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Ulrike Schultze
Southern Methodist University, uschultz@smu.edu

Emanuela Prandelli
Bocconi University

Petri I. Salonen
TELLUS International, Inc

Marshall Van Alstyne
Boston University

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uschultz@smu.edu

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ABSTRACT

The Internet is democratizing commerce by turning economic models that were based on a strict separation between providers and consumers into models where this distinction is increasingly blurred. This implies significant opportunities and challenges for organizations, particularly with respect to the role that their customers play in the generation of economic value. Are customers partners or competitors? While firms typically strive to implement business models that leverage the customers as a resource (i.e., customer co-production), models in which customers are competitors (i.e., peer production) are frequently met with attempts to co-opt these customers (i.e., hybrid co-production). The purpose of this panel, presented at the 2006 International Conference on Information Systems, is to explore the range of Internet-enabled co-production models (i.e., customer and hybrid co-production) and the opportunities and challenges that they present for firms.

Keywords: customer co-production, hybrid co-production, peer production, open source, innovation

I. INTRODUCTION

The Internet facilitates a "shift in the role of the customer – from isolated to connected, from unaware to informed, from passive to active" [Prahalad and Ramaswamy 2004: 2]. Thus, it is democratizing commerce by turning an economic model that was based on a strict separation between providers (of goods and services) and consumers, into a model where this distinction is increasingly blurred (e.g., eBay's online marketplace). This implies significant opportunities and challenges for organizations, particularly with respect to the role that their customers play in the generation of economic value [von Hippel 2005]. Are customers partners or competitors?

II. CUSTOMER CO-PRODUCTION, PEER PRODUCTION, AND HYBRID CO-PRODUCTION

Customer-driven modes of production can broadly be classified into co- and peer-production. Customer co-production is the direct involvement of customers in the generation of value by creating a service context and by participating in the design, delivery, and marketing of a firm's goods and services, which the customers consume themselves [Schultze and Bhappu 2007]. It therefore implies a kind of partnership between the customer and the firm. Examples of customer co-production include using online self-service technology to book a ticket, writing a book review for Amazon.com, or voting a reality TV personality "off the island." Peer production, in contrast, occurs when consumers, who may or may not be part of a community, produce a product or service that is then freely available for use. In peer production, the firm no longer plays a role as a producer as erstwhile customers become competitors. Examples include open-source software development, citizen journalism, and Skype telephony.

In this panel, presented at the 2006 International Conference on Information Systems, we view customer co- and peer-production as the ends of a multi-dimensional continuum representing customer- or user-participative modes of production (see Table 1). This perspective implies that there are a variety of production models, which we broadly refer to as hybrid co-production models, along this continuum. These hybrid co-production models are particularly interesting in that they combine elements of customer co-production and peer-production. For instance, Google relies on the Internet community's hypertext linking practices as a proxy for a site's quality and relevance. By combining this free, peer-produced fund of hyperlinks with its proprietary search algorithm, Google has become one of the leading search engines, a position it leverages with revenue-generating advertisers. Similarly, software firms like RedHat and SugarCRM have found ways of leveraging the peer-produced open-source code with a revenue-generating model.

Table 1. Multi-Dimensional Co- to Peer-Production Continuum

Co-Production	……	**Hybrid Co-Production**	……	**Peer-Production**
		Dimension		
Firm	⇦	*Primary Source of Value Generation* [Benkler 2001]	⇨	Network
Scarce Atoms	⇦	*Nature of Resources* [Anderson 2004]	⇨	Abundant Bits/Information
Revenue	⇦	*Potential for Rent Appropriation*	⇨	Free
Firm	⇦	*Holder of Ownership Rights*	⇨	Community
Professionalism	⇦	*Basis for Quality Assessment* [Benkler 2006]	⇨	Shared Values
Market Forces	⇦	*Production Co-ordination* [Benkler 2006]	⇨	Non-Market Forces

The purpose of this panel is to explore the range of Internet-enabled co-production models (i.e., customer and hybrid co-production) and the opportunities and challenges that they present for firms. Each panelist will address this topic with a unique focus and from a unique perspective. Ulrike Schultze, an IS researcher who is interested in the work-practice and customer-relationship implications of incorporating Internet technology into the co-production, will focus on the implications of self-service technology in service delivery. Emanuela Prandelli, a management scholar whose interests lie in virtual communities of consumption and product innovation, will share insights of her empirical work on the use of technologies and virtual knowledge brokers in the co-design of products. Petri I. Salonen, an entrepreneur in the software industry, will address concerns about business models that include reliance on open-source components and the implications this has for competing with customers. Marshall van Alstyne, an IS scholar who takes an information economics lens to solve problems as diverse as managing spam and open-source software development, will focus on the role of licensing in peer-production environments such as open source development. The panel report ends with a transcription of questions from the audience and responses from panel members.

III. CUSTOMER DRIVEN INNOVATION: TOWARD VIRTUAL KNOWLEDGE BROKERS (EMANUELA PRANDELLI)

This presentation focuses on two emerging patterns that characterize innovation in the knowledge economy: (a) the increasing openness of the innovation process thanks to the role of Information and Communication Technologies (ICT); (b) the emerging role of customers as co-creators of innovation. While customer interaction has always been important in new product development [e.g., Griffin and Hauser 1993; Leonard 1995; von Hippel 2001a; Thomke and von Hippel 2002], the widespread deployment of ICT has greatly enhanced the ability of firms to engage with customers in the product innovation process [Dahan and Hauser 2002b; Urban and Hauser 2004]. The Internet has enabled the creation of virtual customer environments – platforms for collaboration that allow firms to tap into customer knowledge through an ongoing dialogue [Nambisan 2002; Sawhney and Prandelli 2000]. Many companies have developed customer advisory panels to solicit ideas for new products, fostered online communities to encourage dialogue among customers, and built toolkits that enable customers and engineers to co-design products. By allowing businesses to greatly expand their reach while maintaining the richness of their interactions, virtual environments allow them to make customers active participants in the innovation process [Prandelli, Verona, and Raccagni 2006].

Until now, firms have primarily used the Internet as a tool for direct involvement of customers in the firm's innovation process. Customer tool kits that enable leading-edge customers to provide input into innovation can greatly reduce the cost and improve the speed and quality of the innovation process [Von Hippel 2001b]. Virtual communities - i.e., groups of customers sharing knowledge about specific interests and experiences about products [e.g., Kozinets 1999] – allow companies to tap also into social customer knowledge. Customers select themselves on the basis of the focused interests promoted by specific communities, and this self-selection means that they are highly involved and motivated to share knowledge with other customers and community managers.

Innovation researchers have written about the process of using the Internet for adaptive co-development of new products, where customers become co-developers, and firms continually solicit customer feedback in new product development [e.g., von Hippel 1986]. Firms like Netscape and eBay have employed the Internet as a tool to promote adaptive co-development processes. This adaptive process employs iterative prototyping, rapid experimentation, and ongoing customer involvement to integrate the voice of the customer, and to better adapt new products to customer needs [Bhattacharya, Krishnan, and Mahajan 1998; Dahan and Hauser 2002].

However, direct interactions with customers, while necessary to facilitate innovation, can be insufficient at least when the company's purpose is to go beyond incremental change. Firms actually need to create a multi-channel innovation strategy that combines direct customer connectivity with mediated channels that allow firms to connect with customers in ways that the firms simply cannot do by themselves. These mediated channels for innovation are as relevant as the direct channels, because they allow firms to produce complementary customer knowledge [Sawhney et al. 2003]. More specifically, they allow individual firms to collect customer-generated knowledge on a broader basis, and specialize in customer knowledge absorption and re-aggregation. In doing so, firms can broaden their reach and increase the scope of the knowledge they can access.

In fact, direct channels of communication present several limitations. For one, companies may not be able to reach the right customers, because their interactions and perspectives tend to be limited to the markets they already serve. For another, they may find it difficult to reach people at the right time, because customers tend to interact with companies at relatively late stages of the decision-making process. And they may also find it difficult to engage customers in the right context, because customers rarely carry on conversations about their lifestyles and interests on company Web sites. To fully exploit the Internet as an enabler of radical innovation, companies need to complement their direct channels of customer interaction with indirect interactions. Those points of contact can be carried out by independent third parties who function as "virtual knowledge brokers" (VKBs). They help companies in collecting a broader set of innovation stimuli and listening to unusual voices in order to catalyze innovation, supporting them to escape from the "tyranny of their served markets" [Hamel and Prahalad 1994].

THE ROLE AND CHARACTERISTICS OF VIRTUAL KNOWLEDGE BROKERS

VKBs are the virtual manifestation of knowledge brokers (KBs), i.e., third parties who connect, recombine, and transfer knowledge to companies in order to facilitate innovation [Hargadon and Sutton 2000]. In the physical world, KBs work closely with their business customers to provide specific innovation solutions, and have traditionally taken the form of innovation and design consulting firms [Sutton 2002; Hargadon 2003]. VKBs take the form of information intermediaries who leverage the unique capabilities of the Web to absorb valuable market knowledge for innovation.

VKBs differ from KBs in several key respects (see Table 2 for summary). First, they do not offer completely developed design solutions but provide a service that extends to the entire scope of the innovation activity. Second, they do not leverage solutions and technologies already developed within other companies but absorb new ideas and knowledge from customers. This requires the creation and ongoing management of two-way interactions with individual customers and virtual communities on a systematic basis. Third, as a consequence, the collaboration between VKBs and firms which work with them is often not limited to an individual project but can expand over time to support different knowledge needs on an as-needed basis. Clients typically hire a VKB to gather market knowledge in order to enhance either their ability to generate and select new ideas (representing stimuli to incremental but even radical innovation), or their ability to develop, test, and refine new products. Hence, by managing knowledge of distant customers, VKBs may be useful in the front-end as well as at the back-end stages of the innovation management process. So while KBs tend to have a strong client orientation to serve the needs of a firm looking for a specific design solution, VKBs tend to favor a network orientation, providing knowledge absorbed from customers to different companies, repackaged in different ways, to support different stages of the innovation process.

The origin of VKBs is directly explained by the characteristics of the Web. The explosion of connectivity by means of the Internet, together with the development of new information standards, permits an open and almost cost-free exchange of information between actors in any market [Evans and Wurster 1999]. Digital networks allow a large number of players to systematically share ideas and create distributed learning systems [Sproull and Kiesler 1991]. As a consequence, a number of intermediaries have emerged to facilitate knowledge exchange in digital environments, mediating between customers who make buying decisions and the companies that want to reach these customers. These middlemen operate as information intermediaries or "infomediaries" [Hagel and Rayport 1997] by making it easier for customers to obtain information about sellers and by allowing sellers to reach customers.

Table 2. Comparison of VKB, KB and Direct Customer-Firm Interaction

	VKB	KB	Company Website
Type of contact	Mediated	Mediated	Direct
Source of Knowledge	Industrial and Inter-industrial	Inter-industrial	Industrial
Type of outcome	Knowledge for Innovation	Product Design	Knowledge for Innovation
Role in the process	Invention and Innovation	Invention	Invention and Innovation
Type of orientation	Network orientation	Client orientation	Firm orientation
Type of Interaction	Continuous	Spot	Continuous
Core Comp. in Brokering Cycle	Network Access	Absorption and Integration	Absorption and Implementation
Main Limit	Knowledge Implementation	Network access	Network access

ICIS 2006

Source: Verona, Prandelli, Sawhney, (2006), Innovation and virtual environments: towards virtual knowledge brokers", *Organization Studies*.

By going beyond their traditional role as intermediaries who work on behalf of customers to facilitate transactions [Hagel and Singer 1999; Kaplan and Sawhney 2000], some infomediaries have evolved into VKBs by working on behalf of firms to facilitate customer knowledge import to support innovation. Internet firms like CNET.com, Homestore.com, and Edmunds.com have evolved from infomediaries into VKBs in the technology, home ownership, and automobile markets, respectively, by gathering customer feedback on industry-specific products and organizing communities of interests around these industries. VKBs collect distributed individual and social customer knowledge and distribute it to firms after organizing and elaborating it to support innovation [Verona, Prandelli, and Sawhney 2006].

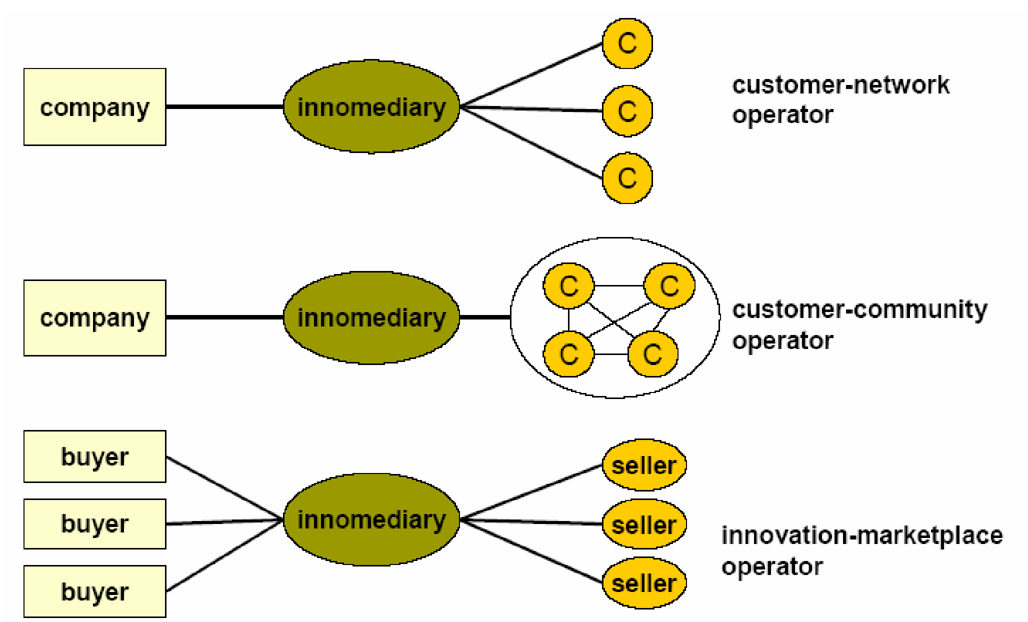
For instance, the virtual knowledge broker iVillage has created a rich virtual community of women. Discussions in the community about, say, apparel, cosmetics, or automobiles could be organized and moderated in ways that would make them very useful to innovators. New product managers, for example, could propose new product concepts, solicit feedback on new products, and observe conversations to get a better understanding of the tacit as well as explicit needs of women. The nodal position that virtual knowledge brokers occupy between companies and customers puts them in a good position to aggregate customer preferences, solicit individual customer feedback, and gather knowledge that emerges from spontaneous conversations among customers.

More specifically, VKBs help companies fill structural holes in the market, that is, gaps between companies and customers that can only be bridged by knowledge brokers [Burt 1992]. Structural holes arise in the context of innovation for several reasons [Sawhney et al. 2003]. First, as we anticipated, despite the Internet's promise of global access, an individual company rarely interacts with prospects, competitors' customers, and non-adopters in emerging markets. It has a structural hole or limited reach into its network of learning relationships. This is a particular problem for companies looking to expand beyond their current markets and products.

Second, companies suffer from the lack of neutrality: customers often feel that the information they get directly from the company is biased or reflective of a vested interest. They are much more likely to trust a third-party that seeks to understand their preferences and opinions of products, brands, and manufacturers. Third, companies can engage in dialogue with their customers in a limited number of contexts. Customers tend to visit a company's Web site when they are far along in their purchase decision, or after they have already made one. As a result, companies may find it difficult to interact with customers when they are still looking for specific information or evaluating different product or manufacturer options.

VKBs can fill these structural holes by creating virtual bridges between companies and their customers across space and time [Sawhney et al. 2003]. On the spatial dimension, VKBs enable companies to engage different kinds and larger numbers of customers and prospects. On the temporal dimension, they allow companies to hear from customers at earlier stages of the decision process. They also allow companies to obtain customer knowledge that is not constrained by the company's mental models or biases. By allowing businesses to see beyond their current markets, customers, and products, VKBs can improve their "peripheral vision."

Just as there are a variety of specific mechanisms that make VKBs work (including portals, vortals, communities, metamediaries, brokers, and exchanges), there are at least three mechanisms that facilitate their activity. The mechanisms differ according to the function they perform, the types of customer knowledge they allow companies to obtain, and the stages in the innovation process they support best. Although VKBs tend to specialize in one mechanism, they may employ more than that. We can identify three main categories of VKBs [Sawhney et al. 2003]: the Customer Network Operator, the Customer Community Operator, and the Innovation Marketplace (see Figure 1 for a graphic representation and Table 3 for a summary).



Source: Sawhney et al. (2003)

Figure 1. Three Types of Virtual Knowledge Brokers

The Customer Network Operator: The simplest form of VKB is the customer network operator. VKBs that fit this label are like online versions of market research vendors that operate customer panels. They support innovation by recruiting and maintaining networks of customers and then providing companies with access to specific customer segments for the purpose of soliciting feedback. Customer network operators are most useful in the stages of concept testing or test marketing, when businesses want to know how customers will react to new products or product concepts. Using this mechanism, companies interact with customers through surveys or by monitoring purchase behavior, so the knowledge they obtain is explicit rather than tacit. In other words, they can use the VKB to find out what customers "know they know" and what they actually purchase, but not what they know but can't express directly, or what they do without being fully aware of their behavior. An example of a customer network operator is the online market research company ComScore Networks. ComScore has recruited a global sample of more than 1.5 million panelists who have agreed to have their Internet behavior confidentially and anonymously monitored. The company uses this huge panel to provide information to companies about their customers, their competitors' customers, or prospective customers; it tracks what people buy, how often, from which sites, and how they respond to online advertising and marketing offers. ComScore aggregates the panelists' online buying information and combines it with data about their offline buying behavior (gleaned from such sources as retail-store scanners and credit card databases) to create a "customer knowledge platform" -- a 360-degree view of the surfing and buying behavior of customers over the entire Internet.

The Customer Community Operator: The customer community operators are VKBs that specialize in connecting businesses with people who form a community based on common interests. They are particularly useful at the ideation stage in the innovation process, when companies are trying to understand customer lifestyles, motivations, and unmet needs. They are also valuable at the product design stage, when product designers and managers need to communicate and collaborate with customers to optimize the designs. Community operators can also help companies identify and profile opinion leaders within a customer population, shape the opinions of early adopters, and accelerate the diffusion of new products through word of mouth.

In the automobile market, the case of Edmunds shows how an infomediary evolved into a customer community operator. Edmunds started out in 1966 as a publisher of automobile buyers' guides. In 1994, the company established Edmunds.com, put its content on the site, made it freely available, and quickly became one of the leading sources of unbiased and comprehensive information for potential automobile buyers. In 1996, Edmunds created the Town Hall, an online automotive community that is a collection of thousands of message boards featuring online discussions on automobile-related topics. Overseen by 13 community managers, it has more than 500,000 registered users and is the world's largest online community of automotive customers. Visitors to the site express their opinions on all matters related to buying, selling, and owning an automobile. Additionally, live chats allow participants to interact with Edmunds.com editors and industry representatives such as designers and engineers.

Edmunds initially created Town Hall as a service for automotive customers but soon realized that it could be a valuable resource for its automobile OEM partners. Thus Town Hall allows automobile OEM executives to host discussions as guests or to answer questions posed by customers. OEM product managers can even create their own subcommunities to discuss a new model that they may bring to market in the future, for example. Some automotive companies have gone further, creating private communities in which they pay Edmunds a monthly fee to host and run their part of the site. Subaru makes use of this service to obtain feedback from a diverse group of customers.

The Innovation Marketplace Operator: The innovation marketplace operator is a "many to many" mechanism whose purpose is to connect sellers of innovation with potential buyers. In this case, the innovations are framed as intellectual property, that is, a discovery, patent, or some kind of know-how. Thus the type of knowledge available for sale is the specialized expertise of professionals. For instance, in June 2001, Eli Lilly created an Internet-based platform called InnoCentive that would support innovation by facilitating direct dialogue between the company on one side and lead users and communities of experts on the other. But InnoCentive quickly evolved into an innovation marketplace, acting as an independent third party to connect a broad range of "solution seeker" companies with a vast base of potential problem solvers. Today InnoCentive is offering its mediated innovation services to companies in pharmaceuticals, chemicals, biotechnology, agribusiness, and consumer products.

The process has four steps. First, scientists review the InnoCentive challenges as posted by companies with problems in need of solutions. The details of each challenge include a molecular structure, problem specifications, the cash incentive, and the deadline for submitting the proposed solutions. Next, they register on the site as potential problem solvers. Third, they choose a specific problem to work on, sign the agreement that transfers ownership of the resulting intellectual property to the company, and get a project room where they can deploy their work. Finally, the company reviews all the proposed solutions, determines the best one, and awards a cash prize to the scientist or team that came up with the winning solution. Awards can range from $5,000 to $1,000,000. Scientists who participate include retired researchers, university professors, researchers working for independent clinical research organizations, and even scientists working for noncompeting pharmaceutical firms.

Table 3. Summary of Virtual Knowledge Broker Typology

	Customer Network Operator	**Customer Community Operator**	**Innovation Marketplace Operator**
Function	Create networks of customers and provide accessed to specific segments	Build and operate online communities for specific interests, lifestyles or products	Create marketplaces for innovation between buyers and sellers of innovation
Source and Type of Customer Knowledge	From individuals (mostly explicit)	Socially generated Within communities (explicit and tacit)	Specialized expertise From innovative customers and professionals
Innovation-Process Stages Supported	Concept test Market Test	Idea generation Product design	Discovery Idea generation
Direct Online-Channel equivalent	Customer survey	Virtual community on company website	Customer advisory panel

Source: Sawhney et al. (2003), "The Power of Innomediation", *MIT Sloan Management Review*, 44 (2), pp. 77-82

In conclusion, from the theoretical standpoint, VKBs extend the concept of KBs to virtual environments, highlighting the ways in which virtual environments enhance the reach and richness of the knowledge brokering function. From the managerial perspective, VKBs are a way to bridge knowledge gaps created by the inability of firms to reach the right customers at the right time and in the right context to benefit from market knowledge.

IV. IMPLICATIONS OF INTERNET-MEDIATED CUSTOMER CO-PRODUCTION (ULRIKE SCHULTZE)

Instead of relying on service representatives to provide customers with information or to complete service requests, firms increasingly encourage customers to complete their own transactions through Internet-based self-service technology. While this strategy can improve customer service by increasing its availability and the customers' control over the transaction, it may also have unintended consequences, particularly for the customer-firm relationship. The argument underlying this segment of the panel is that customer co-production has been part of service delivery for a long time, and that reliance on Internet technology is changing its nature and forms. A multidimensional definition of customer co-production as well as a contingency framework of co-production designs, which were developed by Schultze and Bhappu [2005, 2007], will be used to illustrate this argument. Furthermore, a case study of a firm that implemented a self-service quote-generation system that its B2B customers (insurance brokers) could use [Schultze and Orlikowski 2004] will demonstrate the argument.

MULTI-DIMENSIONAL DEFINITION OF CUSTOMER CO-PRODUCTION

The notion of co-production is not new; indeed it has a substantial history in the public sector. As city and state governments struggle with limited resources, they typically look to citizens to volunteer their time and to assist public-sector service providers with labor and information. In the public administration literature, co-production is thus defined as "direct citizen involvement in the design and delivery of city services with professional service agents" [Brudney and England 1983], and "the degree of overlap between two sets of participants – regular producers and consumers" [Brudney and England 1983]. Co-production, therefore, implies collaboration (or co-laboring) between customers and service providers.

Whitaker [1980] defines co-production in terms of three dimensions: (1) requesting assistance; (2) cooperation; and (3) mutual adjustment. This categorization scheme provides us with a starting point for developing a multidimensional definition of co-production. The different dimensions of co-production in our framework, Figure 2, are activity, mode of cooperation, and type of interdependence. The activity dimension describes *what* customers do to co-produce, whereas the cooperation and interdependence dimensions describe *how* customers co-produce, i.e., their motivation for co-producing and the nature of the customer-provider and/or customer-customer interdependence.

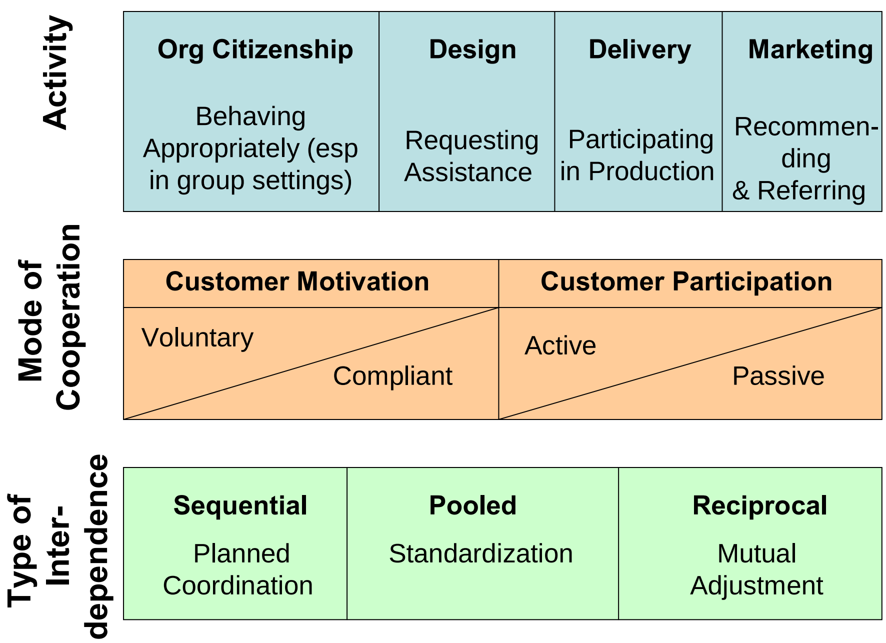


Figure 2. Multi-Dimensional Definition of Customer Co-Production

Activity: Engaging in *organizational citizenship*, i.e., behaving appropriately and in a way that creates a congenial social context, is especially important when a service takes place in a social setting. For instance, travelers on a flight co-produce a safe flight by obeying the orders of the crew, e.g., fastening seatbelts, and clearing the aisles. Gamers who play by the rules are less likely to spoil other gamers' fun than gamers who cheat.

When customers develop a clearer understanding of their needs and make a request for service (either custom or standard), they are engaged in the *design* activity. Emanuela's discussion and research focuses on this activity and highlights customer-led innovation and co-design. However, according to Whitaker [1980], the simple act of requesting assistance is also an example of design.

Delivery, on the other hand, consists of the customer's completion of or participation in the production of goods and services. The degree of customer involvement in delivery varies depending on the nature of the service. While it might only take the act of showing up at the theatre (and maybe clapping at the end of an act) for the customer to complete a live performance of a play, the customer's completion of a fitness or a weight-loss program requires considerably more effort. This is because the successful outcome of the latter is dependent on the customers' committed participation in the production process over an extended period of time.

Traditionally, the *marketing* activities that customers engage in remained largely invisible to providers and firms [Chervonnaya 2003], although the recent emphasis on Internet-based viral marketing and consumer-generated advertising seems to indicate that this is no longer the case. It is noteworthy that consumer-based marketing is not only beneficial to the provider firm (e.g., word of mouth advertising), but also to the customer, especially if the product or service in question is subject to network effects (e.g., instant messaging).

Mode of Cooperation*:* We conceptualize the mode of cooperation as the how and why of a customer's participation in value creation. For instance, Brudney and England [1983] point out that, ideally, customers should cooperate voluntarily in co-production activities, but that there is a fine line between *voluntary and compliant* cooperation in the public sector. For instance, for effective sanitation, residents are expected to move their trash to the curb on a given day of the week. Failure to comply with these rules of co-production typically results in fines, suggesting that customer behavior is motivated by compliance rather than voluntary cooperation.

Brudney and England [1983] also distinguish between *active and passive* cooperation. Active cooperation implies that customers purposefully engage in design, delivery or marketing activities. Passive cooperation, in contrast, suggests that customers refrain from disruptive behavior, thereby enabling other producers to do their work. For instance, by listing only legitimate and legal items on eBay, a seller co-produces an efficient and effective online marketplace.

Type of Interdependence*:* Our third dimension of co-production relates to the nature of the customer-provider (primarily in co-production) and customer-customer (primarily in peer-production) interaction. Relying on Thompson's [1967] typology, we identify three types of interdependence. *Mutual adjustment* occurs when participants base their actions on their joint consideration of the issues. This is accomplished through intensive interaction and the reciprocal modification of each party's expectations and actions. In personal or human services, where the goal is to transform the customer (particularly his/her behavior), developing an understanding of the customer's problems, needs and/or wishes requires mutual adjustment throughout the design and delivery process. According to Thompson [1967], mutual adjustment is the most appropriate coordination mechanism in situations where participants' actions are *reciprocally interdependent*.

In contrast, when participants are *sequentially interdependent*, the most effective coordination mechanism is planning. For instance, organizations forecast what their stock levels or service capacities need to be in order to satisfy consumers' demands. In situations of *pooled interdependence,* coordination is best achieved through standardization. For instance, collaborative filtering technologies on which online recommendation systems are built, rely on a pool (or data warehouse) of customers' product ratings.

THE CO-PRODUCTION CUBE

This multidimensional definition of co-production suggests that customers are valuable resources in the creation of a service context and in the design, delivery, and marketing of goods and services because they supply organizations with knowledge, skill, and labor. Depending on the specific combination of activity, mode of cooperation, and type of interdependence, a service can be visualized as a cube (see Figure 3).

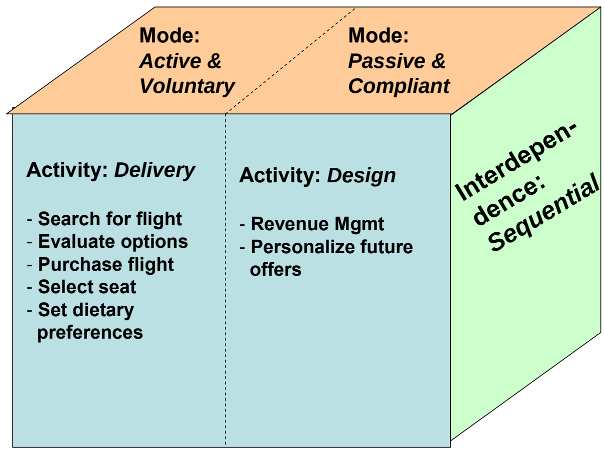


Figure 3. Booking an Airline Ticket Online as a Co-Production Cube

A customer that completes his/her flight reservation through an online, self-service technology is presented with a set list of options regarding flights, seats, and meals, for instance. As the technology offers scripted options and reacts to the customers' responses in a turn-taking manner, this suggests a sequential mode of interdependence. Actively and voluntarily interacting with the reservation system, the customer is essentially completing the booking process, i.e., a delivery activity. However, the customer is also passively and involuntarily engaged in the design of the airline's flight and pricing schedule, as information about not only the options the customer selected but also the options that s/he ignored is captured as part of the airline's revenue management system and personalization engine.

Once a service is described in this manner, we can track how it changes as a result of, for instance, infusing it with more information technology, changing the mode of cooperation from active to passive, or increasing the number of activities customers are expected to complete. Furthermore, we can determine whether the design of a service is appropriate given the nature of the service and the design contingencies associated with the service environment. Based on prior research on service and organizational design [e.g., Argote 1982; Bowen and Jones 1986], we develop a contingency framework (Figure 4) that takes *information equivocality* as a type of input uncertainty and *performance ambiguity* into account.

Information equivocality, which means that information is of doubtful significance and can be interpreted in different ways, implies that the service provider has incomplete information about the what, when, where, and how of the customer's input. The higher the uncertainty associated with the customer's input, the greater the need for flexibility in the customer-firm interaction and the coordination of work within the provider firm [Argote 1982]. The lower the uncertainty, the more scripted these coordinating activities can be.

Performance ambiguity refers to the difficulty of assessing service or product quality [Ouchi 1980]. It relates to the intangibility of the object being exchanged and its complexity, i.e., the difficulty of establishing the role and value of each component's (and participant's) contribution to the quality of the good or service. High performance ambiguity implies high transaction costs because the product or service being exchanged is not completely contractible. In order to assess whether the exchange was equitable, the parties have to monitor each other. Hierarchies and embedded relationships are effective coordinating mechanisms in this instance. In contrast, low performance ambiguity implies low transaction costs because participants can establish complete and enforceable contracts to govern the co-production process and outcome. Thus transaction costs are relatively low, and markets are the most effective coordination mechanism.

		Performance Ambiguity	
		Low	High
Information Equivocality	Low	**Scripted Market** - Booking airline tickets	**Scripted Relationship** - Weight-loss program
	High	**Personalized Market** - Book recommendations	**Personalized Relationship** - Post-graduate education

Figure 4. Co-Production Design Contingency Framework

In our contingency framework (Figure 4), the two structural alternatives for exchange relations between providers and customers are *markets* and *relationships*. Markets are most effective under conditions of low performance ambiguity, whereas relationships are most effective under conditions of high performance ambiguity. The two methods of coordination co-production activities are *scripted* and *personalized*. Scripted modes of coordination are most effective under conditions of low input uncertainty, whereas personalized modes of coordination are most effective under conditions of high input uncertainty. The four resulting co-production designs (quadrants) are therefore *Scripted Market*, *Scripted Relationship*, *Personalized Market*, and *Personalized Relationship*. Examples of services illustrative of each are presented in Figure 4.

Since a more detailed discussion of each quadrant is offered in Schultze and Bhappu [2005, 2007], I will focus on an example of how IT changes the co-production cube and customers' perception of a service in ways that are both intended and unintended by the provider firm.

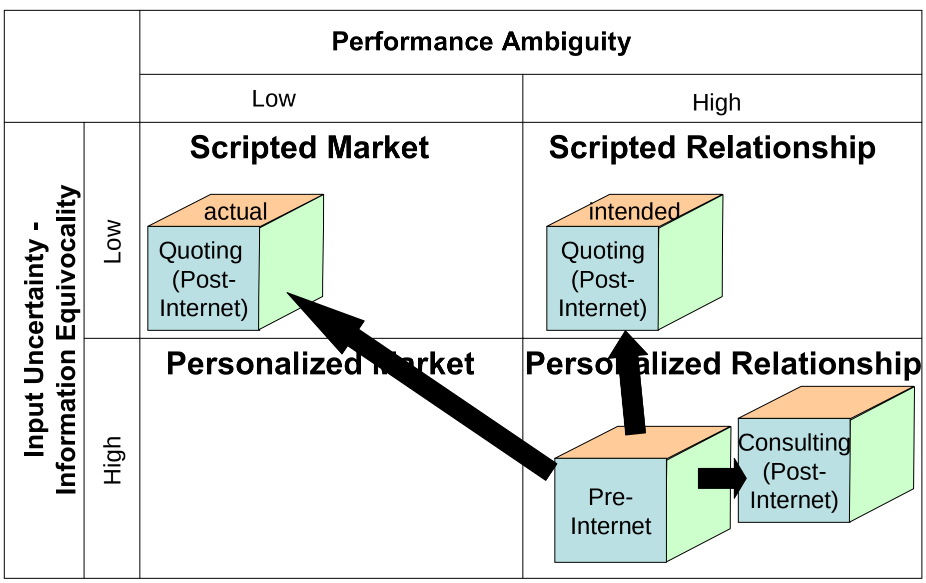
AN ILLUSTRATION: INTRODUCING SELF-SERVICE TECHNOLOGY AT WEBGA

WebGA (a pseudonym) is a "general agent" in the small group health insurance market (a detailed description of this case can be found in Schultze and Orlikowski [2004]). As a general agent, WebGA mediates between independent insurance brokers and insurance carriers by providing brokers with "proposals" or "quotes" for health insurance plans from multiple carriers (i.e., *quoting* services), as well as help with selling (i.e., *consulting* services), e.g., accompanying brokers on sales calls and providing brokers with sales advice and materials such as enrollment forms and benefits packages.

WebGA's revenues consist of an "override," a commission paid by the insurance carrier for insurance policies sold through a general agent. This means that there is a high degree of reciprocal interdependence between WebGA and its customers. While WebGA relies on brokers' sales success for its income, brokers rely on WebGA for information (both public and privileged) and assistance with selling. Furthermore, the information equivocality is high, as "the best health plan" could mean the plan with the lowest cost, the most comprehensive coverage or coverage for specific conditions . Thus, WebGA's service reflects the conditions of the *personalized relationship* co-production design and WebGA traditionally relied on embedded relationships as a means of coordinating the co-production between its sales reps and its customers.

However, in 1999, WebGA complemented its relationship-based customer-firm interface with an Internet-based Self-Service Technology (SST), which allows customers to generate their own insurance quotes. It was anticipated that automating the structured *quoting* activities (i.e., matching the needs of the group seeking insurance with available plans) would free the WebGA reps up to engage in more *consulting* activities (i.e., gathering market intelligence from brokers, and providing them with advice and privileged information). While quoting relied on sequential interdependence for customer-provider coordination, consulting relied on mutual adjustment.

Since the challenges that this SST-enhanced co-production design generated for both WebGA sales reps and their customers have previously been described in detail [Schultze 2003; Schultze and Orlikowski 2004], I will merely map and briefly discuss the consequences of this technology change here (Figure 5). Prior to the introduction of its online quoting technology, the WebGA's co-production design reflected a personalized relationship. Quoting and consulting activities were offered only as a bundle and through personal contact between a broker customer and his/her WebGA representative. The introduction of the online SST meant that quoting and consulting were separated. While the consulting activity remained in the personalized relationship quadrant, the quoting activity was expected to migrate into the scripted relationship quadrant. Indeed, WebGA wanted the relationship between its customers and its reps to remain intact, and therefore sought to maintain virtual integration between quoting and consulting. Thus, every time a customer generated a quote online, their WebGA sales rep was alerted and was expected to follow up with the customer.



Source: Schultze, U. and Bhappu, A.D, (2007). Internet-Based Customer Collaboration: Dyadic and Community-Based Modes of Co-Production, in *Emerging E-Collaboration Concepts and Applications*, Ned Kock (Ed), Hershey, PA: CyberTech Publishing, pp.166-192.

Figure 5. Consequence of WebGA's Introduction of Self-Service Technology

However, the lack of seamless integration between WebGA's provider- and Internet-based channels began to undermine the customer-provider relationship, suggesting that some of

WebGA's customers regarded WebGA's quoting service in terms of a scripted market design, characterized by arm's-length relationships. This presented a problem for WebGA's revenue model, as it did not price its quoting services separately from its consulting services.

CONCLUDING THOUGHTS

Despite the challenges highlighted in the WebGA case, it is noteworthy that the deployment of Internet-based SST has been very successful in co-production designs characterized by relatively low performance ambiguity. For instance, reports that Southwest Airlines was able to close three of its call centers at the end of 2003, in part because more and more customers were booking their flights online, suggests that the implementation of SST has been successful in the scripted market co-production design quadrant. Furthermore, Amazon's success as an online retailer, evidenced by the fact that in February 2004 it earned the highest customer satisfaction index score ever recorded by the American Society for Quality (Michigan State University), suggests that the deployment of SST for services located in the personalized market has been effective. Nevertheless, it appears that we have fewer examples of SST and Internet technology deployments, their success and their impacts on customer co-production in situations of high performance ambiguity, i.e., in the scripted and personalized relationship quadrants. Future research should therefore focus particularly on the co-production designs characterized by high performance ambiguity.

V. DOING BUSINESS IN A WORLD OF HYBRID CO-PRODUCTION (PETRI I. SALONEN)

Being a software entrepreneur in today's world is not easy. Between 1995 and 2004, I led the development of more than 30 proprietary software solutions within the business intelligence and data warehousing domain. In 2004, I made an exit by selling to a large public company based in the U.S. That is when I began exploring opportunities within the open source software market.

My experience with open source is based primarily on my work with TELLUS International, Inc., which I founded in 2004. TELLUS is a solutions provider within the Web 2.0 domain. Wikipedia defines Web 2.0 as "the perceived or proposed second generation of Internet-based services – such as social networking sites, wikis, communication tools, and folksonomies – that emphasize online collaboration and sharing among users." At TELLUS, we leverage these new web services to provide solutions to our client organizations. Our solutions includes Internet portals with technologies such as wikis, blogs, forums, and other social networking tools that create communities with common interest. Our objective is not only to build Web 2.0 solutions but also to educate our customers on how to utilize Web 2.0 to drive business or manage communities of interests.

One of the main reasons why Web 2.0 technologies are receiving so much attention in the press is due to the changes taking place in marketing and public relations. In the past, marketing and PR used high dollar advertising to help generate sales, but lately some of these organizations are using free communication channels such as wikis and blogs as the preferred vehicle for marketing products and solutions around the world. The firms with the most successful Internet-marketing initiatives are the ones that understand search engine optimization (SEO) and that can help drive audiences to a Web site, which also acts as a social networking site.

Even though we are a small company, TELLUS utilizes a globally-distributed workforce. Our primary development team is located in India and project management is done in the country in which the solution is deployed. Our business strategy is to assemble and integrate open source components into unique, value-adding turnkey solutions for our clients. TELLUS's value proposition is not only the integration of these open sources components but also the understanding and knowledge of how these components can be combined to solve client-specific problems.

CHANGES IN THE SOFTWARE DEVELOPMENT MODEL

Shifts in software development models are changing the way software entrepreneurs view market opportunities. In the past, many an entrepreneur saw his/her big break coming from the development of proprietary software and then generating enough market buzz to either get acquired or go public. However, this business logic is increasingly outdated now. According to *InformationWeek* ["SAP Sales Slip as Succession Rumors Swirl" 12.1.2007/Stacy Cowley CRN], software giants such as SAP, Microsoft, and Oracle are no longer experiencing the type of growth that they did during the '90s.

Another trend in innovation and product development is to utilize the Open Innovation Business Model [Chesbrough 2006]. This model addresses both the R&D costs and revenue potentials for an organization. The R&D costs are lowered by using external R&D resources, which creates a larger revenue potential as the markets for innovations broaden.

The way that we are seeing the open model of innovation making itself manifest in the software arena, is in the form of technology platforms. Software organizations are building platforms that are frequently based on Web services and communities, and that support an ecosystem of customers who are dependent on this platform and who may or may not co-produce the platform's value.

An example of a company following the open innovation strategy is Salesforce.com, which recently announced that it is going beyond its ASP-based, Software-as-Service (Saas) CRM solutions to a model where a rich, third-party development community is building additional applications on top of the Salesforce.com platform. According to *CRM Daily* [January 31, 2007: "Salesforce.com's Platform Ambitions," Frank Hayes] Salesforce.com is allowing its own hosted CRM solution to be cannibalized by having third-party developers innovate features and functionality that are competing with Salesforce.com's offering. However, in this new platform model, Salesforce.com will benefit as new applications and solutions, built by the Salesforce.com ecosystem, attracts new users who will ultimately pay for their use of the platform in a trickle-down kind of revenue model.

Opening a proprietary software platform, such as Saleforce.com is doing, is about sharing APIs, and the software vendor stays in the driver's seat by deciding what to expose to the public. Another platform provider that is driving software development in the form of utility computing is Amazon.com, which recently introduced a model that enables software vendors to concentrate on developing technology solutions rather than having to worry about the infrastructure components of the computing platform. According to *BusinessWeek* [November 13, 2006: "Jeff Bezo's Risky Bet," Robert D. Hof], Amazon.com is becoming a digital utility platform for on-demand business processes and small- to midsized businesses. These businesses rely on Amazon.com's multiyear investments in business processes and IT development. This new business model can be characterized as a form of co-production as Amazon.com expects the platform users to build solutions that increase their (and their customers') dependence on and use of the platform. Given the logic of the utility model, revenue grows with increasing use.

What we see in this platform-based software development model is that organizations are opening up the very platforms on which they would previously have relied as the foundation for internal development of derivative software such as a family of products. Previously, this product platform was carefully guarded as it encapsulated the core competence of the company and therefore represented the key to R&D and the firm's competitive advantage [Salonen 2004]. Today, software organizations with tightly-guarded, proprietary software platforms will have a difficult time keeping their platforms competitive, as many Web 2.0 organizations have opened their platforms for co-development using Service Oriented Architectures (SOA).

Even though this platform approach facilitates innovation and creates opportunities for entrepreneurs, it is interesting to note that this strategy may be less threatening to the platform provider's revenue model than one might imagine at first glance. For instance, Tapscott and Williams [2006] recount the story of Paul Rademacher who mashed up listings from Craigslist with Google's mapping service. However, he decided not to pursue this initiative as a standalone business venture because he did not own the data on which the mash-up service was based, and because the barriers to entry were too low, making imitation inevitable.

Thus companies will have to reevaluate a business model based on a proprietary and closed software platform, and consider strategies like the one IBM used in 2003, when it donated a bundle of development tools called "Eclipse" to the public domain. According to Chesbrough [2006], the shareholders should have applauded the management of IBM for opening the innovation process to the public, as this lowered IBM's in-house development costs and broadened the developer base, which brought to the fore additional uses and functionality of IBM's extant software solutions.

OPPORTUNITY FOR SOFTWARE ENTREPRENEURS – OR NOT?

Traditional, proprietary software development typically assumes a revenue model based on one-time software licensing and recurring maintenance fees. For the last 20 years, that was the way I sold software to major organizations around the world. In the last two or three years, however, I have found that organizations are more reluctant to buy licenses; instead, they are demanding pay-per-use fee structures and mechanisms that allow them to pay only for the features and functionality they need. Furthermore, organizations are demanding Internet-based applications that are served to browser-equipped clients, thus lowering organizations' investments in hardware infrastructure and maintenance.

As software entrepreneurs trying to respond to these shifts in the software market, we at TELLUS have explored opportunities with regard to proprietary (e.g., Microsoft or Java) and open source software development. The challenge we face is that each comes with its own business model and logic, and that these represent polar opposites. This makes it difficult to find a middle ground or a hybrid position with a coherent logic on which a sustainable business model can be built. Nevertheless, we have explored opportunities to combine open source with proprietary extensions. By gaining access to a software platform with a rich ecosystem of ready-made components, we can innovate around these open source components to deliver a unique, value-adding product solution to our customers. This unique solution or package could be based on building extensions to the extant open source components, or on a custom combination and integration of available components.

However, the viability of pursuing such a hybrid co-production model is contingent on the platform provider's licensing agreement. As the following excerpt from *InfoWorld's* [November 17, 2006: "Interview: Zimbra turns to channel as competitive weapon," China Martens] interview with the CEO of Zimbra highlights, some software firms are creating the conditions for software production models that mix proprietary and open solutions: "We chose to go with the Mozilla Pubic License [MPL] primarily because it allows downstream value-add by developers who can decide on their own whether to open source. It's more like the Lesser GPL (General Public License). We had a long debate on whether to go GPL or MPL. Firefox uses MPL and Mozilla is respected. There's a shift going on. Companies are open source, but at the same time they need to feed developers and run a company."

For an entrepreneur like me, the open source model presents one particularly formidable challenge: the complexity of the different licensing models. It is virtually impossible for me to figure out all the details and contingencies associated with the various licensing agreements and their variations. And I know I am not alone in my frustration. Based on my many discussions with other software entrepreneurs, it is clear to me that very few really understand what can be done with open source software and what type of limitations are put on using it. Ultimately, the lack of clarity around licenses will hurt innovation, as entrepreneurs like me either avoid open source solutions altogether, or, if we do pursue them, we must either hire expensive lawyers to protect ourselves or run the risk of lawsuits for inadvertently violating a licensing agreement.

Software vendors are to some extent to blame for this situation as they customize the licensing models to fit their requirements and fail to take the needs of the software development community adequately into account. Each open source licensing model has its own nuances. Recently, *eWeek* [December 28, 2006: "A Medical Open-Source Legal Hell Hole," Steven J. Vaughan-Nichols] reported on a legal dispute that Medsphere, the largest open source vendor within the healthcare solution space, was undergoing. The dispute concerns the company founders' right to release some of its code under the GPL. The lawsuit is based on 12-counts ranging from misappropriation of trade secrets, to breach of contract, to breach of duty of loyalty.

THE CO- AND PEER-PRODUCTION CONTINUUM

Figure 6 illustrates examples of different forms of co- and peer-production in the software industry.

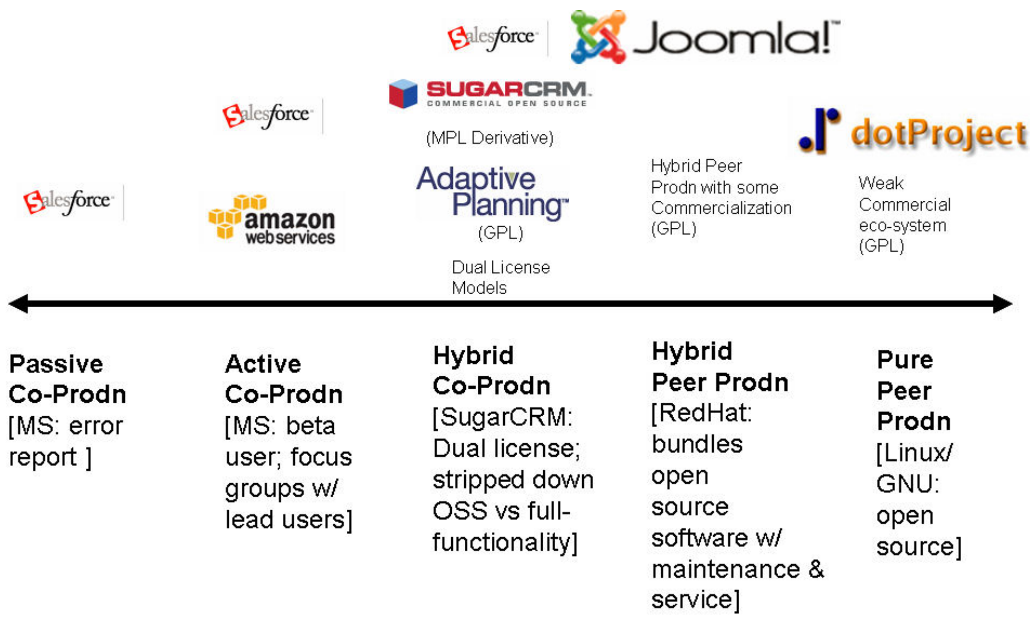


Figure 6. Co- and Peer-Production Continuum: Examples from Software Industry

On the extreme left, we have passive co-production. An example of this is where the software vendor relies on the customer for reporting errors or defects in the software in order to develop patches and improve the next version. To the extent that this reporting function is automated, this scenario represents a highly passive form of co-production.

Active co-production, with examples of Salesforce.com and Amazon Web-services, assumes that both Salesforce.com and Amazon.com want feedback and cooperation from third-party organizations. Salesforce.com has introduced new services such as AppExchange which is a collection of solutions/applications built by third-party vendors. These solutions require Salesforce.com as the foundation, and therefore Salesforce.com and application developers cooperate to build functionality that will benefit end user organizations that subscribe to these solutions.

The hybrid co-production category represents a model where a company relies on a dual licensing model. SugarCRM, for instance, has an open source license of their CRM solution. However, this solution is a stripped version of the full-blown commercial release that SugarCRM sells on a subscription basis. We at TELLUS tested the open source version and found that it lacked major reporting functionality that we needed. This functionality was available in the commercial version, however.

The hybrid peer production model has both pure peer-production elements as well as commercial extensions. An example of this type of model is Joomla.org, which is an open source content management system (CMS) with a large ecosystem of both open source and commercial components. The viability of this environment is based on how widely the CMS is used and how many commercial components are available.

DotProject.org represents a pure peer production model where the ecosystem is based on creating new features and additions without strong commercial interests. Some organizations within the dotProject community sell their implementation services around dotProject software, but there is almost no community developing commercially viable components around this solution. When evaluating the viability of dotProject as a foundation for TELLUS' software development, we had some concerns about the community's long-term viability and strength. In contrast, we did not have the same concerns regarding the Joomla.org community, as it has demonstrated great momentum in commercial components development.

SELECTING A PLACE ON THE CO- AND PEER-PRODUCTION CONTINUUM

During the last two years, we at TELLUS have investigated multiple business models based on open source solutions. We spent considerable time researching more than 10 open source content management systems (CMS) and ended up with one recommended solution, i.e., Joomla. Our selection was based on following factors:

- It has a rich ecosystem with lots of open source components providing different functionality.
- It is easy to use and easy to deploy to end user organizations.
- It is built on industry standard technologies such as MySQL and PHP (LAMP architecture).

Joomla represents a hybrid peer-production model in that it supports proprietary software extensions to its open source platform. These derivative components develop functionality that does not exist in the open source Joomla version. They can be bought from the Joomla marketplace at a reasonable price. In this way, Joomla has created a vibrant commercial ecosystem.

For us, the long-term viability of the ecosystem is one of our most important criteria in selecting an open source platform. Joomla.org was an off-shoot from the Mambo.org community. As a result of internal conflict, the core developers of Mambo.org founded Joomla.org. Even though functionally Mambo and Joomla were initially on a par, the upcoming version 1.5 of Joomla is no longer compatible with Mambo. This means that the ecosystem that these two platforms have shared will now be separated. Thus, at TELLUS, we are hoping that time will prove our decision to back Joomla to be the right one.

IN CLOSING

Based on our analysis and use of open source software, I have concluded that there is no one perfect business model for a software company. Software has become a commodity to some extent, and our belief is that most opportunities in the software space will derive from the development of customer-specific solutions on proprietary platforms such as Salesforce.com or open platforms such as Joomla.org. We also believe that pricing models will change dramatically as open source solutions are becoming increasingly robust and acceptable. Profit margins as high as 95 percent, which used to be common in the traditional software development space, are pretty much gone. Increasingly, software vendors will make their money off services.

Even though we have concluded that many open source solutions are not ready for "prime time," organizations increasingly acknowledge open source's viability even for mission critical applications. We have therefore decided to build our Web 2.0 solutions on open source software. TELLUS' future depends on our ability to understand the market and the functional needs of our customers. We also believe that simple innovation can generate a lot of value. An example here is del.icio.us, which allows users to tag and track URLs. This innovation was simple, yet practical, and worth millions for Yahoo.com and del.icio.us' founder.

Finally, there are still lots of uncharted waters in the hybrid co- and peer-production software models, especially around licensing issues. We have seen some signs of trouble, especially in the form of legal battles like the one involving Medsphere, the well known open source software provider in the healthcare industry.

VI. PEER PRODUCTION, INNOVATION AND OPTIMAL LICENSING (MARSHALL VAN ALSTYNE)

Let me start of by asking how many of you are engaged in peer production? I would submit that as academics, all of us are engaged in peer production when we engage in research, for instance. We rely on and cite previously published ideas, theories, and models, and expand on them in our quest to create new knowledge. We rely on peer reviews to determine what new knowledge is credible and to assure the quality of our journals. We rely on conferences to build networks of interest and collaboration, and to share and discuss ideas. These are all practices of peer production. In fact, the academic model of knowledge production, with which we are so intimately familiar, is an exemplar of peer production. Indeed, if we look closely at the academic model of peer production, we see glimpses of the many thorny issues that make hybrid co-production and peer-production in commercial settings so challenging, especially issues of ownership rights and innovation.

Ownership rights are frequently assured through patents. When Mark Twain's Connecticut Yankee assumed control of the administration of Camelot, his very first official act, he tells us was to start a patent office. Why? Because "a country without a patent office and good patent laws was just a crab, and couldn't travel any way but sideways or backwards." It is therefore interesting to note that article 1, section 8, clause 8 of the U.S. Constitution reads: "Congress shall have power to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries." The basic idea of a patent is that society grants an innovator a limited monopoly in exchange for revealing to society the nature of the innovation.

These constitutionally anchored ownership rights have spawned much debate, especially in light of their impact on innovation. For purposes of simplification, we can divide the debate into arguments that claim "closed is better" and arguments that maintain that "open/free is better." Those arguing for closed is better maintain that the ability to control one's rights over an idea or innovation is a necessary condition for the production of innovation. In the absence of such ownership rights, there is no incentive to innovate [Wagner 2003]. Thus, proponents of closed is better advocate indefinitely long but narrowly focused patents [Gilbert and Shapiro 1990], indefinitely renewable copyright [Landes and Posner 2003], and the ability to capture sequential innovations [Green and Scotchmer 1995].

In contrast, proponents of "open/free is better" highlight that innovation requires free access to prior work in order to facilitate collective production [Benkler 2002; von Hippel and Krogh 2003] and open inquiry [David 2004]. For instance, CopyLeft [1983] was motivated by simple observation that copyrights limit the freedom of developers to build on the works of others. Intellectual property (IP) protection on works of expression – books, plays, and paintings, for example – functions badly in industries that depend on incremental innovation and reuse for production and to improve customer satisfaction or expand networks. Also, highlighting the negative consequences of closely guarded ownership rights, Heller and Eisenberg [1998] illustrate the tragedy of the “anti-commons.” Furthermore, Stallman [1992] argues that free and open access to knowledge and ideas is a fundamental human right.

If we apply these debates to open source software development, we see elements of both arguments. For instance, some argue that open source destroys economic incentives to innovate. Indeed, even Raymond [2000] admits that open source only permits indirect business models that rely on revenue streams from services. However, to build a code base, developers need both access and permissions (or rights). Hold-up and monopsony curb innovation. And lastly, neither patent nor copyright law solves the problem of full disclosure and enablement of the software.

As we know from the open source movement, there are a number of licensing models that have been developed in order to balance the need for access (or openness) with the needs for control (or rights). Before discussing these, however, I would like to highlight two very interesting examples of peer production: Second Life and Google Mash-Ups. Second Life is a virtual world that is built entirely by its members, aka residents. Residents, who take on avatar form in Second Life, build things like landscapes, games (e.g., Tringo), meeting spaces (e.g., amphitheatres, shops and offices), clothes, houses, and décor, as well as walks and dances. Second Life has seen phenomenal growth since its commercial launch in June 2003. In January 2005, there were 100,000 residents in Second Life; by October 2006, this number had grown to over 1 million. These growth statistics can be attributed to the ownership rights that Second Life grants residents over their virtual creations.

Mash-ups areW applications that combine content from more than one source into a seamlessly unified user interface and experience. One of the most useful mash-ups was created by Paul Rademacher, who was house hunting in Silicon Valley (mentioned previously on page 30 by Petri Salonen). He grew tired of the piles of Google maps for each and every house he wanted to see. So he created a Web site that mashed up listings from the online classified-ad service Craigslist with Google's mapping service. The output was a map with pushpins for each of the locations of interest. He had created a Web application by integrating the content of two Web sites. While mash-ups are now sanctioned by Google Maps and enabled by the publications of the applications' APIs, Paul Rademacher's first mash-up required him to hack Google Maps' code. Instead of suing Rademacher and asserting its rights over its mapping application, Google hired him and published the Google Maps API a few months later [CNet News.com, Nov 17, 2005].

How can economic theory help us make sense of these two examples, and provide us with guidelines for identifying licensing models that are optimal for peer production environments? If we return to the control versus openness debate, and model the individual contributor's share of the economic reward of an innovation, we see the following relationships (Figure 7):

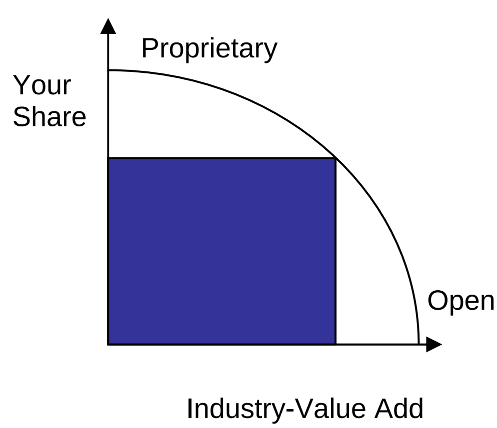


Figure 7. Individual Share of Rewards: A Function of How Much Value Is Created x the Fraction That You Can Capture [Shapiro and Varian 1999].

This graph highlights that the individual's share of an innovation's reward is a factor of value-added-to-industry times your-share, i.e., the blue square in Figure 7. Low and to the right, the industry grows larger but a completely open platform generates modest revenue for the platform sponsor. High and to the left, the sponsor captures a larger share of the value, but the ecosystem is much smaller. This graph also highlights that maximum protection, i.e., a point on the y-axis, does not maximize value to either the individual or society. Instead, maximum value is achieved with a mix of proprietary ownership and open access features, as indicated by the area of the blue square in Figure 7.

Figure 8 outlines in what way this reward formula can create profits.

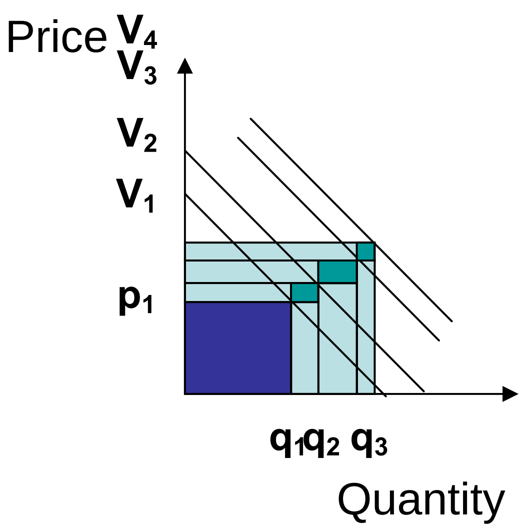


Figure 8. Increasing Total Value through Opening the Platform to 3rd Party Development

Consider the set of demand curves on the left. In this figure, the platform sponsor creates value V_1, then, by opening the platform, allows third party developers to add value V_2, V_3 . . . The platform installed base, creates a valuable market for the 3rd party developers. They in turn add value to the platform, which increases sales of the platform to q_1, q_2, . . . Thus, opening the platform to further development lets both parties win.

Given the incentives that might be harnessed, it is interesting to note that most current licenses, whether open or closed, are boundary solutions (Figure 9). This suggests that these licensing agreements do not take advantage of key insights from economics. In this figure, the horizontal access represents the degree of openness (0=completely closed, 1=completely open). The vertical axis represents the time at which 3rd party developer contributions themselves become open (0=immediately, 1=expiration of copyright).

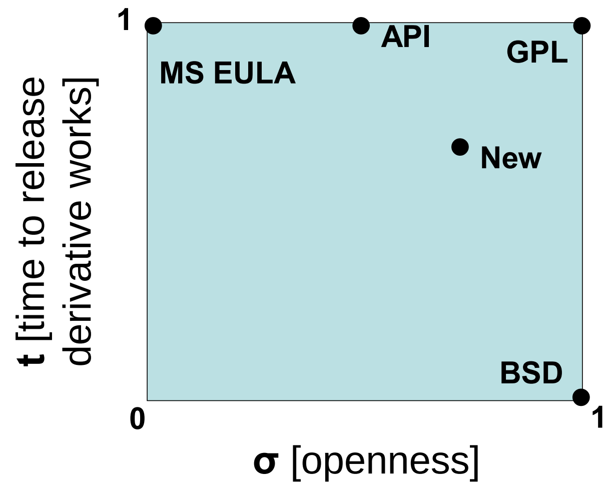


Figure 9. Most Licenses Are Boundary Solutions [Parker and Van Alstyne 2005a].

As Figure 9 shows, GPL represents complete openness, whereas typical corporate End User License Agreements (EULAs) are completely closed, proprietary licenses, irrespective of whether and when derivative works are released. Published APIs, such as those that make mash-ups possible, mix elements of proprietary and open ownership. Nevertheless, they represent a boundary licensing solution. The Berkeley Software Distribution (BSD) license creates incentives to fork the code base (cf., VA Linux, Red Hat Linux, Free BSD, OpenBSD, Net BSD and Mac OSX). Although BSD makes the platform itself open, 3rd party developers can keep their enhancements closed until the end of copyright so new contributions almost never get folded back into the platform.

The objective of some of my recent research is to develop a hybrid licensing model (marked on Figure 9 as “new”), that takes the best of the extant, boundary-solution licenses. This hybridized open license positions intellectual property (such as software) as a platform upon which diverse sources can build innovations and derivative products. This license would set some default parameters that are like the user preference setting that come with a Unix shell script or most software applications. The terms of the license would be set once for a given software platform and be limited to parameter choices that fall within the bounds that are socially optimal for the type of product. By keeping the license and the license design process open, users can understand what they are getting more easily. Furthermore, by parameterizing the license, details can be readily adapted to different industry contingencies. It is important to note that this hybridized license is based on the assertion that open systems can benefit from becoming more like proprietary systems that provide incentives to innovate, and that proprietary systems would benefit from become more like open systems and leveraging the open access to the underlying mechanics (e.g., source code) of the product or platform. While the latter – access to source code – determines whether peer-produced innovation *can* occur, the former – incentives to innovate – determines whether peer-produced innovation *will* occur.

With the right hybridized open license, both individual profits and social welfare can increase (see Figure 10).

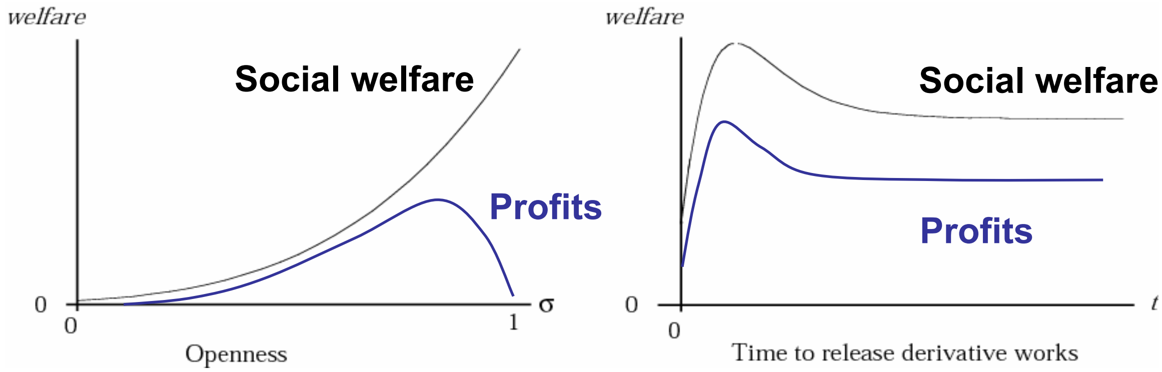


Figure 10. A Hybridized Open License Has the Potential to Increase Both Profits and End-User Welfare

The graph on the left shows total social welfare and profits as a function of platform openness based on a particular set of equations in Parker and Van Alstyne [2005]. It shows that profits rise with the level of openness, up to a point, past which a firm is unable to capture much of the value it creates even though total welfare continues to rise with each increment to openness. The graph on the right shows that the optimal time for a new enhancement to become part of the platform is neither immediately nor arbitrarily late. Letting developers keep their enhancements proprietary for awhile (if they wish to) lets them charge for their new creations. These enhancements should not, however, be kept separate from the platform indefinitely because no one else can build on them.

In the context of an increasing number and variety of hybrid peer production models, one relatively novel strategy that firms should explore involves the use of two-sided networks [Parker and Van Alstyne 2000, 2005b; Eisenmann, Parker, ,and Van Alstyne 2006]. A two-sided network matches two distinct market segments such as end-users and developers, credit card consumers and merchants, and auction buyers and sellers. Examples include MS Windows users and MS applications developers, Visa cardholders and merchants, eBay buyers and sellers, and Monster.com job seekers and employers. Each relies on one group of users to attract another. The platform facilitates the interaction and value generation between these two groups. Often, the platform owners open part of the platform to one of the user groups, effectively giving it away for free. However, they extract rents from the other user group. The tricky part is matching the groups of non-paying users with paying users, and generating not only same-side but also cross-side network effects, as the latter will ensure that growth in one user community will generate growth in the other. An example of a "same-side" network effect is the attraction the online gamers exert on other gamers – both parties are members of the same market segment. An example of a "cross-side" network effect is the attraction that games developers exert over online gamers and, conversely, the attraction that online gamers exert on games developers – these parties belong to distinct market segments that need each other for the games market to develop.

Software platforms, and indeed most information and standards-based platforms, exhibit such two-sided network effects. Managing the optimal license for both parties can greatly facilitate the rate of peer production in a manner that increases the total value of the platform and raises the welfare of everyone involved.

VII. PANEL QUESTION AND ANSWER

Niels Bjørn-Anderson: We have been throwing around the concept of an ambient organization in the last couple of years. Ambient organizations are those where members are everywhere. And a concept that you did not use is that of the noncontractual basis for organizational membership. So maybe the concept of noncontractual members is really key to this discussion.

Marshall Van Alstyne: That's an interesting observation. What you want to do is set up an environment of rules and then turn folks loose and hope that they will do something useful. All of these systems need some sets of rules; even Wikipedia has rules for controversial subjects. But you're right, these rules are noncontractual. With the low transaction costs on the Internet, you can engage in these noncontractual kinds of relationships as long as you understand the system of rules that allow folks to be productive.

Ulrike Schultze: In the service literature, the concept that is used is that the customer is a "partial employee." I personally don't agree with this characterization, because I see the customer relationship as being fundamentally different from an employment relationship. For one, there is the issue of power that is part of the employment relationship. But your question highlights the key issue of "how" you control your customers, who have their own source of power because they are not contractually bound.

Question: Marshall, you showed that there is an optimal licensing point that maximizes both company and social welfare. Is there is a way of finding this point without trial and error?

Marshall Van Alstyne: Ultimately we will be putting a lot of the ideas into our simulation so that folks can go tweak some parameters along different axes and dimensions to find out where they are. Let me give you a couple of rules of thumb: one is the size of the opportunity space. If it's a small project where firms can handle the development themselves, firms will tend to use a proprietary model. Another is the competitive environment, e.g., the clock speed of the industry. If the clock speed is high, you may want to open it up more to get other folks to participate in the development of the product. Another is the availability of useful partners. This is a question of information asymmetry. Is it an environment in which it is easy to identify potential partners, in which case you can choose them and write licensing agreements? Or is it an environment where partners have to self-identify? So those are some of the axes to consider when moving around this licensing space.

Elizabeth Davidson: I think the economic model is very elegant, but I wonder whether it is sufficient. If we take the example of academic co-producers, the question is why do we do that? We do that by having a normative set of rules around plagiarism, for instance. And we have economic incentives too; we co-produce knowledge because it is our job. Furthermore, using the example of Second Life, I wonder how appropriate it is to use economic models and economic rules in non-economic play environments. Don't we have to look at institutional structures, cultural, and social issues in these settings also?

Marshall Van Alstyne: I apologize; I am an economic positivist. One answer to your question actually adds an axis to the model I was talking about earlier. One of the additional parameters is the motives of the folks involved in co-production. The more they are motivated by gift-giving, and provided the entire pool of producers is so motivated, the more you move towards a GPL style license. But as soon as you have people who are economically motivated, those that want to pay the rent, the more you want some kind of economic incentive in place. In terms of the academic environment, the economic incentives are actually part of the larger structure. A lot of the knowledge that we produce has positive externalities, and a lot of those externalities lie in the production, certification, and communication of that knowledge. The university acts as the platform that has to manage the pricing and elasticity of demand across the different communities, i.e., faculty and students. So, I think economic insights are quite powerful in suggesting how these things play out. Another example of two-sided markets is in publishing: the publishing model is changing. Journals, acting as the publishing platform, are having an increasingly difficult time charging the readership, and they are increasingly shifting their charges to the authors. Authors want their knowledge to be distributed.

Ulrike Schultze: I want to follow up on Liz's question regarding the use of virtual or gaming environments to generate insights about "real" or productive environments. There are a lot of people for whom these games have become work. This ranges from running sweatshops of gamers to running a couple of servers of automated avatars in order to earn gold, levels, and other desirable items, like magic swords, that can then be sold for real money in the open market, e.g., eBay. So, there are a lot of market-based, economic forces at play in these game worlds.

Matti Rossi: So are we moving into a utopian environment with these open source and peer-production environments? No money is needed? No companies are needed?

Petri Salonen: Well, I need money! We have seen quite a few software solutions based on open source, and the best way we have found to still make money is to recognize that we don't sell software any more; we sell solutions. That means that we need to find a way of developing something, an innovation that does not exist in the open source world and that adds value and gives me the leverage that I used to have as a software vendor. I used to have 95 percent margins in software. Now, given my experience in the last two years, I don't think that software firms that rely on traditional development will survive. Let's take Joomla, an open source CMS, as an example. It is an entire ecosystem of components that you can use to build an application for your clients. There is no way I can compete with that platform. I have to make money by being innovative in this open source environment.

Marshall Van Alstyne: I would like to push back on your definitions of completely open and utopian. Even if you look at the most free of applications, e.g., Linux and Wikipedia, there are strong structures in place. There is someone who is ultimately responsible for making decisions on controversial topics or which code to include, and there is a strong system of peer review in place. So the question is where you draw the boundaries and where you put the structures in order to get the best output.

Kalle Lyttinen: What I am missing from this discussion is some consideration of the historical factors underlying organizing structures. You have also not talked much about organizational design and the different forms of agency, and issues of what drive them.

Ulrike Schultze: I don't think that any of us here on the panel have addressed these issues in our own research. Part of our objective with this panel was to highlight questions that we should be exploring in the co- and peer-production space. It seems to me that issues of design, agency and intentionality need to be explored, especially on the peer-production end of our continuum.

Emanuela Prandelli: The Innocentive case provides us some insight on the design of the co-production work. While Procter & Gamble is interested in getting ideas and solutions from the Innocentive network, it does not want to give too much away about the products or production challenge it is working on. So, they break the problem down into very small pieces, so that it is difficult to connect each piece to a larger innovation. Members of the Innocentive network are then contracted to work on only a small piece, and they sign away all property rights to their invention in exchange for compensation.

Lakshmi Goel: How can we build co-production models without the contractual agreements that typically ensure coordination and ownership of ideas?

Emanuela Prandelli: In the case of Innocentive there is a formal contract that has to be very detailed. The seeker company poses challenges and awards up to $1 million to the expert or the team of professionals who find a solution. The inventor however loses any property rights over his or her ideas. However, in the case of Subaru, it is very different; they rely on the passion of the customers to generate product ideas without giving them specific monetary incentives. So, I would say that the co-production models depend on the industry and the relationship that the customer has with the product.

John King: One of the things we've been focusing on in IT is the technological effects on the economies of scale. But what this discussion seems to highlight is that what is really going on is what we might call the social economies of scope, and that is illustrated through the example of Wikipedia. If you look at the talk pages of a Wikipedia page you see a complete history and chronology of the evolution, discussion and social network on a topic. And in a lot of cases this contains commentary which includes questions of evidence, what is the role of supposition vs accusation, citations to other sources. And this is a direct appropriation of a well-established and deeply embedded social epistemology. And it has been easily appropriated, and Wikipedia could not work without it. So if we take a more socioeconomic perspective on this, we'll see that a lot of this has to do with economies of scope.

Marshall Van Alstyne: I really like this observation. Often history gives you this wonderful view of how things have evolved. And the observation of how we're evolved the mechanism of peer review that we know from academia for the production of knowledge, and questions about what constitutes evidence and valid ideas, are extremely important concepts that need to be incorporated in the co- and peer-production models. The economies of scope are partly made possible because of the lower transactions costs on the Internet. Now every person with a PC and online access can be an author and a producer of knowledge, but this also raises the bar of responsibility on the community of authors to peer review, to check facts and put checks in place. Wikipedia, as an institutionalized form of blogs, is beginning to see some of that, as bloggers blog one another. So, I think this is a really interesting set of tools that add some new dimensions to old, established practices.

Rolf Wigand: How do you make sense of the recent sale of YouTube, which was based more on its potential economic value rather than its realized economic value?

Petri Salonen: I am building an online community at the moment, and the idea is to build a huge client base, get the people in one niche talking to each other, and then to sell the space. So the value is partly in the content that is being created by the community members, but also what people are willing to pay to gain access to the members of the community.

Marshall Van Alstyne: YouTube is in some sense the latest incarnation of this peer-production phenomenon. Before this video format, it was people creating their own music, and before that it was html pages. It all goes back to lower transactions costs, the ease of creating the content and distributing it. What's striking that this one-year-old company was sold for $1.65 billion, but it is clear that they had generated the hub where people wanted to post their videos. So we have the same kind of coupling and network effect at work here as we saw with e-Bay. So, the way I look at it is in terms of low transactions costs for the distribution of high-bandwidth goods and the network effects that cause convergence of buyers and sellers in one place.

Michael Barrett: I wanted to ask a question around ownership rights in co- and peer-production. In what way can we work out ownership rights in these new production models and help co-producers understand the situation?

Emanuela Prandelli: The problem is that you have two conflicting goals in the co-production model. On the one hand you want to enlarge the pie by giving incentives, and on the other you want the largest piece of the pie, in other words, maximize rent appropriation. Ultimately, you have to define a contract that spells out intellectual property right for the customers. The contracts are going to be different depending on the industry. For instance, Ben and Jerry's, an ice cream producer, offers its own products for free to those customers contributing with useful ideas to the innovation process. Sun Microsystems, when it created a community to develop Jini technology, was even providing co-marketing support to the participants. Again, the incentives depend on the industry and the target group of contributors.

Marshall Van Alstyne: I don't think the issues of intellectual property are finalized. Intellectual property law is an area that is exploding. Twenty-five years ago, the demand for classes in intellectual property law weren't able to attract enough students. Today, law schools and law firms are hiring people specializing in intellectual property law in large numbers. One observation about the way the lawyers are addressing intellectual property, though, is that maximal control does not equal value. You have to balance control and value.

Niels Bjørn-Andersen: You did not refer to Neil Postman's concept of "prosumer" in this panel, that is, the concept of customer as producer and consumer. Also, nobody has mentioned viral marketing.

Emanuela Prandelli: In marketing we recognize the importance of word-of-mouth, and viral marketing is a new form of it. And so we see viral marketing as very important and need to understand how to promote word-of-mouth and customer referrals. Blogs have been becoming an important aspect of viral marketing for some time now. Viral marketing can play a crucial role, especially for the successful introduction of a new product on the market. For instance, in 2002 Lego presented a new model of a train made of its famous bricks named "Santa Fe Super Chief" to 250 of its major fans, selected among the most active participants in Lego spontaneous virtual communities. Just leveraging word-of-mouth phenomena through the Web, with no other communication investments, they were able to sell 10,000 pieces in less than two weeks.

Ulrike Schultze: But viral marketing can also have unintended consequences. For instance, for the Chevy Tahoe, GM allowed people to create their own ads online. Well, you can imagine what some people said in their ads about gas-guzzling SUVs. And for quite a while, these ads were available online. Eventually GM took them down but you can still see them (http://www.network-centricadvocacy.net/chevy/index.html).

Steve Alter: This topic of peer-production got me thinking about a committee that I am on in my university, and that got me thinking about the dark side of co-production. There was a story in the *Wall Street Journal* about Second Life and about some kind of weird thing people were doing in Second Life that was getting in the way of other people's avatars. You mentioned incentives and rules, but in this world where we think we are going to have all this freedom and ability to do things, I was wondering whether you could comment some more about maintaining control but also allowing freedom to innovate and play.

Marshall Van Alstyne: This all goes back to the question by Locke and Hume: how do you set up a social contract? I would encourage you to go to Google Video and find the video on Second Life, which features Linden Lab's CEO and CTO. They talk about how they structured the environment. For instance, they have a sandbox of Second Life for members under the age of 12, and this sandbox and its rules are very different from the environment that you can enter if you're over the age of 18. And then there is the adult section where people engage in all kinds of transactions. So, they've tried to limit some of the negative impacts by limiting action from a distance. While you can make, buy and use weapons, these weapons don't impact the avatar they're used on. I think these questions of social policing are age-old, but they are given new twists in these environments.

Petri Salonen: I just want to add, one way of managing the dark side or unintended consequences of peer production is by relying on reputation systems and the feedback that the community produces. For instance, when I evaluate open source products, I look for strong leaders that make up the community. Because there is always risk. For instance, Joomla was started by a group of key developers that left Mambo. So that raises the question for me then: do I believe in the product or the guys who developed it?

Duane Turex: If we assume that value is created through active participation, for instance sharing music or commenting in a discussion, should we be thinking about building rules that force people to actively participate in the value-creation process, into the design of these co- and peer-production models?

Marshall Van Alstyne: Free-riding and issues of incentives have been an issue in these communities for quite some time. There was a recent article by some folks from HP on free-riding in Gnutella. They plotted contributors to users, and it was an extremely concentrated curve that showed that something like 10 percent of the people were producing 80-90 percent of the content. In these peer-production environments, you should build an architecture that expects something back from the consumer so that there is more mutual rather than asymmetric benefit. At the same time, you want to allow for exploration and trying out new things. We can see an example of this in Second Life: if you've been there for a while, and you want to own real estate, you have to pay rent for it, continuously and over time. Whereas, if you're relatively new and want to try Second Life out for the first time, there are some courtesy accounts and standard avatars that you can use to explore. So this is one way in which the needs for mutual benefits and exploration can be balanced.

Ulrike Schultze: Based on my definition of co-production, there is a passive component. So, we need to explore in what way people contribute and add value through passivity. We might ask questions like what is the value of simply having a community even if they are not all talking.

REFERENCES

Anderson, C. (2004). “The Long Tail,” *Wired*. 12(10).

Argote, L. (1982). “Input Uncertainty and Organizational Coordination in Hospital Emergency Units,” *Administrative Science Quarterly. 27*(3); pp 420-434.

Benkler, Y. (2001). “The Battle of the Institutional Ecosystem in the Digital Environment*,” Communications of the ACM*. 44(2); pp 84-90.

Benkler, Y. (2002). “Coase’s Penguin or Linux and the Nature of the Firm,” *Yale Law Journal.* 112(3); pp 369-447.

Benkler, Y. (2006). *The Wealth of Networks: How Social Production Transforms Markets and Freedom*. New Haven: Yale University Press.

Bhattacharya, S., V. Krishnan, and V. Mahajan. (1998). “Managing New Product Definition in Highly Dynamic Environments,” *Management Science.,* 40; pp S50-S64.

Bowen, D. E., and G. R. Jones. (1986). “Transaction Cost Analysis of Service Organization-Customer Exchange,” *Academy of Management Review. 11*(2); pp 428-441.

Brudney, J. L., and R. E. England. (1983). “Toward a Definition of the Co-production Concept,” *Public Administration Review.* 43(1); pp 59-65.

Burt, R. S. (1992). *Structural Holes: The Social Structure of Competition*. Boston, MA: Harvard Business School Press.

Chervonnaya, O. (2003). “Customer Role and Skill Trajectories in Services,” *International Journal of Service Industry Management.* 14(3/4); pp 347-363.

Chesbrough, H. W. (2003). *Open Innovation – The New Imperative for Creating and Profiting from Technology*. Harvard Business Press, Boston MA.

Chesbrough, H. W. (2006). *Open Business Models*. Harvard Business Press, Boston MA.

Dahan E. and J. R. Hauser. (2002). “The Virtual Customer,” *Journal of Product Innovation Management*.19; pp. 332-353.

David, P. (2004). “Can ‘Open Science’ be Protected from the Evolving Regime of IP Protections?” *Journal of Industrial and Theoretical Economics.* 160(1); p 9-34.

Eisenmann, T., G. Parker, and M. Van Alstyne. (2006). “Strategies for Two-Sided Networks,” *Harvard Business Review.* 84(11); pp. 92-101.

Evans P. and T. Wurster. (1999). *Blown to Bits: How the New Economics of Information Transforms Strategy.* Harvard Business School Press, Boston.

Gilbert, R. and C. Shapiro. (1990). “Optimal Patent Length and Breadth,” *Rand Journal of Economics.* 21(1); pp 106-112.

Green, J. R. and S. Scotchmer. (1995). "On the Division of Profit in Sequential Innovations," *Rand Journal of Economics.* 26(1); pp 20-33.

Griffin, A. and J. Hauser. (1993). "The Voice of the Customer," *Marketing Science.* 12(1); pp 1-27.

Kaplan, S. and M. Sawhney. (2000). "E-hubs: The New B2B Marketplaces," *Harvard Business Review*. 78 (3); pp 97-105.

Kozinets, R. V. (1999). "E-Tribalized Marketing? The Strategic Implications of Virtual Communities of Consumption," *European Management Journal*. 17(3); pp 252-264.

Hagel III, J. and J. Rayport. (1997). "The New Infomediaries," *McKinsey Quarterly*. 4; pp 119-128.

Hagel III, J. and M. Singer. (1999). *Net Worth: Shaping Markets When Customers Make the Rules.* Boston: Harvard Business School Press.

Hamel, G. and C. K. Prahalad. (1994). *Competing for the Future*. Prentice Hall.

Hargadon, A. (2003). *How Breakthroughs Happen. The Surprising Truth about How Companies Innovate*. Boston: Harvard Business School Press.

Hargadon, A. and R. Sutton. (2000). "Building an Innovation Factory," *Harvard Business Review*. 78(3); pp 157-166.

Heller, M. A. and R. S. Eisenberg. (1998). "Can Patents Deter Innovation: The Anticommons in Biomedical Research," *Science.* 280(5364); pp 698-701.

Landes, W. M. and R. A. Posner. (2003). "Indefinitely Renewable Copyright," *University of Chicago Law Review.* 70 (2); pp 471-518.

Leonard Barton, D. (1995). *Wellsprings of Knowledge. Building and Sustaining the Sources of Innovation*. Boston, MA: Harvard Business School Press.

Nambisan S. (2002). "Designing Virtual Customer Environments for New Product Development: Toward a Theory," *Academy of Management Review.* 27 (3); 392-413.

Ouchi, W. G. (1980). "Markets, Bureaucracy and Clans," *Administrative Science Quarterly. 25*(1); pp 129-142.

Parker, G. and M. Van Alstyne. (2000). "Information Complements, Substitutes, and Strategic Product Design" working paper: University of Michigan. http://ssrn.com/abstract=249585.

Parker, G. and M. Van Alstyne. (2005a) "Innovation through Optimal Licensing in Free Markets and Free Software," *Working paper: Boston University* http://ssrn.com/abstract=639165

Parker, G. and M. Van Alstyne. (2005b). "Two-Sided Network Effects: A Theory of Information Product Design," *Management Science.* 51(10); pp 1494-1504

Prahalad, C. K., and V. Ramaswamy. (2004). *The Future of Competition: Co-Creating Value with Customers*. Boston, MA: Harvard Business School Press.

Prandelli, E., G. Verona, and D. Raccagni. (2006). "Web-based Innovation Diffusion," *California Management Review.* 48(4); pp 109-135

Raymond, E. (2000). "The Magic Cauldron" working paper: hurkle.thyrsus.com/~esr/writings/

Salonen, P. I. (2004). *Evaluation of a Product Platform Strategy for Analytical Application Software*, Ph.D. Thesis, Helsinki School of Economics.

Sawhney M. and E. Prandelli. (2000). “Communities of Creation: Managing Distributed Innovation in Turbulent Markets,” *California Management Review.* 42(4); pp 24-54.

Sawhney, M., E. Prandelli, and G. Verona. (2003). “The Power of Innomediation,” *MIT Sloan Management Review.* 44(2); pp 77–82.

Schultze, U. (2003). “Complementing Self-Serve Technology with Service Relationships: The Customer Perspective,” *Electronic Services Journal. 3*(1); pp 7-31.

Schultze, U. and W. J. Orlikowski. (2004). “A Practice Perspective on Technology-Mediated Network Relations: The Use of Internet-based Self-Serve Technologies,” *Information Systems Research. 15* (1); pp 87-106.

Schultze, U. and A. D. Bhappu. (2005). “Incorporating Self-Serve Technology into Co-Production Design,” *International Journal of E-Collaboration.* 1 (4), pp 1-23.

Schultze, U. and A. D. Bhappu. (2007). “Internet-Based Customer Collaboration: Dyadic and Community-Based Modes of Co-Production,” in *Emerging E-Collaboration Concepts and Applications*. Ned Kock (Ed), Hershey, PA: CyberTech Publishing, pp.166-192.

Shapiro, C. and H. Varian. (1999). *Information Rules: A Strategic Guide to the Information Economy*. Boston, MA: Harvard Business School Publishing.

Sproull, L., and S. Kiesler. (1991). *Connections. New Ways of Working in the Networked Organization.* Cambridge, MA: MIT Press.

Stallman, R. (1992). “Why Software Should be Free,” *Free Software Foundation*. April 24.

Sutton, R. (2002). “Weird Ideas That Spark Innovation,” *Sloan Management Review.* 43(2); pp 83-87.

Tapscott, D. and A. D. Williams. (2006). *Wikinomics*. Portfolio, New York

Thomke S. H., and E. von Hippel. (2002). “Customers as Innovators: A New Way to Create Value,” *Harvard Business Review.* 80(4); pp 74-81.

Thompson, J. D. (1967). *Organizations in Action: Social Science Bases of Administrative Theory*. New York, NY: McGraw-Hill.

Urban, G. L. and J. R. Hauser. (2004). “‘Listening In’ to Find and Explore New Combinations of Customer Needs,” *Journal of Marketing.* 68(4); pp 72-87.

Verona G., E. Prandelli, and M. Sawhney. (2006). “Innovation and Virtual Environments: Towards Virtual Knowledge Brokers,” *Organization Studies.* 27(6); pp 765-788.

von Hippel, E. (1986). “Lead Users: A Source of Novel Product Concepts,” *Management Science.* 32(7); pp 791-805.

von Hippel, E. (2001a). “Innovation by User Communities: Learning from Open-Source Software,” *MIT Sloan Management Review.* 42(4); pp 82-86.

von Hippel E. (2001b). “User Toolkits for Innovation,” *Journal of Product Innovation Management.* 18(4); pp 247-257.

von Hippel, E. (2005). *Democratizing Innovation*. Cambridge, MA: MIT Press.

Wagner, P. (2003) “Information Wants to Be Free: Intellectual Property and the Mythologies of Control,” *Columbia Law Review.* 103(4); pp 995-1034.

Whitaker, G. P. (1980). "Co-production: Citizen Participation in Service Delivery," *Public Administration Review. 40*(3), pp 240-246.

ABOUT THE AUTHORS

Ulrike Schultze is an associate professor in Information Technology and Operations Management at Southern Methodist University. Her research focuses on the impact of information technology on work practices, and she is particularly interested in knowledge work. Her more recent research projects are in the area of Internet-based technologies and their implications for customer co- and peer-production. Dr. Schultze frequently relies on multimethod research designs, which include ethnographic observations, interviews, and surveys. Her research has been published in, among others, *ISR*, *MIS Quarterly*, *Information & Organizations.* She has served as an associate editor at *MIS Quarterly* and *ISR.*

Emanuela Prandelli is an associate professor of Management at Bocconi University and Senior Lecturer at SDA Bocconi University School of Management. She holds a Ph.D. in Management and served as a research assistant at St. Gallen University in 1998, and at the Research Centre on Technology, Innovation and eCommerce of the Kellogg School of Management, Northwestern University in 1999, where she was also a visiting professor in 2001. Her research focuses on collaborative marketing, virtual communities of consumption, the study of e-business, and the process of innovation. She published several articles in leading international journals, such as *California Management Review*, *Organization Studies, Journal of Interactive Marketing, MIT Sloan Management Review*. She won the Accenture Award for the best paper published in *California Management Review* in 2000.

Petri I. Salonen received MS degree in accounting from the Swedish School of Economics in Helsinki, Finland, and Ph.D degree from the Helsinki School of Economics. His doctoral thesis, "Evaluation of a Product Platform Strategy for Analytical Application Software" provides software businesses with a fresh view of software development using a product platform strategy. Dr. Salonen is the founder and chief executive officer of TELLUS International, Inc., which provides management, globalization, and virtual office services to European companies entering the U.S. marketplace. Before founding TELLUS, Dr. Salonen served as chief executive officer for InfoManager Corporation, a leading global business intelligence and analytics software vendor. Dr. Salonen and a Finnish book publisher Talentum will be releasing a book about globalization and how Finnish companies should build their business in the new globalization era.

Marshall Van Alstyne received a BA from Yale, and MS & Ph.D degrees from MIT. He is an associate professor at Boston University and a visiting scholar at MIT. His work concerns information economics. In designing information goods, this examines competitive strategy using network effects. In control over information, it concerns who has access to what information, when, and at what price. Work also balances open source principles against those that generate profits and stimulate innovation. Professor Van Alstyne was among the first to document productivity effects of IT and communications at the individual desktop level. His work has received an NSF Career Award, three best paper awards, and has appeared in *Science*, *Management Science*, *Harvard Business Review*, and the popular press. Current papers can be found at http://ssrn.com/author=253298

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