collective action is needed. This interaction happens through networks. Watts further described networks as systems made up of individual parts that are active, that evolve, and that are self-organizing. An occurrence in one part of the network can influence what happens in another connected part.

According to Rheingold (2002), social networks have defined boundaries, use a set of rules that match local needs, allow participants to modify the rules, and have a system of self-monitoring. Communities of practice (Wenger, 2000) are an example. Online communities aim to establish new ideas and share collective knowledge (Hemetsberger & Reinhardt, 2006).

Social-network theory, which guides the present study, focuses on two main perspectives: relationship strength and network position. Granovetter (1973) described network relationships through an analysis of social ties. Individuals are considered strongly tied to each other if there is a high degree of close, frequent, and emotional interactions in the network. Paradoxically, Granovetter hypothesized that the weaker the tie, the more chance information will flow to wider parts of the network. Watts (2003)

continued this argument noting that because individuals with weak ties have less in common, they can produce a wider diversity of thinking. This relationship enables new knowledge, different perspectives, and more unique information to flow throughout.

Ibarra (1993) conjectured that position in a network, specifically network centrality, has an effect on power and innovation. Centrality is considered one of the most common aspects studied in social-network analysis (Borgatti, 2005). Freeman (1979) described network centrality as the position that is most structurally centered in relation to others in the network. As shown in Figure 1, Actor A is considered to be in the most central position; Actors C, D, H, and I are in the most peripheral positions. According to Freeman, more information flows through the most central position; therefore, an individual who is positioned in the center has the most influence on others in the network.

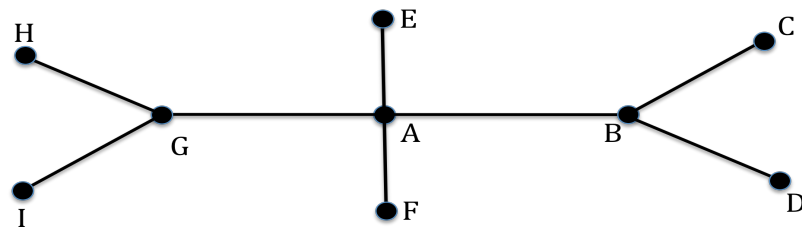


Figure 1. Network structure.

To advance these themes further, Kijkuit and van den Ende (2007) prepared a framework based on social-network theory to explain the interactions in an online community and the ideas generated from them. They support the notion that the best ideas derive from network participants who are part of a heterogeneous and nonredundant network. A heterogeneous and nonredundant network implies a diversity of knowledge and perspectives among participants, thus positively influencing the chance for good ideas to emerge. Kijkuit and van den Ende also suggested that network participants with

weak ties have less in common and can produce a wider diversity of thinking. In the idea-generation phase, their model predicted that the more diverse the network, the more interactions; thus, the more ideas generated, and a higher probability that participants vetted and improved an idea before it reached management consideration. People in the network then redefined and improved on the idea. Potentially, a new idea can emerge.

Hanneman and Riddle (2005) developed several techniques to analyze social-network theoretical concepts. Their methods assist researchers to work with social-network data and prepare visual representations of networks. For the present study, they offer tools to examine the strength of social ties and network centrality. These techniques are further described in the methodology section of this study.

In summary, social-network theory provides an underlying framework for describing patterns and interactions in a CAE. Specifically, the present study examined network relationships (social ties), position (centrality), and frequency of interactions to provide deeper insight into the interactions in an online idea-generation community and the associated ideas that emerge.

Idea Evaluation

Idea-evaluation frameworks appear in new-product-development, innovation, and creativity literatures. Theoretical models in the new-product-development stream focus on the predictability that a new product idea will have success in the marketplace (Goldenberg, Lehmann, & Mazursky, 2001). Innovation literature frames the value of ideas in the broader context of the innovation life cycle, specifically regarding ideas that reach the implementation stage (Hansen & Birkinshaw, 2007; Mariello, 2007; A. Wood, 2003). Finally, the creativity literature concentrates on the effects ideas have on

originality, usefulness, and feasibility in solving problems (MacCrimmon & Wagner, 1994).

Dean, Hender, Rogers, and Santanen (2006) reviewed 90 empirical studies that contained methodologies for measuring the quality of ideas from the innovation and creativity domains. From their analysis they developed an idea-evaluation model comprised of the following constructs: novelty, workability, relevance, and specificity. Idea novelty refers to suggestions that are unique and unusual. Novel ideas are original and often introduce new paradigms. Workability considers ideas that can be implemented. Ideas are workable if they contain acceptable solutions. Relevance refers to ideas that apply to unsolved problems. Relevant ideas have intended purposes and expressed resolutions. Finally, specificity indicates the extent to which an idea has thorough detail. Ideas with specificity have clarity and a sense of completeness. These constructs work together to predict the potential of an idea. The present study used this theoretical model to evaluate ideas.

For this study, the theories of social networks and idea evaluation worked together to provide an understanding of the interconnection between network characteristics and the implementability of the ideas in a CAE (see Figure 2). Specifically, the present study examined whether relationship strength and network position improved the chances of producing implementable ideas. The patterns that emerged from the network in evaluating the value of the ideas guided the design of this study.

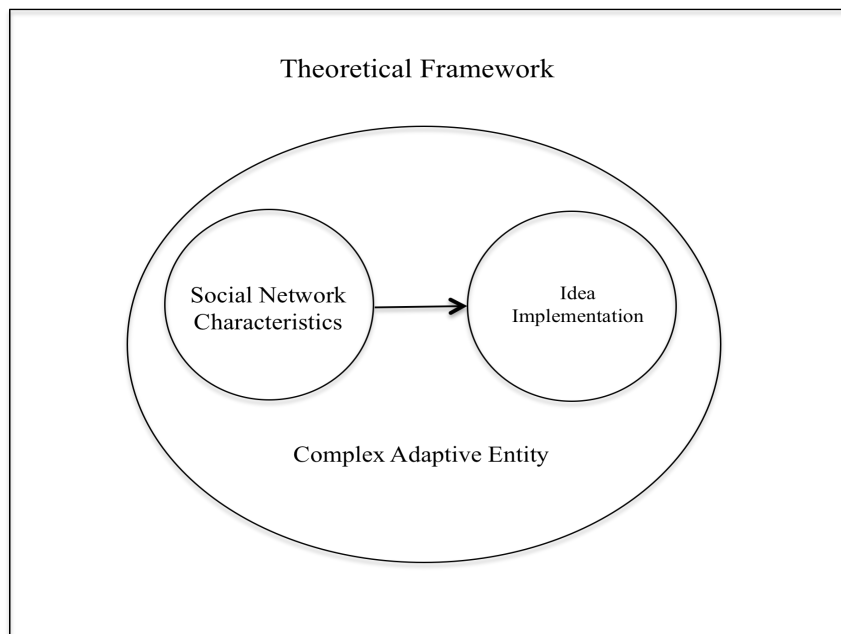


Figure 2. Theoretical framework.

Research Questions

This study investigated an Internet-based idea-generation community and its relationship to stimulating the production of ideas. The research questions examined the network participants, the ideas generated, and the network dynamics as a whole in the production of ideas. There were four research questions: (a) In what ways does Dell's IdeaStorm operate as a social network and what does the network look like? (b) What influence do network relationships have on the implementation of ideas? (c) What influence do network positions have on the implementation of ideas? (d) What is the difference in network centrality between networks that contain high- or low-implementation status?

Limitations

The way firms promote and support innovation is a complex process that has many facets. This study focused on a particular aspect, namely the use of technology and

social networks in the implementation of ideas. Therefore, there were limitations to this study.

First, this study only looked at the front end of innovation. This research did not examine the incubation or adoption processes that also play an important role in innovation. More longitudinal studies would be needed to demonstrate whether the ideas that have been implemented have any long-term impact in the organization.

Second, the individuals represented in this study were users who engaged in discussions on computer hardware. From a technology perspective, this is a fairly sophisticated group of people. Exchanging ideas in an online social network may be second nature to these individuals. Therefore, it may be difficult to generalize these findings to other populations. More research on less technical knowledgeable users is needed to determine if online social networks had similar effects.

Third, it is difficult to reveal the potential self-interests that may have existed among the network participants in this study. The assumption is that these self-interests were benign and the participants engaged for the betterment of the online community. Given the anonymous nature of the participants in the present study, however, there remains the possibility that some had adversarial intentions.

Finally, the data from this study were gathered from an online social network in a limited time period. Network participants were anonymous and there is little knowledge of the management decisions that were involved in the implementation of the ideas. Discussions with idea contributors or decision makers could provide greater insight into the idea-emergence process.

Significance

This study was important for several reasons. First, this research provided a greater understanding of the role technology plays in driving innovative thinking. As technology continues to evolve, more tools can be developed and adopted that can enhance the innovative process. These tools could help decision makers improve their screening process to better forecast potential product ideas. Second, organizations that use this technology could realize a greater competitive advantage. Innovative ideas can result in new products and creative service approaches.

Third, while there is much research on idea generation, previous studies have generally not focused on the quality of ideas. Close examination of the ideas through a theoretical lens can provide evidence of good ideas. Finally, with the shift to social-networking websites such as Facebook and Twitter, academic research is needed to demonstrate the effects these technologies have on individuals, businesses, and societies.

With these new idea-generation technologies, it would seem that innovation capabilities of companies would increase. By gaining insights from these online communities, organizations can identify ways to expand opportunities to improve their innovative processes and inspire creative thinking that can be applied to organizational problems.

Definition of Terms

The following terms have been operationalized for this study:

Actor. A node or a point on a network that is connected to another (Hanneman & Riddle, 2005). For the present study, an actor is a network participant who generates or comments on ideas.

Actor–Actor comments matrix. An array that shows the relationships among idea contributors and idea participants. The rows represent actors who contribute ideas; the columns represent the actors who comment on those ideas. From a network perspective, this array reveals the relationship ties between idea contributors and idea participants.

Category. Idea classifications as setup by Dell. Idea contributors can classify their ideas among a variety of product, corporate, or topical categories.

Centrality. The most structurally centered actor who is closely connected to others in the network (Freeman, 1979).

Connectivity. A network measure that determines the number of paths actors are able use to connect with one another (Hanneman & Riddle, 2005). If there were many paths, then the network would be considered to have high connectivity.

Distance. A network measure that determines how many actors another actor needs to go through to reach the intended target actor (Hanneman & Riddle, 2005). For example, two actors who are directly connected to one another have a distance measure of one.

GENI: An idea-generation software program (MacCrimmon & Wagner, 1994).

Idea contributors. The actors who author ideas in IdeaStorm. The idea contributors make up the nodes of the network.

Idea generation. The process through which ideas emerge from an individual, group, or community.

Idea-generating community. A group of individuals collectively focused on producing ideas that aim to improve an organization's products and processes.

Idea implementability. The extent to which an idea is both novel and of high quality (Dean et al., 2006). In this study, idea implementability was defined as the extent to which an idea can be implemented and accepted.

Idea novelty. The extent to which an idea is unique and uncommon (Dean et al., 2006).

Idea participants. Network actors who enter comments on the ideas that are posed by idea contributors. Idea participants create the links to nodes on the network.

Idea popularity. An idea that is highly promoted by the community.

Idea quality. The extent to which an idea addresses a problem and can be implemented (Dean et al., 2006).

Idea status. The current disposition of an idea in action being taken by the organization.

Innovation. Fresh thinking about new products, services, and/or processes that create value for an organization (Vaitheeswaran, 2007).

Links dataset. A table of data that shows all the network participants that commented on an idea in relation to each idea contributor. The data are organized in that each idea contributor (or node) is repeated for each network participant who shared a comment. This dataset was used to visually depict the links in the network.

NetDraw. A computer software program that enables a researcher to visually represent network data in visual form (Borgatti, 2002).

Network participants. The anonymous individuals who contribute, vote, and make comments on the ideas shared on IdeaStorm.

Node. A connection point or actor on the network. For the present study, nodes are made up of network participants who generate or comment on ideas.

Node dataset. A table of data that captures attributes about each idea contributor. The data collected include the contributor idea, idea title, vote score, number of comments, and category. Each row in the table represents a node in the network.

Relationship strength. The degree to which individuals are connected on a network in closeness, frequency, and emotional interaction (Granovetter, 1973).

UCINET. A software program that is used to conduct social-network analysis (Borgatti, Everett, & Freeman, 2002).

CHAPTER II: REVIEW OF RELATED LITERATURE

Overview

The purpose of the study was to investigate a socially networked online idea-generation community. Specifically, the study examined the specific interaction patterns on an online social network and the emergent ideas. The review of literature commences with research that examines how organizations foster idea generation and then how ideas emerge in those contexts. Next, literature that examines social interaction and social-network analysis follows to reveal insights into how online communities can be used to generate ideas. Finally, the review concludes with examples of empirical studies in which ideas are evaluated and measured. Therefore, the review of literature is organized to cover the following themes: (a) idea generation, (b) social networks, and (c) idea evaluation.

Idea Generation

Innovation begins with the generation of ideas. In an organizational context, ideas emerge from a variety of sources and methodologies. Before understanding where and how ideas emerge, however, it is important to examine the conditions and environments that exist for a firm to welcome new information and have the ability to move ideas further in the innovation process.

Idea-Fostering Environments

Koc (2007) examined the organizational factors that contribute to a firm's capacity to innovate. Koc was specifically curious about the effect information exchange, cross-functional interaction, and idea generation had on innovation. Thus, Koc conducted a cross-sectional field survey with two purposes: identifying the critical factors out of 26

organizational determinants accumulated from the innovation literature (independent variable) and measuring innovation capacity (dependent variable). Innovation capacity was defined as a firm's ability to improve its capabilities and processes in order to produce market-driven products and services.

Koc (2007) distributed the survey to product-development managers representing 91 software-development companies in Turkey. From the results of the survey, the author conducted a factor analysis and determined eight remaining factors for the independent variable: (a) company culture, (b) learning organization, (c) human resource, (d) idea generation, (e) knowledge management, (f) technology focus, (g) cross-functional integration, and (h) knowledge dissemination. For the dependent variable, innovation capacity, Koc included survey questions that addressed participants' perceptions on how their firms take advantage of market opportunities to develop new products. Koc then performed a multiple regression to inspect the relationships between organizational factors and innovation capacity.

According to the findings, idea generation was the strongest predictor for innovation capacity. The results support the significant impact that idea generation has in the innovation process (Koc, 2007).

Understanding a firm's readiness to experiment with new ideas provided the backdrop to Cohen and Levinthal's (1990) foundational study on absorptive capacity. Absorptive capacity refers to firms' ability to respond to external information and creative inputs and apply them to innovative activities. A firm with a high level of absorptive capacity accepts, invests in, and integrates new opportunities into future business strategy and operations. Cohen and Levinthal proposed that, from an

organizational view, absorptive capacity depended on a company's ability to transfer knowledge through social networks across the business function. This dependency is often relied on by research and development (R&D) personnel to disseminate this information across the organization. Therefore, the researchers conducted a study to understand R&D's influence on a firm's capacity to learn. They developed a model that placed absorptive capacity as a mediator between R&D intensity and knowledge-building capabilities.

To test their framework, Cohen and Levinthal (1990) analyzed survey data from 318 R&D laboratory managers in the U.S. manufacturing industry. The dependent variable was R&D intensity, measured by investments in R&D expenditures. The independent variable, learning incentive, was determined by how a firm accepted and applied new information toward company performance. The findings indicated a relationship between the learning conditions and the amount of investment in R&D. The results implied that absorptive capacity is an important consideration, as companies increase their ability to generate ideas. Without investment in absorptive capacity, organizational barriers could prevent them from integrating the latest external technological advances into their organizations. The results of this study could help firms decide where to focus their R&D efforts.

To extend the concepts around absorptive capabilities further, Mei and Nie (2007) studied industry clusters as forms of collaboration for idea generation. These clusters were made up of customers and suppliers. They studied idea generation with respect to the effect of external knowledge and the determinants that create knowledge. They conducted a study in the optoelectronic industry of Wuhan, People's Republic of China

because of the unique way those firms clustered in that particular region. They wanted to determine whether knowledge sharing with customers and suppliers and absorptive capacity had a positive effect on a firm's ability to innovate.

Mei and Nie (2007) distributed a questionnaire to 190 firms in the industry. The survey measured knowledge sharing, absorptive capacity, and innovation. Knowledge sharing was measured by the level of product and process information shared with suppliers and customers; absorptive capacity was measured by assessing how knowledge is collected and used in the firms; and innovation was evaluated by the ability to implement new products in the marketplace and incremental improvements in a firms' processes.

Absorptive capacity had a statistically significant relationship with innovation (Mei & Nie, 2007). Knowledge sharing with customers and suppliers also had a positive effect on innovation. The results imply that by having the ability to absorb new information and exchanging knowledge externally increases a firm's capacity to innovate.

Idea Emergence

As the Mei and Nie (2007) study demonstrated, involving customers is an important part of the idea-generation process. Schreier and Prügl (2008) studied specific types of customers, lead users, who had been influential in new product development and had been an important source of ideas. According to Schreier and Prügl, lead users are consumers who have become experts and trendsetters to such an extent that that they have high expectations for the products they use. They empirically investigated the

relationship between lead users and their tendency to generate ideas, along with their adoption of new products.

Schreier and Prügl (2008) conducted separate quantitative studies using three different sample populations where lead users are typically found: sailplaners, technical divers, and kite surfers. They developed a questionnaire that was used to measure lead usersness, consumer knowledge, idea generation, and adoptive behavior. They contacted participants for all the studies by posting the survey to websites the users frequent. The sample sizes were 129 sailplaners, 193 technical divers, and 139 kite surfers.

All three studies found significant effects (Schreier & Prügl, 2008). For the sailplaners, idea generation was a predictor for lead usersness ($\beta = .14; p < .05$). In the technical-divers sample, the relationship between lead users had a positive impact on new product adoption ($\beta = .16; p < .05$). Finally, for kite surfers, their lead usersness was explained by generating ideas ($\beta = .17; p < .05$) and associated with high product adoption ($\beta = .25; p < .05$). The implications of these findings are that by knowing the underlying nature and characteristics of lead users, companies have additional resources to generate ideas and help better predict success with their new products.

In another customer-related study, Jeppesen and Molin (2003) were interested in ways firms can facilitate idea generation through community engagement in the computer-games industry. They conducted an exploratory case study to examine the learning and idea exchange that occurs in a specific online forum targeted for customer interaction. The researchers, in partnership with a computer-games company, structured an engaging online environment to gather consumer feedback about their products. The researchers wanted to capture learning and idea-generating behaviors by examining

motivation, the types of consumers involved, and the characteristics of their product ideas.

In their study, Jeppesen and Molin (2003) analyzed text conversations between customers over extended periods of time to gather insights on the different types of learning that took place among participants. They found that customers were able to collectively solve complex problems and complete activities that normally would have caused the company to employ people to accomplish. This was especially evident when the company provided online toolkits that consumers could use to help develop products. The implication of these results demonstrated that when companies create ways to engage their external customers, they extend new dimensions to their innovative capabilities.

Bragge and Merisalo-Rantanen (2009) investigated efforts on how to motivate individuals to provide feedback in the postimplementation phase of a web-based information system. They were interested in observing techniques that foster ideas in an online collaborative environment. Using this environment, Bragge and Merisalo-Rantanen provided an intentional mechanism to solicit customer feedback where it is typically nonexistent. The research was conducted on a student information system at a European business school.

Choosing an action research methodology, the researchers used two ideation approaches to gather electronic feedback: individualized and brainstorming. Bragge and Merisalo-Rantanen (2009) then set up two areas for each technique. Both groups were asked their opinions on how the student-information system could be improved and what new features they would like to have. They gathered ideas from 19 student participants for the individualized approach and from 13 students through discussion forums for the

brainstorming technique. The students received course credit for participating. Through a mixture of surveys, interviews, and observations, the researchers gathered data on the subjects' perceptions of participating in the e-collaborative environments.

The results showed that both idea-generation techniques and the technology platform were effective in generating ideas. Motivational methods also appeared to be an important indicator. The incentive of receiving class points seemed an adequate motivating factor (Bragge & Merisalo-Rantanen, 2009). The implications of these results demonstrated that along with providing the proper environment to generate ideas, extrinsic motivation is another critical factor in the process.

Füller, Bartl, Ernst, and Mühlbacher (2006) examined the interactions between customers and suppliers in an online community. They were curious whether this medium could enhance the product-development process. They conducted a case study on the design of a new entertainment system for Audi automobiles. They examined the case through a community-based innovation lens that consisted of defining the attributes of the consumers, identifying the online community, designing the online interaction platform, and providing access. Using the Audi homepage as the target point to recruit participants, they invited users to engage in a virtual design laboratory. Once identified, participants were asked to design their own car entertainment center using the provided online tools. No incentives were offered, and users had full creative license with regard to their ideas.

The experiment yielded 1,662 participants and generated 219 design ideas and 261 interactive comments (Füller et al., 2006). Up to 15% of the ideas were considered original to Audi's R&D department. The diversity among the participants was classified

based on their user characteristics: 9.4% were early adopters, 73.3% routine users, and 15.3% were laggards (slower to adopt). More than 78% of participants indicated that they would participate in this again. The findings demonstrated that users are willing to participate even without incentives. In other words, the stimuli from the design activity were enough to motivate users. Although the results indicate a positive result, more longitudinal work is needed to determine the effect those ideas had on the product over time.

Hadaya and Cassivi (2009) explored the hypothesis that the greater the online engagement between customers and manufacturers in the product-development process, the more improvement results in the overall product innovation. The researchers developed an electronic survey constructed of items that measured collaboration between customers, manufacturers, and product innovation in the firm. They distributed the survey to the CEO's of 2,458 Canadian and European wireless-communication-equipment companies and received 99 responses. This industry was chosen because of its high level of electronic collaboration and commerce.

The findings revealed that when firms electronically engage their customers in generating ideas there is a positive influence on product innovation ($p < 0.05$). When customer demands are high, the study supported the notion that companies are at an advantage when they leverage technology to partner with their customers in developing their products (Hadaya & Cassivi, 2009).

Section Summary

This section demonstrated that it is essential to provide an organizational platform to foster innovation and idea generation. There is also evidence that there are

motivational factors and incentives that can fuel innovative thinking. The authors described that ideas can come from a variety of sources including external communities of customers and partners. Therefore, the present study focused on ideas that emerge from individuals among heterogeneous origins and how an organization responds to them.

Social Networks and Innovation

Through social interaction, networks allow individuals to access a broader range of information, thoughts, and ideas (Capra, 2002). This section explores the literature related to social interactions and sociotechnological environments that cultivate idea generation and the associated network relationships that provide the mechanism for the emergence of ideas.

Social Interaction

Tsai, Shuang-Shii, and Chen (2008) examined the influence that social relationships have on innovation. They surveyed 130 product managers among 500 Taiwanese high-tech firms to assess the consistency and closeness of how their company interacted with its external environment. Innovation was operationalized by examining the originality and success of new products. The two variables were mediated for extent to which technology played a role in the dynamic of the interaction. From the results, they found that social interaction had a positive influence on a firm's ability to absorb ($p < 0.001$) and use ($p < 0.01$) technology, which in turn had a positive relationship to innovation performance ($p < 0.001$). Thus, there was a positive connection between external engagement and internal capabilities. The results implied that when firms

actively engage in external social networks they improve overall performance of their organization.

Zhang and Watts (2008) investigated knowledge sharing in an online community. The purpose of the study was to examine the process in the emergence and exchange of knowledge. The study examined the online community through the practice-and-identity framework that described what the members of the community did (practice) and how they portrayed themselves (identity). This framework enabled the researcher to look at the online community from a social-structure context. The researchers performed a case study on a Chinese online travel forum that contained moderator-led discussions. Participants engaged in the site to exchange knowledge about backpacking in China. The researchers analyzed 7,853 messages among 2,123 topical threads in a 6-week period through the practice-and-identity framework.

From the practice perspective, the researchers found that members were engaged and committed to the site. For example, there was evidence that participants self-policed the content when inappropriate messages were posted. The social community also self-organized to create a repository of shared information that could be helpful to other backpackers. They did this by uploading help files, travel itineraries, and articles. The process was transparent in that moderators and experts were easily revealed. Newcomers could also be identified, as there was evidence that they leveraged the forum as a learning environment. New users, for example, made frequent use of help manuals. Although the findings cannot be generalized, this study demonstrated that an online community could be extended to organizations that want to create environments where knowledge can be exchanged.

Mohannak (2007) examined idea-generation networks among small to midsized firms in the Australian biotechnology industry. The purpose of the study was to examine external linkages and determine if there were benefits for firms to connect with others. Mohannak proposed that by participating in networks, firms increased technological capabilities and enhanced organizational learning. The network in this context included universities, customers, suppliers, research institutes, hospitals, and other firms. Mohannak surveyed 16 biotechnology companies to analyze how they interacted in this network on innovation. The results indicated that there were strong linkages in the network, especially with universities, customers, and suppliers. Specifically, biotechnology companies collaborated with researchers horizontally to expand knowledge and connected with customers and suppliers vertically to gain ideas on new and improved product offerings.

Spraggon and Bodolica (2008) examined networks through the ways ideas and knowledge are shared. They were particularly interested in understanding how small high-technology firms used knowledge to foster innovation. The researchers conducted an explorative multiple-case study that involved five small Canadian software firms. By conducting in-depth interviews, inspecting public documents and archival records, and participating in direct observation, the researchers developed a scale to measure the knowledge-building process among the firms.

Through their analysis, Spraggon and Bodolica (2008) found that there were several informal networks where ideas were exchanged among employees and external colleagues. This was a common factor across all the firms. These networks included communities of practice, virtual communities, and other informal, emergent relationships.

All of these collaborative environments were found to be places of idea and knowledge sharing and problem solving. Much of the interaction was conducted over the Internet; however, Spraggon and Bodolica found that some of the firms focused their online activities toward information archival and repository functions. Knowledge sharing, in those circumstances, was best done through verbal communication.

Social-Network Analysis

In a foundational study, Ibarra (1993) constructed an original framework using social-network analysis and tested it on a small advertising agency. Ibarra hypothesized that network centrality would have a positive effect on innovation. Ibarra conducted informal interviews to understand the network boundaries in the firm and then distributed a questionnaire to 79 participants measuring innovation involvement and network centrality. The kinds of innovations studied were divided among administrative and technical activities. Administrative innovations included internal-process improvements, implementing training programs, and producing company newsletters. Technical innovations focused on new marketing ventures, generating clients, and creating public-relations processes. Network centrality was measured by analyzing the direct and indirect links the respondents indicated on the questionnaire in accordance with the following network relationships: communication, advice, support, influence, friendship, and combined centrality.

The results indicated that network centrality did have an influence on administrative innovations; however, technical innovations did not receive the same support. Ibarra (1993) explained this difference by arguing that technical innovations tended to be more strategic and client facing, thus requiring more senior-management

involvement. Administrative innovations focused mostly on internal pursuits; therefore, those in central network positions, regardless of their organizational rank, had broader influence on implementing those activities.

Ibarra (1993) was also interested how sources of power played a role in innovation. In the same study the researcher compared individual power variables such as tenure, prestige, education level, and authority with respect to influence on innovation. The findings demonstrated that those variables did have strong effects on both administrative and technical innovations; however, network centrality mediated the effects of those nonnetwork variables. Therefore, these results implied that network position generated its own source of power in an individual's influence on innovation, and mediated the effects of individual power and formal position.

Kratzer and Lettl (2008) considered network centrality in their research on the relationship between lead users and ideas. They used school-age children as their sample because, due to the lack of mature background knowledge, they predicted that children's social interaction would be useful. They proposed that children with a high degree of network centrality would demonstrate lead-user and creative behaviors.

To gather data, Kratzer and Lettl (2008) used a questionnaire to measure lead users and conducted an idea-generation experiment to understand creativity and social interactions. Fifteen groups of children aged 7 through 10 were asked to formulate ideas to improve an online application. Through observations, their interactions were recorded and then subsequently entered into UCINET, the software program that analyzes social networks used in the present study. Creativity was measured by groups of children

performing tasks; then experts related to the software program evaluated the quality of their output.

From their results, they found a significant positive relationship found between creativity and lead usersness ($R^2 = 0.64$). Also, from a social-network perspective, a regression analysis found that children with high network centrality had a significant and positive relationship between both lead usersness ($R^2 = 0.45$) and creativity ($R^2 = 0.28$; Kratzer & Lettl, 2008).

Although difficult to generalize, the findings imply that centrality and a mix of weak and strong ties explained lead usersness because it gives the individual the most access to information. That location can also inspire the creativity needed to generate new ideas because at that position there are fewer obstacles and the child can access a broader diversity of information. Lead-user traits such as trendsetting and expectation of benefits explained the motivation to create and generate ideas (Kratzer & Lettl, 2008).

Björk and Magnusson (2009) used social-network analysis to study the interrelationship between network connectivity and the quality of the ideas. They gathered data from a Swedish company that had a well-matured online database that captured ideas from their employees. The researchers loaded 1,740 ideas from 340 contributors into UCINET. With UCINET, Björk and Magnusson were able to determine the network position of the idea generator by analyzing the connections to that idea. This analysis produced a network-centrality measure for all the ideas. The researchers then evaluated the ideas for quality by grading them based on their novelty and usefulness.

The results revealed that ideas generated by individuals in the most central positions in the network produced the highest quality ideas ($\chi^2 = 15.87, p = 0.0012$).

Thus, the findings showed that there is a significant positive relationship between network centrality and idea quality. As noted in other studies on network centrality (Freeman, 1979; Ibarra, 1993; Perry-Smith, 2003), individuals in central positions have the greatest access to knowledge and information. This puts them in an ideal place to produce the best ideas. The present study extended this analysis.

Section Summary

The literature in this section outlined innovation, specifically from a social-network perspective. Innovative behaviors occurred when companies engaged in online communities and created linkages between themselves and others. Several studies showed that network-analysis techniques have been used to understand patterns of creative behavior among individuals and ultimately the production of good ideas. The present study examined social-network relationships as they relate to the generation of creative ideas.

Idea Evaluation

Organizational leaders and researchers have employed a number of criteria and techniques to evaluate ideas. This section examines idea-evaluation models and their empirical use to help predict product success and demonstrate creative outputs.

Goldenberg et al. (2001) developed and empirically tested a model that predicted success or failure of a new product. They prepared an idea-classification system based on two stages: the contribution of the idea and the circumstances in which it emerged. In the first stage they proposed a set of five early determinants that are founded on market-based or product-based schemes: (a) attribute dependency, (b) component control, (c) replacement, (d) displacement, and (e) division. For example, component control

assessed whether a new idea created a link between one component and another related or unrelated component. A bandage falls into this classification because it is the creation of a link between two independent components, gauze and tape. The next stage examined the idea from five different perspectives of emergence: need spotting, solution spotting, mental invention, market research, or following a trend. Need spotting, for instance, is when the need for the idea preceded the actual form. Thus, in the bandage example, a person who was bleeding needed a way to secure gauze over a wound.

The researchers conducted two empirical studies, hypothesizing that the determinants they developed would have an influence on product success. In the first experiment, they randomly divided 70 product patents into two groups: those that were successful and those that were unsuccessful. Using a three-judge panel, they categorized each of the patents according to their classification system. The results revealed that they had an 89.5% chance of predicting product success ($p < 0.01$). In the next study, they coded 30 samples of successful and unsuccessful products. They conducted a regression analysis and found that the variables used had a predictive power rate of 81.9% ($p < 0.05$). The implications of these results demonstrated that there are ways to determine whether an idea will be successful in the marketplace.

In a foundational study, MacCrimmon and Wagner (1994) developed an evaluation model based on creativity attributes. They developed the following five criteria that measure the originality and usefulness of an idea: (a) novelty, (b) nonobviousness, (c) workability, (d) relevance, and (e) thoroughness. They tested these dimensions by empirically studying the effect of an idea-generation software program, GENI. A group of 48 undergraduate business students were asked to solve a set

of five problems by using pencil and paper, the GENI software, and a generic word processor. Three independent raters judged the ideas using the five dimensions.

Satisfactory interrater reliability scores demonstrated that there was general agreement in the use of the measures. The findings from the study indicated that ideas produced from GENI were more creative than those developed through the traditional pen and pencil or word-processing tools.

Various forms similar to MacCrimmon and Wagner's (1994) evaluation model have been used subsequently in a number of different studies. Chirumbolo, Mannetti, Pierro, Areni, and Kruglanski (2005), for example, focused just on the novelty aspects in their definition of idea creativity. In their research, they examined cognitive motivation, specifically need for closure, and its effect on creativity in small groups. In this study, need for closure was defined as the desire for an individual to get clear and specific information on a question or problem, limiting any chance for ambiguity or confusion. For their experiment, they divided 84 female undergraduates among 21 groups of four. Each group was classified based on their need for closure. Each group was provided with a task of writing product slogans for an advertisement agency. Their output was evaluated by identifying the number of unique ideas, rating each idea based on originality, and then, through the use of judges, providing an overall group creativity score (interrater agreement between judges was $r = .90$ at $p < .001$). Through the use of an ANOVA, the researchers were able to confirm their hypotheses that groups with higher need for closure produced significantly lower creative slogans.

In another cognitive study, Potter and Balthazard (2004) explored the effects of two different types of memory cueing (input and cause cueing) on quality idea

generation. Input cueing is where others provide advanced probes to an individual in a brainstorm activity; whereas, cause cueing is where individuals create their own probes based on what caused the problem. The researchers predicted that input cueing would generate lower quality ideas and cause cueing would result in higher quality ideas. Eighty-two undergraduate students participated in an electronic brainstorming activity where they were divided into four groups, each exposed to different treatments: cause cues only, input cues only, both cause and input cues, and no cues. The ideas generated were measured for both quantity and quality. For idea quality, the researchers developed a scale that evaluated ideas based on creativity, effectiveness, and feasibility. In their findings, they found support for their hypotheses: input cueing produced significantly fewer high-quality ideas (28 % less, $p < .001$), cause cueing produced significantly more high-quality ideas (26 % more, $p < .001$). They also correlated quantity with high-quality ideas and also found a significant positive relationship ($r = .48$, $p < .001$).

Miura and Hida (2004) used an idea-evaluation model to explore creativity among diverse and similar groups. Group diversity referred to heterogeneous members who were capable of producing a wide variety of ideas. Group similarity was comprised of members with shared experiences and mutual understanding. The researchers hypothesized that these groups were more likely to produce creative outputs than those that did not have either of those characteristics. They devised a creativity score by evaluating ideas based on novelty, originality, and solution solving.

The researchers designed a 2 X 2 (Low/High Group Diversity x Low/High Group Similarity) factorial study in which group type was the independent variable and idea creativity was the dependent variable. They separated 168 undergraduate students into

groups of three. Their task was to produce as many unusual usage ideas for an assigned object (e.g., a wire coat hanger). Groups were then assigned a group type. A group was considered diverse if there were a high number of categories needed to classify their ideas. A group was judged similar if there was frequent category duplication. The ideas were then coded for creativity based on the three dimensions. The results indicated that there was a significant main effect on idea creativity for group diversity, $F(1,52) = 4.77$, $p < .05$ and group similarity, $F(1, 52) = 7.30$, $p < .01$. They also found that groups with both high-similarity and high-diversity levels generated a significantly higher number of creative ideas ($p < .05$). The findings supported their original hypothesis that groups with both characteristics had notable creative output.

Section Summary

As demonstrated, researchers described a diversity of evaluative methods that intend to predict the future success of ideas. Success was described through the generation of creative outputs as well as the potential favorable outcomes of new products and services. The present study focused on many of these aspects to determine the quality of ideas.

Summary of Review of Related Literature

This literature review summarized empirical studies representing the source of ideas, the interplay in social networks, and the means by which ideas are evaluated. The interrelationship among these topics influenced the design and analysis of this research. Thus, it is important to synthesize and connect how this literature relates and contributes to the present study.

The research varied in the ways in which technology was described as a medium for idea sharing and knowledge exchange. Many of these studies considered online communities (Füller et al., 2006; Zhang & Watts, 2008), online forums (Jeppesen & Molin, 2003), e-collaborative environments (Bragge & Merisalo-Rantanen, 2009; Hadaya & Cassivi, 2009), innovation networks (Mohannak, 2007), and online databases (Björk & Magnusson, 2009). While the terminology varied, all of these studies demonstrated that technology assists in creating environments where innovation can occur. In this context, technology serves as a medium where knowledge sharing, creativity, and innovative capacity can be systematically researched. The present study extended this area by investigating an online community that was specifically designed for idea sharing.

Next, the literature on social networks supported the notion that the study of interactions among groups of people provides deep insights into how knowledge and information is exchanged. Empirical evidence showed that the structural aspect of the network, specifically network centrality, served as a predictor of effective innovation (Björk & Magnusson, 2009; Ibarra, 1993). Research, however, on the relational aspects of social networks, as they relate to idea generation, is lacking. Granovetter (1973) and Watts (2003) theorized that weak tie strength among network participants enables new knowledge, different perspectives, and free flow of information. In the context of idea-generation communities, these conjectures lack adequate empirical support. The present research aims to fill this gap.

Finally, the literature on idea evaluation demonstrated that there are a variety of techniques to evaluate ideas. A number of studies have used idea-evaluation frameworks to analyze new-product development success (Goldenberg et al., 2001), idea creativity

(MacCrimmon & Wagner, 1994; Miura & Hida, 2004); and memory and cognition (Chirumbolo et al., 2005; Potter & Balthazard, 2004). Few studies, with the very recent exception of Björk and Magnusson (2009), have evaluated ideas in the context of social networks. The present study adds to this literature stream by using an idea-evaluation framework that focuses on implementability and acceptability to assess the creative outputs of ideas generated on a social network.

In summary, the research literature is thorough with regard to idea generation, social networks, and idea evaluation. As has been shown, however, there is a lack of empirical research where these three converge. The present study aims to fill this gap by analyzing the contribution of online social networks to the stimulation of ideas.

CHAPTER III: METHODOLOGY

Restatement of Purpose

The purpose of the study was to study a socially networked online idea-generation community. Specifically, the study examined the specific interaction patterns of an online social network and the emergence of ideas. Using social-network analysis, the interaction among the network participants was studied. This analysis included examining the relationships among network participants in the generation and implementation of the ideas. Network participants were those who shared and commented on ideas posted on IdeaStorm (2010), a public online community of Dell customers. Data were collected from a sample of the output from network participants including the ideas, comments on those ideas, and Dell's assessment of the quality of the ideas.

Research Design

Social-network analysis was used to guide the present study in providing insight into the behavior of the idea-generation community. Social-network analysis measures the social patterns and interactions among individuals (Freeman, 2004). According to Freeman, social-network analysis has the following features: (a) examines the structural tie relationships that link individuals, (b) analyzes empirically based information, (c) relies on graphical representations of networks, and (d) uses mathematical modeling of data. In their review of over 90 empirical studies, Betts and Stouder (2004) found social-network analysis to be an important research methodology for understanding social phenomena, organization behavior, and innovation.

Social-network analysis differs from other prevailing methods, such as survey research, in that it looks at the effects of interaction and influence among actors on the

network rather than analyzing individual behavior (Freeman, 2004). The research design for the present study followed social-network analysis techniques that involve both visual and computational inspections of the network to uncover holistic patterns of individual actions. Social-network analysis is appropriate for the present study because the purpose was to examine the interrelationship between interaction patterns on an online social network and the production of ideas. The analytical tools from social-network analysis provided a systematic, organized, and visual model of the idea network under study.

Using this research approach, this study examined the network participants that share and interact with ideas on the IdeaStorm website and the relationship that those interactions have on the implementation potential of the ideas. Therefore, the overall data-collection analysis procedures were as follows: (a) the ideas in IdeaStorm were sorted into two levels of idea implementability (high/low); (b) a sample of each level was extracted from the same 1-month period; (c) for each idea, the individual who contributed the idea and all the individuals that commented were organized into datasets that arrange the individuals into nodes (the idea contributor) and links (the individuals who commented on those ideas); (d) network diagrams for each of the two samples were created to visually show the connections and interactions between the idea contributors and those who commented; and (e) the two networks were then examined with social-network analysis software to gain an understanding of the network connections and centrality of the individuals engaged in the idea-generation process.

Table 1 arranges the data-collection and -analysis strategy by research question. Specific details about the population and sampling procedures, data collection, and data analysis are explained in subsequent sections.

Table 1

Data Collection and Analysis Strategy

Research question	Data collection	Data analysis
In what ways does Dell's IdeaStorm operate as a social network and what does the network look like?	Nodes & links datasets	Network diagram
What influence do network relationships have on the implementation of ideas?	Actor-actor datasets	Connection/distance
What influence do network positions have on the implementation of ideas?	Actor-actor datasets	Centrality
What is the difference in network centrality between networks that contain high- or low-implementation status?	Actor-actor datasets	<i>t</i> -test

Population and Sample

IdeaStorm

The population of this study was individuals who interacted on IdeaStorm, a public online community of Dell customers who provide ideas on product and services. The site is made up of four primary activities: (a) viewing all posted ideas, (b) posting original ideas, (c) voting on ideas by either promoting or demoting them, and (d) commenting on ideas. Anyone who has Internet access can view activity on the website; however, in order to vote, comment, or share an idea, a network participant must create a unique ID and register name and e-mail-address information with Dell. Only an individual's ID is viewable to the public. As of this writing, the community has contributed 12,968 ideas, promoted 699,178 ideas, and posted 87,810 comments. Dell has implemented more than 380 of the ideas from this community.

To post an idea to the site, a user can first search the database to see if it is already posted. If not, the user fills out an idea-suggestion form with (a) the idea title; (b) up to three category selections that are chosen among product ideas, Dell corporate ideas, and general topical ideas; and (c) a narrative summary of the idea, which can include links and images. Once a user submits an idea, the database program will check to see if there are any close duplicates. If so, the idea can be deleted or modified before it gets published. Once the idea is posted, it is subject to subsequent voting and commenting activity by the community along with other statistical information about the idea. Other navigational features of IdeaStorm include the ability to (a) view ideas by category; (b) sort ideas by popularity, entry date, or comments at the general or categorical level; and (c) read monthly blogs posted by Dell that share information about what is happening with some of the ideas.

There are two primary ways to understand the potential success of an idea: the vote score and idea status. The first way reflects the community's interest in an idea. An idea receives 10 points each time it is promoted and loses 10 points each time it is demoted. Thus, an idea could have a positive or negative total score. The highest score on IdeaStorm, as of this writing, was 116,400, which is the total difference between the positive and negative votes. The second way is that an IdeaStorm moderator determines the idea status. An idea can be assigned the following idea status: (a) acknowledged, (b) already offered, (c) archived, (d) under review, (e) not planned, (f) partially implemented, or (g) implemented. Although ideas are generally not deleted, unpopular ideas or those that are archived tend to fall to the bottom of the database.

Sample Selection

To determine the criteria used for each sample, ideas were identified based on their implementability and acceptability. For purposes of this study, the status assigned by Dell reflected the implementation level of the idea. Table 2 shows the specific criteria that were used for each sample. The sample for the present study was drawn from ideas that were entered into IdeaStorm during the month of October 2008. This time period was selected based on the following conditions: (a) the idea must be at least a year old so that there was ample opportunity for Dell to determine action of the idea, and (b) the chosen month must have enough ideas (at least 25 for each idea level) to create the idea networks and provide meaningful results. After searching the database, October 2008 fit those criteria best. All ideas that have the idea status reflected in Table 2 were used in the analysis.

Table 2

Selection Criteria for Idea Samples

Implementability level	Idea status
High	Implemented or partially implemented
Low	Already offered, archived, not planned

The procedures for selecting the research sample were as follows: (a) using the sorting function in the database, ideas were classified based on the criteria listed in Table 2; (b) ideas were identified during the month of October 2008; and (c) for each idea, the ID information for the idea contributor and participants was captured. These samples determined the network participants who were subject to the subsequent social-network analysis, as explained in the data-analysis section.

Instrumentation and Data Collection

Network data are arranged differently from survey data. For example, in a traditional survey, the researcher would typically represent the data in a rectangular array where the rows may represent the individuals or groups in the study and the columns portray the various attributes of those subjects. Network data, on the other hand, are displayed with the same individuals or groups on both the rows and the columns in a square, actor–actor matrix (Hanneman & Riddle, 2005). The advantages of displaying data in network form is that each cell then represents whether a relational link exists between those two subjects (see Figure 3).

Survey Data			
	Age	Gender	Score
Person 1	24	F	81
Person 2	47	M	99
Person 3	36	F	70
Person 4	19	M	56

Network Data				
	Person 1	Person 2	Person 3	Person 4
Person 1	-	1	0	1
Person 2	0	-	1	1
Person 3	1	0	-	0
Person 4	1	0	1	-

Figure 3. Examples of data arrays.

As the network data example demonstrates, the data is often binary in that a relationship either exists or does not exist. Also, depending on the research question, the

relationships may be reciprocal or nonreciprocal. For example, in a study about knowledge sharing, Person 1 may have shared knowledge with Person 2; however, Person 2 may not have shared knowledge with Person 1.

A number of network-analysis and visual-mapping procedures can be applied to reveal themes and patterns about the relationships of the actors on the network. Connection strength, network centrality, and structural analysis are among the techniques used with network data. Network diagrams are also important because they can reveal further insights about the data. The network diagram, shown in Figure 4 visually represents the network data from the prior example. Note that the arrows show the reciprocity of the relationship.

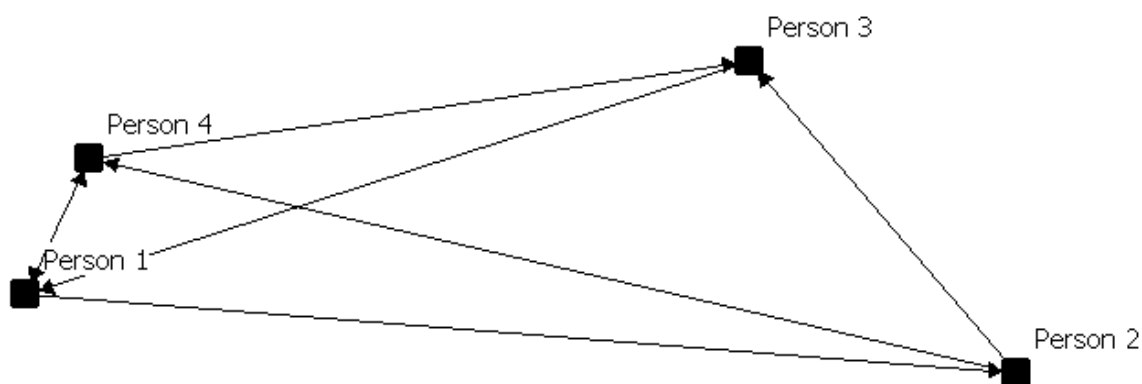


Figure 4. Network diagram.

To prepare for the social-network analysis, the data need to be collected and documented so that relationships and patterns can be best understood. A social network is composed of two key components: (a) the set of individuals or actors who make up the points and nodes, and (b) the relationships or ties among these actors (Hanneman & Riddle, 2005). For purposes of the present study, a node was essentially the actor who

created or commented on an idea. The individuals who commented on the idea is represented by the various links to the idea author.

The data collection entailed creating the ideas network and preparing the data for network analysis. The following sections describe the data-collection procedures in alignment with the remaining research questions.

The Idea Networks

Two idea networks were created that each represent the interactions among the actors in the idea samples. To create the idea networks, two sets of databases for each of the two samples were created: (a) the first dataset included information about the individuals who shared their ideas and their attributes (b) the second data set represented the relationship links among individuals who commented on those ideas.

Node Dataset

The node dataset was collected for each sample. The data-collection instrument (see Appendix B) was made up of the following components: (a) the ID represents the name of the idea contributor, (b) the Idea Title is the short description the contributor gave the idea, (c) the Vote Score is the numerical difference between positive votes and negative votes for the idea, (d) the Number of Comments represent the number of comments shared about that idea, and (e) the Category is the topic the contributor chose from a list of available idea categories. Every idea in IdeaStorm was made up of these components and was relatively straightforward to collect.

Links Dataset

The links datasets were comprised of the relationships to each of the nodes (see Appendix C for the data-collection instrument). In other words, all the network

participants who commented on the idea were considered links. The Node IDs represented the individuals who contributed the ideas; the Participant IDs were the network participants who commented on them. Because of the number of individuals who commented on ideas, there were often several Participant IDs for each Node ID. Therefore, the Node IDs were repeated for each network participant who entered a comment.

Preparation for Network Analysis

The next step was to create a visual representation of the two networks. To conduct this analysis, the links databases were converted into two actor–actor matrices. Each participant (or actor) was assigned a number. The data inside the actor–actor matrices are binary. Thus, if a relationship exists between two actors, then a 1 is placed in the matrix; if no relationship exists, a 0 is placed in the matrix. An example of an actor–actor matrix is shown in Appendix D.

The actor–actor datasets were imported into NetDraw Network Visualization (Borgatti, 2002), a software program that is used to graphically display social networks. NetDraw provided a visual layout of the idea samples. The datasets and the network diagram were then used to describe the nature of the network, as framed in the second research question and shown in Figure 5.

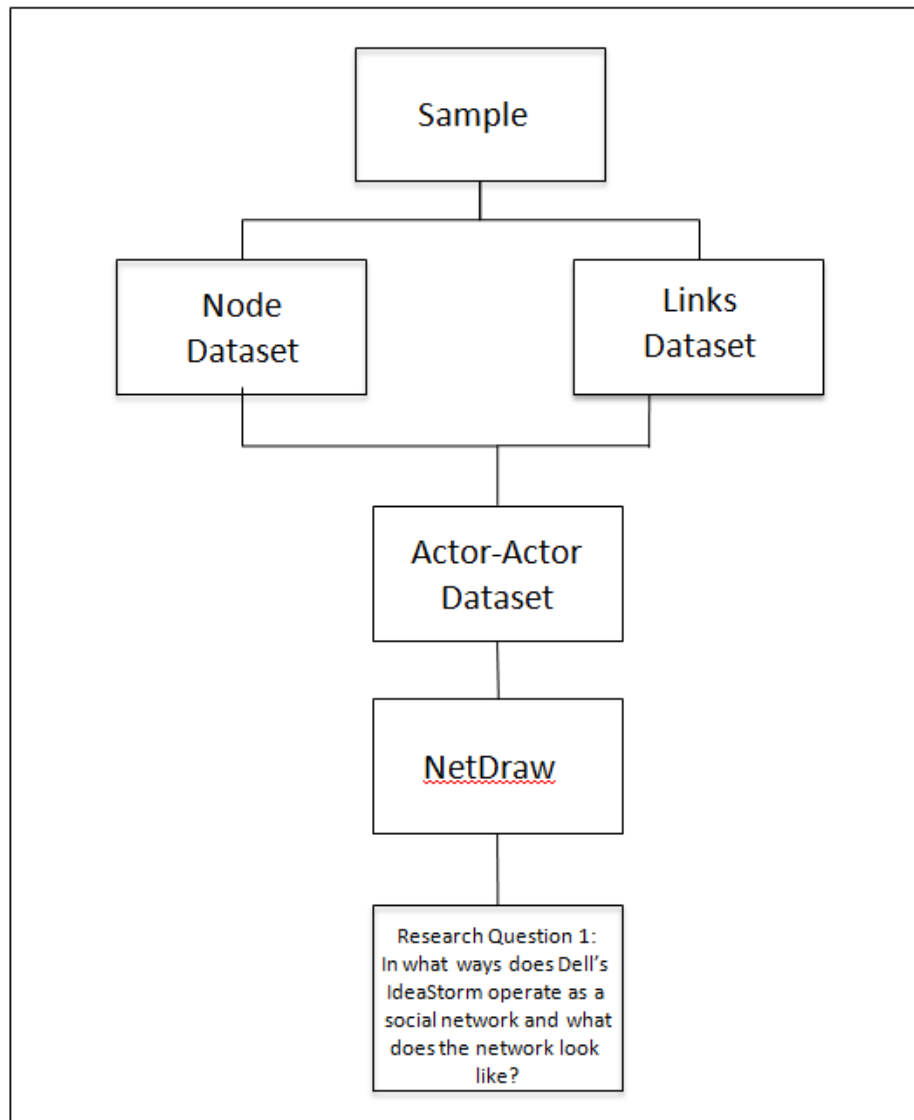


Figure 5. Data collection schema for network diagram.

Data Analysis

The data analysis was conducted using UCINET (Borgatti et al., 2002), a social network-analysis software program. The rationale for using UCINET was that it reads datasets and then produces a wide assortment of network and statistical analyses, including centrality measures, network cohesion, and network hypothesis-testing

procedures. Another advantage is that UCINET is integrated with NetDraw, thus network diagrams can be produced.

For the present study, the two actor–actor datasets were analyzed in UCINET. The data analysis is depicted in Figure 6, followed by a description of each process in more detail.

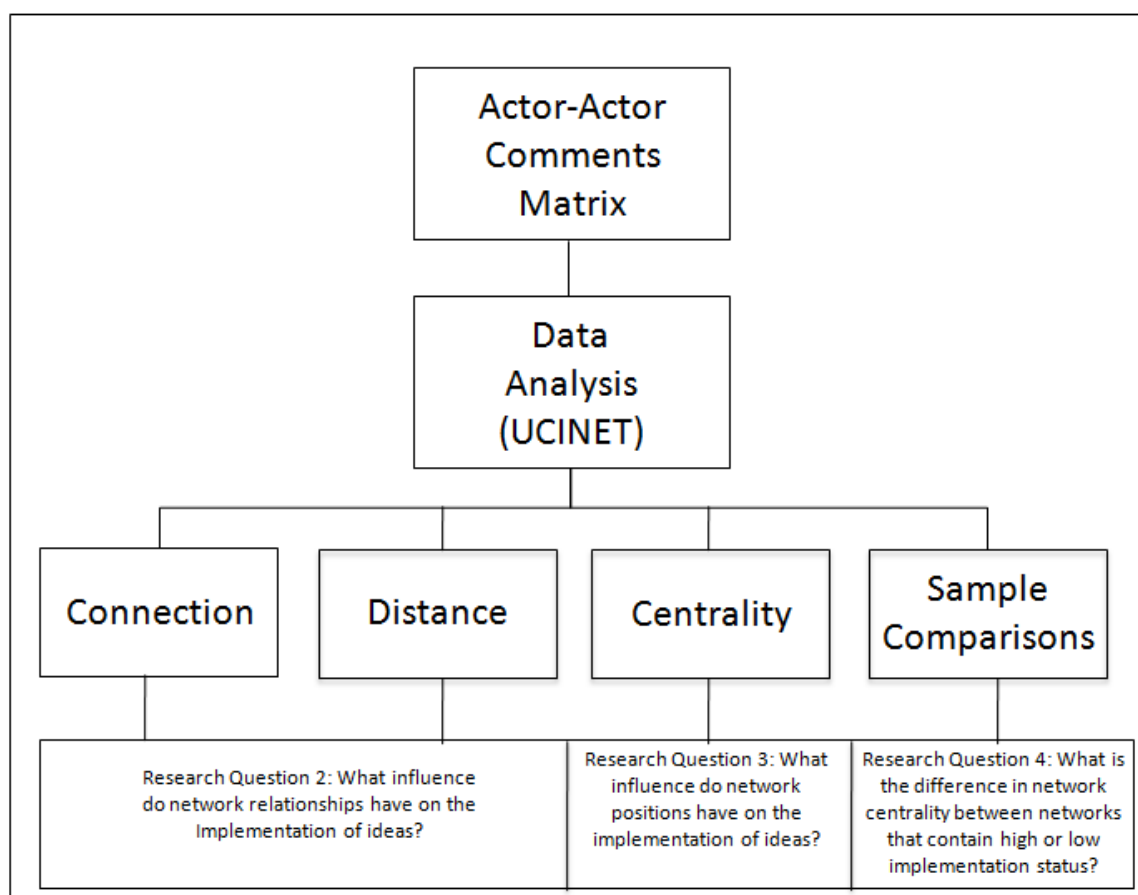


Figure 6. Data-analysis process.

Connection

Connectivity analysis provided information regarding (a) network size, (b) actor degree, and (c) density. Network size reflected the total number of relationships that existed among the actors. Typically, the size reflected the number of nodes on the

network (Hanneman & Riddle, 2005). Actor degree reflected the number of connections that an actor had with other actors. This included information about the direction of the ties, in-degree and out-degree statistics. For example, when Actor 1 commented on Actor 2's idea, a tie was sent "out" from Actor 1 and received "in" by Actor 2. Finally, the network density was calculated. According to Hanneman and Riddle (2005), density represents the ratio of actual ties to the total number of ties possible in the network. The more points on the network that are connected, the greater the density. To obtain these statistics, the actor–actor datasets were analyzed on UCINET using the Univariate Stats and Density commands.

Distance

The data analysis thus far addressed direct connections among the actors. Not all actors, however, are directly connected to each other. Hanneman and Riddle (2005) described distance as the number of steps it takes one actor to reach another. If two actors are directly connected, then the distance between them is one. If one actor has to first go through another actor, then the distance would be two. The shorter the distance, the more strongly the actors are linked. This relationship can be likened to the six degrees of separation concept or Kevin Bacon theory in which an individual is no more than six connections away from anyone else (Watts, 2003). UCINET quantifies this by calculating the geodesic distance, the shortest possible path between two points, among all the nodes in the network. To measure distance, the actor–actor datasets were compiled on UCINET using the Distance command with the geodesic setting.

Centrality

Freeman (1979) described network centrality as the position that is most structurally centered in relation to others in the network. To measure centrality, the actor–actor datasets were analyzed on UCINET using a command called Freeman’s Approach. This measure calculated network centrality for in-degree and out-degree information. Freeman’s Approach was applied to all the notes in the idea network.

Sample Comparisons

To determine if there is a statistically significant difference in the mean degree centrality between the two levels of idea samples, a *t*-test was performed using the hypothesis testing tools in UCINET. The dependent variable was the Freeman centrality measure and the independent variable was idea implementability with two levels. The dependent variable was already calculated during the centrality measurement phase. To measure the independent variable, an attribute file was created with a single column that identified each idea group. The two levels of the independent variable were then compiled with the Freeman centrality measure to run the *t*-test.

Role of the Researcher

I have had academic preparation in the domains of complexity science, networks, and advanced research methods, as well as past and present corporate experience in implementing idea programs. In addition to completing a master’s degree in educational technology at the University of San Francisco, my work in two courses was particularly formative in preparation for this study. First, the course, Creativity and Complexity, encompassed the topics of creativity and innovation in the context of complexity theory. That course had a particular focus on networks and their role in the study of relationships

among individuals. Second, in Advanced Statistics, I studied both descriptive and inferential statistical analysis, which provided the analytical background used in this study.

At Visa International, I was part of the design team for an employee innovation initiative, Ideas in Action. The purpose of the program was to harvest ideas from employees for management review. Employees used a custom-built web form to submit ideas. Those suggestions were routed to an innovation review team for acknowledgement and assessment. The program had limitations, however, in that employees were not able to see the ideas that were submitted by others. It functioned simply as an electronic suggestion box.

I then applied the lessons-learned from the Ideas in Action program to a new idea-generation initiative at my current company. The program, entitled ideaX, is an online social network for employees to post, vote on, and discuss ideas with each other. The same technology that built IdeaStorm is used for ideaX. The intent behind ideaX was to channel ideas across the organization about growth, cost savings, and other business-improvement. The social-networking aspect of the environment serves as a mechanism to inform management of promising ideas that could positively impact the business. The background from those two experiences proved useful in the interpretation of the findings and the discussion of future implications from this work.

CHAPTER IV: FINDINGS

Overview

This study used network analysis to examine the specific interaction patterns on an online social network, IdeaStorm, and the implementation of ideas. The interaction among the network participants was studied. This analysis included examining the relationships among the network participants about the generation and implementation of ideas. The following sections address the findings from the four research questions that guided this study.

Descriptive Statistics and Summary of Ideas

Prior to addressing the research questions, it was useful to examine the general statistics and an overall summary of the ideas in the networks. For example, in the network with high implementability status, displayed in Table 3, there were 25 ideas contributed by 17 participants. (Some participants submitted more than one idea in that month.) Those ideas received 237 comments from 43 participants. These fundamental demographics will provide context for the research questions.

Table 3

Idea Networks

Implementability status	Ideas	Idea contributors	Comments	Total participants
High	25	17	237	43
Low	43	37	162	74

A summary of all the ideas are presented as follows: Table 4 displays ideas with high-implementability status and Table 5 displays ideas with low-implementability status.

Table 4

Ideas with High Implementability Status

Submitter ID	Idea title	Number of comments	Category
anjilslaire	Dell Mini 9 in more colors	7	Netbooks
badblood	Voting bug...	5	IdeaStorm
edoovel	Offer a smaller Dell Studio Laptop	9	Sales Strategies
ewalk153	Dell Mini Ubuntu (Linux) Missing Webcam	31	Dell Website
feranick	The SSD in the mini 9 should have a partition as big as the actual size (currently limited to 4GB)	4	Linux
haloman	Desktop colors	4	Desktops
haloman	Dell laptop to compete w/ apple air	0	Laptops
haloman	The back button doesn't seem to go back completely to where you started	9	IdeaStorm
haloman	No points for posting (I don't want them) and your points should be in your profile box on the top right	7	IdeaStorm
james-94	Change the Storm Room to match IdeaStorm	0	Dell Community
james-94	Make it easier to tell if you voted up or down on ideas	31	IdeaStorm
jervis961	Fix the Log in error	9	IdeaStorm
jmxyz	Remove the cross-site-scripting code between IdeaStorm and force.com	5	IdeaStorm
jotje	Children's PC	5	Education
laxboy10	Thinner Notebooks	7	Laptops
mbhmirc	Point of contact backups	1	PartnerStorm
phubert	New IdeaStorm not fully compatible with Firefox?	8	IdeaStorm
phubert	Logging in triggers Firefox NoScript XSS violation blocking	6	IdeaStorm
phubert	Restore alternate (sort) views of the Top Idea Makers List	41	IdeaStorm
phubert	New IdeaStorm login issues need to be fixed	2	IdeaStorm
phubert	Following links to a new tab forces a new login - and doesn't get me the ink anyway!	6	IdeaStorm
sugarbear	Fix the SMB blog contact us link, it's broken	2	Dell Community
vptech	Make it easier to take care of daily tasks like checking on orders	1	Dell Web site
winoffice	Bring back the original font sizes	17	Dell Web Site
zmjzmz	Bring back RSS	20	IdeaStorm

Table 5

Ideas with Low Implementability Status

Submitter ID	Idea title	Number of comments	Category
adrian_fd	Fan Battery for projectors	4	Accessories
badblood	Can you put the “ideas in action” link	2	Ideastorm
badblood	Make the idea viewing area a little bigger	29	Ideastorm
bruce.doss	Insiron 518 needs better options	1	Desktops
cannon	Savings of shipping costs for Dell	1	Sales Strategy
castlefox	Remove NumLock button from all keyboards	9	Accessories
coffeebandit	Cleanable keys	4	Accessories
david714	Never use snap type fasteners on any laptop parts	1	Laptops
dika	Link to Mod comments	2	IdeaStorm
dumzki	CD Monitors with USB Port or Media Card Reader	5	Monitors and Displays
edoovel	Black keyboard please	6	Accessories
frank3000	Dell.com Pages Detailing Each Model	2	Dell Web Site
fx11	Glitches in Premier shopping cart	1	Advertising and Marketing
fxi	Docking station with cooling	2	Accessories
gear	Killer Netbook for Summer 2009 / Back to School Release	2	Laptops
green32	Offer low-Electromagnetic Field-option on laptops	1	Laptops
haloman	To save space per page, make the ideas posted a scrollable down and up box if they are too big/and the comments	1	IdeaStorm
haloman	Let us promote and then demote if we change our mind and vise-versa	5	IdeaStorm
jamesc	Stop restricting Sales to business	2	Sales Strategies
jb_91723	Better site navigation	2	Dell Web Site
Jervis961	Don’t “upgrade” the forums like did IdeaStorm	5	IdeaStorm
jtkerry	High Speed Network Auto Switching	3	Broadband and Mobility
lucas32	You don’t give the RED option for the m6400 when you are customizing	1	Precision Workstations
luck101	making xps a lot more personalized/creative	1	XPS
majorn0ob	update the synaptics touch pad driver to support their new multitouch gestures!	1	Software

table continues

Submitter ID	Idea title	Number of comments	Category
mbhmirc	Provide premiere login on signup of partner program	3	PartnerStorm
mbhmirc	Full product range for partners	3	PartnerStorm
mbhmirc	Delivery dates for UK customers	1	PartnerStorm
ncr_customer engineer	Cash payouts for good ideas	3	IdeaStorm
netjens	please build an ultra silent desktop pc	8	Desktops
phubert	Support the Empowered People	6	IdeaStorm
phubert	Every link to Ideastorm displays the same name in Firefox TABS - please fix!	2	IdeaStorm
pmb2008	Vostro 1710 with the Vostro 1700 keyboard please!	2	Vostro
putt	have more than just one picture	1	IdeaStorm
ranjanpatro	Windows XP for Laptop should not be so costly	7	Laptops
robertobiggio	list specifics of notebook lcd on dell.com	2	Dell Web Site
sanju	Laptop Rain Guard	1	Accessories
sk	laptops	1	Laptops
stormrider451	New XPS m1330, where's the sleeve/cd case	7	Accessories
techtraveler	Checkpoint-Friendly Laptop Bags	7	Accessories
wcondron	Laptop should switch power plans when changing from AC to battery	3	Laptop Power
winoffice	Bring back the Web site bar on top	5	IdeaStorm
winoffice	Change the "already offered" category	7	IdeaStorm

The network participants were identified if one either contributed or if one commented on any of the ideas in this sample. To illustrate, the following is an idea thread that had a high-implementability status (implemented):

Idea Title: Dell Mini in more colors

Submitted by: Anjilslaire

Status: Implemented

Idea Body: I'd like to see the Mini 9 available in more colors, such as red, blue, green, etc.

Comments:

Gregconquest: Yes, this is good. Keep in mind, though, that it has been only the lid that has varied in color. I'd love to get a forest green mini 9 as long as it is green all the way around.

Anjilslaire: The lid only is fine with me, just get some great colors on this thing :)

MarianoL: List is fine for me!!! I want the Sea Sky!!!!

Ftolead: The Red that was in the “teaser” photos, or an Alpine/Forest Green would be nice.

Fanfoot: We have a red XPS 1330 at home which has a matte finish and is really beautiful! I too would love to see Mini 9’s in other colors (racing green, red, blue). Even custom colors or selectable skins wouldn’t be beyond the pale.

Vida_k: We released new color options today including red and pink and 3 new designs. Check them out.

Atxmob: We still need brown, blue and other colors that are standard in Dell’s others.

In this example, the network participants were (a) the individual who put forward the idea, Anjilsiare, and (b) the individuals who made comments, Gregconquest, Anjilsiare, MarianoL, Ftolead, Fanfoot, Vida_k, and Atmob. These individuals form a special relationship in the idea network such that those that make comments serve as ties to the idea contributor Anjilsiare. From a network perspective, these individuals serve as nodes that reflect connections between the idea contributor and those that make comments.

Similarly, the following an example illustrates an idea that had a low-
implementability status (archived):

Idea Title: Remove NumLock button from all keyboards

Submitted by: Castlefox

Status: Archived

Idea Body: Remove NumLock button from all keyboards. That button has no function and I hate seeing that light on because I like to play games in the dark. Please remove all NumLock buttons from keyboards supplied from Dell.

Comments:

Noxo: Please leave it. I use it all the time.

Elkar: What do you mean “has no function”? Maybe not one that you use, but it does have a function. How else would you propose to switch the number pad from numbers to directional keys? As for gaming, just stick a piece of electrical tape over the light if it’s a distraction.

Jborton: How do you propose changing between cursor and numeric keys?

Winoffice: You are kidding me, are you?

Winoffice: Maybe you should simply press the NumLock button, then the light would turn off. Now how would you do that without the NumLock button?

Winoffice: This idea is silly!!

Fx11: ...you forgot to suggest getting rid of the 5 key, Fn key, SysRq key, ScrollLock key...

Fx11: If you want you can pop the key off with a screwdriver. But if the NumLock really bothers you use a hammer instead. If the power key gets in the way you can pull it off too.

Paperpilot: If you don't like the NumLock, try this <keyboard>. No, NumLock or number pad. Nice big, bright keys for fooling around in the dark, too.

In this example, (a) Castlefox was the idea contributor and (b) Noxo, Elkar, Jborton, Winoffice, and FX11 were ties to Castlefox.

In both examples, relationships were formed among the idea contributors and those that chose to comment on the idea. The remaining research questions will examine these relationships with respect to networks.

Research Question 1

This section discusses the findings related to Research Question 1: In what ways does Dell's IdeaStorm operate as a social network and what does the network look like? This research question examined the relationship of the participants from a social-network perspective. This was accomplished by examining the network diagrams for each of the two idea networks: (a) ideas with high-implementability status and (b) ideas with low-implementability status.

To create the idea networks, the ideas were arranged into link datasets and actor–actor matrices, as depicted in Tables 4 and 5, respectively. An example of the actor–actor matrix for ideas with high-implementability status is shown in Appendix E. The data from each actor–actor matrix were entered into NetDraw to construct the network diagrams.

Figure 7 displays the networks that contain participants who contributed ideas with high-implementability status and their relationships with those who commented on them. The network displays nodes that correspond with a participant in the network. The lines (or ties) represent the links between the idea contributors and those who made

comments. If a participant made a comment on an idea, an arrow pointing toward the idea contributor depicts it. For example, laxboy10 on Figure 7 had four different participants make comments: haloman, claudio_ch, suomo, and christopher25. The thickness of the lines represents the strength of the ties between the nodes. In this study, the more comments the same participant made for another's ideas, the stronger the tie.

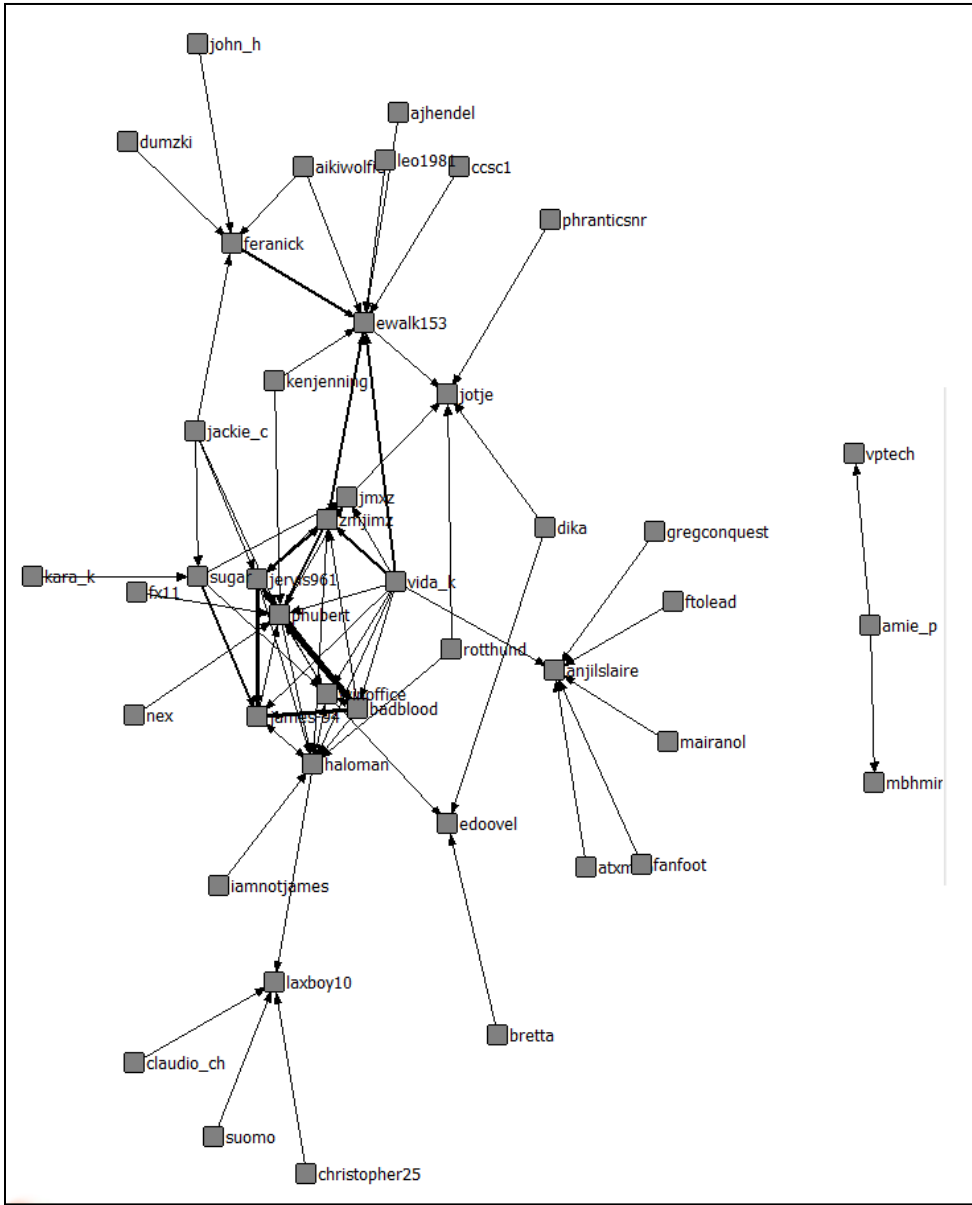


Figure 7. Network of ideas with high-implementability status with moderator.

Upon a closer look at the network, one participant in particular, `vida_k`, appeared to send comments to several participants. By studying `vida_k`'s comments, it became clear that `vida_k` is a Dell employee and a moderator of the IdeaStorm site. The following exchange demonstrates `vida_k`'s participation in the network:

`Ccsc1`: Too bad for me. I already printed a copy of my wish list and gave it to my wife to order for Christmas present. ... But if the camera is not available I will go with another brand. ... I sure wish Dell would explain their actions. Like another poster said, I won't use a webcam often, but want it there when I need it. ... Are you out there Dell???

`Vida_k`: Yes, `ccsc1`—we're here! I've been looking into the root of this before commenting. We removed the webcam from all models because of supply issues. We plan to add it back as soon as possible.

`Ccs1`: Thanks Dell (`vida_k`) ... That is what I needed to hear. I will wait until the webcam is available again to order. ... Thanks for the quick response.

Given that `vida_k`'s role as moderator and influencer has the potential to skew the results, the subsequent analysis will be conducted without `vida_k`'s participation.

Therefore, Figures 8 and 9 display the networks that will be analyzed, the network of ideas with high- and low-implementability status, respectively. For Figure 8, there are 42 nodes, which matches the number of participants in that network without the moderator (as shown in Table 6). The 17 idea contributors are identified by counting the nodes that have arrows pointing to them. Similarly, for Figure 9, there are 73 nodes, including the 37 contributors that have arrows pointing toward them.

Both networks reveal many connections among the participants. Upon visual inspection, however, a number of observations can be made. First, the network of ideas with high-implementability status (Figure 8) appears more cohesive. In other words, there seems to be more of a center of activity, especially among `phubert`, `jervis961`, `winoffice`, and `james94`. Those participants appear to have many ties to other participants. In the network of ideas with low-implementability status (Figure 9), however, there does not

appear to be a center. This difference will be validated when measures of centrality will be determined and discussed later in the study.

Second, the participants in Figure 8 all appear to be connected with the exception of two sets of participants (vptech, amie_p, & mbhmir, and anjislare mairanol, ftolean, fanfoot, gregconquest, & atxmob). In Figure 9, however, there are more sets of disconnected participants (luck10 & websterh, lucas32 & mano_g, mtah & robertobiggio, majorn0ob & jakegub, percomp & fxi, gear & changturkey).

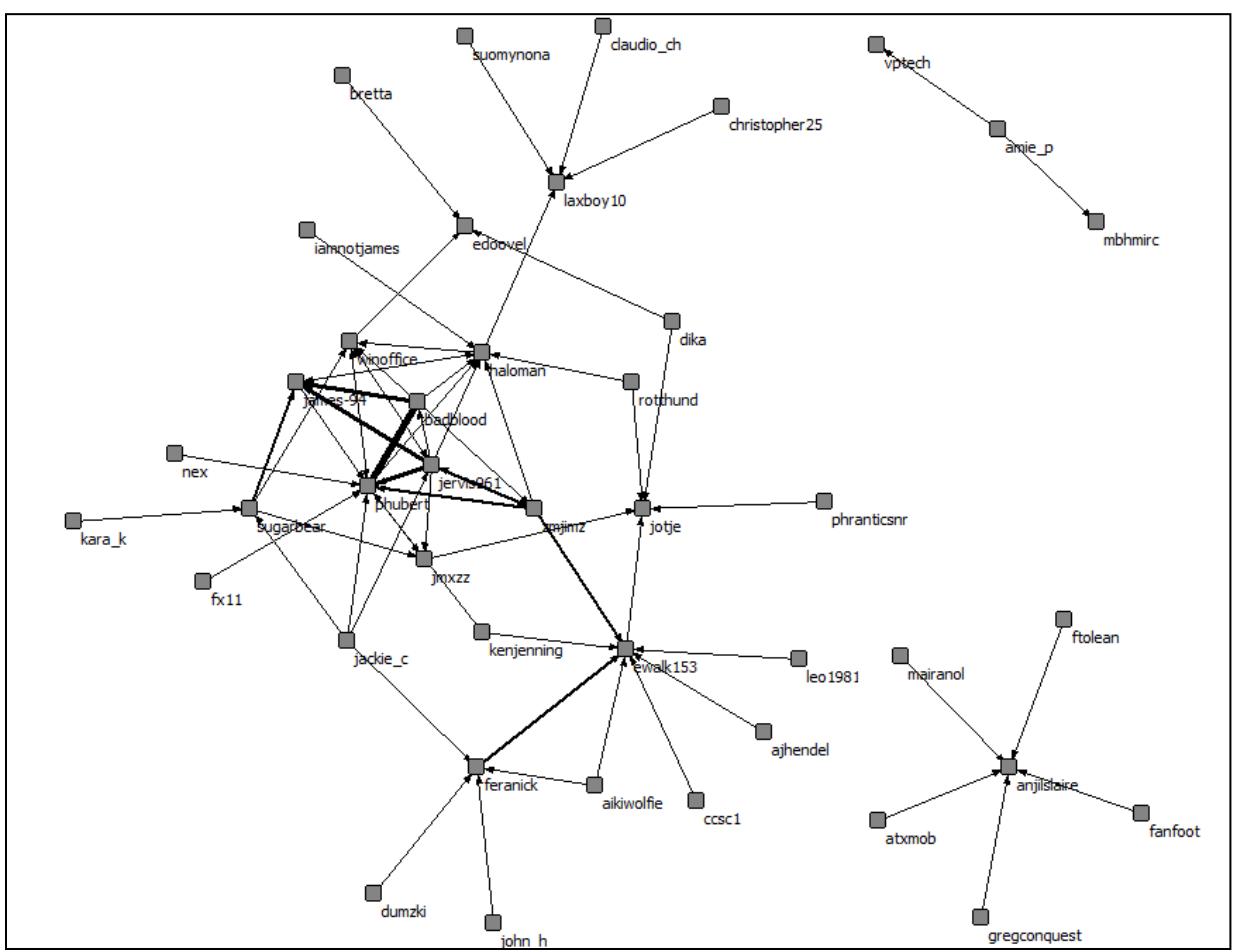


Figure 8. Network of ideas with high implementability status without moderator.

participants are the most active and most connected in the network. For example, phubert, jervis961, james94 and badblood, have many connections and are highly active network participants.

This research question explored the two idea networks from a visual perspective. The remaining research questions will use statistical results to validate these visual findings as well as reveal additional information about the networks.

Research Question 2

This section discusses the findings related to Research Question 2: What influence do network relationships have on the implementation of ideas? To measure relationship strength, connectivity and distance data are considered. This research question addressed both networks from the whole perspective and from the key participants in those networks.

Table 6 displays connectivity and distance statistics for both networks. As in earlier results, size represents the number of unique participants in each of the networks. The total number of possible connections for each of the networks is displayed based on their size. In other words, for the network with high-implementability status, the 42 participants have a total of 1,722 possible ways to be connected. By examining the density results, it appears that both networks are low in the percentage of connections present compared to the total available. For example, for the network of ideas with high-implementability status, only 3.83% of all possible ties exist. Interestingly, the network of ideas with low-implementability status has an even smaller percentage.

In distance, both networks reflect that the maximum number that one participant needs to go through to reach another participant is 5. The average distance for both

networks is similar although for the network with low-implementability status, the average distance is slightly higher, indicating that on average it takes individuals in that network a little longer to reach each other, but the value is not significant.

To explore network relationships at an individual level, Table 7 (network with high-implementability status) and Table 8 (network with low-implementability status) display out-degree and in-degree statistics for the most active participants. Specifically, any participant that either sent out or received more than one tie was included on these tables.

Table 7

Out-Degree and In-Degree Statistics—Network With High-Implementation Status

Participant	Out-degrees	In-degrees	Out-degrees normalized	In-degrees normalized
jervis961	7	3	17.1	7.3
badblood	5	1	12.2	2.4
jackie_c	4	0	9.8	0.0
zmjimz	4	2	9.8	4.9
haloman	3	7	7.3	17.1
phubert	3	9	7.3	22.0
sugarbear	3	2	7.3	4.9
winoffice	3	5	7.3	12.2
aikiwolfie	2	0	4.9	0.0
amie_p	2	0	4.9	0.0
dika	2	0	4.9	0.0
james-94	2	4	4.9	9.8
kenjenning	2	0	4.9	0.0
rotthund	2	0	4.9	0.0
ewalk153	1	7	2.4	17.1
feranick	1	4	2.4	9.8
jmxz	1	3	2.4	7.3
anjilslaire	0	5	0.0	12.2
edoovel	0	3	0.0	7.3
jotje	0	5	0.0	12.2
laxboy10	0	4	0.0	9.8

Table 8

Out-Degree and In-Degree Statistics—Network With Low-Implementation Status

Participant	Out-degrees sum	In-degrees sum	Out-degrees normalized	In-degrees normalized
haloman	9	2	12.5	2.8
sugarbear	6	0	8.3	0.0
winoffice	6	5	8.3	6.9
aikiwolfie	5	0	6.9	0.0
elkar	5	0	6.9	0.0
jackie_c	4	0	5.6	0.0
wallyhorse	3	0	4.2	0.0
zmjzmz	3	0	4.2	0.0
dika	2	2	2.8	2.8
dumzki	2	4	2.8	5.6
jervis961	2	3	2.8	4.2
paperpilot	2	0	2.8	0.0
haloman	9	2	12.5	2.8
ncr_customerengineer	1	3	1.4	4.2
phubert	1	6	1.4	8.3
adrian_fd	0	4	0.0	5.6
badblood	0	4	0.0	5.6
castlefox	0	6	0.0	8.3
coffeebandit	0	3	0.0	4.2
edoovel	0	4	0.0	5.6
jamesc	0	2	0.0	2.8
jb_91723	0	2	0.0	2.8
jtkerry	0	3	0.0	4.2
mbhmirc	0	3	0.0	4.2
netjens	0	5	0.0	6.9
ranjanpatro	0	3	0.0	4.2
stormrider451	0	2	0.0	2.8
techtraveler	0	3	0.0	4.2

For the network with high-implementability status, jervis961 and badblood had the highest number of out-degree ties. Similarly, haloman, sugarbear, and winoffice had

the highest number of out-degree ties on the network with low-implementability status. These participants engaged the most with the ideas on the network. They potentially had the most influence in both a positive and negative way on many of the ideas in the networks. The out-degree normalized measures standardized these results relative to each network. Thus, while jervis961 (Table 7) had less out-degrees than haloman (Table 8), jervis961 sent out more ties in proportion to the network (17.1% versus 12.5%). Thus, jervis961 had more effect on its network than did haloman. This positive trend for the network with high implementability status continued with the remaining participants.

The participants with the highest number of in-degree ties were haloman, phubert, and ewalk153 for the network with high-implementability status and castlefox, phubert, and winoffice for the network with low-implementability status. These are the most prominent participants receiving the most feedback from different sources. Notably, the in-degree sums were less overall in the network with low-implementability status, as were the in-degree normalized measures. This result indicates that, in general, fewer participants engaged overall with the ideas in the network with low-implementability status.

Research Question 3

This section discusses the findings related to Research Question 3: What influence do network positions have on the implementation of ideas? This research question examined the out-degree and in-degree statistics a step further to reveal where the center of action appeared in each of the networks. The analysis examined network centrality for each of the networks as a whole and for the most active participants.

For Research Question 2, participants with the highest out-degrees and in-degrees were identified. Using Freeman’s approach, calculations in UCINET provided additional statistics to help understand the amount of influence these individuals had on the network. As shown in Table 9, on average 1.57 ties ($SD = 1.41$) are sent among the participants in the network with high-implementability status, and on average 1.13 ($SD = 1.62$) ties are sent among participants in the network with low-implementability status. In comparing these means with the individual out-degree and in-degree data on Table 7 and Table 8, it becomes even more evident that certain participants are far more connected than others. Thus, for the network with high-implementability status, jervis961, badblood, phubert, ewalk153, and haloman appear to be the most central participants. On the network with low-implementability status, haloman, sugarbear, castlefox, phubert, and winoffice appear to be the most central participants. Observing the interactions of these participants on the network diagrams, Figures 8 and 9, can further validate this finding.

Table 9

Idea Networks—Degree Centrality Means

Implementation status	Out-degree		Out-degree normalized		In-degree		In-degree normalized	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
High	1.57	1.41	3.83	3.46	1.57	2.37	3.83	5.79
Low	1.13	1.62	1.58	2.26	1.13	1.56	1.58	2.17

Table 10 shows the overall network centralization for both networks. These results reveal that the network with high-implementability status has more centralization for out-degree and in-degree ties. This implies that the network has more participants

who are connected to other participants. Further, this network had a higher in-degree percentage compared to its out-degree percentage. This suggests that the idea contributors had more prominence than those who made comments. Interestingly, the opposite is true in the network with low-implementability status.

Table 10

Idea Networks—Network Centralization

Implementation status	Network centralization (out-degree)	Network centralization (in-degree)
High	13.6%	18.6%
Low	11.1%	6.8%

Research Question 4

This section discusses the findings for Research Question 4: What is the difference in network centrality between networks that contain high- or low-implementation status? To address this research question, two *t*-tests were conducted to see if there was a statistically significant difference in the mean centrality measure of both networks.

The first *t*-test compared the normalized mean out-degrees for each of the networks. The result yielded a significant difference, $t(113) = 4.21, p < .001$, in out-degree centralization for the network with high-implementability status ($M = 3.83, SD = 3.46$). These results suggest that participants who engaged with the ideas in the network with high-implementability status had more influence than those on the network with low-implementability status.

The second *t*-test compared the normalized mean in-degrees for each of the networks. The results yielded a significant difference, $t(113) = 2.98, p < .01$, in in-degree

centralization for the network with high-implementability status ($M = 3.83$, $SD = 5.79$).

These results suggest that participants who suggested the ideas in the network with high-implementability status had more prominence than those on the network with low-implementability status.

Summary of Findings

The findings overall suggest that the activities on IdeaStorm can be expressed from a social-network perspective. By using social-network analysis, some insights into relationships among participants who both suggested and commented on ideas were found.

The network diagrams revealed patterns on both networks that helped describe the interactions among participants. For example, the network with high-implementability status appeared to have more of a center of activity and the participants seemed more connected. The network with low-implementability status, however, had more disconnected participants.

In network relationships, the networks with high-implementability status were denser and required slightly less distance for participants to interact with others. This suggests a network with more cohesion and overall strength.

In addition, participants' positions in the networks appeared to have an impact on idea implementability. In the network with high-implementability status, individuals who were in the center had more influence and prominence than in the network with low-implementability status. This was further demonstrated by the results from the sample comparisons of the network-centrality means.

The next chapter will discuss these findings with respect to the theoretical framework and research literature of this study. Implications and limitations of this study will also be discussed.

CHAPTER V: DISCUSSION, CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS

Introduction

This chapter is divided into six sections: (a) a summary of the study, (b) a discussion of the findings with respect to the theory and research literature that guided this study, (c) a summary of conclusions from the findings, (d) implications for business and education, (e) recommendations for further research, and (f) personal reflection.

Summary of the Study

This study used network analysis to examine the specific interaction patterns on an online social network, IdeaStorm, and the emergence of ideas. The interaction among network participants was studied. This analysis included examining the relationships and network positions among participants with respect to the quality of the ideas. The findings revealed that activities on IdeaStorm can be expressed from a network perspective and that insights into relationships among participants were apparent.

Discussion

IdeaStorm provided a platform for those interested in Dell's products and services to exchange and discuss ideas. Researchers have referred to these spaces as marketplaces for ideas (Rigby & Zook, 2002; R. C. Wood & Hamel, 2002). The extraction of ideas from October 2008 is consistent with the concept of an active commerce of ideas, suggestions, feedback, and knowledge. The ideas in the system were arranged such that individuals could make suggestions visible so that others could comment or vote on those ideas. The interface design of the environment made it straightforward to identify the ideas and the individuals who participated.

As noted in the research literature, this type of community has the potential for supporting the creation of knowledge for an organization (Hemetsberger & Reinhardt, 2006; Spraggon & Bodolica, 2008; Wenger, 2000). There was evidence of this with many of the ideas that were exchanged through IdeaStorm. The comments to those ideas created online discourse that generally developed the original ideas more comprehensively. This was especially evident with ideas that were implemented. The nature of those comments toward implemented ideas had the effect of adding more nuance, specificity, and affirmation of the original idea. The ideas not implemented tended to have comments that ridiculed the idea or echoed the lack of originality on behalf of the person suggesting the idea. This combination of ideas and comments served as knowledge that Dell could then potentially use to improve their products or avoid mistakes.

The behavior of the IdeaStorm community is also consistent with organizations actively involving their customers in the idea-generation process (Hadaya & Cassivi, 2009; Jeppesen & Molin, 2003). By making IdeaStorm available to their customers, Dell was able to leverage the external community to contribute to the innovation of their offerings. Critical to the idea-generation process, Schreier and Prügl (2008) referred to these specific kinds of customers as lead users. The IdeaStorm participants were consistent with lead-user characteristics because they often appeared to be very knowledgeable about Dell's computer products.

To illustrate, the following idea shows evidence of the engagement of lead users:

Idea Title: Logging in triggers Firefox NoScript XSS violation blocking
Submitted by: Phubert
Status: Implemented

Idea Body: The NoScript extension sees potentially dangerous cross-scripting when one tries to logon to IdeaStorm.

Comments:

Zmjjmz: I wouldn't detect that because I have NoScript allowing this site, but before I did it did come up with an error when I tried to reset the pass.

Phubert: I get the error with every login... and no auto login now????

Zmjjmz: Did you allow the storm site to execute scripts?

Zmjjmz: Oh actually it just happened to me. I was able to log in fine, but it still showed some XSS and it was blocked.

Jackie_c: This has been resolved. Thanks!

Zmjjmz: Well Firefox still crashes for me trying to login, but that seems to be some weird FF issue.

Because the research literature supports the notion that lead users are expert suppliers of ideas and have a vested interest in maturity of products (von Hippel, 1986), IdeaStorm served as an extended resource for Dell's innovation process. The example illustrated the characteristics of sophisticated users with interest in solving a problem.

The next sections provide a discussion based on each research question.

Research Question 1

In what ways does Dell's IdeaStorm operate as a social network and what does the network look like? This research question explored the relationship of the participants on IdeaStorm from a social-network perspective. The idea networks (Figures 7 and 8) in this study are consistent with concepts from social-network theory that describe networks as dynamic structures where interactions and social identities exist in a self-organizing fashion (Rheingold, 2002; Watts, 2003). First, IdeaStorm served as a platform where social relationships formed. Individuals on the networks had identities, and the network diagrams reflected the collective action of those participants. Some evidence of the establishment of social relationships appeared in the following interaction:

Phubert: Badblood, Petzy sends her birthday greetings to you! Is your birthday the 25th (or thereabouts)?? Add mine as well!

Badblood: why thank you phu and many thanks to petzy! When is she coming back?

Phubert: You're welcome, bb! Apparently Petzy has no plans to return here. She communicates with sugarbear and me via email. I believe she has a new job now and has moved into a new home. The culture there is a bit confusing to me as is ours to her! I've been dealing with heart issues... rather unexpectedly. So far cardiac insufficiency isn't indicated (so far as I know, anyway). All the basic tests and imaging performed.. after 3 visits to Emergency. :-).

Jervis961: Have you ever done the math to see what percentage of the comments here belong to you phubert? Between the two of us we have posted about 11% of the total comments on IdeaStorm

Badblood: Where is phu by the way. Is he off romancing petzy or something?

The relationships among the participants could be expressed in network terms such as nodes, links, and ties. The diagrams show how the individuals are connected to each other. This enabled the networks to be viewed at both the individual and collective levels. Thus, the ideas, in a sense, are what made the networks form and evolve.

The network diagrams also revealed where participants converged on ideas. For example, in the network with high-implementability status, the diagrams showed star-like patterns surrounding anjislair, ewalk153, and phubert. In a star-shaped network, the center participants have the most access to others in the network, thus making them more influential and powerful (Hanneman & Riddle, 2005). This particular placement will also be discussed below, as part of the discussion on network centrality.

In contrast, the networks illuminated places where ideas got isolated. For example on the network with low-implementability status, luck101, robertobiggio, majorn0ob, lucas32, fxi, and gear offered ideas that only got feedback from individuals who had no other connections in the network. These same individuals did not engage with others in the network. Perhaps as expected, this phenomenon did not appear as frequently in the network with high-implementability status.

Research Question 2

What influence do network relationships have on the implementation of ideas?

From the findings, neither of the two networks benefited from high-connectivity statistics. Given the participant sizes and possible number of connections, the density percentages were rather low. Even though the network with high implementability had a higher density percentage (3.83% versus 1.58%), one might expect a smaller network to be denser because it is easier for participants to reach each other.

On an individual level, it was rare that a participant generated an idea and commented on others. Even ewalk153, who offered the idea that was most popular (a vote score of 720), only contributed to one other idea. One exception was phubert on the network with high-implementability status. Phubert's in-degree (9) and out-degree (3) scores resulted in a core position in the network. A closer examination, however, revealed that phubert's interactions were focused only on ideas related to the IdeaStorm site rather than product or process ideas for Dell. Perhaps phubert's network connection strength influenced others to make additional suggestions about the site. Almost half of the ideas in the network with high-implementability status were related to improvements of the IdeaStorm site. The networks with low-implementability status had far lower percentage.

Network-relationship strength also raises the question of weak ties. As indicated in much of the research literature, ideas flow efficiently in networks that contain weak ties (Granovetter, 1973; Kratzer & Lettl, 2008; Perry-Smith & Shalley, 2003). With little exception, both idea networks contained a majority of weak ties. This is perhaps due to the anonymity of the participants and the worldwide reach that IdeaStorm provided. In an anonymous network, there is less risk to share an unconventional idea, opening up

possible suggestions that might not have normally been likely to emerge. Although the network with high-implementability status had fewer participants, it did have more comments to the ideas that were posed. The exposure of ideas to a diverse group of individuals with different perspectives was likely beneficial to the idea-generation process (Perry-Smith & Shalley, 2003).

Research Question 3

What influence do network positions have on the implementation of ideas? Ibarra (1993) discussed that position in a social network does have an effect on the community. Participants in the center have more exposure and potentially the most influence over others in the network. Thus, it was of interest in the present study to examine the participants who held central positions in the networks, particularly the network with high-implementability status.

According to the findings, the network with high-implementability status had five participants with high centrality: jervis961, badblood, phubert, ewalk153, and haloman. In general, they provided the most ideas and made the most comments. They also appeared to be hubs on the network diagram.

For example, ewalk153 was a strong provider of ideas (high in-degrees). Upon closer look, however, ewalk153 only had one idea. That idea had the highest vote score and the most number of comments for a single idea. The following is a partial illustration of the energy behind that one idea:

Idea Title: Dell Mini Ubuntu (Linux) Missing Webcam

Submitted by: ewalk153

Status: Implemented

Idea Body: It would be great if the Dell Mini product site would add back the webcam option for the Ubuntu Linux version of the product.

When the site first launched both the 0.3 megapixel camera and the 1.3

megapixel camera were available as configuration options, but they have since been dropped from the site when ordering the linux version of the product. Any ideas from Dell on why the change in product offering? Any chance that this will be added back in as a product configuration offering? I have to imagine that the drivers for a webcam are available, and if not, there are plenty of developers who would be interested in building them. This site lists a lot of information on getting a webcam running on a linux pc:

Comments:

Zmjzmz: Yeah, looks like you can only get the webcam on the most expensive one...

alkiwolfi: This is stupid. To get a webcam working in Gnome all you need to do is install Cheese. Just type *sudo apt-get install cheese* in a terminal window and enter your password when prompted and that's it. Cheese will be installed and your web cam will work.

Ewalk153: aikiwolfie—exactly. I can't see any reason for them to have removed the product configuration option.

Feranick: I have a feeling the webcam hardware is not supported in Ubuntu, so they dropped. Cheese it's only a front-end, doesn't include drivers. If those are not in the kernel (or in modules for the kernel), there is no way the webcam will work. Of course this is stupid from Dell part to choose a webcam NOT supported in Ubuntu, but hey, here we go...

The comments on this idea continued to evolve over time and concluded with Dell implementing the webcam back into their product. Ewalk153's position in the network in this example supports the type of participant with whom others seek to directly engage (Hanneman & Riddle, 2005). In a sense, this idea served as a magnet in the network.

This example demonstrates how important central positions are in a network. Whether a participant plays the role of an influencer or out of prestige, the central position appears to have an advantage over other locations in the network.

Research Question 4

What is the difference in network centrality between networks that contain high- or low-implementation status? The findings on this research question did indicate a significant difference between the strength of network positions of the two idea networks. The mean centrality measures for both idea generators (in-degrees) and idea contributors

(out-degrees) in the network with high-implementability status were significantly stronger than in the network with low-implementability status.

Perry-Smith and Shalley (2003) discussed the spiral relationship between network centrality and idea implementability. They found the people tend to converge on creative ideas and, in a sense, want to be part of the action. The network with high-implementability status in the present study demonstrated some of those attributes. Good ideas became hubs and provided engagement among participants.

Given the likelihood of lead-user participation, the network with high-implementability status is consistent with Kratzer and Lettl's (2008) findings regarding the positive relationship between idea implementability, network centrality, and lead users. Central-network positions were highly desired by suspected lead users because those positions gave them the most access to other lead users. That association was found to have the potential to result in the most creative ideas. It is perhaps no surprise, then, that the network with high-implementability status had significantly stronger central-network participants.

IdeaStorm also fits with the idea-generation framework presented by Kijkuit and van den Ende (2007). They expressed the importance of network structure in the idea-generation phase. Big groups with weak ties may produce a wider diversity of thinking and more interactions produce better ideas. This is how IdeaStorm worked, and, in the network with high-implementability status, that kind of interaction was evident. By leveraging the network with high implementability status, Dell could tap the knowledge created and drive innovative ideas forward.

Conclusions

This study used network analysis to explore the specific interaction patterns on an online social network, IdeaStorm, and the emergence of creative ideas. The findings revealed that activities on IdeaStorm can be expressed from a network perspective and that insights on relationships among participants were revealed.

By Dell offering IdeaStorm to its customers, the company supported the notion that idea generation is an important part of the innovative process (Koc, 2007). In a sense, with IdeaStorm Dell created a computer network that served as a metaphor for a social network. Thus, IdeaStorm could be studied from the lens of social-network theory and methods. Network language such as connectivity, centrality, links, nodes, hubs, and ties were used describe the relationships among participants in the idea community. Formal social-network methods provided a useful research frame to describe the interactions on IdeaStorm. With these tools, the networks could be represented in a way that patterns about social relations, connectivity, and network positions were more perceptible than with other methods.

The findings revealed that IdeaStorm provided a marketplace for ideas that contributed to the creation of knowledge for Dell. Through the engagement of customers and lead users, Dell was able to implement many of the ideas that were generated from the community. The exchange of ideas generally operated much like a social network through the means of weak tie connections. Consistent with Granovetter (1973), the weak ties provided bridges to others in the network, thus supporting the flow of ideas.

There were differences found between the networks in idea implementability. The network with high-implementability status was denser and had stronger relationships.

Although unclear if these relationships resulted in groundbreaking ideas or just focused on the improvement of the network itself still needs to be determined. Also, network position seemed to be an important factor. The participants who held central positions were found to have more influence and prominence in the more creative network. Those center positions were found to be more influential than in the network with low-
implementability status.

The idea networks were consistent with the behavior of a CAE (Cilliers, 1998). Like ant colonies, both networks had similarities of interactive, nonlinear systems. There was no apparent leader, and the emergence of ideas was what gave the networks their shape and life. IdeaStorm provided a structure made up of a loose set of rules in how ideas were shared; however, the community was able to adapt by sharing ideas that helped the community itself. Also, similar to a CAE, IdeaStorm contained feedback loops through the use of comments and the engagement of Dell employees. Finally, although IdeaStorm operated as a network, it was unlikely that individual participants were aware of the impact they may or may not have had on the rest of the community. It is through the language of networks that made it possible to have more of an understanding of how individual ideas could have an influence into far-reaching areas of the community.

Implications

Based on the findings, there are practical implications for action that extend to professional and academic disciplines. This section is divided into two parts:

(a) implications for business and (b) implications for education.

Implications for Business

Fostering innovation is critical to the future success of any organization. With changes in technology, social trends, and customer demands, companies may find that their current business models are obsolete. For example, Eastman Kodak, a past leader in photography, has struggled to survive in the digital age (de la Merced, 2012). To combat this, organizations may need to reinvent themselves to survive. The findings from the present study suggest that businesses need to create environments where creative ideas can thrive. These innovative ideas can lead to new products and services that differentiate them from their competitors. Whether it is through a mechanism such as IdeaStorm or through other online social-networking tools, it is to a great advantage that firms leverage their employees and customers to assist with their innovative process.

Organizations also need to adopt the proper change-management efforts that help enable new ideas to be absorbed into their organizations and get new innovations out to the market. One specific area is examining absorptive capacity, which describes the ability for a firm to process new knowledge and transfer that knowledge throughout the company (Cohen & Levinthal, 1990; Mei & Nei, 2007). It would be unfortunate if a company was able to generate good ideas, but, because of how the business functions, was unable to implement them.

Finally, organizations need to align their human-capital practices to support innovation. Compensation systems should reward experimentation and intelligent risk taking. Training and development programs need to focus on areas that educate employees on ways to spark their implementability and be more innovative. Companies should also dedicate their external recruiting efforts to not only leverage social-

networking tools to find great talent, but also hire individuals who possess both the skills and potential to adapt to change and bring fresh approaches to their work.

Implications for Education

Innovation and social networks are also important in education. Universities that are able to tap their academic communities from a social-network perspective have a tremendous opportunity to improve their operations and the quality of education. These networks exist among professors, administrators, students, and other staff. The findings from the present study imply that there are ways to leverage these groups to generate new ideas.

With the evolution of technologies, especially in the area of online social networks, academic units need find ways to incorporate these tools into curricula. Students entering the university have grown up using these tools and have high expectations for their use. One particular area is how social technology can foster implementability with learning groups (Bereiter & Scardamalia, 2003; Paulus, 2000).

Finally, network-analysis techniques should be taught along with other research methods. As shown in the present study, network analysis has provided an important lens in the study of social interactions. Traditionally, network studies may be associated with mathematics and physical sciences; however, as this study has demonstrated, there are social and educational implications that network analysis can address.

Recommendations for Further Research

This research could be extended in many different directions. Therefore, the discussion of future research will be divided into three areas: (a) idea-generating communities, (b) social-networking methodology, and (c) idea-evaluation systems.

The present study focused on a particular group of individuals, specifically participants who were interested in Dell's products and services. Another potential group to examine are open-source communities. These are self-organizing communities that have been found to have outstanding idea-generating capabilities (Hemetsberger & Reinhardt, 2006; von Hippel, 2007). Another emerging trend is crowdsourcing, which is the purposeful recruitment of an online community that has been specifically engaged to help businesses solve problems (Brabham, 2008). Future research could include these and other communities (including nonanonymous participants) in network analysis and idea evaluation.

The social-networking methodologies used in the present study were only a small subset of a myriad of approaches that can be deployed. For example, further research could include deeper analysis on connectivity and positional measures like looking more closely at the network distances between participants or more sophisticated measures of centrality (Hanneman & Riddle, 2005). In addition to studying weak tie relationships, another extension to the present study would be analyzing structural holes, which is a concept that investigates how intermediaries in a network can create bridges between others who normally would not be connected (Burt, 1992). Also, the present study had a sample size and time limitation, specifically participants who generated ideas during the month of October 2008. Using different months or longer time periods could have had a different effect on behavior of the resulting networks.

The present study was also limited in the idea-evaluation model that was used, which focused primarily on whether an idea was implemented. There were other data points, though, that merit additional investigation. For example, studying the relationship

between idea popularity and idea implementability could lead to further insights. Another extension to the present study is whether certain idea categories were easier to implement. Ideas about the improvement of IdeaStorm, which were relatively easy for moderators to implement, for example, may have skewed the data on ideas that were more difficult to implement. Finally, study could explore other stages of the life cycle of an idea beyond idea generation. Specifically, the processes in which ideas are nurtured and refined are areas to investigate.

Personal Reflection

This study provided me deeper insight into idea generation and social networks. Having implemented a similar internal idea program, ideaX, at my firm, brought practical relevance to this study. The intent of ideaX was to foster ideas to improve the company's culture, products, and processes. Now that ideaX has been in place for 2 years, the results have been mixed. Employee ideas mostly focused on workplace ideas such as better tea selections in the kitchens, hand dryers in the bathroom, and implementing a sabbatical program. It has been disappointing that more business-related ideas have not materialized.

Newer tools have now emerged that may move the conversations from ideaX to different platforms. A recently implemented social-networking product called Chatter, which is a Twitter/Facebook-like environment for corporate consumption, appears to have more appeal and functionality. Chatter lets employees form interest groups, share articles and thoughts, engage in dialogue, and create personal identities. Perhaps a more thriving social-network environment will lead to more sophisticated conversations and novel ideas.

This study has also inspired me to do further work on innovation in my organization. My efforts have focused on foundational skills that aim to improve innovative behaviors such as employee motivation, critical thinking, and creativity in business. I have also introduced thought leaders to my organization that seek to infuse new notions on the subject of innovation. In one particular session, Johnson (2010), whose latest book focused on the origins of groundbreaking ideas, described the concept of a liquid network. Hundreds of years before Twitter and Facebook, people gathered in London coffeehouses, Johnson described, to share knowledge, debate issues, exchange ideas, and make new discoveries. These “liquid networks” still exist today, but now, with the help of technology, these networks extend across the world. A good idea has never had so much potential.

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APPENDIXES

APPENDIX A

PROTECTION OF HUMAN SUBJECTS MEMO

April 7, 2010

IRBPHS
University of San Francisco
Department of Counseling Psychology
2130 Fulton Street
San Francisco, CA 94117-1071

Re: Dissertation IRBPHS – Michael D. Jacobson

This memo is to state that the dissertation authored by Michael D. Jacobson (Student ID #10861964) will not have human subjects as sources of data. All data will be collected from a public electronic source which does not include the identification of any specific human subject. Therefore, there will not be an approval letter from the Institutional Review Board for The Protection of Human Subject (IRBPHS) included in the application for advancement to candidacy.

Please contact me if you have any questions.

Regards,

Deborah P. Bloch, Ph.D.
Dissertation Chairperson

APPENDIX B

SAMPLE NODE DATA COLLECTION INSTRUMENT

ID	Idea title	Vote score	Number of comments	Category
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APPENDIX C

SAMPLE RELATIONSHIP LINK DATA COLLECTION INSTRUMENT

Node ID (Idea Contributors)	Participant ID (Network participants who shared comments)
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APPENDIX D

SAMPLE ACTOR-ACTOR DATA COLLECTION INSTRUMENT

Participants				
	Actor 1	Actor 2	...	Actor <i>n</i>
Participants	Actor 1			
	Actor 2			
	...			
	Actor <i>n</i>			
