CROWDSOURCING NEW PRODUCT IDEAS OVER TIME: AN ANALYSIS OF DELL'S IDEASTORM COMMUNITY

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Abstract

Several organizations have developed ongoing crowdsourcing communities that repeatedly collect ideas for new products and services from a large, dispersed "crowd" of non-experts (consumers) over time. Despite its promises, little is known about the nature of an individual's ideation efforts in such an online community. Studying Dell's IdeaStorm community, serial ideators are found to be more likely than consumers with only one idea to generate an idea the organization find valuable enough to implement, but are unlikely to repeat their early success once their ideas are implemented. As ideators with past success attempt to again come up with ideas that will excite the organization, they instead end up proposing ideas similar to their ideas that were already implemented (i.e., they generate less diverse ideas). The negative effects of past success are somewhat mitigated for ideators with diverse commenting activity on others' ideas. These findings highlight some of the challenges in maintaining an ongoing supply of quality ideas from the crowd over time.

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1. INTRODUCTION

The need for innovation is consistently a top business priority among CEOs (Andrew, et al. 2010; Jaruzelski and Dehoff 2010) and a key issue in academic research (Krishnan and Ulrich 2001; Hauser, et al. 2006). Given the need for a continual stream of new products and services, firms have traditionally relied on an internal staff of professional inventors to generate ideas (Ernst, et al. 2000; Schulze and Hoegl 2008). Despite these investments in traditional innovation activities however, firms continue to be disappointed with their innovation outcomes (Andrew, et al. 2010; Jaruzelski and Dehoff 2010).

Many organizations are now outsourcing their ideation efforts in an attempt to get fresh ideas into their innovation process. One approach that is receiving substantial attention is "crowdsourcing," a neologism created by *Wired* magazine contributor Jeff Howe (Howe 2008). As he defines it, crowdsourcing is the act of taking a task once performed by an employee and outsourcing it to a large, undefined group of people external to the company in the form of an open call. Several organizations have implemented online crowdsourcing systems that gather ideas for new products and services from a large, dispersed "crowd" of non-experts (e.g., consumers). These web-enabled systems for ideas have been called the new and improved Suggestion Box 2.0 (Weiss 2006).

Some crowdsourcing applications take the form of a *one-time* contest or multi-stage tournament (Terwiesch and Xu 2008; Terwiesch and Ulrich 2009). For example, consider the recent *Betacup* challenge that received a lot of offline and online press attention. This contest was created to reduce the number of non-recyclable cups that are thrown away every year by creating a more convenient alternative to the reusable coffee cup (Bostwick 2010). Over four hundred ideas were submitted by several hundred individuals from all over the world between April and June 2010 with the winner receiving $10,000 (Elliott 2010). The *LED Emotionalize Your Light* competition, on the other hand, was a three month contest in 2009 with two stages (Bullinger, et al. 2010). Sponsored by Osram (a subsidiary of Siemens), participants were invited to propose ideas for LED solutions with a wellness or well-being focus. Almost six hundred ideas were submitted during the first phase (with three winners splitting €5,000), of which ten ideas moved into the second, improvement phase (where three winners split €2,000). The limited empirical research on innovation contests include descriptive cases studies (e.g., Bullinger, et al. 2010), as well as studies of the relationship between individual and contest characteristics and the number of ideators/solvers in a contest (Yang, et al. 2009) or problem solving effectiveness (Jeppesen and Lakhani 2010; Boudreau, et al. 2011).

Other crowdsourcing applications, and the type considered in this paper, involve individuals generating ideas *repeatedly* over time. For example, Dell (computer hardware) and Starbucks (coffee) were recently in the headlines for their ongoing efforts in having a large consumer community suggest, discuss, and vote on thousands of new product and service ideas (Sullivan 2010). Unlike one-time challenges where ideators typically only submit one idea during a limited timeframe and a winner is selected based on the "best" submitted idea, participants in these ongoing crowdsourcing communities are usually asked to keep on

proposing any big or small ideas that might improve the organization's products and services (Dell's IdeaStorm has been collecting consumer ideas since February 2007 and Starbucks' myStarbucksIdea since March 2008). With the exception of a few cases studies (Howe 2008; Di Gangi and Wasko 2009; Di Gangi, et al. 2010), there is a dearth of published empirical studies involving this type of crowdsourcing community.

Companies are very interested in ongoing crowdsourcing communities because consumers presumably have specialized knowledge about their own problems with existing products, and they are intrinsically motivated to freely contribute their ideas (von Hippel 2005; Fuller 2010). Moreover, there is good reason to believe that under the right conditions individuals can generate ideas that an organization finds valuable enough to implement (Kavadias and Sommer 2009; Magnusson 2009; Poetz and Schreier 2010; Girotra, et al. 2010). In addition to an almost limitless source of ideas, possible benefits from these ongoing communities include direct contact with customers as well as consumer input into the innovation process that is better, faster and cheaper than traditional market research (Boutin 2006; Howe 2008). Both Dell and Starbucks report that they have already implemented a few hundred consumer ideas submitted through their crowdsourcing communities. Despite its intriguing promises however, very little is known about the nature of an individual's ideation efforts in a crowdsourcing community over time. Understanding the key factors that drive the repeated generation of ideas that an organization wants to implement is necessary to fully appreciate the potential of these crowdsourcing communities and thus, their effectiveness. Here, an ideator's past participation in the community is of interest and a key question is whether ideators with past success in proposing ideas that are implemented continue to generate the types of ideas an organization desires to implement.

In this paper, two years of publicly available data from Dell's IdeaStorm community is used to study the nature of a crowd sourced idea generation process over time. While the majority of ideators only propose a single idea, very few of their ideas are implemented (Lotka 1926). Instead, most of the implemented ideas are proposed by serial ideators (i.e., individuals submitting ideas on at least two separate occasions). Building on the established theory around cognitive fixation (Jansson and Smith 1991; Smith 2003; Burroughs, et al. 2008), an individual's past success in generating implemented ideas is shown to have *negative* effects on their subsequent likelihood of proposing another idea the organization wants to implement. As ideators with past success attempt to repeatedly come up with ideas that will excite the organization, they instead end up proposing ideas similar to their ideas that were already implemented (i.e., they generate less diverse ideas). While there are no sure-fire ways to overcome fixation effects, the brainstorming literature suggests that context-shifting by interacting with diverse others can increase the quality of an individual's output (Dugosh, et al. 2000; Nijstad, et al. 2002; Smith 2003). Following this line of reasoning, the diversity of an individual's past commenting activity is found to have *positive* effects on an individual's subsequent likelihood of generating another idea the organization finds valuable enough to implement. Thus, the negative effects of past success are somewhat mitigated for ideators that comment on a diverse set of others' ideas.

2. NEW PRODUCT IDEAS FROM THE CROWD

Before developing the theoretical framework for this study, let us consider some of the ideas from Dell's IdeaStorm crowdsourcing community listed in Table 1. These ideas span a diverse range of topics (categories) and typically include information about customer needs (problem information) as well as ways of satisfying these needs (solution information). Because they are voluntarily offered, ideas from the crowd often show a low degree of elaboration and thus can sometimes be vague and immature (Magnusson 2009; Di Gangi and Wasko 2009; Di Gangi, et al. 2010). In addition, it should not be surprising if some of the proposed ideas are already known to the organization. For example, several consumer ideas in Table 1 are currently offered by Dell (e.g., Dell has offered gift cards for many years and has had its own magazine *Power Solutions* since well before 2005). Clearly, these ideas are not novel (as will be discussed later, all ideas tagged as being already offered are dropped from the analysis in this study).

[insert Table 1 about here]

Several ideas from the crowd seem to be very creative. Creative ideas are both novel (relatively new compared to other available ideas) and *potentially* useful to an organization in the short or long run (Amabile 1996; Shalley, et al. 2004; George 2007; Burroughs, et al. 2008). From Table 1, "Have Michael Dell in the Dell commercials," "Advertise on www.Hulu.com," and "Buy Lenovo" all have their own underlying logic—and all were *not implemented* by Dell! Thus, creativity alone is not enough. Consider, for example, that the vast majority of really creative ideas have no commercial value (Levitt 1963; Silverberg and Verspagen 2007) and that many patented ideas end up on one of the numerous weird and wacky patent web sites (Czarnitzki, et al 2011). Achieving the organization's innovation goals requires that some ideas are actually valuable enough to be implemented (Mumford and Gustafson 1988; West 2002; Franke, et al. 2006). In the words of Ted Levitt (1963), "Ideas are useless unless used. The proof of their value is in their implementation." Consequently, this study focuses on ideas that an organization does not already offer (new ideas) *and* considers valuable enough to implement (i.e., quality ideas). It is worth noting that unlike the prior literature which relies on subjective rater assessments of idea quality (e.g., Magnusson 2009; Giotra, et al. 2010; Kornish and Ulrich 2011; Poetz and Schreier 2011), the present study considers ideas that were *actually implemented* by an organization.

While many people only link innovation with radical breakthroughs that may change a company's existing way of doing business, it is important to recognize that innovation also encompasses ideas for incremental improvements to existing products and services (Mumford and Gustafson 1988; Shalley, et al. 2004; Vandenbosch, et al. 2006). In most cases, the implemented incremental improvements are considered to be quick-wins by the organization (Dahl, et al. 2011; Silverman 2011). For example, the suggestion by jervis961 in Table 1 to post a video from one of Dell's global events can probably be considered to be an incremental idea—implementing it made sense to Dell, it was not too costly, and it probably increased goodwill among some customers. On the other hand, some of the crowd generated ideas are highly valuable

(Bjelland and Wood 2008; Jouret 2009; Killian 2009). For example, the idea by dhart listed in Table 1 ("Pre-Installed Linux; Ubuntu; Fedora; Open SUSE; Multi-Boot") generated thousands of votes and hundreds of comments within Dell's community. Because of the tremendous support for offering computer systems with Ubuntu (an open source Linux desktop operating system), Dell quickly surveyed their customers about preferred distribution options (over 100,000 people completed the survey). Working through the associated production issues, Dell began selling three computer systems with Ubuntu 7.04 pre-installed a few months later (Menchaca 2007). This idea was tagged as partially implemented because the original idea called for the pre-installation of a wide variety of open source software that is not as yet offered.

A unique feature of IdeaStorm is that implemented ideas are publicly identified (e.g., see Table 1). Almost half of all implemented ideas involve changes in the styling, design, and hardware of Dell products. Another third of the implemented ideas deal with open source software, the IdeaStorm community, and web site. The remainder of the implemented ideas concerns other suggestions involving the environment, service and support, and retail operations. Not surprisingly, implementation costs vary considerably across ideas. Unfortunately, there is no available information on the costs or organizational impact associated with each implemented idea. But what is known is that very few ideas, including ideas that may seem like only small improvements, pass Dell's internal quality screening process (Dell reports on their IdeaStorm website that less than 4% of all submitted ideas have been fully or partially implemented). Thus, whether or not an idea is actually implemented is the key success outcome considered in this study.

3. THE THEORETICAL FRAMEWORK

In this section, the theoretical framework that guides the empirical study is discussed. A common theme in the new product literature is the importance of novel combinations and rearrangements of ideas, components, products, technologies, strategies, etc. (Simonton 2003; Fleming and Szigety 2006). Additionally, research in cognitive psychology supports the notion that quality ideas result from new and original arrangements of elements from existing knowledge bases (Ward 1994; Dahl and Moreau 2002). The larger and more diverse an individual's domain-relevant knowledge base, the more alternative ideas can be obtained by combining, recycling, recombining, and further developing these pieces of information (Amabile 1988; 1996; Hargadon and Sutton 1997; Fleming and Szigety 2006). In order to generate an idea the organization finds valuable enough to implement, an individual must access relevant information, often from diverse knowledge bases (Amabile 1988; 1996). Indeed, high quality ideas are rare because of the difficulty individuals have in accessing this information (Fleming and Szigety 2006). Research indicates that there are both positive and negative factors that can influence the retrieval of pertinent information during the idea generation process.

3.1 The Effects of Past Success

There is a large and growing literature in cognitive psychology and creativity taking the position that past experience is detrimental to future ideation efforts. In particular, research finds that a pervasive

impediment to accessing relevant and diverse knowledge bases is cognitive fixation (Jansson and Smith 1991; Smith, et al. 1993; Ward 1994; Smith 2003)—people tend to fixate on the principles and features of prior examples, leading to ideas that are less novel and less valuable (Smith, et al. 1993; Marsh, et al. 1996; Dahl and Moreau 2002). As defined by Smith (2003, p16), fixation is "something that blocks or impedes the successful completion of various types of cognitive operations, such as those involved in remembering, solving problems, and generating creative ideas." Also called unconscious plagiarism (or cryptomnesia), individuals are often unaware that they are fixating on the characteristics of past examples (Marsh and Landau 1995; Marsh, et al. 1999). Research into cognitive fixation goes back to early experiments by Maier (1931), Duncker (1945), and Birch and Rabinowitz (1951) which demonstrate that individuals have great difficulty in deviating from previously successful problem solving strategies even when a problem requires a new solution approach. In other words, past experience can limit the knowledge and heuristics used in the ideation process, leading to lower quality ideas.

Jansson and Smith (1991) were the first researchers to demonstrate fixation effects in the product design process. Individuals in their experiments were asked to come up with as many ideas as they could to solve various design problems (e.g., measuring cup for the blind, spill-proof coffee cup, medical monitoring device). Subjects in the control group only received a one-page problem statement, whereas subjects in the fixation group also received a second page with an example diagram of a possible design for the problem. They found that the design solutions generated by the fixation group were much more likely to include features of the example designs than the control group. Moreover, the fixation group also tended to include flawed aspects of the example designs that violated the problem statement. These general findings have been confirmed in many other situations, including those involving novices and experts (Jansson and Smith 1991), externally provided examples and examples generated by the individual themselves (Ward 1994), exemplars in the form of pictures as well as detailed verbal descriptions (Purcell and Gero 1992), and non-Western, non-industrialized cultures with limited technology (German and Barrett 2005). Importantly, Dahl and Moreau (2002) find that individuals generate less original ideas when examples are provided, and these ideas are less valuable (consumers have relatively low willingness to pay for the suggested designs).

Purcell and Gero (1992; 1996) extend the Jansson and Smith (1991) experiments by showing that fixation effects only occur with example designs that include principles which are already familiar. Further, Perttula and Sipila (2007) find that fixation effects are highest when the exemplars contain features that are commonly known. These studies suggest that cognitive fixation is related to an individual's established knowledge base—people are more likely to become fixated when prior examples are familiar. This is particularly relevant in a crowdsourcing setting where an organization publicly identifies only a few ideas that

are implemented. Here, an individual's own[1] implemented ideas are clearly very familiar and thus are highly salient exemplars of the types of ideas that the organization desires (Weiner 1985; Lindsley, et al. 1995). Similarly, the examples in the published experiments are highly salient to subjects because very few are used.

Taken together, this discussion suggests that an individual's past success in proposing implemented ideas is detrimental to their subsequent ideation efforts. This literature and research findings are summarized in the following hypothesis.

H_1: *An individual's likelihood of proposing an implemented idea is negatively related to their past success in generating implemented ideas.*

Various explanations that have been suggested to account for the negative effects of cognitive fixation are reviewed by Marsh, et al. (1996) and Perttula and Liikkanen (2006). One rationale that is generally consistent with reported experimental findings is a variant of Ward's (1994) structured imagination theory. According to this theory, people unconsciously summarize the general features of known exemplars by creating a new mental category such as "ideas desired by Dell." Further examples (i.e., implemented ideas) help to define (or redefine) this new category. This seems to be consistent with the crowdsourcing experiences of the top contributor to Dell's IdeaStorm site (Jervis 2010):

> Users sometimes have ideas that would force Dell to go outside their comfort zone and go in a direction where Dell would take the lead…This mindset has caused Dell to often only partially implement a user's idea or just not get it right (Dell doesn't really discuss or clarify ideas with users in most cases). *Sometimes the result is that the user will narrow their focus in future ideas based on the part that Dell did adopt. In essence they become less innovative and fall more into line with the safe approach Dell usually follows.* [emphasis added]

Thus, previous implemented ideas may influence what individuals believe to be "acceptable" ideas. In agreement with this explanation, Dahl and Moreau (2002) find that prior examples structure the form of subsequent ideas (i.e., ideas tend to conform to the high-level aspects of prior examples). If this mechanism is at work, then individuals with past success in generating implemented ideas will propose ideas that will be related to their previous implemented ideas, i.e., their subsequent ideas will be less diverse. This discussion is summarized in the following hypothesis.

H_2: *An individual's likelihood of proposing diverse ideas (i.e., ideas that differ from their previous implemented ideas) is negatively related to their past success in generating implemented ideas.*

3.2 The Effects of Past Commenting Activity

Research generally recognizes that interaction and idea exchange among individuals can facilitate the retrieval of relevant and diverse knowledge during the idea generation process (Hinsz, et al. 1997; Kohn and

[1]A similar line of reasoning can be used to hypothesize the effects of others' implemented ideas. However, unlike the case of own implemented ideas (in which Dell informs the original ideator), there are no good measures of whether an individual is even aware of others' ideas after their implementation in the Dell IdeaStorm data used in this study (e.g., there are very few comments on an idea after it is implemented). As discussed in the final section, this presents an opportunity for future research.

Smith 2011). A fundamental belief in brainstorming is that interacting with diverse others can stimulate associations in memory that lead to higher quality ideas (Osborn 1953). In traditional brainstorming studies, these interactions include face-to-face as well as computer mediated discussions. Several researchers confirm that interactions with diverse others involving the sharing of information and ideas has a positive effect on ideation efforts (Amabile 1996; Perry-Smith and Shalley 2003). These general results have been found in offline and online settings (Nijstad and Stroebe 2006). Interactions and communication with diverse others helps individuals to generate various alternatives, revise their own knowledge, and refine their ideas, making it more likely that an organization wants to implement the proposed ideas (Perry-Smith and Shalley 2003; Perry-Smith 2006).

While there are no sure-fire methods to overcome fixation effects, the literature suggests that context-shifting by making use of others' perspectives and ideas can increase the quality of an individual's output (Dugosh, et al. 2000; Nijstad, et al. 2002; Smith 2003). Prior research shows that sharing diverse ideas can stimulate other ideas or categories of ideas when individuals are motivated to directly attend to the stimulus ideas (Dugosh, et al. 2000; Dugosh and Paulus 2005; Rietzschel, et al. 2007; Kohn, et al. 2011). In crowdsourcing communities, ideas are shared online among members via reading, voting, and commenting. Because detailed information is available[2], this study focuses on an individual's commenting activity. While their motivations to participate in crowdsourcing communities vary, individuals that actively interact by commenting on others' ideas generally perceive more benefits, tend to feel a greater sense of community membership, and take their contributions seriously (Preece, et al. 2004). Thus, it seems reasonable to assume that commenters first attend to the focal ideas of their comments by reading them. Interacting with others via online comments also has been shown to promote active and critical thinking (Garrison, et al. 2001; Schellens and Valcke 2005). Ideators that comment on a diverse set of other members' ideas should develop a better understanding of consumer needs, leading to ideas that are more likely to be valuable to the organization and thus have greater chances of being implemented.

At the same time, arguments from the previous section might suggest that cognitive fixation on others' ideas can impede ideation efforts. However, unlike a traditional brainstorming situation in which a small group generates relatively few ideas in a fixed time period, in an ongoing crowdsourcing community thousands of ideas are proposed (few of which are deemed by the organization to be valuable enough to be implemented) over time (typically there are several days between idea generation and commenting activity). As compared to an ideator's own ideas which are actually implemented, the large number of others' ideas in a crowdsourcing community is not expected to be as salient. Moreover, fixation is generally reduced when there is time between idea generation sessions (i.e., due to incubation effects; Smith 2003; Linsey, et al. 2010). Finally, Dugosh, et al. (2000) find that the ideation efforts of individuals separately exposed to others' ideas

[2]Unfortunately, within the IdeaStorm community studied in this paper there are no complete data on the ideators that only read ideas, nor on voter IDs or voting dates.

(via a tape recording) was higher than interacting groups (that discussed each other's ideas)—suggesting that fixation is less important when individuals are asynchronously exposed to others' ideas. Thus, idea exchange via commenting in a crowdsourcing community is not likely to be influenced by fixation effects.

Taken together, this discussion suggests that there will be a positive relationship between the diversity of an individual's commenting activity and their subsequent chances of proposing an idea that the organization finds valuable enough to implement. The following hypothesis summarizes these arguments.

H_3: *An individual's likelihood of proposing an implemented idea is positively related to the diversity of their past comments on others' ideas.*

Flexibility (or breadth) is traditionally considered to be an important dimension of creativity (Torrance 1966; Guilford 1967)—e.g., breadth of attention has been found to be beneficial for innovation outcomes (Friedman, et al. 2003). Moreover, Dugosh, et al. (2000) and Nijstad, et al. (2002) find that individuals generate more diverse ideas after attending to stimulus ideas from a diverse set of categories. Together, these studies suggest that individuals commenting on a wide set of others' ideas will tend to generate more diverse ideas that will differ from their previously implemented ideas. Thus, the following hypothesis is offered.

H_4: *An individual's likelihood of proposing diverse ideas (i.e., ideas that differ from their previous implemented ideas) is positively related to the diversity of their past comments on others' ideas.*

4. DATA

Data for this study comes from the publicly available information on Dell's IdeaStorm web site. According to their web site, "The goal is for you, the customer, to tell Dell what new products and services you'd like to see Dell develop." IdeaStorm has won a number of awards including the 2008 PR Innovation of the Year and the 2008 Award for Collaboration and Co-Creation by the Society for New Communications Research. IdeaStorm is lauded as being an excellent, best-in-class crowdsourcing application (Howe 2008; Sullivan 2010).

To participate, individuals must join the IdeaStorm community (at no cost) by selecting an anonymous username (you do not have to be a Dell customer to join). Like most crowdsourcing applications, information on demographics and personal characteristics are not collected (the IdeaStorm community is a "large, undefined" crowd). Ideastorm members can propose ideas as well as comment and vote on the ideas of others. Anyone submitting an idea agrees to give Dell a royalty-free license to use the idea with no restrictions.

In addition to titling their idea and giving a description, consumers can tag their idea based on 39 different categories (e.g., new product ideas, laptops, sales strategies). Each idea can be classified in up to three categories; typically, however, ideas are assigned a single category. Similar to prior research (Ward 1994; Audia and Goncalo 2007), these idea categories are an objective measure of the extent to which an idea differs from an individual's previous ideas. A list of these categories is in Table 1.

The IdeaStorm review team reads each idea within 48 hours of posting to ensure that it meets Dell's terms of use. This team has educated Dell executives and employees how to best utilize IdeaStorm to find and act on ideas, and how to communicate the status of any ideas they use so this can be reported on the IdeaStorm web site. Answering a query by a user about how decisions on ideas are made, Dell's IdeaStorm Manager states that "the formal governance process consists of a senior-level idea review team that reviews the top ideas on IdeaStorm, and works them through the right departments for further study or implementation" (Dell_Admin1 2007). This manager goes on to note that there are two additional, informal governance processes: "One is a top-down process: a weekly summary of the top ideas and major discussion threads is sent to our executive leadership team, who discuss and monitor the status of those ideas. Another is a bottom-up process: employees in a number of departments review ideas that relate to their area of expertise." Most of Dell's departments have identified a category expert who serves as a business champion for IdeaStorm. This champion helps vet ideas and communicates with the IdeaStorm review team regarding the status of ideas in their department. Additionally, community members are vigilant in monitoring the ideas that Dell eventually adopts, informing the IdeaStorm team when one of their ideas (or even the ideas of other members) is implemented. To cut down on duplicate ideas (Kornish and Ulrich 2011), contributors are encouraged to first search the IdeaStorm site for similar ideas. In addition, the IdeaStorm team and community members patrol the web site for duplicate ideas (which are then merged together). Thus, there is every reason to believe that Dell considers IdeaStorm to be an integral part of the way they do business (Killian 2009).

IdeaStorm was officially launched in February 2007. Information on all of the ideas proposed between its inception and June 2009 was collected. In order to allow a time buffer for community activity around an idea to stabilize, ideas generated during the last four months were dropped from the analysis. Over the two year period February 2007 – February 2009, 4,327 individuals generated a total of 8,895 ideas. During the same period, 348 ideas (or about 4% of all ideas proposed) were implemented. Individuals that have an idea accepted by Dell (about 5% of all ideators) receive a pen in an engraved box (Sullivan 2010); no monetary compensation is awarded[3]. Implemented ideas are also publicly discussed by Dell administrators in their "Ideas in Action" blog, and are appropriately tagged on the IdeaStorm web site. Overall, Dell seems to be happy with the general quality of ideas (Killian 2009)[4].

[insert Figures 1 and 2 about here]

Descriptive information on the IdeaStorm population is in Figure 1. Almost 85% (Figure 1: 3623/4327) of all ideators only offered an idea on a single occasion (note that an individual can submit more

[3]According to their terms of service, Dell can acquire any intellectual property rights associated with the materials submitted to IdeaStorm for $1000. However, there is no evidence that Dell has ever exercised this option.
[4]One metric that speaks to idea quality is the number of proposed ideas that are already offered by the firm. During the two year period of this study, only 94 ideas (or around 1% of all ideas proposed) were found to have already been offered by Dell. As noted in the next section, these ideas are dropped from the analysis since they are not novel.

than one idea during the same day). Consistent with the main hypothesis $\mathbf{H_1}$, Dell implemented 11.8% (Figure 1: 111/944) of the ideas from serial ideators with one or two implemented ideas versus only 7.0% (Figure 1: 95/1356) of the ideas from serial ideators with more than two implemented ideas ($z=3.96$, $p<0.00$). Further, in line with $\mathbf{H_2}$ about 23% of the ideas proposed by serial ideators with more than two implemented ideas were in new categories (as compared to 67% of the ideas from serial ideators with one or two implemented ideas and 83% of ideas from serial ideators with no implemented ideas).

In agreement with the literature (Simonton 2003; 2004), the chances an individual generates an implemented idea is directly related to their ideation efforts. As indicated in Figure 2, most of the implemented ideas are proposed by serial ideators—only 3.9% of the one-time ideators in IdeaStorm had their idea implemented, while 15.1% of serial ideators (who had an average of over six ideas per individual) had at least one idea eventually implemented ($z=11.71$; $p<0.00$). Importantly, serial ideators do not seem to be motivated by an early success (e.g., only 6.5% of serial ideators had their first or second idea implemented, and less than half of these individuals proposed a subsequent idea after one of their ideas was implemented). Ideators that submit more than one idea in the same day also are significantly more likely to generate an idea that Dell finds valuable enough to implement (Figure 2). As suggested by Figure 2, ideation efforts and community participation seem to go hand in hand—serial ideators and ideators with multiple submission days are also more likely to comment on others' ideas. Further, active community participation via commenting seems to be associated with serial ideators rather than ideators with an implemented idea (37.7% of serial ideators with an implemented idea, and 35.6% of serial ideators with no implemented ideas, commented on at least one idea, whereas only 21.3% of one-time ideators with an implemented idea, and 17.3% of one-time ideators with no implemented ideas, commented on at least one idea).

[insert Figures 3, 4 and 5 about here]

Monthly counts of proposed ideas are shown in Figure 3. During the first few weeks after the web site was unveiled, ideas poured into IdeaStorm. From a peak of almost 1,200 ideas during the first month, the number of suggested ideas rapidly declined over the next six months, eventually steadying at a constant level. As shown in Figure 4, the number of individuals proposing ideas exhibits a similar exponentially declining time pattern. Figure 4 also suggests that a large fraction of the ideas in any month are generated by new members. The reason for this is that most people offer just one idea (although one person suggested more than 250 ideas).

Monthly counts of proposed ideas that were implemented are also shown in Figure 3. Not surprisingly, the number of implemented ideas is closely related to the total number of submitted ideas. While few consumers propose more than one idea that is implemented (although one person did suggest more than 25 ideas that were eventually implemented), the majority of individuals (almost 95%) never propose an idea that Dell found valuable enough to implement during this two year period. Over one-third of

the implemented ideas from one-time ideators were submitted in the first month after IdeaStorm was initiated (less than 10% of the implemented ideas from serial ideators were proposed in the initial month).

Finally, Figure 5 confirms that the majority of implemented ideas come from serial ideators. During the first few months after IdeaStorm began operations, many ideators offered a single idea that was implemented by Dell. But after six months, the number of implemented ideas suggested by serial ideators was double those by one-time ideators.

5. THE EMPIRICAL STUDY

In this section, the hypotheses developed earlier are formally examined. To do this, an unbalanced panel data set was constructed based on two years of daily[5] IdeaStorm data at the individual level (February 2007 - February 2009). Here, observations are only included in the estimation sample if an individual *i* proposed an idea not already offered by Dell in day *t*. Definitions for all the variables are in Table 2.

[insert Table 2 about here]

5.1 Measures

5.1.1 Dependent Variables. Because $\mathbf{H_1}$ and $\mathbf{H_3}$ concern an individual's likelihood of proposing an implemented idea, an appropriate dependent measure to test these hypotheses is y_{it}, a binary[6] variable where a value of one indicates that individual *i* proposed an idea in day *t* that was eventually implemented (otherwise zero), i.e., y_{it}=1 if individual *i* proposed an implemented idea in day *t*. $\mathbf{H_2}$ and $\mathbf{H_4}$ involve an individual's likelihood of proposing diverse ideas (ideas that differ from their previous implemented ideas). In this case, the dependent variable analyzed is a count (that takes on positive integer values) y_{it}, defined to be the number of ideas proposed by individual *i* in day *t* that are not in the same categories as their prior implemented ideas. Importantly, both of these dependent measures are: (1) publicly available from the IdeaStorm web site, (2) objective (they do not rely on subjective assessments), and (3) consistent with the related literature (Ward 1994; Dugosh, et al. 2000; Nijstad, et al. 2002; Smith 2003; Audia and Goncalo 2007).

5.1.2 Past Success. The measure of past success in this research is based on the cumulative number of implemented ideas proposed by individual *i* before day *t*. In practice however, it can take some time after an idea was initially submitted to decide if it merits implementation. Updates posted as comments (which are dated) are used to determine the specific date when an idea was implemented. For example, on May 29, 2008 jervis961 proposed an idea titled "Don't put the Dell logo upside down on Mini Inspiron" (it seems that the earlier logo on the cover looked upside down when viewed by someone using the laptop). However, it wasn't until September 4, 2008 that vida_k (the new Dell IdeaStorm Manager at the time) posted a comment "Changed status to **IMPLEMENTED**" under this idea. In this case, *past success in generating*

[5]Prior studies also have aggregated Internet activity data to the daily level (Park and Fader 2004).
[6]In less than 0.2% of all observations, an individual proposed more than one implemented idea in the same day (8 observations had two, and 2 observations had three, implemented ideas). For the IdeaStorm data, count model estimation results parallel those of the logit model to be discussed.

implemented ideas (defined as the cumulative number of implemented ideas proposed by individual *i* that were known to be implemented before day *t*) is constructed based on implementation dates, not submission dates. As the previously proposed ideas are filtered, there is a slight upward trend over time in the number of reported ideas that were implemented—the mean time between submission and reported implementation is just over six months.

Because the measure of success in this study is determined by the company (i.e., ideas they implement), an alternative explanation for $\mathbf{H_1}$ is that Dell "spreads the love around" by systematically ensuring that any individual does not have multiple implemented ideas, no matter the quality of the proposed ideas. There are two main reasons against this argument. First, it is clearly not in Dell's best interest to do this due to the implementation and opportunity costs involved. Second, there is no evidence that the ideas of IdeaStorm top contributors (i.e., individuals listed on the IdeaStorm leaderboard) are systematically discounted (e.g., 6.5% of the top twenty contributors' ideas were implemented versus only 3.4% of the ideas of everyone else; $z=5.53$, $p<0.00$).

5.1.3 Past Commenting Activity. Idea exchange within the IdeaStorm community is measured based on an individual's previous activity in commenting on the ideas of other community members. Like ideas, comments are tracked by commenter and date. Across all the categories in which they commented on others' ideas, almost 75% of the time ideators made a comment in a category before submitting their first idea in that category. This is consistent with the notion that commenting activity generally precedes ideation efforts across categories. To construct *diversity of past commenting activity* (defined using an entropy measure over the idea categories: $-\sum_j p_j \ln(p_j)$, where p_j is the proportion of others' ideas in category *j* individual *i* commented on before day *t*; Harrison and Klein 2007), comment dates were compared with dates of submitted ideas.

5.1.4 Control Variables. Several variables to control for possible effects due to other individual or situational factors are also included in the analysis (see Table 2). To control for the possibility that success is simply due to greater cumulative productivity (Simonton 2003; 2004), *prior experience in generating ideas* (defined as the cumulative number of ideas generated by individual *i* before day *t*) is included in the analysis. An individual's *age* (defined as an individual's time in the IdeaStorm community) is used to control for any effects of aging on output. To control for the possible effects of the diversity of an ideator's own ideas, *diversity of past ideas* (defined using an entropy measure over an individual's own ideas) is included in the analysis. Category dummies are included to control for any inherent differences in the propensity for implemented ideas across topics, and monthly time dummies are used to account for any other unobserved time-varying effects.

Seminal work in creativity argues that an individual's productivity in generating quality ideas is highly related to their total output (Simonton 2003; 2004). Thus, the absolute number of ideas generated by an individual in a day should be positively related to their likelihood of proposing an implemented idea in that

day. The standard approach of including the number of ideas generated by individual i in day t as an exposure constraint[7] is followed in this study. Across all consumers in the IdeaStorm data set, 495 (over 10%) had two or more ideas in a single day (one person proposed 20 ideas in the same day)[8].

5.2 Estimation Approach

Panel logit models are used to estimate the effects of the explanatory variables when the dependent variable is binary and panel Poisson[9] models are used when the dependent variable is a count (Cameron and Trivedi 2009). The individual-effects logit model is $\Pr(y_{it}=1) = \Lambda(\alpha_i + \beta\mathbf{x}_{it} + \gamma z_i)$ where y_{it} is the dependent variable (that takes on the values of 0 or 1) and $\Lambda(w)=e^w/(1+e^w)$; the individual-effects Poisson model assumes that y_{it} (that takes on values of positive integers) is Poisson distributed with mean $\Lambda(v)=e^v$. Here, x_{it} are all the variables that vary over individuals and time, z_i are the variables that describe the individuals but do not vary over time, and α_i captures all the unobserved differences between ideators that are stable over time and not otherwise accounted for by z_i.

Based on a Hausman type test (see Allison 2005), fixed effects models are preferred over random effects models for the IdeaStorm data. It is worth noting that the conclusions to be discussed are generally robust to random effects models. Due to the large number of panels (individuals), estimation of the fixed effects models is accomplished using a conditional maximum likelihood estimator where all time-invariant individual effects α_i are conditioned out of the model using an individual's total count (Cameron and Trivedi 2009). Importantly, a fixed effects model removes any unobserved heterogeneity across ideators. While this approach allows the individual specific effects to be correlated with the independent variables (and thus is less likely to be biased), a conditional fixed effects model has some important caveats. In particular, ideators that have $y_{it}=0$ (or 1 for a logit model) for all t are eliminated from the estimation sample due to the conditioning, and time-invariant variables z_i (including the constant) cannot be estimated. In other words, one-time ideators are not included in the estimation sample—instead, serial ideators are used to estimate the Poisson models and serial ideators with one or more implemented ideas are used to estimate the logit models (see Figure 1). It is worth noting that the relatively large number of zeroes (i.e., 85% of the ideas from serial ideators are not implemented) in the data does not lead to a sampling bias in favor of the proposed hypotheses. Instead, the large number of zero observations will make it more difficult to find statistical support for the hypotheses. More important, Cramer, et al. (1999) report that parameter estimates are quite robust to relatively large imbalances in samples sizes involving zero observations.

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[7]Including this constraint (the coefficient of *ln(Number of ideas)* =1) controls for possible differences across ideators in sheer quantity of ideas proposed in a single day (Cameron and Trivedi 2009).

[8]The submission date is assumed to be the same as the date when the idea was conceived. Although it cannot be completely ruled out, there is no evidence that individuals actually generate many ideas over the course of several days and then submit them in batch during one day. Active IdeaStorm members login to the community every day, and use automatic activity updates through their IdeaStorm dashboard, RSS, Twitter and Facebook feeds.

[9]Panel Poisson models generally provide a more stable fit to the IdeaStorm data than panel negative binomial models.

5.3 Results

Descriptive statistics for all the variables are in Table 2. Because all of the explanatory variables (with the exception of the diversity measures and dummy variables) are highly skewed, their log transforms are used in the estimations.

[insert Table 3 about here]

Estimation results are in Tables 3 and 4. These models provide very good fits to the IdeaStorm data as indicated by the significant Wald Chi-square statistics. In general, the estimated coefficients for the time dummies do not reveal any significant pattern[10]. The results for the category dummies across models suggest that ideas related to the Dell community, web site, IdeaStorm, retail operations, printers, Precision workstations and Vostro computers have significantly higher chances of being implemented. Although the details are not shown here, there is no evidence that ideators systematically propose more ideas in these categories over time.

As shown in Table 3 (Model 1), the negative and significant estimated coefficient for *past success in generating implemented ideas* strongly supports $\mathbf{H_1}$ while the positive and significant estimated coefficient for *diversity of past commenting activity* is in line with $\mathbf{H_3}$. Model 2 demonstrates that these results are robust to an alternative, stricter definition of implemented ideas. Here, ideas that were implemented very quickly (possibly because the proposed idea was already being considered by Dell or was an error) or very slowly (possibly because the proposed idea involved technology that Dell was already waiting for) are not considered. For example, thebittersea proposed an idea about pricing differences between systems that was implemented within one month because, as it turns out, there was an error on the web site (see Table 1). An idea proposed by hawk473vt in February 2007 that Dell should develop a rugged laptop for marine use was tagged as being implemented more than two years later (see Table 1). In this case however, Dell had already signaled their intentions of developing a rugged product line by introducing a semi-rugged laptop (ATG D620) in January 2007, which was eventually followed by their XFR product line (that exceeds military standards) in 2008 and 2009. Trimmed implemented ideas, therefore, only include implemented ideas with implementation times of between thirty days and one year.

Additional robustness analyses are also shown in Table 3 (Model 3). Here, estimation results for subsamples of ideators with few and many implemented ideas are reported. To do this, *past success in generating implemented ideas* and *diversity of past commenting activity* are multiplied by dummy variables for whether the individual had ≤ 2 or >2 implemented ideas (see Table 2). Strong support for $\mathbf{H_1}$ is again found, indicating that the detrimental effects of past success are not only observed for serial ideators with many implemented ideas but also for those with relatively few implemented ideas. These results suggest that the negative effects of past success are not simply due to the fact that many ideas are not implemented. Interestingly, strong

[10]Only information after February 2007 (see Figure 3) was also considered in a separate analysis not reported here. Not surprisingly, very similar conclusions to those that will be discussed in this section are obtained.

support for **H_3** only comes from serial ideators with few implemented ideas. The reason for this seems to be that IdeaStorm members with a lot of past success already have a relatively high diversity of commenting activity and thus there is little variance on this measure for them (the diversity measure of ideators with >2 implemented ideas is almost twice as large as that of ideators with $\leq$2 implemented ideas; $t=26.27$, $p<0.00$). This is consistent with the significantly lower estimated coefficient for the effects of past success for serial ideators with many implemented ideas (Wald $\chi^2=5.69$; $p<0.02$), i.e., the negative effects of past success are somewhat mitigated for serial ideators who already are engaged in diverse commenting activity.

[insert Table 4 about here]

As shown in Table 4 (Model 1), the negative and significant estimated coefficient for *past success in generating implemented ideas* strongly supports **H_2**. This result in consistent with Ward's (1994) structured imagination theory that ideators in an ongoing crowdsourcing community tend to fixate on their past success by generating less diverse ideas that are similar to their previous implemented ideas. Model 2 demonstrates that these results are robust to an alternative dependent measure involving ideas in any new category for the individual (defined to be the number of ideas proposed by individual *i* in day *t* that are in new categories for them, i.e., this is their first idea in that category).

The insignificant coefficient estimate for *diversity of past commenting activity* in Table 4 (Models 1 and 2) is contrary to **H_4**. This result suggests that serial ideators with diverse commenting activity do not in turn propose more diverse idea themselves. This finding is inconsistent with the brainstorming literature which argues for a positive effect as stated in **H_4**. At the same time however, this literature also finds that cognitive stimulation from attending to others' ideas can lead to productivity gains in the number of ideas generated (Dugosh, et al. 2000; Nijstad, et al. 2002). This possibility is explored by estimating the relationship between the explanatory variables and a dependent variable involving the number of additional ideas proposed by individual *i* in day *t*. As shown in Table 4 (Model 3), the coefficient estimate for *diversity of commenting activity* is positive and significant. Thus, there is strong evidence that serial ideators with diverse commenting activity propose more ideas, some of which are eventually implemented by Dell.

6. DISCUSSION

In this research, the nature of a crowd sourced idea generation process over time is empirically investigated. Two years of panel data involving several thousand ideas and individuals is studied in the context of Dell's IdeaStorm ongoing crowdsourcing community. Most consumers only propose a single idea and few of these are ideas the organization wants to implement (Figure 1). Instead, serial ideators account for the largest share of implemented ideas (Figures 2 and 5). Among serial ideators, past success in generating implemented ideas is found to have detrimental effects on their subsequent likelihood of proposing another idea the organization eventually implements (Table 3). Past success is also shown to be negatively related to the number of diverse ideas proposed (Table 4). Thus, as serial ideators with past success attempt to come up with ideas that will excite Dell, they instead end up proposing less diverse ideas that are similar to their

ideas that were already implemented. In addition, the diversity of commenting activity on others' ideas is found to have positive effects on an individual's subsequent likelihood of generating another implemented idea, but is not related to the number of diverse ideas proposed (Table 4). Instead, commenting activity seems to be related to an increase in the quantity of ideas proposed (Table 4).

The panel analyses in the present study extend the existing literature by considering the key individual-level factors associated with idea generation in a crowdsourcing community. In particular, an individual's past success and past commenting activity are shown to directly relate to their chances of proposing another successfully implemented idea. In contrast to the research on the patenting activity of inventors (Audia and Goncalo 2007; Conti, et al. 2010), the present study empirically demonstrates that individuals in the crowd are unlikely to generate additional implemented ideas once some of their ideas are implemented. Methodological and/or contextual differences between studies may account for these distinct results. Methodologically, research involving patents only considers granted patents—i.e., these studies ignore patent applications that were never granted[11], meaning that they do not explain the differences between successful and unsuccessful patenting activity. Contextually, patenting activity by professionals (employees) is part of their job whereas ideas are voluntarily contributed in crowdsourcing communities. In the case of patenting therefore, organizational learning theories suggest that past success will be positively related to future productivity (March 1991).

6.1 Implications

This research involving an analysis of individual-level ideation efforts is a first step towards addressing the key question of whether the supply of quality ideas can be sustained by an ongoing crowdsouring community over time. In the case of Dell's IdeaStorm, the majority of implemented ideas come from serial ideators. As suggested by the declining proportion of new IdeaStorm members that become serial ideators shown in Figure 6, Dell's future supply of quality ideas may be drying up. Currently, management closely tracks the site's activity (number of ideas, comments, votes), but not member statistics. As suggested by Figure 4, Dell should be monitoring the total number of individuals proposing an idea as well as the total number of individuals proposing an idea for the first time. Similar values for these metrics indicate that new members are not becoming serial ideators, which will ultimately lead to a reduction in the number of ideas offered by the crowd that the organization finds valuable enough to implement.

[insert Figure 6 about here]

Further, as their ideas are implemented and externally recognized, serial ideators become less likely to subsequently propose further ideas the organization wants to implement. Ideators with past success tend to propose less diverse ideas because they focus on the general aspects of their previously implemented ideas. This suggests that an organization like Dell should attempt to: (1) entice new members into the community

[11]Audia and Goncalo (2007) note that up to half of all patent applications are rejected.

who are unencumbered by past success, and (2) convert these ideators into serial ideators. Even then, serial ideators tend to only generate implemented ideas over a relatively short period of time.

At the same time however, the diversity of a serial ideator's commenting activity is found to mitigate the negative effects of past success (i.e., diversity of past commenting activity is positively related to the likelihood of proposing an implemented idea). Thus, active engagement and diverse participation of serial ideators in discussion forums should be encouraged as it is associated with the generation of ideas the organization finds valuable enough to implement. This activity is especially important for serial ideators with relatively few implemented ideas (serial ideators with many implemented ideas already seem to be actively engaged in commenting on others' ideas). While there are no sure-fire ways to overcome fixation effects (Smith 2003), published research also suggests that the use of analogies can help (Dahl and Moreau 2002; Linsey, et al. 2010). Various engineering related design-by-analogy methods are reviewed by Linsey, et al. (2010). Interestingly, there is also some evidence that fixation can be reduced by simply instructing individuals to not focus on prior examples (Chrysikou and Weisberg 2005). Thus, ongoing crowdsourcing communities might introduce explicit instructions for ideators to use analogies and to not focus on their prior ideas that were implemented.

Finally, it is interesting to note that Dell has recently introduced StormSessions to its IdeaStorm community—a place where community members can participate in "hyper-focused idea-generation sessions." These brainstorming sessions center on a specific topic (question) and last for a relatively short amount of time (e.g., a couple of weeks). While only a dozen or so sessions have been completed to date and participation has been relatively low, these sessions have the potential to reduce fixation effects by getting ideators to shift their attention away from their own previously implemented ideas.

6.2 Limitations and Future Research

Although Dell's IdeaStorm represents the gold standard for new product idea crowdsourcing applications, the generalizability of the specific results from this study may be limited. Future research might, therefore, attempt to confirm the roles of past success and commenting activity found in this study in other settings besides computer hardware and software. The present study is also limited to the publicly available data on the IdeaStorm web site. More refined measures of community activity (e.g., comment and vote valence), idea creativity (e.g., perceptions of novelty, usefulness, and feasibility), and idea diversity (e.g., based on the idea's description and content) might lead to other hypotheses and, consequently, a deeper understanding of the nature of crowdsourced ideation over time.

The IdeaStorm data only allow the effects of an individual's own implemented ideas to be studied. It would be very interesting to also consider the possible effects of others' implemented ideas (which would necessitate a measure of whether ideators attend to others' implemented ideas). Do ideators also fixate on the general characteristics of others' implemented ideas, leading to less valuable ideas? The theory of

cognitive fixation and structured imagination has not so far considered the possible effects of different exemplar sources.

In all likelihood, commenting activity by itself is a conservative measure of community member interactions. While the potential differences between simply reading someone else's idea versus also commenting on that idea could not be examined here, the brainstorming literature indicates that innovation outcomes are improved when individuals directly attend to these other stimulus ideas (Dugosh, et al. 2000; Dugosh and Paulus 2005; Kohn, et al. 2011). Future research might, therefore, examine whether other community activities like voting can also mitigate the negative effects of fixation on prior success. Recent experimental research also confirms that building off the ideas of others can be beneficial in the idea generation process (Kohn, et al. 2011). Thus, it would be interesting to see if collaboration during the ideation process is helpful in repeatedly generating quality ideas over time.

The marketing literature has a long standing interest in methods for improving idea generation (e.g., Goldenberg, et al. 2001; Toubia 2006), but is generally silent on "best" approaches for idea selection. From the present study, it is clear that the crowd can generate ideas an organization finds valuable enough to implement. However, much less is known about whether consumers are effective in selecting ideas that can be implemented (West 2002: Rietzscel, et al. 2010). And, next to nothing is known about idea selection in crowdsourcing applications where ideas are publicly submitted and rated by consumers over time.

Finally, improving our understanding of reward and feedback mechanisms in ongoing crowdsourcing communities presents an excellent opportunity for future research. For example, several crowdsourcing systems such as Threadless and Innocentive offer monetary rewards for innovative ideas, yet report that very few individuals win more than once (Jeppesen and Lakhani 2010). At the same time, thousands of software programmers willingly contribute their time to various open source software projects for no tangible rewards (Shah 2006). Future research might analyze secondary data involving actual crowdsourcing applications and/or construct experimental scenarios to determine the proper rewards and feedback to maintain (or increase) the crowd's output quantity and quality over time (e.g., Toubia 2006).

6.3 Conclusions

Organizations are very interested in the crowdsourcing model because consumers presumably have specialized knowledge about their own problems with existing products, and they are intrinsically motivated to freely contribute their ideas for new products and services. Many companies and entrepreneurs have rushed to develop and implement crowdsourcing communities, even though very little is known about their effectiveness. Most crowdsourcing communities have not been in existence very long, so there is no established history of successes and failures. This empirical study of Dell's IdeaStorm community reveals that serial ideators are more likely than consumers with only one idea to generate an idea the organization finds valuable enough to implement, but are unlikely to repeat their early success once some of their ideas are implemented. The negative effects of past success however, are somewhat mitigated for individuals that have

diverse commenting activity. These findings highlight some of the difficulties in maintaining an ongoing supply of quality ideas from the crowd over time, and emphasize the need for more research on crowdsourcing communities.

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Table 1
Selected Ideas from IdeaStorm
(ideator; category†; date submitted/date implemented)

Already Offered
Dell Technology and Applications Magazine (tonyman262; Advertising & Marketing; Feb 20, 2007)
Offer a Student Discount (dormlord52; Education; Jul 9, 2007)
Contribute to Ubuntu (darkproteus66; Linux; Apr 24, 2008)
Wireless Headphones for mp3 (cargwella; Accessories; Jul 1, 2008)
Gift Vouchers (sh; Advertising & Marketing; Dec 9, 2008)
Laptop Cover (matchew; Accessories; Jan 5, 2009)

Not Implemented
Have Michael Dell in the Dell Commercials (carap; Advertising & Marketing; Feb 16, 2007)
Have Firefox Pre-Installed as Default Browser (robinjfisher; Software; Feb 18, 2007)
Dell EV: Design and Sell an Electric Car (dhart; New Product Ideas; Feb 21, 2007)
Dell Should Sponsor American Idol (guardianxps; Advertising & Marketing; Mar 24, 2007)
Biodegradable Computers (reg; Desktops & Laptops; Mar 30, 2007)
Dell - Offer the Blank Keyboard (jorge; Accessories; Jun 2, 2007)
Start Offering Dell Products to General Public in Poland (lukasz_wisniewski; Dell; Nov 12, 2007)
Add an Automatic Spell Check to IdeaStorm (jervis961; IdeaStorm; Feb 10, 2008)
Make it Easier to Clean the Fans on Laptops (pwl2706; Laptops; Jul 10, 2008)
Discount Coupons for Top IdeaStorm Users (bbr; Advertising & Marketing; Jul 16, 2008)
Can We Get Studio Hybrid with Ubuntu? (arhere; Linux; Aug 1, 2008)
IdeaStorm Live!! (aikiwolfe; Advertising & Marketing; Nov 6, 2008)
Advertise on www.Hulu.com (jervis961; Advertising & Marketing; Nov 30, 2008)
Buy Lenovo (jervis961; Dell; Jan 9, 2009)

Partially Implemented
No Extra Software Option (ootleman; Software; Feb 16, 2007/Jul 20, 2007)
Pre-Installed Linux; Ubuntu; Fedora; Open SUSE; Multi-Boot (dhart; Desktops & Laptops; Feb 16, 2007/Jul 20, 2007)
Multi-Touch Screen (wkornewald; Monitors & Displays; Mar 8, 2007/Jul 17, 2008)
Offer More Configurations with 64-bit Windows Vista (hbruun; Desktops & Laptops; Feb 21, 2008/Nov 18, 2008)

Implemented
Rugged Laptop for Marine Use (hawk473vt; Laptops; Feb 17, 2007/Mar 9, 2009)
Implemented: Ubuntu Dell is Le$$ than Windows Dell (thebittersea; Linux; May 5, 2007/May 24, 2007)
Invest in Mini-Projectors (badblood; New Product Ideas; Jul 23, 2007/Sep 25, 2008)
Vostro 1500 with 7200 RPM Hard Drive Option (liraco; Servers & Storage; Aug 21, 2007/Apr 15, 2008)
Dell Community Member Awards (jervis961; Dell Community; Aug 27, 2007/Oct 1, 2007)
Post a Video of Your Global Mobility Event (jervis961; Advertising & Marketing; Aug 8, 2008/Aug 21, 2008)
You Ask Us Questions (brokencrystal; IdeaStorm; Aug 19, 2008/Jan 5, 2010)
Children's PC (jotje; Education; Oct 7, 2008/Aug 11, 2009)

†Idea categories include: accessories (keyboards, etc.), Adamo, advertising and marketing, broadband and mobility, Dell, Dell community, Dell web site, desktops, desktops and laptops, digital nomads, Dimension, education, enterprise, environment, gaming, IdeaStorm, Inspiron, laptop power, laptops, Latitude, Linux, monitors and displays, netbooks, new product ideas, operating systems, Optiplex, PartnerStorm, Precision workstations, printers and ink, retail, sales strategies, servers and storage, service and support, simplify and save, small business, software, Studio, Vostro, and XPS.

Table 2
Variable Definitions and Summary Statistics
(N=3498)

Variable	Definition	μ	σ	Min	Max
Implemented ideas	=1 if individual *i* proposed an idea in day *t* that was eventually implemented (0 otherwise)	0.06	0.23	0	1
Number of proposed ideas not in already implemented categories	number of ideas proposed by individual *i* in day *t* that are not in the same categories as their prior implemented ideas	1.73	1.10	0	10
Past success in generating implemented ideas	cumulative number of implemented ideas proposed by individual *i* that were known to be implemented before day *t*	0.74	2.43	0	27
Diversity of past commenting activity	$-\sum_j p_j \ln(p_j)$, where p_j is the proportion of others' ideas in category *j* individual *i* commented on before day *t*	1.67	1.11	0	3.04
Age	time in the IdeaStorm community of individual *i* at day *t* (days)	123.43	167.98	0	739
Diversity of past ideas	$-\sum_j p_j \ln(p_j)$, where p_j is the proportion of (own) ideas in category *j* individual *i* proposed before day *t*	1.64	0.84	0	2.95
Past experience in generating ideas	cumulative number of ideas generated by individual *i* before day *t*	28.58	51.37	1	252
Ideator with ≤2 implemented ideas	=1 if individual *i* had a total of ≤2 implemented ideas; 0 otherwise	0.75	0.44	0	1
Ideator with >2 implemented ideas	=1 if individual *i* had a total of >2 implemented ideas; 0 otherwise	0.25	0.44	0	1

Table 3
Panel Logistic Fixed-Effects Regression Results for Implemented Ideas
(standard error in parentheses)

Variables	Model 1	Model 2	Model 3
Explanatory Variables			
ln(Past success in generating implemented ideas)	-1.08[a] (0.36)	-1.36[a] (0.51)	
× Ideator with ≤2 implemented ideas			-4.81[a] (1.62)
× Ideator with >2 implemented ideas			-1.00[a] (0.37)
Diversity of past commenting activity	0.69[b] (0.30)	0.85[b] (0.40)	
× Ideator with ≤2 implemented ideas			0.66[b] (0.31)
× Ideator with >2 implemented ideas			-0.09 (0.45)
Controls			
ln(Age)	-0.49[a] (0.15)	-0.34 (0.19)	-0.47[a] (0.15)
Diversity of past ideas	-0.53 (0.44)	-0.72 (0.58)	-0.28 (0.45)
ln(Past experience in generating ideas)	0.42 (0.35)	0.58 (0.45)	0.47 (0.35)
Time dummies	included	included	included
Category dummies	included	included	included
Log-likelihood	-289.40	-177.06	-284.36
χ^2 (df)	152.68[a] (61)	103.59[a] (61)	162.76[a] (63)
N	1539	1354	1539

[a]significant at 0.01 level (2-tail); [b]significant at 0.05 level (2-tail)

Table 4
Panel Poisson Fixed-Effects Regression Results for Diverse Ideas
(standard error in parentheses)

Variables	**Model 1**	**Model 2**	**Model 3**
Explanatory Variables			
ln(Past success in generating implemented ideas)	-0.34[a] (0.06)	-0.60[a] (0.14)	0.09 (0.13)
Diversity of past commenting activity	-0.03 (0.03)	-0.01 (0.04)	0.29[a] (0.10)
Controls			
ln(Age)	-0.01 (0.02)	0.04 (0.02)	-0.09 (0.06)
Diversity of past ideas	-0.15[b] (0.06)	-0.38[a] (0.08)	-0.12 (0.16)
ln(Past experience in generating ideas)	0.24[a] (0.05)	-0.15 (0.08)	-0.09 (0.12)
Time dummies	included	included	included
Category dummies	included	included	included
Log-Likelihood	-3345.41	-2178.64	-1140.28
χ^2 (df)	361.15[a] (61)	678.21[a] (61)	1015.07[a] (61)
N	3498	3498	2349

[a]significant at 0.01 level (2-tail); [b]significant at 0.05 level (2-tail)

Figure 1
IdeaStorm Population
(February 2007 – February 2009)

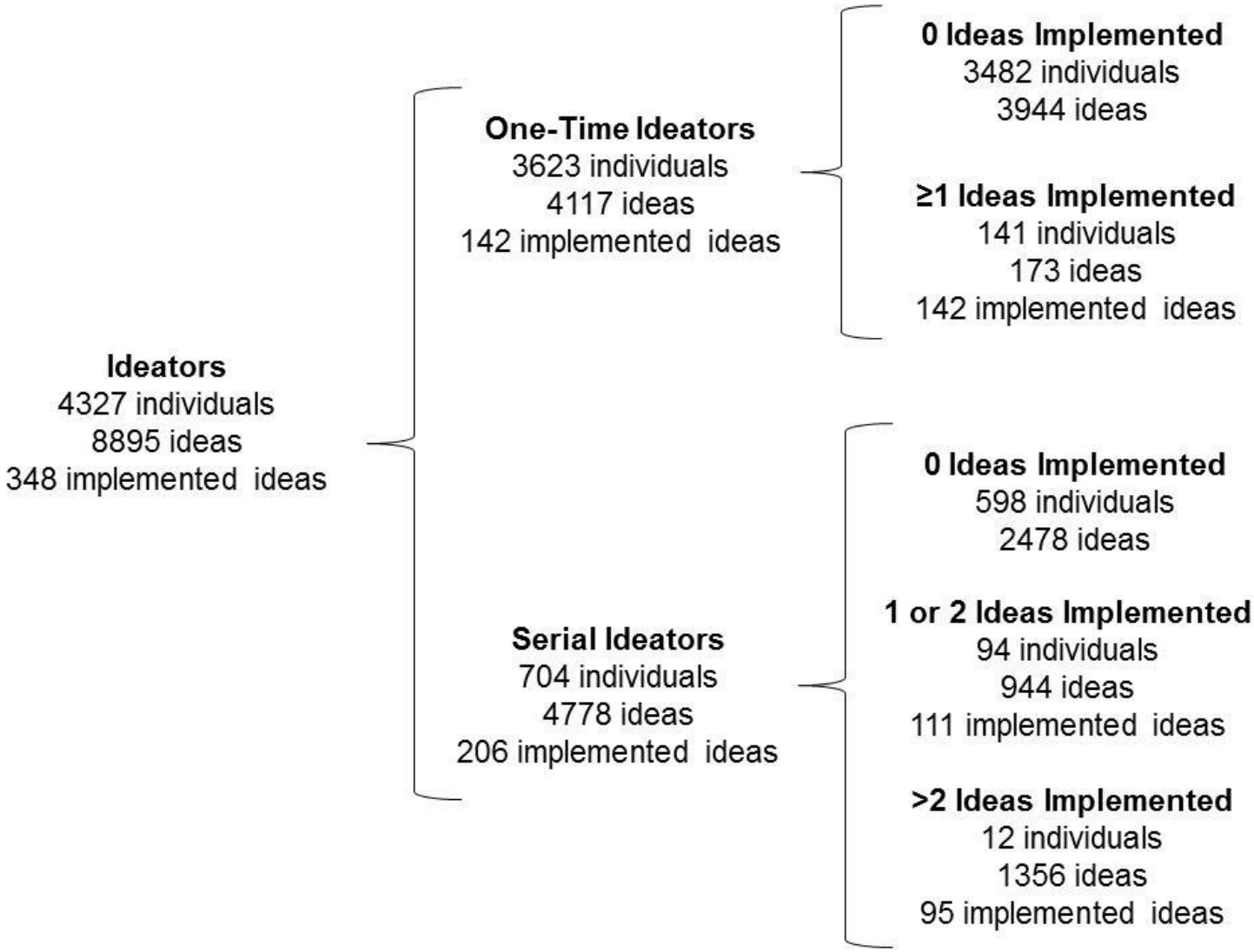

Figure 2
Ideator Productivity

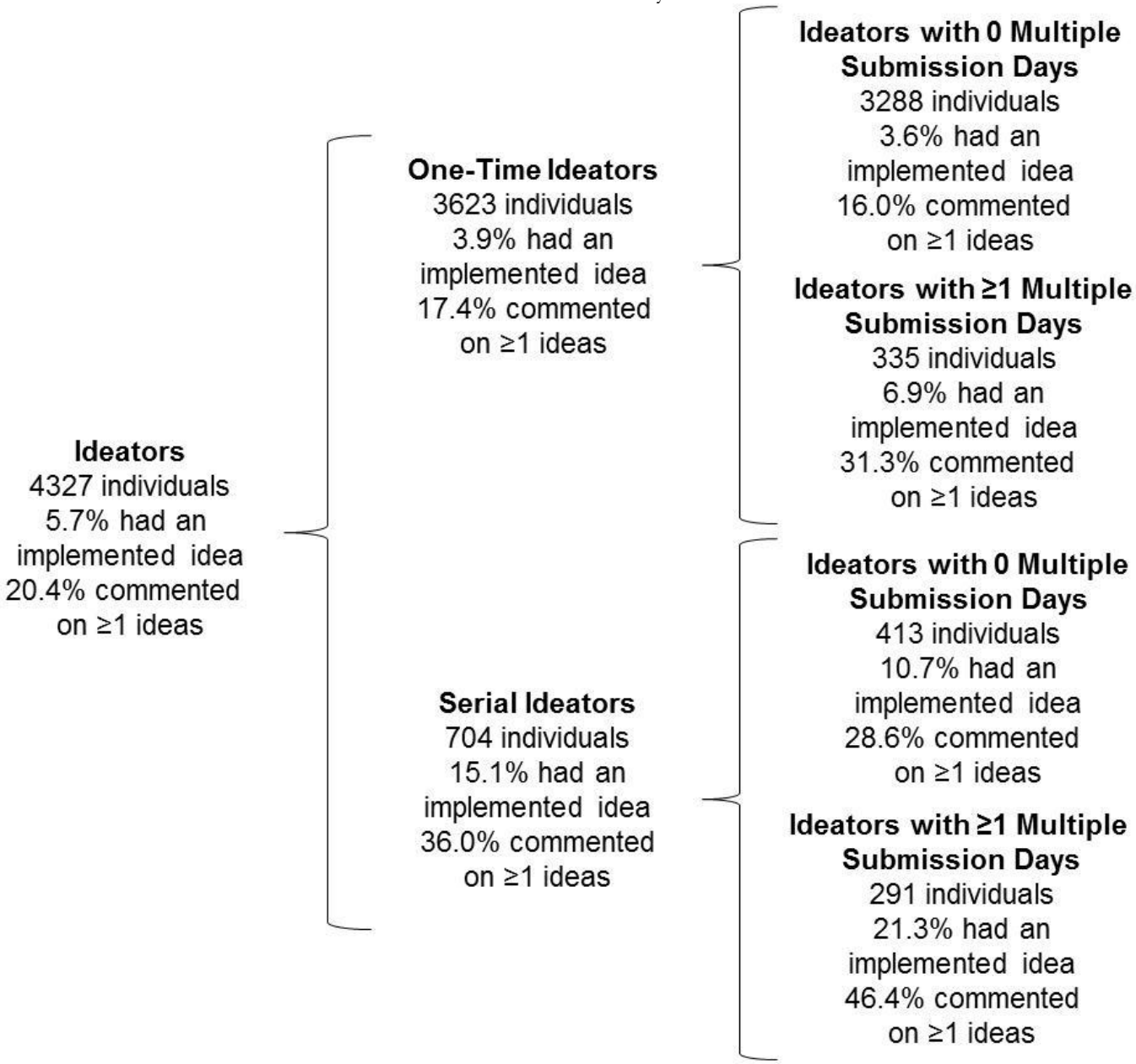

Figure 3
Number of Ideas over Time in IdeaStorm

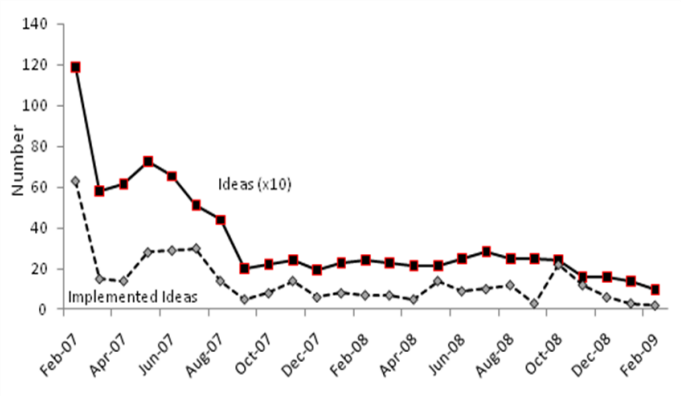

Figure 4
Number of Ideators over Time in IdeaStorm

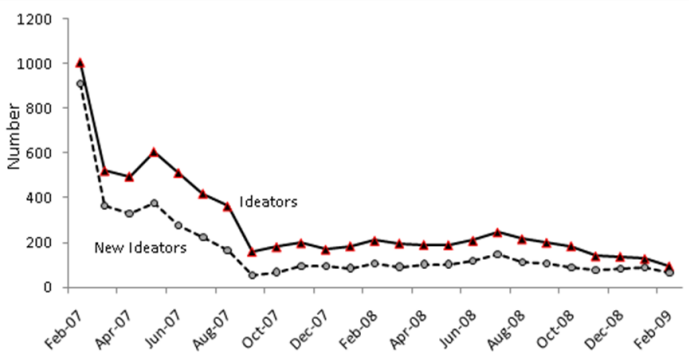

Figure 5
Cumulative Number of Implemented Ideas
over Time in IdeaStorm

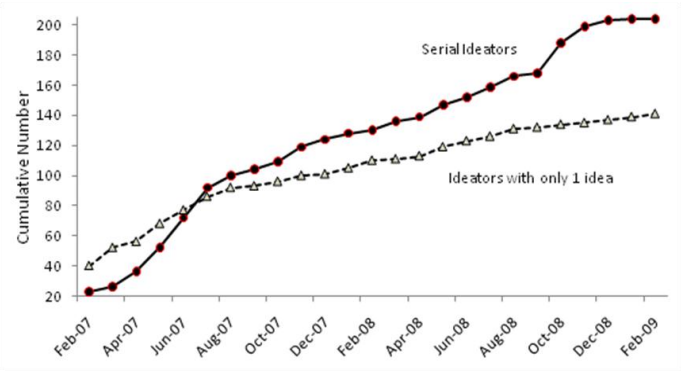

Figure 6
Proportion of New IdeaStorm Members
that Become Serial Ideators