COLLABORATING TO CREATE: THE INTERNET AS A PLATFORM FOR CUSTOMER ENGAGEMENT IN PRODUCT INNOVATION

MOHANBIR SAWHNEY, GIANMARIO VERONA, AND EMANUELA PRANDELLI

In the networked world, firms are recognizing the power of the Internet as a platform for co-creating value with customers. We focus on how the Internet has impacted the process of collaborative innovation—a key process in value co-creation. We outline the distinctive capabilities of the Internet as a platform for customer engagement, including interactivity, enhanced reach, persistence, speed, and flexibility, and suggest that firms can use these capabilities to engage customers in collaborative product innovation through a variety of Internet-based mechanisms. We discuss how these mechanisms can facilitate collaborative innovation at different stages of the New Product Development process (back end vs. front end stages) and for differing levels of customer involvement (high reach vs. high richness). We present two detailed exploratory case studies to illustrate the integrated and systematic usage of Internet-based collaborative innovation mechanisms—Ducati from the motorbike industry and Eli Lilly from the pharmaceutical industry. We derive implications for managerial practice and academic research on collaborative innovation.

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INTRODUCTION

In an increasingly dynamic business environment, firms are realizing the importance of collaboration for creating and sustaining competitive advantage. Collaboration with partners and even competitors has become a strategic imperative for firms in the networked world of business (Brandeburger & Nalebuff, 1996; Gulati, Nohria, & Zahere, 2000; Iansiti & Levien, 2004). More recently, scholars in strategy and marketing have focused on collaboration with customers to co-create value (Prahalad & Ramaswamy, 2004; Thomke & von Hippel, 2002). While collaboration with customers can span several business processes, one of the most important is collaborating to create value through product innovation.

In this paper, we examine how the Internet can serve as a powerful platform for enabling collaborative innovation with customers. While customer interaction has always been important in new product development (von Hippel, 1988), the widespread deployment of the Internet has greatly enhanced the ability of firms to engage with customers in the product innovation process (Dahan & Hauser, 2002). By creating virtual customer environments (Nambisan, 2002), firms can tap into customer knowledge through an ongoing dialogue (Sawhney & Prandelli, 2000). The Internet enhances the ability of firms to engage customers in collaborative innovation in several ways. It allows firms to transform episodic and one-way customer interactions into a persistent dialogue with customers. Through the creation of virtual customer communities, it allows firms to tap into the social dimension of customer knowledge shared among groups of customers with shared interests. And it extends the reach and the scope of the firm's customer interactions through the use of independent third-parties to reach non-customers—competitors' customers or prospective customers.

Firms can use a variety of Internet-based mechanisms to facilitate collaborative innovation. These mechanisms differ in terms of the stage of the new product development process that they are most useful for, and the nature of the customer interactions they enable. While optimistic claims abound on how best practice firms are leveraging the Internet to connect with customers, there is little formal research on collaborative innovation. We take a first step in this area by identifying several Internet-based mechanisms for collaborative innovation. We present detailed case studies to show how best-practice firms are using these mechanisms to improve the speed, cost, and quality of their new product development process. Through these in-depth case studies, we derive lessons for organization and strategy, as well as the implications for academics and managers.

The paper is organized as follows. We begin by contrasting traditional perspectives on customer involvement in the new product development process with the emerging perspective on customer collaboration in virtual environments. Next, we describe a number of Internet-based mechanisms for engaging customers in product innovation, and highlight the relevance of these mechanisms at different stages of the product innovation process, and for different levels of customer involvement. We then present two case studies of best practice firms that have implemented some of these mechanisms—Ducati Motor from the motorcycle industry, and Eli Lilly from the pharmaceutical industry. We conclude by summarizing implications for academics and managers.

CUSTOMER ENGAGEMENT IN PRODUCT INNOVATION: THE TRADITIONAL PERSPECTIVE

In literature and in practice, product innovation is generally conceptualized as a five-stage New Product Development (NPD) process—ideation, concept development, product design, product testing, and product introduction (e.g., Ulrich & Eppinger, 2003; Urban & Hauser, 1993). Firms use varied techniques to solicit customer input in order to create better new products faster. In the front-end stages of the NPD process (ideation and concept development), firms use market research techniques like focus groups, customer surveys and quantitative techniques like conjoint analysis to create, test, and refine new product concepts. At later stages in the NPD process, firms use quality function deployment, prototyping, product testing, and test marketing to design and improve products and marketing strategies for new product introduction (Urban & Hauser 1993).

While firms have always sought to hear the "voice of the customer," customers have traditionally tended to play a passive role as recipients of the firm's innovation activities. Firms seek to improve fit between their

offerings and customer needs by surveying customers and importing knowledge from leading-edge customers into the firm (von Hippel, 1988). Drivers of the firm's innovation success include the firm's market sensing ability (Day, 1994), effective R&D and manufacturing routines (Hayes, Wheelwright, & Clark, 1988) and the right balance of organizational competences (Verona, 1999). The traditional perspective on customer engagement implicitly views value creation and innovation as a firm-centric activity, with most information flowing in a one direction from the customer to the firm (Prahalad & Ramaswamy, 2004). When customers are viewed as passive recipients of innovation, the firm has a limited understanding of customer knowledge developed within their specific contexts of experience; and there is little emphasis on iterative dialogue to refine and enhance ideas. Further, if one excludes costly tools like participant observation (Leonard & Rayport, 1997), there is little opportunity to engage communities of customers to tap into the social aspects of knowledge. Finally, the firm tends to be biased towards listening to its current customers, and even among these, to its most important customers.

CUSTOMER ENGAGEMENT IN VIRTUAL ENVIRONMENTS: THE CO-CREATION PERSPECTIVE

The Internet is an open, cost-effective and ubiquitous network (Afuha, 2003). These attributes make it a global medium with unprecedented reach, contributing to reduce constraints of geography and distance (Cairncross, 1997). Further, the Internet potentially allows firms to overcome the trade-off between richness and reach because it is interactive in nature (Evans & Wurster, 1999). In the physical world, communicating (and absorbing) rich information requires physical proximity or personal interactions with customers. These constraints limit the number of customers that the firm can dialogue with. On the other hand, the firm can interact with a large number of customers through customer surveys, but this type of interaction does not allow for a rich dialogue. However, Internet-based virtual environments allow the firm to engage a much larger number of customers without significant compromises on the richness of the interaction.

Virtual environments also increase the speed and the persistence of customer engagement. Due to cost and effort limitations, traditional market research techniques like focus groups and surveys are limited in terms of the frequency with which firms can engage with customers, and the time taken to solicit customer input. In virtual environments, customer interactions can happen in real-time, and with a much higher frequency. The physical and cognitive effort needed for the firm as well as customers is far lower in virtual environments, so the interactions can be more frequent and more persistent. The key constraint is the willingness of customers to participate in interactions and privacy concerns that may limit the depth of information that customers may be willing to share with the firm.

Virtual environments also enhance the firm's capacity to tap into the social dimension of customer knowledge, by enabling the creation of virtual communities of consumption (Kozinets, 1999). Customers self-select themselves and participate in spontaneous conversations. This makes them highly involved in a joint experience of co-creation. Finally, the Internet increases the flexibility of customer interactions: customers can vary their level of involvement over time and across sessions. For instance, customers participating in a discussion group or a community can choose their level of involvement (Hagel & Singer, 1999; Hoffman & Novak, 1996). Firms can allow customers to interact with them at different levels of commitment based on their interests and perceived payoffs from interaction, and they can modify their level of participation as their commitment increases over time.

The extended reach, enhanced interactivity, greater persistence, increased speed, and higher flexibility of virtual environments combine to produce three key benefits for collaborative innovation with customers: (a) the *direction* of communication; (b) the *intensity* and *richness* of the interaction; and (c) the *size and scope* of the audience (Table 1).

The direction of interaction evolves from one-way knowledge import to an interactive dialogue. This two-way dialogue helps firms to progressively learn about and learn from individual customers and groups of customers. The richness of the interaction increases because virtual communities of customers help firms to tap into social knowledge in addition to individual customer knowledge. Virtual customer communities allow the firm to immerse itself into the

TABLE 1 Key Differences Between Customer Collaboration in Physical and Virtual Environments

	THE TRADITIONAL PERSPECTIVE—CUSTOMER ENGAGEMENT IN PHYSICAL ENVIRONMENTS	THE CO-CREATION PERSPECTIVE—CUSTOMER ENGAGEMENT IN VIRTUAL ENVIRONMENTS
Innovation Perspective	Firm-centric	Customer-centric
Role of the Customer	Passive—customer voice as an input to create and test products	Active—customer as a partner in the innovation process
Direction of Interaction	One way—firm to customers	Two way—dialogue with customers
Intensity of Interaction	Spot—on contingent basis	Continuous—back-and-forth dialogue
Richness of Interaction	Focus on individual knowledge	Focus on social and experiential knowledge
Size and Scope of Audiences	Direct interaction with current customers	Direct as well as mediated interactions with prospects and potential customers

experiential contexts of customer consumption on an ongoing basis, rather than on an episodic basis that characterizes traditional ethnographic customer research. Further, the size and scope of the audience increases because the firm can participate in interactions mediated by third parties that are able to reach non-customers or prospective customers who may not have any relationship with the firm, or may perceive the firm as having a biased point of view. In summary, virtual environments augment customer collaboration by helping firms to engage customers in conversations rather than knowledge import, to gather individual as well as social knowledge, and to involve customers directly as well as through third-party mediators.

MAPPING INTERNET-BASED COLLABORATION MECHANISMS TO THE NPD PROCESS

Internet-based collaboration mechanisms can be mapped to the NPD process based on two important dimensions—the *nature of* customer involvement that is needed, and the stage of the NPD process at which the customer involvement is desired. In terms of the nature of customer involvement, Internet-based collaboration mechanisms can be classified into mechanisms that emphasize reach versus mechanisms that emphasize richness of the interaction. While the reach-versus-richness trade-off is not as severe on the Internet as it is in the physical world, it still is a decision that the firm needs to make. The firm may want to emphasize richness over reach if it is interested in generating ideas and insights, while it may value reach over richness if it is interested in validating hypotheses with a representative sample of customers. Internet-based collaboration mechanisms may also be classified in terms of their usefulness at different stages of the NPD process: some mechanisms are more relevant at the front-end stages of the process (idea generation and concept development stages), while others are better applied to enhance the back-end stages of the process (product design and testing). Figure 1 shows a variety of Internet-based mechanisms classified on these two dimensions.

Mechanisms that are useful at the early stages of the NPD process include suggestion boxes where customers can contribute their own innovative ideas. For instance, Ben & Jerry allows customers to contribute ideas for new products (prepackaged ice cream) as well as services (especially packaging and distribution) in a dedicated area called "Suggest-a-Flavor" on its Web site. Firms can also engage customers through customer advisory panels to solicit customers' feedback on a systematic basis, such as those created by Hallmark (the Hallmark Idea Exchange) and by Procter & Gamble (the P&G Advisors program). To

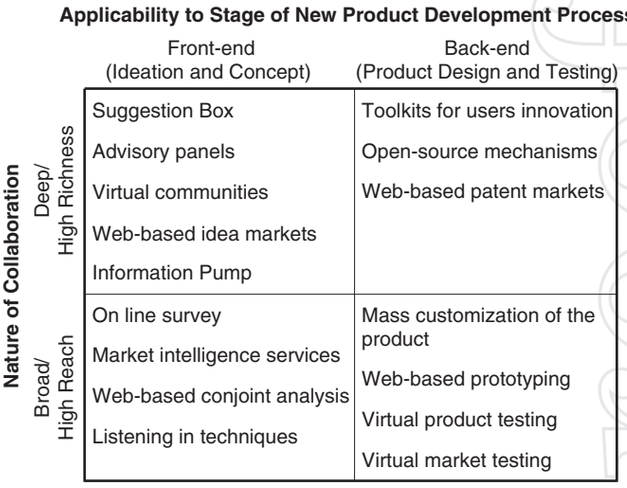

FIGURE 1

Mapping Internet-Based Collaboration Mechanisms Based on Nature of Collaboration and Stage of NPD Process

make suggestion boxes and customer advisory panels effective, it is essential for the firm to establish clear rules regarding intellectual property rights, so that the company can use the innovative ideas suggested by customers, while customers can benefit through financial or non-monetary incentives. Well-designed incentives have been found to remarkably improve collaborative idea generation (Toubia, 2004).

New product development at the early stages can also benefit from online virtual communities, which bring together users who have common interests and engage in online conversations to share their experiences with like-minded people (Hagel & Armstrong, 1997; Kozinets, 1999). Virtual communities are a rich source of socially generated knowledge. This socially generated knowledge provides insights that complement the knowledge generated from individual customer interactions. These insights cannot be gleaned from one-on-one interactions with customers. To facilitate customer participation in virtual communities, the firm may rely on intangible incentives like recognition and opinion leadership in consumer-oriented markets, while it may need to provide economic incentives in business-to-business market settings.

Members of virtual communities often show a high degree of involvement and often even specific technical competence—as in the case of communities of video game enthusiasts (e.g., www.Idsoftware.com) and networking engineers (e.g., Cisco Networking Professionals Forum). Reward mechanisms can also be introduced to encourage the most competent users to compete in Internet-based innovation marketplaces to solve specific problems (Nalebuff & Ayres, 2003). These marketplaces are typically hosted by third parties, because of their ability to aggregate communities of experts. Examples of such innovation marketplaces include HelloBrain (www.hellobrain.com), Experts Exchange (www.experts-exchange.com), NineSigma (www.ninesigma.com) and Yet2.com (www.yet2.com).

Turning to mechanisms that provide validation at the front end of the NPD process, online surveys—the simplest and most traditional use of the Internet for collaborative innovation—are a popular tool (Burke, Rangaswamy, & Gupta, 2001). In the search for successful new product ideas, firms seek to reduce uncertainty by interacting directly with customers to understand their needs and preferences. Online surveys are most useful for understanding articulated or explicit customer needs and in situations where the firm can accurately identify target audiences for its offerings. Firms can create online concept labs to test customer reactions to new products that are currently under development, as Volvo has done with its Volvo Concept Lab (www.conceptlabvolvo.com). And firms can harness online market intelligence services that monitor millions of blogs, Web sites, and bulletin boards to identify trends in customer behavior. For instance, firms like IntelliSeek (www.intelliseek.com) allow firms to monitor customer sentiment and customer buzz for specific product categories and brands to uncover trends that may be useful for product development. Another technique that is useful at the early stages is the technique of listening in (Urban & Hauser, 2004), which involves recording and analyzing information exchanged between individual users and virtual experts who provide advice to help customers identify product concepts that best meet their needs. To the same end and with a higher degree of accuracy, consumers can be asked to make trade-offs among attributes of new product concepts using Web-based implementations of conjoint analysis, as has been done in industries ranging from cameras to toys (Dahan & Hauser, 2002). For instance, General Motors has created a Web-based tool (www.autochoiceadvisor.com) that helps customers to

choose the right automobile for them, based on their preferences. This tool allows GM to collect quantitative data on customer preferences from hundreds of thousands of customers on an ongoing basis, at very low incremental cost. This data helps product developers to understand how customer preferences are evolving with changing market conditions, and can guide the development and refinement of new concepts.

Moving to the later stages of the NPD process, virtual environments allow customers to directly participate in designing and developing new products. Toolkits for user innovation can be created to exploit new technologies such as computer simulation in order to make NPD faster and less costly (Thomke & von Hippel, 2002). For example, National Semiconductor offers an online toolkit called Webench (webench.national.com), an online design environment for circuit designers. Using tools from the Webench site, circuit designers can design and test new circuits, and can have prototype power supply kits delivered anywhere in the world in 48 hours. Customer toolkits can be expanded to allow customers to customize products and even develop them through mechanisms of repeated trial and error. They can even be used to get customer suggestions on patents for finished products. And customer toolkits can be used by communities of customers to build upon designs that have been created by other customers, as in the case of designing new games for mobile phones (Piller, Ihl, Fuller, & Stotko, 2004). The concept of peer-to-peer customer collaboration to develop new products concept has found its most significant expression in the form of open-source mechanisms—communities run by and for the users that allow hundreds and even thousands of individual contributors to collaboratively develop new products and services (von Krogh & von Hippel, 2003). In these systems, individual users do not develop the product by themselves—as in the application of customer toolkits at the individual level. Rather, they make small individual contributions to a community-based development effort.

Moving to mechanisms that facilitate validation at the back-end stages of the NPD process, firms have several options to engage customers to support product and market testing. The most advanced applications involve mass customization of products (Randall, Terwiesch, & Ulrich, 2004), such as the personalized sneakers that can be purchased on Nike's Web site. Digital environments can also significantly contribute to simplifying and making the new product testing stage more efficient before launching a product on the market, as Google does by beta testing new ideas in the Google Labs section of its Web site. Web-based beta testing is very common in the software, e-commerce, and video game industries. New technologies such as rapid prototyping, simulation, and combinatorial methods make it possible to generate and test different product versions quickly and cheaply (Thomke, 1998). The Internet makes it possible to simultaneously test different product configurations (virtual product testing) as well as different marketing mixes to complement the supply (virtual market testing) in order to choose the best solution with direct collaboration of the end-customers (Dahan & Srinivasan, 2000).

CASE STUDIES ON INTERNET-ENABLED CUSTOMER COLLABORATION IN PRODUCT INNOVATION

There is a paucity of academic literature on the experiences of firms that have successfully used the Internet as a platform for collaborative innovation. Hence, we adopt an exploratory approach to derive patterns and implications. We follow the logic of grounded theory (Glaser & Strauss, 1967), by employing a multiple-case-study methodology (Eisenhardt, 1989; Miles & Huberman, 1994). In the tradition of other qualitative approaches used in business research, we rely on a small number of highly visible examples of the object of our inquiry to develop our insights (Pettigrew, 1990). The two companies we study are a European firm in the automotive industry and a U.S. firm in the pharmaceutical industry. We selected these companies because they are leading-edge practitioners of Internet-based collaborative innovation. The case studies were informed by in-depth interviews with senior managers and a detailed search of publicly available information from financial statements, internal documents and industry publications. Interviewees within each firm were chosen on the basis of their specialized knowledge and experience, following a key informant approach (Kumar, Stern, & Anderson, 1993; Philipps, 1981). In-depth interviews with executives and managers were conducted during 2003 and early 2004 at Ducati and

Eli Lilly. The approach was nondirective, based on individual semi-structured interviews (McCracken, 1990) that are flexible yet are controlled (Burgess, 1982). We used an open-ended approach to questioning so that we could identify emergent themes in collaborative innovation.

Ducati Motor

In the motorcycle industry, companies create competitive advantage not only based on technical product superiority, but also on their ability to interact with their customers and create deep customer relationships across the entire lifecycle of ownership. Motorcycles are a lifestyle-intensive product, so motorcycle companies need to foster a sense of community among their customers in addition to offering innovative product features.

Ducati Motor, a manufacturer of motorcycles headquartered in Italy, was quick to realize the potential for using the Internet to engage customers in its new product development efforts. The company set up a Web division and a dedicated Web site, www.ducati. com, in early 2000, inspired by the Internet sales of the MH900evolution, a limited-production motorcycle. Within 30 minutes, the entire year's production was sold out, making Ducati a leading international e-commerce player. Since then, Ducati has evolved its site to create a robust virtual customer community that had 160,000 registered users as of July 2004. Community management has become so central at Ducati that management has replaced the words "marketing" and "customer" with the words "community" and "fan." Ducati considers the community of fans to be a major asset of the company and it strives to use the Internet to enhance the "fan experience." Ducati involves its fans on a systematic basis to reinforce the places, the events, and the people that express the Ducati life style and Ducati's desired brand image. The community function is tightly connected with the product development and the fan involvement in the community directly influences product development. Ducati uses Web-based mechanisms to support rich as well as broad customer engagement, at the front-end as well as at the back-end stages of its product development process (Figure 2).

Virtual communities play a key role in helping Ducati to explore new product concepts. Ducati has promoted

Nature of Collaboration	Applicability to Stage of New Product Development Process: Front-end (Ideation and Concept)	Back-end (Product Design and Testing)
Deep/ High Richness	Tech Café	Design Your Dream Ducati
	Advisory programs supported by product engineers	Focalized contest
	Ducati Service	Ducati Garage Challenge
	Technical Forum & Chat	Virtual Teams
Broad/ High Reach	On line survey to improve the Website	Mass customization of the product
	Polls & feedback sessions	Web-based product testing
	My Ducati	
	Virtual scenarios	

FIGURE 2
Ducati's Internet-Based Collaborative Innovation Initiatives

and managed ad-hoc online forum and chats for over three years to harness to strong sense of community among Ducati fans. Over 200 messages are posted every day on Ducati forums. The most popular discussion is about products and the biking experience. These conversations are highly relevant for Ducati to better understand customer needs and gain insights into new products and services. Ducati also realized that a significant number of its fans spend their leisure time not only riding their bikes, but also maintaining and personalizing their bikes. As a result, Ducati fans have deep technical knowledge that they are eager to share with other fans. To support such knowledge sharing, the company has created the "Tech Cafè," a forum for exchanging technical knowledge. In this virtual environment, fans can share their projects for customizing motorcycles, provide suggestions to improve Ducati's next generation products, and even post their own mechanical and technical designs, with suggestions for innovations in aesthetic attributes as well as mechanical functions. To support their ideas, they can attach text or graphics files. In the customer service area of the Web site, individual bikers can self-signal their technical competencies and solve mechanical problems posted by other Ducati fans. These technical forums help Ducati to benefit from spontaneous customer knowledge sharing, and help the company to glean suggestions for improving its marketing, engineering, and customer support. They have also significantly reduced the number of calls coming into

the company's call centre, resulting in significant savings on customer support.

While not all fans participate in the online forums, those who do participate provide rich inputs for exploring new product concepts and technical solutions. These forums also help Ducati to enhance customer loyalty, because its fans are more motivated to buy products they helped to create. Ducati's CEO has mandated the involvement of all the company's product engineers in customer relationship management activities. They are required to periodically interview selected Ducati owners from the company's online database of registered fans—adding a physical dimension to the online interaction. Ducati also attempts to go beyond its customer base in an effort gather ideas from as broad an audience as possible. Ducati community managers monitor relevant forums and bulletin boards hosted on independent Web sites, such as the community of American Ducati fans hosted on Yahoo!. Ducati community managers take part in these forums, sometimes identifying themselves and remaining anonymous at other times, based on the nature of the topics and the sensitivity of the audience to privacy concerns. Ducati managers also monitor vertical portals created for bikers, including Motorcyclist.com and Motoride.com; micro-sites that aggregate specific segments of interest to Ducati's. These include sites that aggregate women bikers—the fastest growing demographic group in motorcycling—as well as "girlfriends, wives, and mothers of Ducati fans." And Ducati monitors other virtual communities that have lifestyle associations with the Ducati brand. For instance, Ducati has entered into a partnership with the apparel fashion company DKNY to tap into their community and interact with their members. Through these diverse "listening posts," Ducati tries to ensure that it expands its peripheral vision beyond its own customers, and beyond the customers it can reach directly by itself.

The ideas and insights that emerge from the mechanisms we describe are rich and creative, but they do not necessarily represent the preferences of the broader market for Ducati products. To validate its insights, Ducati uses online customer surveys to test product concepts and to quantify customer preferences. As a testimony to the ability of Ducati to create an ongoing customer dialogue and create a sense of engagement with its fans, Ducati gets extraordinary response rates, often in excess of 25% when it surveys its customers. Ducati uses customer feedback for activities that go beyond product development. The layout and functions of Ducati's Web site are shaped by customer feedback, and the guests for live chats on the Web site are also chosen based on customer input.

To encourage customers to participate in online surveys, Ducati has created a sophisticated incentive system based on both tangible and intangible payoffs. For instance, every week Ducati launches a competition called "Name the picture": participants have to guess what part of the bike an image shows to enter the "Hall of Desmohead-Fame." In these events, technical knowledge becomes a passport to enter a highly qualified virtual community of fans. Ad-hoc surveys are also created to get feedback about specific products and strategic directions for marketing activities like new product concept selection. For instance, three concepts for the new Ducati Sport Classic were presented on October 2003 simultaneously at the International Exhibition of Tokyo as well as on Ducati's Web site. No engineering components had been developed yet at that time. Fans were asked to provide their feedback about the opportunity to produce the new Sport Classic. Almost 15,000 answers were collected in five days, with more than 96% recommending the production of all the three models. Ducati's new Web site, which went online in September 2004, features a new registration form where fans can share personal information about their experience with Ducati motorbikes and allows them to provide suggestions for accessories that can complement the biking experience. Similar features are also featured on the customized MyDucati pages that each fan can create and personalize.

Ducati also pursues Internet-based customer collaboration at the back end of its NPD process. Virtual communities play an important role at the product design and market testing stages. For instance, in early 2001, the community managers of Ducati.com identified a group of customers on its Web site that had particularly strong relationships with the company. They decided to transform such customers into active partners, involving them in virtual teams that cooperate with professionals from R&D, Product Management, and Design of Ducati Motors. These virtual teams of customer work with the company's engineers to define attributes and technical features for the "next bike."

Through this mechanism, Ducati recognizes opinion leadership and provides recognition for members within its customer community. Contests are also used in order to enhance and reward customer involvement. For instance, the company created a competition called "Design Your Dream Ducati," where fans were challenged to interpret in any form their "Dream Ducati," by offering artistic as well as technical ideas. The winning ideas were selected by a team that included the CEO, the chief manager of the Design Department, and the Creative Director.

Future contests will focus on specific areas of interest for the company, to solicit solutions to specific mechanical and aesthetic problems—a form of Web-based idea market. The company also plans to integrate its online and offline mechanisms for customer engagement. For instance, during the World Ducati Week (WDW), an annual gathering of Ducati fans from all over the world in Italy, the company organizes the Ducati Garage Challenge. The purpose of this gathering is to allow bike owners to show how they transformed their Ducati based on their skills and creativity. In the 2004 gathering, more than 20 motorcycles constructed by Ducati were remodelled by the imagination of customers who worked in their workshops to transform their dreams into reality. The winners are selected through votes cast by official Ducati riders, as well as by the company's technical and styling directors.

Notwithstanding the origin of the "next bike," all new product designs are reviewed and tested with a broader sample of customers. Ducati's fans can surf thousands of pages illustrating the mechanical features of Ducati motorbikes. Within the virtual community, current and future Ducati bike owners discuss and review proposed product modifications that can be tested online in the form of virtual prototypes. They can even vote to reject proposed modifications. They can also personalize products to their preferences, and can ask Ducati technicians for suggestions on personalizing their bikes to their preferences. To answer such questions, the Internet division relies on technical experts within the company.

Eli Lilly

The pharmaceutical industry relies heavily on innovation to sustain competitive advantage. The average cost to discover and develop a new drug is more than $500 million, and the average length of time from discovery to patent is 15 years. Eli Lilly, an Indianapolis-based pharmaceutical firm, has created an Internet-based platform to support collaborative innovation involving its customers—patients, doctors, clinicians, researchers, and health care providers. The company employs more than 35,000 people worldwide, and markets medicines to treat depression, schizophrenia, diabetes, cancer, osteoporosis, and many other diseases in almost 140 countries. Like its competitors, Eli Lilly invests heavily in R&D, consistent with the philosophy of its founder, who referred to research as "the heart of the business, the soul of the enterprise."

In recent years, the company has sought to make its innovation processes more widely distributed by leveraging the Internet. In the late 1990s, the company created a new division, e.Lilly, dedicated to using the Internet to manage customer interactions with the explicit purpose of supporting R&D activities. e.Lilly focused on engaging potential creative partners, including customers, in a dialogue to explore new ideas and strategies for growth. e.Lilly aimed to create new and unanticipated connections among patients, doctors, and employees, because these connections facilitate creative solutions to innovation problems. e.Lilly is responsible for two main streams of Web-based activities—generation of new drugs and creation of new patient solutions. Each stream of activities is pursued through a specific Web site and ad-hoc mechanisms of customer engagement, selectively applied at the early stages and later stages of the innovation process (Figure 3).

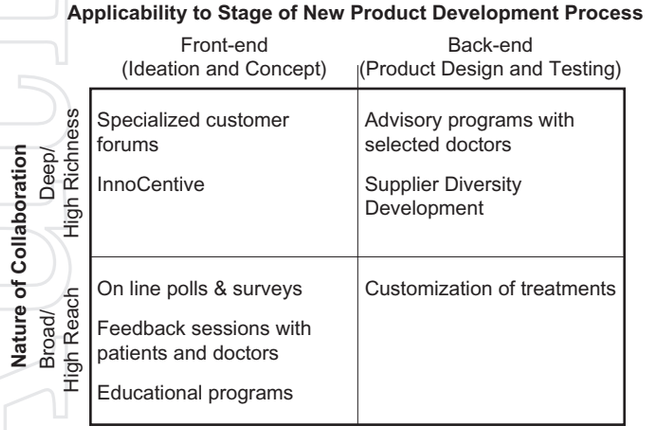

FIGURE 3
Eli Lilly's Internet-Based Collaborative Innovation Initiatives

In order to collaboratively explore new solutions to problems of patients suffering from diseases, the company invites them to participate in specialized forums where they can socialize their experiences and share advice. Ad-hoc forums allow the medical community and patients affected by the same pathologies to engage in a shared experience of learning about a specific health condition, while providing useful insights to the company in order to creatively drive its idea generation process.

To enhance its validation activities at the front end, Lilly educates and involves patients on a broader basis, through the corporate Web site (www.elililly.com) and its direct links to related Web sites, such as the Lilly Center for Women's Health (www.lillywom enshealth.com). Patient involvement in therapy is enhanced through customized information offered on the Web and feedback sessions. The purpose is to empower patients to choose their personal treatment options by providing them with information about diseases as well as potential therapies. At the same time, Lilly is able to generate valuable feedback about new product concepts from a representative sample of customers through online polls and surveys.

Eli Lilly also uses the Internet as a platform for involving scientists in the innovation process, by directly engaging them in innovation-related problem solving. The company has created a venture called InnoCentive (Innovation + Incentive) that functions as a Web-based market where solutions to problems are traded and participation is enhanced through competitive problem solving. The purpose of InnoCentive is to enable collaboration with lead users and communities of experts who have expertise to solve innovation related problems. InnoCentive posts scientific problems for solution by qualified scientists, without regard to geography, time zones, or background. The InnoCentive.com Web site encourages scientists to find problems that match their qualifications and then work independently or collaborate to find the best solution. InnoCentive allows Eli Lilly to engage experts from around the world on a contingent basis to facilitate its R&D efforts. InnoCentive has been spun off as an independent company, and it has broadened its mission to acting as an independent third party that connects "solvers" with "seeker" companies in a variety of industries including biotechnology, agribusiness and consumer products.

A key issue in facilitating customer involvement in innovation is the design of appropriate reward mechanisms for customers. In the case of InnoCentive, scientists are offered cash rewards that are explicitly defined on the Web site. Scientists work and submit solutions with the understanding that only the best solution will receive the financial award. InnoCentive is a cost-effective, convenient, and speedy mechanism for Eli Lilly to tap into the broad and rich base of distributed knowledge among the world's scientists. It allows Lilly to expand its scientific research and development capacity, without adding to its employee costs.

To understand the power of this Internet-based distributed innovation platform, consider an example of an innovation challenge—to improve the manufacturing process of a chemical called 4-(4-hydroxyphenyl) butanoic acid. After Eli Lilly's internal R&D organization had spent 12 person-months of work on this problem, the result was a five-step process that needed expensive starting materials and produced low yields. The goal was to devise a two-step process that had a starting cost of less than $100 per kilogram and produced a better yield. The problem was posted on InnoCentive's site in June 2003. It soon received several submissions, including a promising approach suggested by Werner Mueller, a retired senior scientist from Hoechst Celanese. At the end of November 2003, Mueller's fifth submission was accepted and he was awarded $25,000 by InnoCentive. In less than five months, one scientist had solved a problem that had eluded a team of researchers at Eli Lilly. By the end of 2004, more than 70,000 leading scientists and scientific organizations in more than 165 countries had registered to solve problems on InnoCentive's Web site. InnoCentive has also signed up several companies including BASF, Dow Chemical, and Procter & Gamble to post scientific problems confidentially on the InnoCentive Web site.

Eli Lilly also engages its customers at later stages in the NPD process. Doctors are engaged through advisory programs aimed at supporting continuous feedback on specific solutions to selected pathologies, in order to better anticipate market evolution and identify the most appropriate period to launch a new treatment on the market. An extension of these programs has driven to the Supplier Diversity Development (SDD), aimed at broadening participation of minority and women-owned businesses—often

managed by the same company's clients, such as researchers and clinicians—in the Lilly supplier base to levels more reflective of the diverse business community. And patients are involved in customizing the treatments and therapies the company provides them, based on their preferences and the specifics of their disease conditions. The basic drugs can be the same, but the therapy is personalized case by case to reflect the individual history and experience.

DISCUSSION

The purpose of this paper was to highlight how the Internet can serve as a powerful platform for collaborative innovation with customers. While customer knowledge has always played a key role in managing product innovation, today's competitive environment demands going beyond merely importing the "voice of the customer" through traditional market research mechanisms. The Internet allows firms to engage customers more broadly, more richly, and more speedily. It allows firms to create ongoing customer dialogue, absorb social customer knowledge, and scan knowledge of potential or competitors' customers. By establishing direct, persistent, and interactive dialogue, the firm can access knowledge at low cost from individual customers as well as from communities of communities. In virtual environments, it can better select lead users or, better, let them self select. In addition, the firm is neither constrained by geographical boundaries nor by the boundaries of its served markets in the selection of lead users.

While this exploratory inquiry needs to be followed up with further empirical analysis, our study contrasts the traditional perspective on customer involvement in innovation against the emerging perspective of co-creation facilitated by the Internet. We illustrate how the characteristics of the medium—interactivity, reach, speed, persistence, and flexibility—permit firms to explore new frontiers in co-creation of value. We also outline a variety of Web-based mechanisms for customer collaboration, and provide a framework for classifying the mechanisms in terms of the nature of the collaboration (deep versus broad) and the applicability to stages in the NPD process (front end versus back end).

Our case studies reveal three themes in Internet-based collaboration with customers to support new product development, relating to (a) the absorption and integration of complementary forms of knowledge through different mechanisms; (b) organizational transformation as a prerequisite for the success of collaborative innovation and; (c) the emergence of mediators who facilitate collaborative innovation.

The first theme we observe is that the Internet should be used as an integrated platform for engaging customers in multiple ways for different purposes. Both Ducati and Eli Lilly selectively use a diverse portfolio of Internet-based mechanisms to support different stages of the NPD process, and to acquire different types of knowledge. For instance, Ducati uses its virtual communities to enhance idea generation and tap into the competencies of lead users, but then relies on specific polls to verify the soundness of these ideas by involving larger numbers of customers to generate successful "next bikes." These polls achieve extraordinary response rates, because the sense of belonging to the community increases individual commitment and brand loyalty. A similar virtuous cycle enacts within the Eli Lilly Web site, where patients develop trust and commitment towards the company because it provides them with information on their specific diseases, and committed customers, in turn, help the company to improve its treatments and, hence, further increase their loyalty. Eli Lilly's ability to integrate patients' experiences shared in the forums hosted in its corporate Web site with the scientists' contributions through the InnoCentive venture plays an important role in defining new treatments and the best approaches to marketing the treatments.

Internet-based mechanisms positively impact both the content and process dimensions of knowledge to support new product development. On the content dimension, knowledge-sharing processes at a social level generate knowledge that is rooted in specific experiential contexts. These virtual contexts allow the firm to gain insights into socially generated knowledge that would not be possible to glean using traditional research techniques. On the process dimension, there is a resonance among different forms of customer participation in the company's activities. A strong sense of belonging to virtual communities enables strong social relationships, which increases individual customers' willingness to share their knowledge with the company. Conversely, the ability to develop personalized relationships with

individual customers has a positive impact on their trust and involvement with the firm. The higher involvement in turn enhances customers' intention to participate in communities managed by the company or even by independent third parties.

The various Internet-based collaboration mechanisms are synergistic, and therefore can be employed simultaneously as part of an integrated innovation strategy, and not as independent "silos" for customer dialogue. Firms should strive to integrate all these channels to create an integrated portfolio of mechanisms that they can use to pursue different forms of knowledge, for different purposes, to support different stages of the NPD process. More specifically, the tools for front-end stages and deep customer engagement (suggestion boxes, advisory panels, virtual communities, Web-based idea markets) are more relevant to the ideation and concept development stages. Consider, for example, the Tech Cafè, technical forums, Ducati service area, and customer advisory programs run by Ducati; and the specialized customer forums and the InnoCentive Web site managed by Eli Lilly. The tools in the front-end stages and broad customer engagement (online surveys, market intelligence services, Web-based conjoint analysis, listening-in techniques) are more useful at the concept-testing phase, while the tools in the back-end stages and broad customer engagement (toolkits for users innovation, open-source mechanisms, Web-based patent markets) are better suited to improve the product design phase (e.g., contests like "Design Your Dream Ducati" and virtual teams organized by Ducati; as well as the advisory programs with selected doctors run by Eli Lilly). Finally, the tools related to the back-end stages and broad customer engagement (mass customization, Web-based prototyping, virtual product testing and virtual market testing) are most relevant at the product and market testing stages in the NPD process. In summary, the synergistic usage of different tools supporting different phases of the new product development is an important factor in enabling successful Internet-based collaborative innovation with customers.

The second theme we observe from the case studies relates to the organizational changes that need to accompany the adoption of collaborative innovation with customers. While customer engagement in product development has received a lot of attention in recent years, there is little academic research on the organizational adoption of such mechanisms. An interesting finding in our case studies is that both companies we studied underwent significant organizational transformation as they embraced collaborative innovation. Ducati reorganized its entire marketing department around the community function, and also tightly linked the community management function with the division in charge of the NPD process. Specific organizational roles have been created to support continuous customer knowledge sharing within the company, selectively distributing the knowledge garnered through the Internet to specific departments that can benefit from the information. Eli Lilly had to create e-Lilly as a new hybrid organization to manage its collaborative innovation efforts. And it created the InnoCentive spin-off to encourage innovative thinking and to allow InnoCentive to become an independent Web-based innovation marketplace serving other companies. We believe that true co-creation will require a fundamental redesign of marketing processes and the marketing organization to support continuous dialogue with customers, as well as to systematically share the knowledge generated through this dialogue within the firm in a way.

The final theme that we find is the emergence of autonomous Web-based innovation marketplaces. Third parties like InnoCentive and NineSigma play an important role as intermediaries in facilitating collaborative innovation, allowing the firm to expand its peripheral vision beyond its own customers and its own Web site. Similarly, vertical portals for bikers provide Ducati with knowledge it could not gather from its loyal and enthusiastic fans on its own Web site. These intermediaries allow firms to access prospects and competitors' customers, who are unlikely to interact directly with the firm in conversations. Third party Web-based innovation marketplaces act as knowledge brokers (Hargadon & Sutton, 1997) allowing firms to access unbiased customer knowledge, and to gain insights into opportunities that lie beyond the firm's immediate field of view (Sawhney, Prandelli, & Verona, 2003). This mediated process complements the traditional processes of direct innovation controlled by the individual firm. Mediated activities of innovation represent an interesting and profitable extension of the traditional business of information intermediaries.

In conclusion, co-creation of value is an important source of competitive advantage in the network economy (Prahalad & Ramaswamy, 2004). While co-creation is a compelling notion, it needs to be described and analyzed for every specific marketing process, including customer relationship management, new product development, customer support, sales, marketing communications, and brand building. We hope that this paper provided useful insights into co-creation in virtual environments to support one key marketing process—developing new products. We also hope that our work stimulates further investigation into other processes for collaboration, including collaborating with customers to define value propositions, deliver value, share value, and communicate value.

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