

# **Creating and Evaluating New Product Ideas with Idea Markets**

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The creation and evaluation of new product ideas are crucial initial tasks in the new product development process. Three factors influence the quality of the output of these two tasks positively: (1) a large number of ideas and idea creators involved, (2) group decisions instead of individual decisions, and (3) methods that combine the creation of ideas with their evaluation. Idea-markets help combine these three factors. They use virtual stocks to represent new product ideas, let participants trade those stocks in a virtual marketplace, and use the efficiency of market-based aggregation and the resulting stock prices as indicators for the likely success of various new product ideas. Therefore, we propose the concept of idea markets as a new method to create and evaluate new product ideas. We describe the methodology of idea markets and discuss their scope for designs. We present the results of a real-world intranet-based idea market in a large, high-tech B2B company. We empirically assess the feasibility of idea markets for creating and evaluating new product ideas, analyze the quality of the idea market's ability to create and evaluate new product ideas, compare the evaluations of an idea market with those of experts, and outline the participant's as well as the top-management's evaluations of the overall performance of the idea market. Our results indicate that idea markets are a promising new method to support the new product development process.

*Key words:* Idea Generation, Idea Evaluation, Idea Screening, New Product Development, Idea Markets, Prediction Markets, Virtual Stock Markets, Innovation

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## **1 Introduction**

Due to the rapid replacement of existing products in the market, the persistent development of new successful products is one of the most essential challenges for companies. The creation and the evaluation of new product ideas are important initial tasks in the new product development process. These two tasks at the so-called “fuzzy front-end” of new product development are particularly compelling, because the creation of new product ideas requires both creativity and long-range forecasting abilities, and the evaluation of new product ideas suffers from a high level of uncertainty. The quality of initial product ideas can yet determine the commercial success or failure of products in the marketplace, making idea generation the highest point of leverage of the new product development process (Goldenberg et al. 2001). Prior research shows that the following three factors positively influence on average the quality of new product ideas: (1) a large number of product ideas and idea creators (Diehl & Stroebe 1987, Griffiths-Hemans & Grover 2006), (2) group decisions instead of individual decisions (e.g., Lorge et al. 1958; van Bruggen et al. 2002, Ozer 2005) and (3) methods that combine the creation of ideas with their evaluation (Toubia 2006).

Our approach, idea markets, helps combining these three factors. Hence, we propose idea markets as a new method for creating and also simultaneously evaluating new product ideas. Idea markets use virtual idea stocks to represent new product ideas, let participants order and trade shares of those stocks on a virtual market place, and use the efficiency of markets and the resulting stock prices as indicators for the likely success of the new product ideas. The most important distinctions between idea markets and prediction markets such as the ones described in Gruca et al. (2003), Pennock et al. (2001), Spann & Skiera (2003) and Wolfers & Zitzewitz (2004) are that (i) the set of available stocks in traditional prediction markets is fixed by the initiators, whereas it is variable in idea markets and dependent upon the number of new product suggestions from the participants, and (ii) that the value of the stocks in an idea market cannot depend on the realization of a specific market situation in the near future. These distinctions require a thorough extension of the traditional design of prediction markets.

The aim of this paper is to propose and develop idea markets as a new method to create and evaluate new product ideas. Therefore, we describe idea markets, discuss their different scope for designs, evaluate empirically the feasibility of idea markets for finding new product ideas, analyze the quality of the idea markets' ability to create and evaluate new product ideas, compare the evaluations of an idea market with those of experts, and outline the participants' as well as the top-management's evaluations of the overall performance of the idea market. We present the results of a real-world intranet-based idea market that lasted for five weeks in the beginning of 2006 involving more than 500 participants from all hierarchical levels in a high-tech B2B company with a revenue of more than two billion US\$. These results suggest that idea markets are a promising method to support the idea generation process.

We have organized the remainder of the paper as follows. In Section 2, we support the use of idea markets for creating and evaluating new product ideas. Section 3 explains the design considerations for idea markets. Section 4 describes an empirical study that uses idea markets for creating and evaluating new product ideas at a technological company. Section 5 concludes the paper with managerial implications, limitations and directions for future research.

## **2 Success Factors for Idea Generation Methods**

Previous research investigated many methods for the creation of new product ideas (for a recent summary see Crawford & Di Benedetto (2006)). Our motivation behind proposing idea markets as a new method for creating and evaluating new product ideas rests on the finding that the following three factors positively influence the quality of new product ideas and that idea markets help combining these three factors: (1) a large number of ideas and idea creators, (2) group decisions instead of individual decisions, and (3) methods that combine the creation of ideas with their evaluation. Therefore, we first explain the possibly positive influence of these three factors on the quality of new product ideas and then outline the idea markets' ability of combining these three factors.

## **2.1 Large Number of Ideas and Idea Creators**

The quality of new product ideas can be decisive for the commercial success of the resulting products (Goldenberg et al. 2001). However, it is difficult to determine the best idea creators, i.e., the persons to be included in the process of idea creation, as well as the critical characteristics of good new product ideas. This difficulty is driven by the rather stochastic nature of creativity: best product ideas may even arise unexpectedly and not on demand (Hargadon & Sutton 1997), and a diverse pool of skills of the participants might enhance the chances to find an unconventional, maybe breakthrough new product idea. Lead users can be a valuable source for new product ideas (von Hippel 2005). Yet, lead users might be difficult to identify (Spann et al. 2006). Since it cannot be anticipated in advance as to *who* might have the next product idea of a high potential, the integration of several external and diverse sources such as employees, suppliers, consultants, customers, or researchers is advisable in this pursuit to broaden the search process (e.g. Alam 2003, Emden et al. 2006, Majchrzak et al. 2004).

Given this uncertain nature of idea creation, methods for idea creation should enable participants to come up with a broad scope of ideas because several studies show that the quantity of new product ideas correlates positively to its quality (Diehl & Stroebe 1987, Potter & Balthazard 2004, Simonton 1999). Therefore, many creativity techniques such as brainstorming try to not narrow participants' creativity (Diehl & Stroebe 1987). Further, the development and ascertainment of new ideas can be enhanced by additional expertise or methods (e.g. Goldenberg et al. 1999, Troy et al. 2001, Hender et al. 2002). MacCrimmon & Wagner (1994) show for example that software with creativity-supporting features can improve the creative output. Additionally, organizational creativity mechanisms have a strong influence on the innovative performance of a company as they provide an innovation friendly environment (Bharadwaj & Menon 2000).

## **2.2 Interactions between Experts: Group Decisions**

The quality of creative output can be enhanced by the interaction of idea creators and their exchange of opinions. The exposure to unusual product ideas triggers individual creativity and increases

the quality of ideas created (Garfield et al. 2001, Goldenberg et al. 1999). In addition, the access to other product ideas can inspire other participants to suggest better product ideas. Open-access idea competitions, ideation games as well as idea markets provide such a transparency where participants can observe other ideas (Toubia 2006). Nunamaker et al. (1997) also show that the associated collaborative idea creation and the anonymous criticism in group decision support systems improve the quality of new ideas.

Interaction between new product evaluators is also beneficial for the quality of their evaluations. This is why the evaluation of new product ideas by a small number of experts increases the chances of failure. In addition, the use of small groups that decide about the idea's life-or-death is doubtful, because managers and consumers, as well as experts and novices often disagree systematically when selecting product ideas or concepts (Toubia & Flores 2006, Moreau et al. 2001). Interactive and iterative evaluation techniques such as the Delphi method enable participants to learn from each other and update their opinions, thus improving the overall decision quality (Rowe & Wright 1999). Diversity in expertise enhances the accuracy of the decision making (Ozer 2005). In addition, Jansen et al. (2006) also show that a high degree of centralization of decision making reduces the company's exploratory innovation. As a consequence, it is often beneficial to include more than one or a few experts in the creation and evaluation processes and let these experts interact with one another.

### **2.3 Combining the Creation of Ideas with their Evaluation**

Most conventional techniques for idea generation support either the creation (e.g., brainstorming method) or the evaluation (e.g., Delphi method) of new product ideas. This separation provides the benefit that participants can be very imaginative in the creation process. However, it poses the problem that idea creators receive no immediate feedback on their ideas. The distribution of product ideas in terms of their quality, commercial success or new-to-the-world criteria is usually much skewed, with a tiny portion of ideas being of a high quality. The fast, yet efficient screening of a large number of ideas is also

a challenging problem because a company can only pursue a rather moderate number of ideas for further development (Chandy et al. 2006, Majchrzak et al. 2004).

In a large scale setting, the immediate screening of ideas reduces the number of ideas which helps to avoid information overload and cognitive inertia (Pinsonneault et al. 1999). A large number of insufficient ideas visible to every one might increase the individual costs of screening, thus lowering the motivation of the participants in the idea evaluation tasks, thereby potentially harming the average quality and perceived usefulness of the method. The more accurate the initial screening decision, the more resources can be allocated to an in-depth analysis and actual implementation of the few good ideas (Majchrzak et al. 2004).

In addition, immediate feedback might assist potential idea creators to improve the quality of their new product ideas and provide an incentive to submit better ideas, and thus reduce the cost of idea screening. Toubia (2006) shows that individually customized incentives based on the impact of the participants' ideas improve the quality of new product ideas, in turn reducing the cost of screening when a large number of ideas are presented. The success of idea competitions might also be driven by the competitive nature of getting evaluations and rewards for good idea creations (Piller & Walcher 2006). Further, combining idea creation and idea evaluation can help to select the decision makers for idea evaluation. Participants who are able to create new product ideas usually possess the relevant knowledge about the products and are likely to have assessment abilities to evaluate the product ideas as well. Integrating these participants seems to have a positive influence on the successful evaluation of new product ideas.

## **2.4 Overview of Methods for Idea Generation**

Table 1 categorizes methods for idea creation and idea evaluation. They differ according to the tasks of idea generation (creation, evaluation or both), the number of participants and the degree of interaction among participants. Idea markets are characterized by an integration of a large number of participants, their interaction and the combination of both tasks, namely idea creation and evaluation.

Such a combination is attractive because all three characteristics positively influence the success of new product ideas. Table 1 shows that communities for user innovation also have such desirable characteristics. The major differences are that idea markets are an organizational creativity mechanism, which can be better guided by companies than user-driven communities, that the market mechanism efficiently aggregates diverse opinions in the market and that the corresponding market prices transparently reflect the evaluation of ideas.

		<i>Idea Generation Tasks</i>					
		<b>Idea Creation</b>		<b>Idea Evaluation</b>		<b>Idea Creation and Evaluation</b>	
		<b>Few</b>	<b>Many</b>	<b>Few</b>	<b>Many</b>	<b>Few</b>	<b>Many</b>
<i>Interaction Level</i>	<i>Number of Participants</i>						
	<b>No Interaction (Individual decision)</b>	Nominal Group Technique	Idea Competition	Product Portfolio Analysis	Voting, Checklists	Nominal Group Technique	Group Support Systems with Voting
<b>Interaction (Group decisions)</b>	Brainstorming	Group Support Systems	Delphi Group Discussion	Discussion Boards	Communities for User Innovation <b>Idea Markets</b>		

**Table 1: Methods for Idea Creation and Evaluation**

### 3 Description of Idea Markets

The objective of idea markets is to create a virtual market where all participants can suggest new product ideas and collectively evaluate those ideas through a market mechanism. Idea markets use idea stocks to represent new product ideas, let participants trade the stocks on a virtual market place, and use the efficiency of markets and the resulting stock prices as indicators for the possible success of the different new product ideas. The description of an idea stock can contain textual descriptions and multi-media enhanced content. The basic principle behind using the market mechanism for idea generation is to exploit the power of markets to efficiently evaluate a large number of stocks, as the market mechanism stands out for its ability to aggregate dispersed opinions (Hayek 1945). The efficient market hypothesis posits that all information available on a stock is reflected in its price (Fama 1970, Smith 1982).

Idea markets are an extension of prediction markets. Prediction markets also connect a group of participants together on a virtual market place and let them trade shares of virtual stocks. These stocks represent a bet on the outcome of future market situations, and their value depends on the realization of these market situations. Once the outcome of a specific market situation is known in a prediction market, each share of virtual stock receives a cash dividend (pay-off) according to the respective actual market outcome (e.g., \$1 for each product unit sold). Such types of prediction markets were initially applied in the form of a political stock market to predict the outcome of the Bush versus Dukakis 1988 U.S. Presidential Election with participation restricted to members of the University of Iowa community (for a more detailed description of prediction markets see Spann & Skiera (2003) or Wolfers & Zitzewitz (2004)). In almost two decades of research, prediction markets achieved promising results for short term forecasting such as political events, sports competitions or business outcomes (Chen & Plott 2002, Gruca et al. 2003, Forsythe et al. 1992, Pennock et al. 2001, Servan-Schreiber et al. 2004, Spann & Skiera 2003, Wolfers & Zitzewitz 2004). Further, prediction markets have been proposed for product concept testing (Dahan et al. 2006) and long-term forecasting (Hanson 1992).

### **3.1 Specific Design Aspects of Idea Markets**

The most important differences between idea markets and prediction markets are in the determination of the set of available stocks, the determination of the pay-off value of those stocks and, to a minor extend, the number of stocks that are available at the beginning of the idea market.

#### **Determination of the set of available stocks representing new product ideas**

Prediction markets operate with virtual stocks that are determined by the initiator of the stock markets. Political election markets in the US usually operate with virtual stocks that represent the respective presidential candidates or parties and popular markets such as the Hollywood Stock Exchange introduce a new virtual stock for each movie in production or planning. Idea markets differ because each stock represents a new product idea and these ideas are created by the participants themselves. Thus, idea markets need to be able to deal with an unknown and dynamic number of virtual stocks. Thereby, two

opposing effects need to be taken into account. In order to gather as many product ideas as possible, formal criteria for idea submissions should be set at a minimum level (Troy et al. 2001, Baker & Freeland 1972). However, a very large number of product ideas may lead to distraction and information overload, thereby hampering the individual's idea creation and evoking high screening costs. Hence, idea markets need to implement mechanisms that deal with how new product ideas, here idea stock candidates, float as idea stocks into the idea market. Three different approaches fulfil this task:

(i) *Acceptance of all ideas*: The simplest mechanism is to automatically trade every idea that is submitted and meets the minimal formal requirements like that of a comprehensive and complete description. While being cost-effective and rather easy to implement, the immediate trading of all ideas may be detrimental in large scale settings, because it might lead to a very high number of low-quality stocks in the market.

(ii) *Expert screening*: One or several experts might decide about whether an idea is appropriate for being traded in the idea market or not. Such a procedure is easy to implement in case of a single expert. Yet, a single expert might also fail to recognize valuable ideas. A group of multiple experts might partly solve that problem, but lead to higher costs and additional time to coordinate a group decision.

(iii) *Market screening*: Similar to an initial public offering (IPO) in financial markets, participants in idea markets can decide themselves on which ideas should be traded on idea markets. As on financial markets, such IPO mechanisms provide an incentive for the participants to quickly recognize valuable idea stock candidates. The following two possibilities can be taken into consideration for this:

- *Initial public offering with a uniform price*: Shares of idea stocks are offered at an equal price to all participants in the idea market. If participants decide to buy a minimum number of shares within a given time period, the idea stock will be sold to those participants and released for trading in the idea market. Otherwise, the idea stock is withdrawn. The creator of the idea might benefit by receiving a reward proportional to the initial stock price or other incentives. The advantage is that the market decides on which idea stocks will be traded. However, the fixed initial stock price evens out the rewards for very good new product ideas.

- *Initial public offering with a variable price:* Instead of offering all idea stocks at the same price, an auction mechanism can be used to determine the initial price of a stock in order to account for quality differences of ideas. The advantage is that very good ideas can lead to high initial prices and idea creators might benefit by receiving a reward proportional to such a high initial price. However, the auction mechanism might be difficult to understand for participants that are less familiar with financial markets.

### **Pay-off value of idea stocks**

The value of a share of virtual stock of a prediction market depends on the realization of the market situations that are linked to the specific stock. For example, a share of stock in a political stock market could be worth \$1 for each percentage point of votes that the particular candidate receives, or \$1 if the candidate wins the election and nothing otherwise. Such a link to exogenous events is not feasible for idea markets, because not all product ideas will ever be realized and the realization decision might depend upon the results of the idea market. Therefore, an external basis is required to calculate the pay-off value of a stock and hence the final portfolio values for all participants. Dahan et al. (2006) use the last traded price of the stock as the pay-off value of the stock and a random end of the experiment. However, the absence of an external pay-off might lead to irrational behavior or self-fulfilling prophecies (Smith et al. 1988), which might require to run the stock market several times. A further possibility is to use a proxy measure that represents the value of an idea. The number of hits on search engines or the number of quotes in bibliographic databases might serve as a proxy measure (Mangold et al. 2005, Daim et al. 2005). While being easy to implement, the quality of the approach depends strongly on the proxy measure and it is likely that participants of idea markets get access to relevant information about the proxy measure. Another alternative is to use an expert committee to decide on the value of the idea stocks that are traded on the idea market. Such an approach has the advantage that it is relatively easy to implement and it is exogenous to the idea market. However, the participants might question the knowledge of the experts and might be disappointed if they do not agree with or cannot understand their decisions.

### **Number of idea stocks at the beginning of the market**

Since the set of stocks is based on the suggestions of the participants, there are no stocks available at the beginning of the market, which might lead to a slow start of the idea market, because the participants cannot trade immediately. Such a slow start might be avoided by having a small number of stocks available in the market that are based on the ideas of some pre-selected participants or experts in a company. Such initial ideas might be easily disguised for fellow participants as regular ideas due to the anonymous setting.

### **3.2 General Design Aspects of Idea and Prediction Markets**

Spann & Skiera (2003) enumerate a detailed list of design options for prediction markets extended in Table 2 to also cover the specific design aspects of idea markets. We focus on the important features of idea markets: the choice of market mechanism and incentives for participants. Our main criteria for selecting the market mechanism are that it should maintain a sufficient liquidity for a high number of idea stocks, it should be easy to understand and it should lead to efficient prices. The most common market mechanism in prediction markets, the double auction, requires a matching bid-and-ask order pair for a trade in order to determine the price of a stock trade. This mechanism operates well in the case of a large number of traders that are willing to sell and buy stocks. However, in idea markets that last several days or weeks, a rather low trader-to-stock ratio is likely. The reasons behind this are that the number of participants is usually limited, the participants trade asynchronously and the number of idea stocks increases over time, because all the participants are encouraged to submit new product ideas. In this situation, a double auction might limit trading opportunities, which might decrease the participants' interest in the idea market. The use of a trading agent similar to a market maker on NASDAQ or the “Virtual Specialist” at the Hollywood Stock Exchange avoids this shortcoming. The automatic version of the trading agent uses an algorithm to automatically set price quotes that allow the buying and selling of stocks at any time.

<b>Step</b>	<b>Decisions</b>
<i>Choice of Forecasting Goals</i>	<ul style="list-style-type: none"> <li>- Selection of the prediction issue</li> <li>- Duration of the idea market</li> <li>- Access: Open to the public or limited participation</li> <li>- Formulation of the payoff function: final market price, use of proxy measures (e.g. expert committee)</li> </ul>
<i>Incentives for Participation and Information Revelation</i>	<p><i>Composition of Initial Portfolios / Endowment</i></p> <ul style="list-style-type: none"> <li>- (Investment of real money) or endowment</li> <li>- Provision of loans and alternative investment opportunities</li> </ul> <p><i>Remuneration / Incentive Mechanism for idea evaluation</i></p> <ul style="list-style-type: none"> <li>- Monetary vs. non-monetary rewards</li> <li>- Linear vs. non-linear relationship between performance and reward (i.e., tournament)</li> <li>- Incentives not based on performance: e.g. Random rewards amongst a specific group or all participants</li> <li>- Incentives for idea creation and evaluation                             <ul style="list-style-type: none"> <li>- Real or virtual money</li> <li>- Separate or joint rewards</li> </ul> </li> </ul>
<i>Financial Market Design</i>	<ul style="list-style-type: none"> <li>- Initial number of stocks on the idea market</li> <li>- Trading mechanism:                             <ul style="list-style-type: none"> <li>- Market maker (i.e., dealer)                                     <ul style="list-style-type: none"> <li>- Choice of initial quotes</li> <li>- Quote adjustment to order flow</li> </ul> </li> <li>- Double auction</li> <li>- Combination of types</li> </ul> </li> <li>- Introduction of ideas to market                             <ul style="list-style-type: none"> <li>- Acceptance of all ideas</li> <li>- Expert screening</li> <li>- Market screening                                     <ul style="list-style-type: none"> <li>- Initial public offering with a uniform price</li> <li>- Initial public offering with a variable price</li> </ul> </li> </ul> </li> </ul>

**Table 2: Scope for Design Decisions of Idea Markets**

As for every idea generation method, an important prerequisite for an idea market to perform well is to recruit at least some traders with an interest in new product ideas, possessing some degree of relevant knowledge (Spann & Skiera 2003). This condition requires the careful tailoring of the incentive system. Extrinsic incentives can be provided for both creating and evaluating ideas and the two activities can be rewarded together or separately. Joint rewards occur if both activities increase the portfolio value and motivate participants to perform well at both activities. Separate rewards occur if idea creation activities are compensated by rewards that do not influence portfolio values. In case of similar rewards, idea market initiators have to weight the rewards for idea creation and evaluation, which is usually accomplished by

deciding on the amount of (virtual) money that idea creators receive for their ideas. Unbalanced rewards might lead to a situation in which participants only focus on one of these two activities. Large incentives should draw the interests of experts, but might also lead to risky trading behavior. To avoid this, smaller incentives can be chosen or a lottery of rewards could be conducted among the best-performing participants. Apart from those extrinsic rewards, the competitive nature of idea markets can also provide a strong intrinsic motivation for participants to perform well.

## **4 Empirical Study**

The goals of this study are to empirically test the feasibility of an idea market for creating and evaluating new product ideas in a real-world setting, analyze the quality of the idea market's ability to create and evaluate new product ideas, compare the evaluations of an idea market with those of experts and outline the participants' as well as senior management's evaluations of the overall performance of the idea market. Therefore, we made use of an idea market in a large German technological company that operates in more than 100 countries. Its revenues totaled more than two billion US\$ in 2006, 90% of which yielded from high technological B2B products and with 80% outside the home country. The parent company has various subsidiaries worldwide and holds a very diverse product portfolio. The idea market was designed based on extensive discussions with executives responsible and was carried on with their constant contact and approval.

### **4.1 Description of the Empirical Study**

The idea market lasted 36 days in spring 2006 and was open to all employees. The web application provided a look-and-feel that was close to the one of real financial markets. The user interfaces were in German and English, and were adapted to corporate design conventions to ease the training for novice users. Since the company did not have any experience with such an idea market, the authors provided their own software which was applied in several projects before. One week prior to the official start the idea market was tested by a small group of employees. Prior to the start of the idea market, the rules and rewards were explained in the corporate monthly as well as on the idea market website. The idea market

was linked to the corporate intranet and emails were sent to employees with an address in the central email directory. Flyers were distributed in factories to attract blue-collar workers as well. Users could only register through the intranet with a self-selected user name and randomly generated password. A short five-page tutorial and user instructions were available online. In addition, a discussion board was provided. The best ten traders received prizes worth 3,000 US\$ altogether, ranging from 100 US\$ to 1,500 US\$. The first prize was handed out to the winner during a major corporate event on innovation. The idea market used a virtual currency. The participation was free of charge and participants could trade with the virtual fantasy currency units, which could not be exchanged for a real-world currency. After the registration on the intranet, each trader was endowed with 10.000 virtual cash (for the ease of explanation, we use '\$' for the virtual currency).

The idea market consisted of three categories to explore the level of task specificity best for idea markets - category a: new technologies for the company, category b: new product ideas for a specific product category, and category c: innovative product- and business ideas for the company. For category a, the price of an idea stock reflected the estimated percentage of revenues influenced by the respective technology in ten years. In category b, the price of an idea stock depended on the estimated number of units that will be sold of such a product in ten years. The last category c was a miscellaneous category for product and business ideas of any kind, of which the ten best ideas were worth 100 \$ and 0 \$ otherwise. In categories a and c, the numbers are by definition scaled on a [0.01;100] interval. A similar price range for category b is desirable. As the executives estimated maximum sales of about one million units per year for a product in this category, 1 \$ corresponds to 10.000 units in category b.

To determine a pay-off, we formed an experienced expert committee with four persons: two R&D directors: one of another large technology company and one of a small technological company, a director of a major strategy consulting company and a CEO of a venture capital company. They evaluated the product ideas and determined a pay-off value for each idea stock. They discussed their decisions on the idea stocks during a half-day meeting in the last week of the idea market, but scored individually each

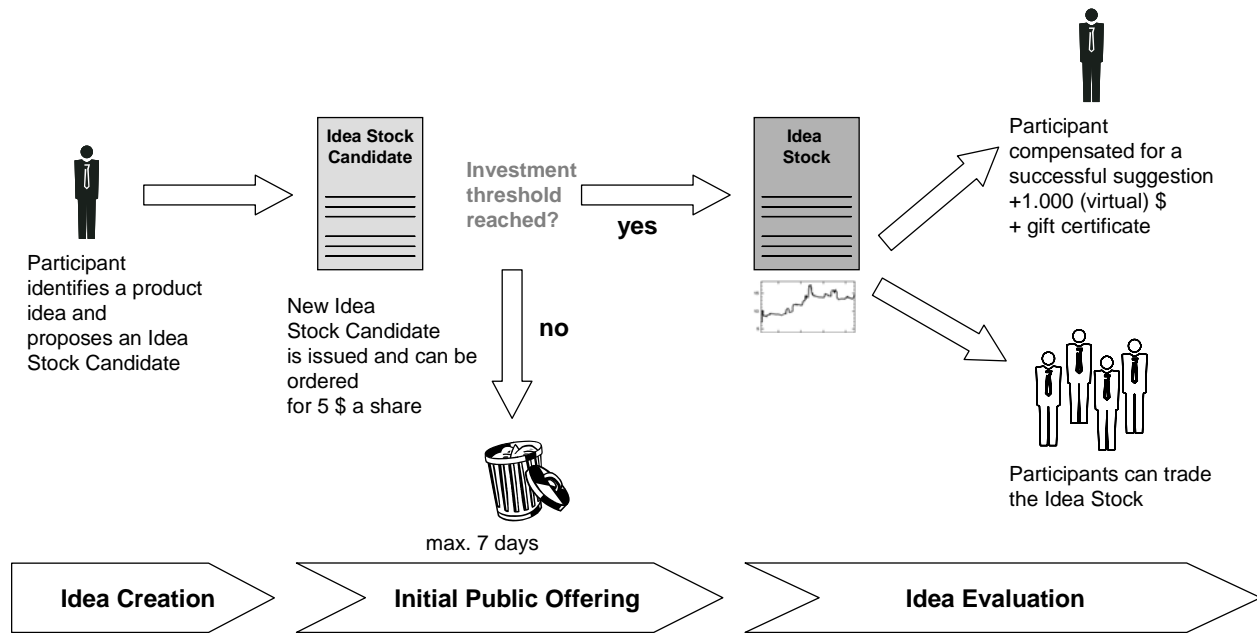
idea stock. Table 3 provides an overview of the forecasting task and the pay-off determination of the different categories.

<b>Category</b>	<b>Forecasting Task</b>	<b>Determination of Pay-Off</b>
a. New technologies for the company	Percentage of revenues influenced by the respective technology in 2016 (ten years from 2006)	Expert committee estimated the percentage of revenue of the corresponding new technology, each percentage point was equivalent to 1 \$
b. New product ideas for a specific product category	Number of units that will be sold in 2016	Expert committee estimated the number of units to be sold in 2016, 10.000 units were equivalent to 1 \$
c. Innovative product- and business ideas for the company	Predict the most innovative product- and business ideas	Each member of the expert committee selected the 10 best ideas according to his assessment. Then, 10 ideas with the highest score were worth 100 \$, and 0 \$ otherwise

**Table 3: Forecasting Task and Pay-Off Determination of Categories**

To avoid too many product ideas with a rather moderate quality on the idea market, we used the screening process described in Figure 1. Every participant could suggest a new product idea. The rules for idea suggestions were that the product idea had to be “new to the idea market” (first come, first serve principle) and “new to the company”, meaning not developed or sold as a product yet. No other formal restrictions were put on the way as to how the participants had to describe their new product idea. They could also enter external links, quote other publications or upload the respective images or sketches. The participants were asked to submit their ideas both in English and German, if not they were translated into the other language. This kind of new product idea was formed to an idea stock candidate and was offered to the participants of the idea market by a uniform price IPO mechanism. During the next seven days, the shares of idea stock candidates could be ordered for 5 \$ of virtual currency each. In case the new product idea reached the threshold quantity, it became an idea stock and was traded in the market; otherwise it was dropped from the list of idea stock candidates, but was still visible on the website. To lessen the possibility of collusion and to limit the influence of single participants on the IPO, each trader could only buy for a maximum of 4,000 \$, equivalent to 800 shares of each idea stock candidate. The threshold quantity for making a successful IPO was adjusted to three levels, taking into account the growing number of market participants (20,000, 30,000 and 40,000 \$ for 0-50, 51-150 and over 150 active market

participants, respectively). Suggestions for new product ideas were not possible after the 24<sup>th</sup> day of the idea market.



**Figure 1: Screening Process for Floating New Product Ideas**

The idea creators of the first 25 idea stocks were awarded gift certificates worth 30 US\$ and 12 US\$ gift certificates were awarded for the remaining idea stocks. Furthermore, the corresponding idea creator was awarded an additional 1.000 \$ for his virtual portfolio. The initial price for each stock was 5\$. The following prices for each share of stock were calculated with an automated price adjustment rule. Price adjustments were based on the ratio of bids-and-asks of the last ten trades. Traders could buy and sell the idea stock at the price shown at any time, provided they had sufficient virtual cash. After each trade, the price was updated to the new quote.

To boost the trading from traders who registered first and to provide examples for idea stocks, ten ideas collected by the innovation team were visible at the beginning. Seven of those were tradable right from the first day of the idea market and three of them were idea stock candidates.

## **4.2 Evaluation Criteria of the Empirical Study**

We build up on the success measures for marketing management support systems and evaluate the acceptance of the idea market, the quality of idea creation and evaluation, and the overall performance of the idea market (for details see Table 4). In line with the common approach of marketing management support systems (Wierenga et al. 1999), we collected feedback from both, participants in the idea market and managers. For this, we conducted a survey with 25 senior managers ("management survey" in the following) with an average of 9.0 years of industry experience, one week before the end of the idea market, in order to avoid an influence of the expert committee's judgments on the manager's evaluation of ideas. The survey of the participants of the idea market ("participant survey" in the following) was done two weeks after the end of the idea market. 118 participants filled out the online questionnaire completely (38% response rate). No significant differences were observed between survey-respondents and non-respondents with respect to their interest in the idea market (measured by the number of page views), trading activity (measured by number or size of trades) and market performance (measured by the final portfolio value). However, survey respondents made up a higher share of idea creators (54%) than the whole sample (32%) ( $p < .01$ ). Yet, no significant differences between idea creators in both groups of respondents and non-respondents were observed regarding the overall number of ideas per idea creator with or without a successful IPO.

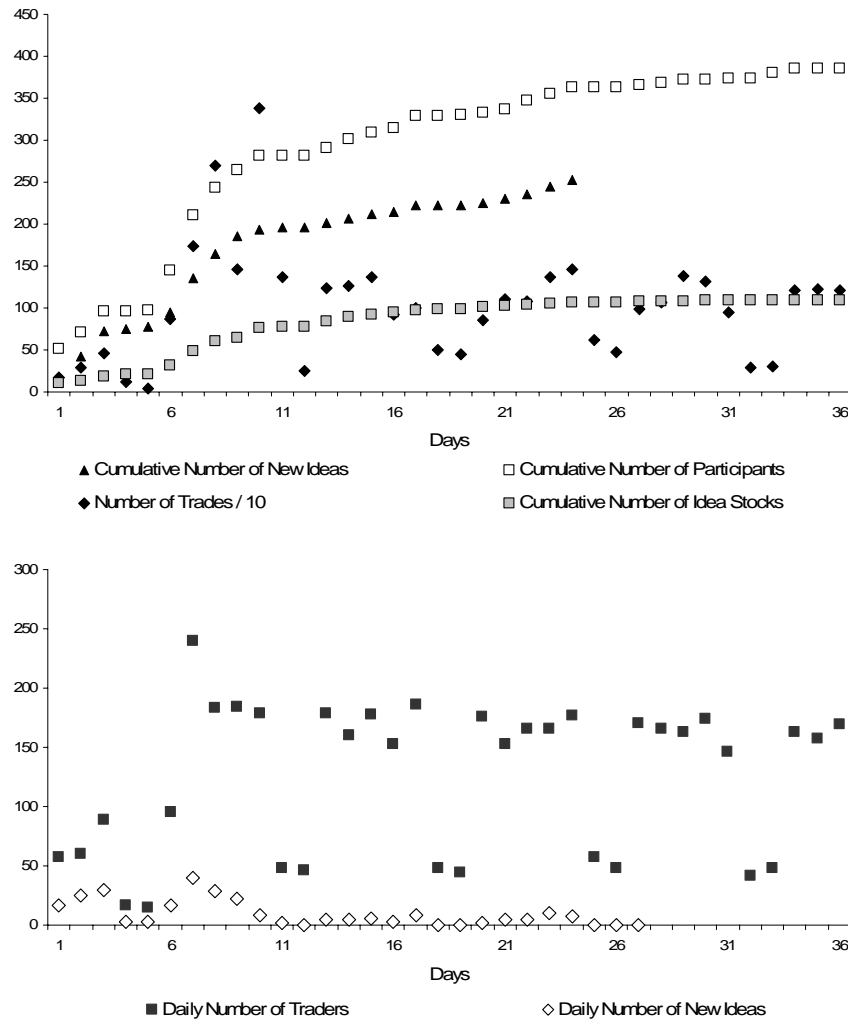
<b>Evaluation Category</b>	<b>Measure and Data Source</b>
<b>Acceptance of Idea Market</b>	<ul style="list-style-type: none"> <li>- Number and development of the number of participants (data from idea market)</li> <li>- Number and development of the number of trades (data from idea market)</li> <li>- Number and development of the number of idea stocks (data from idea market)</li> <li>- Participants' interest (participant survey)</li> <li>- Share of idea creators who had never suggested a new product idea before (participant survey)</li> <li>- Share of participants who are not involved in the new product development (participant survey)</li> <li>- Willingness of repeated participation (participant survey)</li> </ul>
<b>Quality of Idea Creation</b>	<ul style="list-style-type: none"> <li>- Quality of ideas (management survey)</li> <li>- Share of idea suggestions that were traded in the market (idea market)</li> <li>- Ability of idea market to stimulate ideas (participant survey and management survey)</li> </ul>
<b>Quality of Idea Evaluation</b>	<ul style="list-style-type: none"> <li>- Number of trades per idea stock and number of trades of Top 10 idea stocks in a category (data from idea market)</li> <li>- Participants' assessment of idea market's evaluation (participant survey)</li> <li>- Management evaluation of idea market's ability to improve forecasts of new product success (management survey)</li> <li>- Participants' agreement with evaluations of the expert committee (participant survey)</li> <li>- Consensus with experts (idea market)</li> </ul>
<b>Overall Performance of Idea Market</b>	<ul style="list-style-type: none"> <li>- Perceived usefulness (participant and management survey)</li> <li>- Interest for new product development (participant survey)</li> <li>- Overall evaluation of the idea market (management survey)</li> <li>- Management's recommendation of idea markets (management survey)</li> <li>- Repetition of the idea market (management survey)</li> <li>- Willingness to participate once more (participant survey)</li> <li>- Ability of idea markets to involve employees in the new product development process (management survey)</li> </ul>

**Table 4: Evaluation Criteria for the Empirical Study**

### 4.3 Acceptance of Idea Market

642 participants registered for the idea market and 576 logged in at least once. 36,435 trades were made. 397 participants executed at least one trade or submitted at least one product idea. An overwhelming majority of 86% of the registered participants - especially employees with an access to a PC - was from the company's home country (Germany); the second largest group was from the United States (9%). The remaining 5% came from 17 different countries, which indicates the ability of the idea market to draw interest among a diverse group of participants. The majority of the registrations occurred on the 7<sup>th</sup> day; shortly after an email announcement was send out. On average, the idea market attracted on weekdays a remarkably high number of 157 participants a day. Figure 2 shows that this number remained fairly constant during the five weeks the idea market was running. 128 traders (33% of all active

traders) suggested 252 unique product ideas during the 24 days<sup>1</sup> of the idea submission period. The maximum number of ideas suggested by a single trader was eleven of which three made the IPO. Only few ideas contained images, mostly were general descriptions with a maximum of two pages (average length of the idea description was 748.2 letters ( $\sigma=613.8$ ) which corresponds to approximately 90 words). Figure 2 shows that 77.1% of all ideas were submitted during the first ten days of the idea market and that 67.6% of all idea stocks were available for trading within the first two weeks.



(Days 4 and 5 represent weekends, respectively days 11 and 12, 18 and 19, 25 and 26, 32 and 33)

**Figure 2: Overview over activities on the idea market**

<sup>1</sup> The idea submission period ended on a Friday (24<sup>th</sup> day of the idea market), because of the IPO-period of seven days.

On an average, the participants traded 14.7 different idea stocks ( $\sigma=15.4$ ) and studied 37.8 ( $\sigma=42.5$ ) different idea stock descriptions. 60% of the participants at the idea market are currently not involved in the new product development and 55% of the idea creators never had suggested a product idea before. The idea creators stated that the probability of suggesting the ideas without the idea market would have been only 25.4% (i.e. 74.6% of ideas would not have been proposed without the idea market). An overwhelming majority of 89% of the participants stated in the participant survey that they would participate again (choosing points 5-7 on a 7-point Likert-Scale,  $\mu=6.1$ ;  $\sigma=1.5$ ;  $p<.01$ )<sup>2</sup>. They also affirmed that the idea market was fun ( $\mu=5.7$ ;  $\sigma=1.5$ ;  $p<.01$ ). The extrinsic incentives for successful participation at the idea market were rather low. Yet, the participants evaluated the appropriateness of incentives for idea suggestions with a mean value of 4.7 ( $\sigma=1.6$ ;  $p<.01$ ) and the importance of the offered rewards for participation with 3.9 ( $\sigma=2.0$ ; n.s.). They also stated that 67.5% of all ideas would have been suggested on the idea market even without providing any rewards. These results are in line with previous research on the motivation of employees, showing that extrinsic incentives are not as important for participants as intrinsic motivation (Griffiths-Hemans & Grover 2006). This is also reflected by the average score of 5.7 ( $\sigma=1.5$ ;  $p<.01$ ) for the statement that the motivation for idea suggestions was to support the company.

These results underline the feasibility of idea markets for creating and evaluating new product ideas in real-world settings. The number of participants is high and the idea market draws high interest among employees from different functional responsibilities and did not slow down during the five weeks of operations (Figure 2). More than half of the ideas came from participants that are currently not involved in the new product development process, which indicates that the idea market attracted huge interest from employees, who otherwise would not have created and evaluated new product ideas.

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<sup>2</sup> p indicates here and in the following always the level of significance for being different from the mean point of the scale (4). Unless specified otherwise, the scale is always a seven point Likert-Scale, where the end point 7 indicates 'completely agree'.

#### 4.4 Quality of Idea Creation

The quality of the ideas is evaluated by considering the share of ideas finally traded as idea stocks on the idea market and the senior management's evaluation of the quality of the ideas. 252 ideas were submitted by 128 participants, 39 as ideas for new technologies (category a), 49 as specific product ideas (category b) and 164 as product and business ideas (category c). 100 (40%) of those ideas were finally traded as idea stocks, 22 (56%), 21 (43%) and 57 (35%) of those in the three categories a, b and c respectively. These values indicate that the idea market was able to reject as well as support a significant number of ideas.

Table 5 shows the results of the senior management's evaluation of the quality of the ideas. All values are significantly different from the scale mean. In addition, the senior management evaluated the average quality of the 20 best ideas in each category with an average value of 4.9, 4.3 and 5.0 ( $p < .01$ , n.s., and  $p < .01$  respectively). Furthermore, the company also decided to pursue some of the ideas that were traded on the idea market. Hence, the results indicate a good quality of ideas suggested to the idea market.

Quality of Idea Creation	Evaluation by Managers ( $N=25$ )*
Newness of the best twenty ideas (in your opinion) for your company	4.8 ( $\sigma=1.3$ ; $p < .01$ )
Newness of the best twenty ideas (in your opinion) compared to the competition	4.5 ( $\sigma=1.3$ ; $p < .1$ )
Originality of the best twenty ideas (in your opinion)	4.9 ( $\sigma=1.3$ ; $p < .01$ )
Market potential of the best twenty ideas (in your opinion)	4.8 ( $\sigma=1.3$ ; $p < .01$ )
I would take the outcome of the idea market when it comes to the final decision on ideas into account	5.2 ( $\sigma=1.3$ ; $p < .01$ )
The idea market generates more ideas than alternative methods	5.7 ( $\sigma=1.3$ ; $p < .01$ )
The ideas generated on the idea market are of higher quality than those elicited by alternative methods	4.2 ( $\sigma=1.2$ ; n.s.)

\* Survey 7-point Likert-Scale (1 completely disagree – 7 completely agree)

**Table 5: Senior Management's Evaluation of Idea Creation**

We also asked the participants about the idea market's ability to stimulate ideas. 64 of the 118 survey respondents indicated to have submitted at least one idea. Participants agreed to the statement that other ideas on the idea market stimulated them to create own ideas ( $\mu=4.5$ ,  $\sigma=2.0$ ;  $p < .05$ ), the share of participants with scale points 5-7 being 54.7% thereby. This indicates that many ideas would not have been created without the idea market.

#### **4.5 Quality of Idea Evaluation**

The quality of the idea evaluation is assessed by the activities in the market to value idea stocks, the participants' and the senior management's assessment of the evaluation of the market and the level of agreement of the idea market's evaluation and the one of the expert committee. The average number of traders per idea stock is 46.2 ( $\sigma=30.4$ ) and the average number of trades is 334.3 ( $\sigma=261.5$ ). The top 10 idea stocks in the three categories a, b and c had on average 91.1 ( $\sigma=39.6$ ), 48.5 ( $\sigma=20.2$ ) and 95.9 ( $\sigma=29.7$ ) different traders and 709.2 ( $\sigma=282.5$ ), 312.3 ( $\sigma=202.0$ ) and 734.6 ( $\sigma=341.7$ ) trades respectively. These values indicate that the stocks were frequently traded by a sufficient number of traders. We also find a positive correlation of .23 ( $p<.01$ ) between the number of submitted ideas of a market participant and his or her trading volume as a measurement for trading activity. This points out that there was no clear cut between creators and evaluators of ideas.

The participants strongly agreed to the statement that it is good that all participants can evaluate ideas ( $\mu=5.9$ ;  $\sigma=1.6$ ;  $p<.01$ ). Yet, they only assigned a value of 3.1 ( $\sigma=1.8$ ;  $p<.01$ ) on the 7-point scale to the statement that the idea market appropriately evaluated their ideas. The senior management assigned a value of 4.4 ( $\sigma=1.9$ ; n.s) for the statement that the idea market made a reliable prediction about the future market success and a value of 4.8 ( $\sigma=1.3$ ,  $p<.01$ ) regarding the statement that the idea market improves the forecasts of the success of new product ideas. They also stated that a final decision about the ideas should take the results of the idea market into account ( $\mu=5.2$ ,  $\sigma=1.3$ ,  $p<.01$ ).

The correlation between the judgments of the expert committee and the final prices on the idea market was 0.10 (n.s.) for category a (new technologies), 0.36 ( $p<.1$ ) for category b (specific product ideas) and 0.47 ( $p<.01$ ) for category c (product and business idea). Idea creators assessed the expert committee's evaluation slightly worse than the one of the idea market ( $\mu=4.4$  vs. 5.0,  $p<.01$ ). Yet, the agreement with the expert committee is still far from being high.

In short, the idea market actively evaluated the idea stocks, but the consensus between the evaluation of the idea markets, the one of senior management, the individual participants and the expert

committee is only moderate. Yet, this dissent also reflects the high uncertainty related with the prediction of the success of new product ideas, which is, among others, also reflected by the commonly observed high failure rates of new product introductions even after extensive market research. The four experts also partly disagreed on the evaluation of the ideas, reflected by an average coefficient of variation of 1.12 for the 48 stocks in the categories a and b. Despite all this, an overwhelming 81% of the participants agreed in principle with determining the pay-off value by an expert committee.

#### **4.6 Overall Performance of the Idea Market**

The overall performance of the idea market is evaluated by the participants' and senior management's assessment of the performance of the idea market. The participants and the senior management perceived the idea market to be very useful for the company ( $\mu=5.3$ ;  $\sigma=1.4$ ;  $p<.01$ ; respectively  $\mu=5.1$ ;  $\sigma=1.1$ ;  $p<.01$ , both on a 7-point Likert-Scale). The senior management confirmed even more strongly that the idea market should be conducted again ( $\mu=5.7$ ;  $\sigma=1.5$ ;  $p<.01$ ). 84% of all senior managers would also recommend the use of idea markets to other companies. In addition to this, our discussions with executives of the company revealed that the idea market involved more employees of the company in a new product development process than any other method in the past ( $\mu=5.9$ ;  $\sigma=1.0$ ;  $p<.01$ ). An overwhelming majority of 89% participants stated that they would participate again at the idea market (indicating a scale point 5 and higher on the 7-point Likert scale,  $\mu=6.1$ ;  $\sigma=1.5$ ;  $p<.01$ ). 57.6% of participants testified that the idea market increased their interest for new product development (indicating a scale point 5 and higher on the 7-point Likert scale,  $\mu=4.4$ ;  $\sigma=1.7$ ;  $p<.05$ ).

It is certainly too early to evaluate the commercial success of the new product ideas that were created by the idea market and, thus, the monetary impact of the idea market. In addition, the company's policy is to not provide any information on products that are under development. However, we are allowed to reveal that several product ideas are currently under consideration for further ascertainment. In addition, the initiating and responsible manager of the company was promoted after the end of the stock market and the idea market project team recently won a corporate award. That award especially

highlighted the unique feature of the idea market to integrate employees from all over the world. A similar award was not rewarded for any other new product development method before.

## **5 Discussion**

Our results indicate that idea markets seem to be a new and capable tool for supporting the development of new product ideas. The most remarkable results of our empirical study are the fairly high and constant number of participants from all functional levels across different subsidiaries, over the entire duration of the idea market, the very high number of ideas that would not have been proposed without the idea market (74.6%), the perceived usefulness of the idea market among participants and senior management ( $\mu=5.3$ , respectively  $\mu=5.1$ ), the high agreement of the senior management to conduct the idea market again ( $\mu=5.7$ ), a share of 84% of senior managers who would also recommend idea markets to other companies, a recent promotion of the responsible manager for the idea market and an award for the team that was responsible for the project "idea market". Apart from these measurable results, the company might benefit in the long-term by the increased interest of their employees in new product development.

We believe that idea markets are feasible for a broad range of idea generation domains that can involve consumers, employees or any other kind of experts. They can be easily established as a recurring event in a company and the diversity of participants might especially help to find many different new product ideas. Certainly, idea markets need the top management to encourage the employees to participate and create as well as to evaluate product ideas, to permit "trading" during working hours and to provide resources and investments in software, operators and incentives.

This study has several limitations as a result of its exploratory nature. The participants' enjoyment can be partly explained by a high degree of newness of the method. Due to the long development times for the product categories in this technological company, we are currently not able to measure the commercial success of the traded new product ideas. Further, data on individual work characteristics and personal traits of the traders could not be collected due to legal restrictions, but would have been

interesting to reveal insights into the individual motivation behind the creation and evaluation of ideas. Our follow-up discussions with the executives of the company also indicated that future idea markets might place higher formal requirements for the ideas that are submitted to the idea market and aim for a shorter duration of the idea market.

Future research should repeat idea markets, which might enable a more thorough investigation of the best design. Our extrinsic incentives were rather small, but seemed to have worked well. Nevertheless, other incentive schemes might have worked even better. The same reasoning applies to the choice of trading hours, the duration of the market, and the target group for participants. The senior management of the company involved in this study was very satisfied with the performance of the idea market. This is certainly good news, but does not indicate that other new product development methods would not have shown comparable or better results. Although the corporate reward and managerial feedback indicate that this is less likely, future studies could compare the performance of idea markets with other methods. In addition, future research could also analyze if the combination of idea markets with other methods for idea creation is beneficial. For example, brainstorming methods might be used to create ideas, which can then be evaluated by the idea market. Future research might also aim at enhancing the idea creation process in such a way that participants can collaborate to jointly develop or improve new product ideas already suggested.

## **References**

- Alam, I. 2003. Commercial Innovations from Consulting Engineering Firms: An Empirical Exploration of a Novel Source of New Product Ideas. *Journal of Product Innovation Management* **20**, 300-313.
- Baker, N.R. & J.R. Freeland. 1972. Structuring Information Flow to Enhance Innovation. *Management Science* **19**, 105-116.
- Bharadwaj, S. & A. Menon. 2000. Making Innovation Happen in Organizations: Individual Creativity Mechanisms, Organizational Creativity Mechanisms or Both? *Journal of Product Innovation Management* **17**, 424-434.
- Chandy, R., B. Hopstaken, O. Narasimhan & J. Prabhu. 2006. From Invention to Innovation: Conversion Ability in Product Development. *Journal of Marketing Research* **43**, 494-508.

- Chen, K.-Y. & C.R. Plott. 2002. *Information Aggregation Mechanisms: Concept, Design and Implementation for a Sales Forecasting Problem*. Working Paper. California Institute of Technology.
- Crawford, M. & A. Di Benedetto. 2006. *New Products Management*. Boston, MA: McGraw Hill.
- Dahan, E., A.W. Lo, T. Poggio, N.T. Chan & A. Kim. 2006. *Securities Trading of Concepts (STOC)*. Working Paper. University of California at Los Angeles.
- Daim, T.U., G. Rueda, H. Martin & P. Gerdtsri. 2005. Forecasting Emerging Technologies: Use of Bibliometrics and Patent Analysis. *Technological Forecasting & Social Change* **73**, 981-1012.
- Diehl, M. & W. Stroebe. 1987. Productivity Loss in Brainstorming Groups. *Journal of Personality and Social Psychology* **53**, 497-509.
- Emden, Z., R.J. Calantone & C. Droge. 2006. Collaborating for New Product Development: Selecting the Partner with Maximum Potential to Create Value. *Journal of Product Innovation Management* **23**, 330-341.
- Fama, E.F. 1970. Efficient Capital Markets: A Review of Theory and Empirical Work. *Journal of Finance* **25**, 383-417.
- Forsythe, R., F. Nelson, G.R. Neumann & J. Wright. 1992. Anatomy of an Experimental Political Stock Market. *American Economic Review* **82**, 1142-1161.
- Garfield, M.J., N.J. Taylor, A.R. Dennis & J.W. Satzinger. 2001. Modifying Paradigms - Individual Differences, Creativity Techniques, and Exposure to Ideas in Group Idea Generation. *Information Systems Research* **12**, 322-333.
- Goldenberg, J., D.R. Lehmann & D. Mazursky. 2001. The Idea Itself and the Circumstances of Its Emergence as Predictors of New Product Success. *Management Science* **47**, 69-84.
- Goldenberg, J., D. Mazursky & S. Solomon. 1999. Toward Identifying the Inventive Templates of New Products: A Channeled Ideation Approach. *Journal of Marketing Research* **36**, 200-210.
- Griffiths-Hemans, J. & R. Grover. 2006. Setting the Stage for Creative New Products: Investigating the Idea Fruition Process. *Journal of the Academy of Marketing Science* **34**, 27-39.
- Gruca, T.S., J.E. Berg & M. Cipriano. 2003. The Effect of Electronic Markets on Forecasts of New Product Success. *Information Systems Frontiers* **5**, 95-105.
- Hanson, R. 1992. Idea Futures: Encouraging an Honest Consensus. *Entropy* **3**, 7-17.

- Hargadon, A. & R.I. Sutton. 1997. Technology Brokering and Innovation in a Product Development Firm. *Administration Science Quarterly* **42**, 716-749.
- Hayek, F.A.v. 1945. The Use of Knowledge in Society. *American Economic Review* **35**, 519-530.
- Hender, J.M., D.L. Dean, T.L. Rodgers & J.F. Nunamaker. 2002. An Examination of the Impact of Stimuli Type and GSS Structure on Creativity: Brainstorming Versus Non-Brainstorming Techniques in a GSS Environment. *Journal of Management Information Systems* **18**, 59-85.
- Jansen, J.J.P., F.A.J. Van Den Bosch & H.W. Volberda. 2006. Exploratory Innovation, Exploitative Innovation, and Performance: Effects of Organizational Antecedents and Environmental Moderators. *Management Science* **52**, 1661-1674.
- Lorge, I., D. Fox, J. Davitz & M. Brenner. 1958. A Survey of Studies Contrasting the Quality of Group Performance and Individual Performance, 1920-1957. *Psychological Bulletin* **55**, 337-372.
- MacCrimmon, K.R. & C. Wagner. 1994. Stimulating Ideas through Creativity Software. *Management Science* **40**, 1514-1532.
- Majchrzak, A., L.P. Cooper & O.E. Neece. 2004. Knowledge Reuse for Innovation. *Management Science* **50**, 174-188.
- Mangold, B., M. Dooley, R. Dornfest, G.W. Flake, H. Hoffman, T. Kasturi & D.M. Pennock. 2005. The Tech Buzz Game. *IEEE Computer* **38**, 94-97.
- Moreau, C.P., D.R. Lehmann & A.B. Markman. 2001. Entrenched Knowledge Structures and Consumer Response to New Products. *Journal of Marketing Research* **38**, 14-19.
- Nunamaker, J.F., R.O. Briggs, D.D. Mittleman, D.R. Vogel & P.A. Balthazard. 1997. Lessons From a Dozen Years of Group Support Systems Research: A Discussion of Lab and Field Findings. *Journal of Management Information Systems* **13**, 163-207.
- Ozer, M. 2005. Factors Which Influence Decision Making in New Product Evaluation. *European Journal of Operational Research* **163**, 784-801.
- Pennock, D.M., S. Lawrence, L.C. Giles & F.A. Nielsen. 2001. The Real Power of Artificial Markets. *Science* **291**, 987-988.
- Piller, F.T. & D. Walcher. 2006. Toolkits for Idea Competitions: A Novel Method to Integrate Users in New Product Development. *R&D Management* **36**, 307-318.

- Pinsonneault, A., H. Barki, R.B. Gallupe & N. Hoppen. 1999. Electronic Brainstorming: The Illusion of Productivity. *Information Systems Research* **10**, 110-133.
- Potter, R.E. & P. Balthazard. 2004. The Role of Individual Memory and Attention Process During Electronic Brainstorming. *MIS Quarterly* **28**, 621-643.
- Rowe, G. & G. Wright. 1999. The Delphi Technique as a Forecasting Tool: Issues and Analysis. *International Journal of Forecasting* **15**, 353-375.
- Servan-Schreiber, E., D.M. Pennock, J. Wolfers & B. Galebach. 2004. Prediction Markets: Does Money Matter? *Electronic Markets* **14**, 1-10.
- Simonton, D.K. 1999. *Origins of Genius*. New York, NY: Oxford University Press.
- Smith, V.L. 1982. Microeconomic Systems as an Experimental Science. *American Economic Review* **72**, 923-955.
- Smith, V.L., G.L. Suchanek & A.W. Williams. 1988. Bubbles, Crashes and Endogenous Expectations in Experimental Spot Asset Markets. *Econometrica* **56**, 1119-1151.
- Spann, M., H. Ernst, B. Skiera & J.H. Soll. 2006. Identification of Lead Users for Consumer Products via Virtual Stock Markets. *Journal of Product Innovation Management* **forthcoming**.
- Spann, M. & B. Skiera. 2003. Internet-Based Virtual Stock Markets for Business Forecasting. *Management Science* **49**, 1310-1326.
- Toubia, O. 2006. Idea Generation, Creativity, and Incentives. *Marketing Science* **25**, 411-425.
- Toubia, O. & L. Flores. 2006. Adaptive Idea Screening Using Consumers. *Marketing Science* **forthcoming**.
- Troy, L.C., D.M. Szymanski & P.R. Varadarajan. 2001. Generating New Product Ideas: An Initial Investigation of the Role of Market Information and Organizational Characteristics. *Journal of the Academy of Marketing Science* **29**, 89-101.
- van Bruggen, G.H., G.L. Lilien & M. Kacker. 2002. Informants in Organizational Marketing Research: Why use Multiple Informants and How to Aggregate Responses. *Journal of Marketing Research* **39**, 469-478.
- von Hippel, E. 2005. *Democratizing Innovation*. Cambridge, MA: MIT Press.
- Wierenga, B., G.H.v. Bruggen & R. Staelin. 1999. The Success of Marketing Management Support Systems. *Marketing Science* **18**, 196-207.
- Wolfers, J. & E. Zitzewitz. 2004. Prediction Markets. *Journal of Economic Perspectives* **18**, 107-126.