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User Innovation: Why and How?

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User Innovation: Why and How?

by

F. Basar Kurtbayram

An Abstract of a Project
in
Creative Studies

Submitted in Partial Fulfillment
of the Requirements
for the Degree of

Master of Science

May 2007

Buffalo State College
State University of New York
Department of Creative Studies

ABSTRACT

There is a new innovation trend which is gaining immense momentum lately: user innovation. The purpose of this project was to examine the current literature, blogs, and online forums to understand the dynamics of user innovation in order to answer the questions: what are the main characteristics of user innovation?; why do users innovate?; how do users innovate?; what are the benefits of user innovation?; and is there a future for this trend?. The answers suggest that user innovation is a permanent change in innovation methods, and that user innovation has the potential to change the foundations of global economy. Examples of various user innovation artifacts are also examined in this project.

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F. Basar Kurtbayram

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Date

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Dates of Approval:

_____   _____
                                            Dr. Mary C. Murdock
                                            Associate Professor
                                            Project Advisor

_____   _____
                                            F. Basar Kurtbayram
                                            Candidate

To my family,

Acknowledgments

While preparing this project, I was fortunate to have several people providing me with insight, information and feedback. I would like to thank everyone for their contributions. Mary Murdock provided much needed wisdom, direction and many suggestions for this project. Andy Burnett provided many interesting resources and valuable feedback. Some of the information in this project wouldn't be included by me, if Andy hadn't asked questions. John Cabra provided useful insights on future of innovation in addition to many innovation resources. If it wasn't for my cohort, I wouldn't be able to find all the user innovation: my cohort was instrumental in providing me with many examples of user innovation. I prepared this project utilizing software products of user innovation: OpenOffice, Firefox and Thunderbird. I am grateful to all of the collaborators in user innovation projects who provide us with these tools.

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SECTION ONE: BACKGROUND TO THE PROJECT

Introduction

There is a new innovation trend that gained momentum as a result of the large decreases in the cost of computer hardware and communications: user innovation (Benkler, 2006; Chesbrough, 2003a, 2003b; Raymond, 1999; Seybold, 2006; von Hippel, 1988, 2005). These days new products or services are created in coordination with the users or totally by users. Users, who are not even employees of the firm that owns the product, are now becoming the main actors in the problem solving for innovation process. This method of innovation, where innovations are originated by users (individuals, customers or firms) but not by manufacturers, is called "*user innovation*" (von Hippel, 2005). User innovation is a new territory that brings big opportunities for both individuals and companies. In a networked world, solutions can be found much faster and effectively than before. From now on, innovation problem solving process will not be limited to individuals under the same roof.

Purpose and Rationale

I chose this project becuase it is important to understand user innovation trend so that we can start to manage it properly. The purpose of this project is to examine the current literature, blogs and online forums to understand the dynamics of user innovation in order to answer the questions; what are the main characteristics of user innovation?; why do users innovate?; how do users innovate?; what are the benefits of user innovation?; and is there a future for this trend?. In the following pages, all these questions and more will be answered.

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Outcomes of This Project

   The main outcome of the project will be an examination of the following topics: user innovation types, the reasons behind user innovation's move to mainstream, general characteristics of user innovation, the reasons for users to innovate, advantages and disadvantages of user innovation, the ways to encourage user innovation, and the future of user innovation.

SECTION TWO: PERTINENT LITERATURE

There is a growing interest in user innovation subjects in the last couple of years. This has been reflected in the number of books and articles published lately (Seybold, 2006; von Hippel, 2005). In this chapter, I classified and listed some of the most cited resources I used in this project. While researching for this project, I read from many resources which I found interesting; however, I wasn't able to use all of them within the limitations of this project. I added those additional resources under "Further Readings" section on page 5. Readers who are interested to find out more about user innovation and related areas can enjoy the resources in further reading section as well.

Selected Bibliography and Further Readings Related to User Innovation

Resources on Innovation

Chesbrough, H. (2003). *Open innovation: The new imperative for creating and profiting from technology.* Boston, MA: Harvard Business School Press.

Christensen, C. M. (1997). *The innovator's dilemma: When new technologies cause great firms to fail.* Boston, MA: Harvard Business School Press.

Mulgan, G., Steinberg, T., & Salem, O. (2005). *Wide open: Open source methods and their future potential.* London: Demos.

Seybold, P. (2006). *Outside innovation: How your customers will co-design your company's future*. New York: Collins.

Taylor, W.C.,& LaBarre P.G. (2006). *Mavericks at work: Why the most original minds in business win.* New York: Wiliam Morrow.

von Hippel, E. (1988). *The sources of innovation.* New York: Oxford University Press.

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

Resources on Social Networks and Collaboration

Barabási, A. (2002). *Linked: The new science of networks.* Cambridge, MA: Perseus Pub.

Gladwell, M. (2000). *The tipping point: How little things can make a big difference.* Boston, MA: Little, Brown and Company.

Johnson, S. (2001). *Emergence: The connected lives of ant, brains, cities and software.* New York: Scribner.

Surowiecki, J. (2004). *The wisdom of the crowds.* New York: Doubleday.

Tapscott, D., & Anthony D. W. (2006). *Wikinomics: How mass collaboration changes everything.* New York: Portfolio.

Resources on Innovation and Legal Issues

Benkler, Y. (2006). *The wealth of networks: How social production transforms markets and freedom.* New Haven, CT: Yale University Press.

Lessig, L. (2001). *The future of ideas.* New York: Random House.

Lessig, L. (2005). *Free culture: The nature and future of creativity.* New York: Penguin.

Resources on Creativity and Social Structures

Brooks, D. (2000). *Bobos in paradise.* New York: Touchstone.

Cialdiani, R.B. (1984). *Influence*. New York: William Morrow.

Diamond, J. M. (1997). *Guns, germs, and steel: The fates of human societies.* New York :W.W. Norton & Co.

Fukuyama, F. (1995*). Trust.* New York: Free Press Paperbacks.

Jacobs, J. (1961). *The death and life of great American cities*. New York: Random House.

Johansson, F. (2006). *The Medici effect:What elephants and epidemics can teach us about innovation*. Boston, MA: Harvard Business School Press.

Kao, J. J. (1996). *Jamming: The art and discipline of business creativity.* New York : Harper Business.

Rheingold, H. (2002). *Smart mobs: The next social revolution.* Cambridge, MA: Perseus Pub.

Resources on Technology

Anderson, C. (2006). *The long tail: Why the future of business is selling less of more.* New York: Hyperion.

Gershenfeld, N. (2005). *Fab: The coming revolution on your desktop--from personal computers to personal fabrication.* New York: Basic Books.

Negroponte, N. (1995). *Being digital.* New York: Knopf.

Raymond, E.S. (1999). *The cathedral & the bazaar :Musings on Linux and open source by an accidental revolutionary.* Cambridge, MA: O'Reilly.

Weinberger, D. (2002). *Small pieces loosely joined.* Cambridge, MA: Perseus.

Further Readings Related to User Innovation

Christensen, C.M., Anthony, S.D., & Roth, E.A. (2004). *Seeing what's next: Using theories of innovation to predict industry change.* Boston, MA: Harvard Business School Press.

Hamel, G. (2000). *Leading the revolution.* Boston, MA: Harvard Business School Press.

Kim, W.C. & Mauborgne,R. (2005). *Blue ocean strategy: How to create uncontested marketplace and make the competition irrelevant.* Boston, MA: Harvard Business School Press.

Resnick, M. (1997). *Turtles, termites, and traffic jams: Explorations in massively parallel microworlds.* Cambridge, MA: MIT Press.

Sutton, R.I. (2002). *Weird ideas that work:11 ½ practices for promoting, managing and sustaining innovation.* New York: Free Press.

SECTION THREE: PROCESS PLAN

I planned to research and write the project in three phases and complete the project in roughly 150 hours;

Phase 1: Information gathering and reading;
Phase 2: Prepare the text, receive guidance from instructor, get support from SBP, and write the text;
Phase 3: Changes, corrections, additions, feedback loop and production of final text for approval.

It took about 40% more time to finalize the project than I had originally planned. The extra time was needed to understand the details of the subject better and make sense of the diverse as user innovation ecology.

Timeline

Week of	Activity	Hours
January 29th	Morning pages	5
January 29th	Research on innovation types	16
February 5th	Morning pages	5
February 5th	Online research for user collaboration sites	8
February 5th	Start reading literature on user innovation	10
February 12th	Morning pages	5
February 12th	User innovation literature research and reading	5
February 19th	Morning pages	3,5
February 19th	User innovation literature reading and online research for practical examples	16
February 26th	Morning pages	3,5
February 26th	User innovation literature reading and online research for practical examples	29
March 5th	Morning pages	3,5
March 12th	Morning pages	3,5
March19th	Morning pages	3,5

March19th	User innovation literature research and reading	10
March 26th	Morning pages	3,5
March 26th	User innovation literature research and reading	8
April 2nd	Morning pages	3,5
April 2nd	User innovation literature research and reading	5
April 2nd	Start writing the project	36
April 9th	Morning pages	3,5
April 9th	Write first draft	12
April 16th	Morning pages	3,5
April 16th	Write sections 4,5 and 6	24
April 23rd	Morning pages	3,5
April 23rd	Revise sections 4,5 and 6	6
	Total hours	**235**

SECTION FOUR: OUTCOMES

Until recently, most innovations were made by firms internally, and users saw the finished product only after it was given to the market by the manufacturer. However, as we will see the in this project, these days there is strong move towards innovating outside of the firm by people, organizations or other firms that have no contractual link with the manufacturer firm (Chesbrough, 2003a, 2003b). In this new innovation mode, innovators are not necessarily compensated monetarily for their contributions. In the literature, this new mode of innovation is given many names by different sources: Do-It-Yourself innovation ("The Rise of Creative Consumer", 2005), user innovation (von Hippel, 1988, 2005), outside innovation (Seybold, 2006), commons-based peer-production (Benkler, 2006), customer innovation (Seybold, 2006), open innovation (Chesbrough, 2003a, 2003b), crowdsourcing (Howe, 2006), user-led innovation (Ornetzeder & Rochracher, 2006), user manufacturing (Piller, 2006), user-driven innovation (Jeppesen & Molin, 2003), open-source movement (Raymond, 1999), and personal fabrication (Gershenfeld, 2005). A user is an individual or a firm that expects to benefit from using a product or a service. In contrast, manufacturers expect to benefit from selling a product or a service (von Hippel, 2005). For the purposes of this project, innovations originated by users (individuals, customers or firms) but not by manufacturers are products of "*user innovation*". Throughout the text sometimes other names of user innovation are used interchangeably.

This project examines user innovation. Firstly, user innovation types will be introduced. After that, the reasons behind user innovation's move to mainstream

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will be discussed. That will be followed by characteristics of user innovation.

These sections will give one enough information to understand the reasons for

users to innovate, advantages and disadvantages of user innovation, and the

ways to encourage user innovation, which are also examined. Lastly, the

outcomes of the project will end with a brief on future for user innovation.

User innovation started on the internet mostly when online communities

collaborated for software development. Today there are still many software

developments in which user innovators collaborate, however user innovation is

not limited to only online communities any more, it is becoming widespread by

each passing day. As of April 2007, there were 1.55 million registered users

working on 146,000 open source software projects only in the web community

Sourceforge.net (Sourceforge.net, 2007). A well-known user innovation product

Linux, has more than 25% of the global server software market and is increasing

its market share as governments like China, Spain and Turkey start adopting it.

Another user innovation product, Apache web server, is running on 71% of the

web servers while out-competing giants like Microsoft and Sun Microsystems

(Wheeler, 2006). At another user innovation site, thinkcycle.com, users develop

designs for problems of third world countries. The site has projects in diverse

subjects from projects for electricity generation in rural areas using bicycles to

cholera treating solutions and rice planting machines. A user innovation site for life

scientists, www.bioforge.net, hosts projects for biotechnology tools and promotes

user innovation in life sciences. Two examples of the user innovation projects at

bioforge.net are: constructing crop genes that are resistant to insects and building

cancer diagnostics tools. Users at www.endtas.com, design, share and then build boats. GE Plastics works with its customers in the innovation process to produce customized products (Yon, 2003). Istockphoto presents an opportunity for all users to share and market their pictures (Howe, 2006). In addition to these pure user innovation examples, there are mixed cases where some percentages of industries' outputs are user innovated. Von Hippel (1988, p. 4) studied sources of innovation in nine unrelated areas: scientific instruments, semiconductor and printed circuit board process, pultrusion process, tractor shovel-related, engineering plastics, plastic additives, industrial gas-using, thermoplastics-using, and wire termination equipment. He found out that percentage of products developed by users varied from as little as 6% (tractor shovel-related) to as large as 77% (scientific instruments).

<center>User Innovation Types</center>

As seen from the examples so far, user innovation scene is as diverse as the participants are. Since user innovation is a daily changing and expanding area, classifying this moving target into specific types is difficult. However, for the purposes of this project, user innovation can roughly be classified into seven types, although there might be some overlap between them. In order to have better understanding of user innovation, it is best to examine real life examples. In the following paragraphs, for each of the seven user innovation types, first a short description of the user innovation end product is given which is followed by examples and a short case.

Type 1

In this innovation type end product is digital, the development platform is controlled by users and the product is 100% produced by users. Two examples of this type of user innovation are Apache web server and Linux operating system. We will examine the case of Linux.

In 1991 Linus Torvalds, then a graduate computer science student in Finland, wanted run UNIX (an operating system) on his PC. The only program available to run UNIX on PCs had limited functionality and was expensive for him. So, Torvalds started to write his own version. But he did something unusual in the process, he posted the entire program he had written on the internet and asked for contributions.

Linux innovation process. In the Linux innovation process anyone who wanted to contribute could download the program, add new features, test for bugs or post fixes. These additions and fixes would then be evaluated by other more experienced computer programmers who were voluntarily working on the project as everybody else (Raymond, 1999; Mulgan, Steinberg, &Salem, 2005). Linus Torvalds had an unusual style of software development; he released the software early and released often, sometimes a couple of versions everyday; he delegated anything he could; he was very open about the deployment process, as everything was in the open, anyone who wanted to contribute to Linux could do that easily (Raymond, p. 3). These features of Linux brought its widespread global acceptance. In 2002, it was estimated that Linux had 7 to 27 million users worldwide and was growing at a rate of 200% a year (Lerner & Tirole, 2002b). In

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this type of user innovation, the problem-solving process is a cycle similar to

Creative Problem Solving process. I explained this process in Figure 1. Linux

community users come up with new needs as in step 1 that they want to add as a

feature to Linux operating system. Those needs are turned into product design in

step 2 and step 3 by a core group of users, which I have termed "gatekeepers".
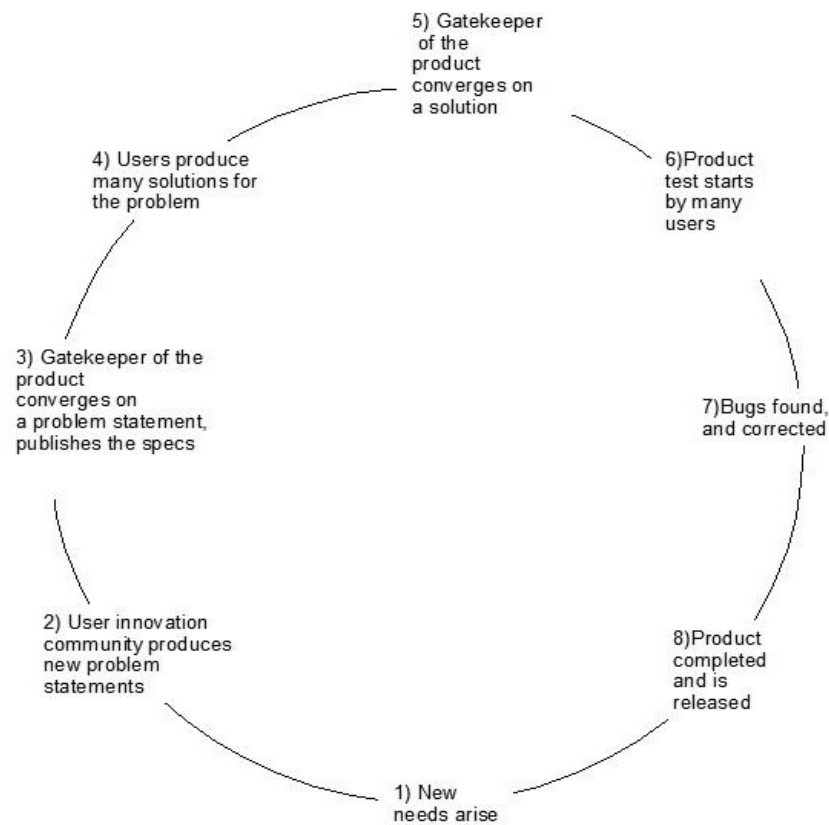

Figure 1. Linux user innovation process represented per Creative Problem
Solving model. © Basar Kurtbayram, 2007.

Then thousands of users start creating solutions for the new design. The users

decide on which problem they will be working on; there is no central control.

When enough numbers of solutions are submitted, gatekeepers choose solutions to add to Linux in step 5. In step 6, the most successful part of Linux user innovation starts: looking for problems (termed 'bugs').Thousands of users start actively testing the program to the limit. As there are many people testing the program, this step performs better than most commercial projects. When bugs are found, they are corrected in step 7. If they can't be found, then another solution is implemented in step 8. Once the product is tested, it is released for general use and the cycle starts all over again. Another strength of user innovation is the speed: this whole cycle can be completed in one day, a speed impossible to match by commercial products (Raymond, 1999).

Linux, today. In Linux development, contributing users were all volunteers in the beginning, however with the rising success of Linux, profile of users have changed greatly. Linux is still free and is still open source; however, these days most of the programmers are paid employees of Fortune 100 tech firms (Tapscott & Anthony, 2006), because the industry backing of Linux exploded. IBM is one of the biggest backers of Linux (Benkler, 2006). So far IBM has contributed over $1 billion to Linux development by donating intellectual property, people and know-how. IBM benefited from its investment in Linux fast: although IBM had no revenue from Linux in 2000, in 2003 Linux-related services revenue of IBM was $2 billion (Benkler, 2006, p. 47). This revenue is more than the total revenue from IBM's 29,000 patents. IBM's fast investment recovery in user innovated Linux convinced many other firms to start investing in user innovation software development.

Type 2

In this innovation type end product is digital, the innovation platform is controlled by the company and all innovation is done by users. Some examples for this innovation type are: Wikipedia, Myspace, Flickr, Virtualtourist, Youtube, Ebay, Ohmynews, and slashdot.org.

In the case of Wikipedia, Jimmy Wales launched a web-based encyclopedia that can be updated by users in 2001. By 2004, Wikipedia was larger than Encyclopedia Britannica and Encarta combined (Mulgan et. al., 2005). Wikipedia is wholly created, edited and published by the 2006 Times Magazine Person of the Year: You (Grossman, 2006). Wikipedia, is a user innovation platform like Ohmynews, slashdot.org, Flickr and many more, where the content is created and updated by the users. Wikipedia utilizes an easy to use web authoring technology called wiki, with the help of which any user can edit any article at Wikipedia.

Flexibility and ease of user is behind the phenomenal growth of Wikipedia. This ease of use and flexibility can cause problems of its own sometimes, because not all entries are of high quality and there may be times when some entries are knowingly filled with wrong information by users. However according the scientific journal *Nature*, Wikipedia does have comparable reliability with established information resources. There is an average of four mistakes per article in Wikipedia and a traditional encyclopedia like Britannica has three mistakes per article (Giles, 2005). One advantage of Wikipedia became obvious after these study results were published in *Nature*: All the mistakes in Wikipedia,

which were noted in the study, were corrected in a matter of days, while *Britannica* had to wait for the next paper edition.

Type 3

In this innovation type end product can be digital or material and is designed by the users utilizing toolkits supplied by the company. Once the product design is completed, the design is integrated to an existing product by the company as per the user's specifications. Two examples are of this type of innovation are Threadless and GE Plastics. We will examine the case of GE Plastics.

General Electrics is a large multinational company with over $130billion annual revenues. GE Plastics is one of the twelve divisions that make up General Electrics. In order to respond to customer demand faster, GE Plastics has opened "customer innovation centers" in USA, China and The Netherlands (Yon, 2003). At GE Plastics the user innovation toolkits are utilized to produce custom designed colored plastics for the demanding customers. The company already produces plastics with more than 20,000 different colors for wide variety of customers with diverse needs. When a customer needs a new color for a product that is not in the catalogue, GE simply arranges a meeting with GE engineers and the customers at a GE customer innovation center. At the meeting customer and GE co-design the color using the user innovation toolkits together. Once customer decides on the color and features, GE engineers take care of producing it using GE techniques.

Type 4

In this innovation type end product is material and is manufactured by company, while innovative ideas and artifacts are harvested from users. Some examples of this type of innovation are: LEGO, Kraft Foods, and Jones' Soda. We will examine the case of LEGO.

LEGO launched a new product called Mindstorms in 1998. The product consisted of connectible plastic parts, which LEGO was known for and programmable robotics for moving the parts as a novelty. The company wasn't sure how the market would react to this product because there was no similar product in the market then. LEGO was simply not able to forecast sales. After the first Mindstorms sets were sold, LEGO started observing the customers, how they used Mindstorms, what ages of users were and what the problems with the product were. Then users started making changes in the software of the robotic parts without any encouragement from LEGO. Actually it was illegal to make any changes on the software per the sales license of Mindstorms. Instead of stopping the users, LEGO decided to wait and observe more. There were many actions going on in LEGO email groups and user communities. In one case, Paul Wallich documented how the user community focused on increasing the speed of the software and users designed a version of the software that was four times faster than LEGO's original version (Seybold, 2006, p. 38). After seeing the effectiveness of the user innovation process, LEGO decided to let users revise LEGO's software at will and added a "right to hack" item into the sales license of the software. Koerner (2006) tells that as a result of this decision, many new

features which LEGO had never thought of was built into the robots by the users. Today, LEGO deliberately manages Mindstorms online communities and controls the user innovation processes to harvest and to implement ideas from the users. In addition to online communities, LEGO utilizes lead-user method and keeps in touch with its most advanced users methodically.

Type 5

In this innovation type end product can be digital or material, external innovations and ideas are collected, managed and evaluated by the company from a selected network of external collaborators. Two examples for this type of innovation are P&G and NineSigma. We will examine the case of P&G.

Procter & Gamble is a multinational consumer goods company. Since its foundation 170 years ago, P&G has been developing new products using traditional research and development methods. These days, P&G is moving to another method for developing new products: "Connect and Develop". Taylor and LaBarre (2006) have met with vice president of innovation at Procter & Gamble, Larry Huston. Huston explained that the reason they are moving to another model for developing products is that the existing business model for R&D is broken. He explained that P&G has 7500 researchers in 150 different areas of science, but when one looked around the world for these 150 areas, there were at least 1.5 million researchers outside the firm with better or equal training of P&G researchers. In other words, there were 200 researchers outside P&G for each P&G researcher, and 200 could invent better than one.
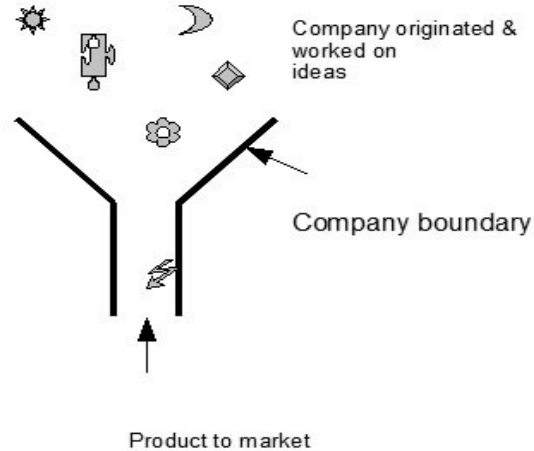
Figure 2. Traditional Research and Development model.
Adapted from Chesbrough (2003a).

Because of this reason, P&G decided to open itself to innovation outside the company and aimed to get at least half of the innovations from outside the company from users, consumers, suppliers, and collaborators.

Connect and Develop model is parallel with Chesbrough's open innovation model (2003a). In the traditional innovation model, all ideas and projects for innovation are internal (Figure.2). They are filtered by the company and the products are produced. Due to effects of user innovation, companies like P&G have started to move to transparent models of innovation. In open innovation, firms are not limited by internal resources, they deliberately look for external ideas or innovations to implement. These companies don't waste resources converging in all ideas, they look for external ideas which have been already evaluated. Also if an idea or innovation is not feasible to implement internally, it can be sold

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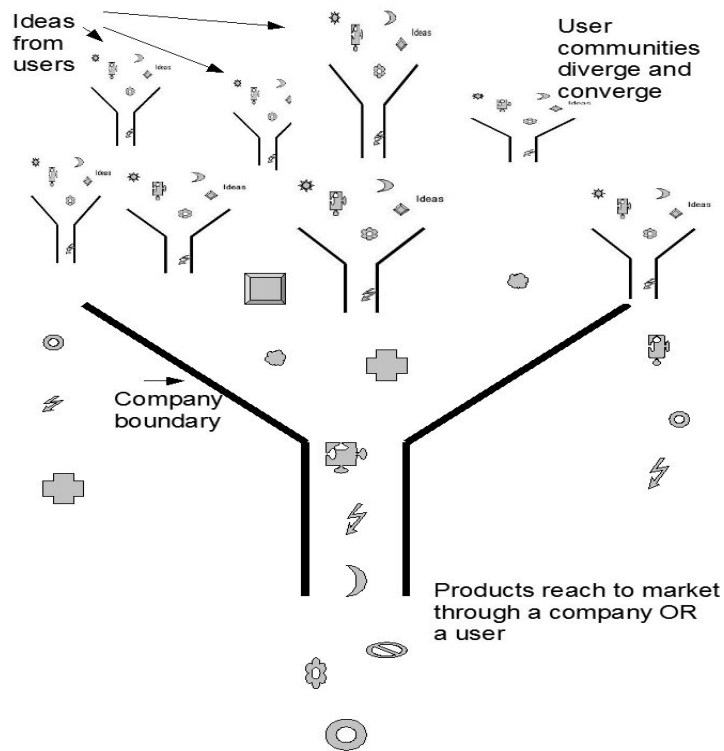
Figure 3. Open innovation model.
Adapted from Chesbrough (2003a).

outside the company even if it is not a finished product (Figure.3).

Type 6

In this innovation type end product is material, the product is designed and manufactured by users. Two examples for this type of innovation are endtas.com and desktop fabrication. We will examine the case of endtas.com.

Endtas.com is a web site where users can exchange ideas on how to design and build their own boats and robots. Ozkal Ozsoy, the "web captain" of the site, explains that the site has two sections which attract different profiles of

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users, the boat building section has 40% of users from other countries and 60% from Turkey whose average age of users is over 30, and the robot building section has 70% of users from Turkey and most of the rest from South Asia, Philippines, Malaysia and Thailand, and most of the users are between the ages of 14 to 30. The users of endtas.com can download or upload plans for boats or robots. Once they download a plan they are free to revise and build them. If a revised plan works well, it is generally uploaded back to the web site for sharing (O.Ozsoy, personal communication, April 11, 2007). Ozsoy adds that he is recommending users to stick with the plan when especially building boats, but users never take his advice. According to Ozsoy, he has never seen a boat built according to a plan, there is always something revised by users, and sometimes quite novel ones. On the other hand robot builders are not creative as they mostly stick with the plans. As an example of a successful boat builder, Ozsoy cites a Brazilian who, after downloading the plans for a boat and revising them, has built a sailing boat and has made expeditions to remote islands in Brazil.

Type 7

In this innovation type end product is digital labor or digital product harvested from users of distributed networks and is generally modular in nature. Some examples are Istockphoto, Mechanical Turk, and Innocentive. We will examine the case of Istockphoto.

Istockphoto is another company enabled by cost decrease in network connection and digital image technology: it is a marketplace for the work of amateur photographers. Anyone who has digital copies of their pictures can post

pictures to the site, where buyers flock due to bottom-rock pricing. There are now about 25,000 users to the web site. While professionals charge $300 to $600 for a photo, Istockphoto charges between $1 and $5 per basic image Howe (2006). The cost isn't zero, but it costs a lot less than paying traditional employees.

How Did User Innovation Become Mainstream?

The cost of telecommunications and computer hardware dropped tremendously in the last 15-20 years. In early 1990s the speed of an internet connection for a typical home user was 2400 bits per second. These days, if a customer pays the same amount of money for her internet connection as she did in 1990, she will get an internet connection speed of at least 2,048,000 bits per second: the cost of transmitting information has decreased by an unbelievable 99.88%. For the PC she is using, Moore's law is indeed working: computer processors got twice powerful every 18 months since early 1970s. An average PC that we have in our homes today has about 2000 times more processor power than in 1990 while the cost stayed about the same. If this customer makes a phone call to another PC user with a Voice over IP program like Skype or NetMeeting, the cost of making a phone call will be zero. While online, she can talk to her friend, and at the same time she can share her last vacation pictures or show the plans for the house extension they are building. In the past, she would need to travel to her friend's place to show the pictures and the house extension plans. Now both can stay in their homes, while easily sharing information. The cost of accessing information has decreased to a level unseen in human history before. In short, internet and computer have killed the distance. And distance is

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not the only victim of internet and computer, it is only a start.

Mathematicians have proved that while number of members of a network increase arithmetically, the value of the network to its members increases exponentially with each new member (Barabási, 2002; Johnson, 2001;Kelly, 1997). Each new member to a network, increases the value of the network to users and encourages more participation as a result of increased value. Let's take the adoption of email as an example. When email was a novelty used only in universities, value of having an email account was minimal, users were restricted to whom they can send email. However once large adoption of email started by the masses, the value of having an email account increased exponentially. Email account owners could communicate with large portion of their social networks. Not having an email address became unacceptable. Gladwell (2000), wrote about the emergence of ideas, trends and fads seemingly out of nowhere. According to Gladwell, before an idea "tips", it may exist for a long time without much effect. In most cases, the difference between an idea that tips and the one that doesn't is the number of connections that the person holding the ideas has to the other humans in the network. An idea has much larger chance of propagating if it is hold by a well-connected individual in a network. In user innovation, these well-connected individuals are replaced by collaboration communities ,like sourceforge.net or Linux, that work to innovate a product together. Collaboration networks were under our radar for most of the 1970s, when only university communities were connected to internet. For this reason, early user innovation products of 1970s ,such as UNIX operating system, were created in academia. So

the foundations for collaboration networks and user innovation were already in place when we came to 1990s. User innovation was just waiting for "the perfect storm", decrease in network access costs, to "tip". The drop in computing and communications costs opened the gates for people who always wanted to communicate with like minded ones around the world, but weren't able. Before the cost drop, if you had a idea, you could share it with your social circle which is limited to around 150 people for most of us. Now, anyone with an internet connection can share any information with the world. The growing number of people with internet access increased the value of internet exponentially. With every additional input, with every new instrument, program, idea published on the internet, the value of being on the net and collaboration with others grew. Internet enabled user innovation by providing an outlet for ideas to become products. As Brooks (2000) stated " ...[information age] has taken products of the mind and has turned them into products of the marketplace" (p. 147).

A firm can be described as a specialized process that turns materials or ideas into products by using specialized knowledge and selling the output in the marketplace. The knowledge base of a firm is a result of processing internal or external information, and processing information has its own costs. In his 1937 seminal paper "Nature of the Firm" Ronald Coase identified that there are three kinds information costs for a company; search costs, such as finding other companies to work with; contracting costs, such as lawyers and negotiation costs; coordination costs, for coordinating different parties that the firm makes business with. These costs are called transaction costs. Tapscott and Anthony (2006)

indicated that, per Coase's law, a firm will tend to expand until the costs of organizing an extra transaction within the firm becomes equal to the costs of carrying out the same transaction on the open market. Rheingold (2002), in his book "Smart Mobs", interviewed with Marc Smith who was a sociologist studying human networks for Microsoft. Smith explained that "Whenever a communication medium lowers the costs solving collective action dilemmas, it becomes possible for more people to pool resources. ' More people pooling resources in new ways' is the history of civilization in seven words" (p. 31). In the late 1990s, in some areas, the cost of innovating in company became equal or more than innovating outside the company.

The costs of external information search and coordination transactions have decreased to levels unheard of before, therefore if a service can be bought in the marketplace at equal cost, the firm will not be able to expand in that area. Now users, who previously had no ways of meeting with each other or ensuring that they were heard by the manufacturing firm, can pool their resources and can innovate in many areas limiting growth of firms. Mauboussin (2006) observed that " for the companies that largely rely on physical resources, the costs associated with scarcity lead to diseconomies of scale and hence limit size and growth. Companies that primarily create knowledge don't face the same barriers..." (p. 101). As we saw in the previous section, most large firms started to embrace user innovation. This was inevitable, as economy was shifting from production of atoms to production of bits (Negroponte, 1995). The firms started to support user innovation not because it was a nice to have, but because it was the only way to

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stay in business.

In the last 30 years, production methods became so efficient and so well documented and repeatable that the wealth production shifted from materials to ideas. In the past, access to materials and capital were more important than having a ideas. While materials based production is moving to countries like China and India, the developed world was embracing production based on information, where they might have a chance to out-compete China and India. In materials based production, capital and access to materials are the most important factors to create wealth. In information based production, ideas and collaborative networks of people are the most important factors. Benkler captures this important point very clearly " given the zero cost of existing information and the declining cost communications and processing, human capacity becomes the primary scarce resource in a networked information economy" (2006, p. 52).

General Characteristics of User Innovation

There are some general characteristics of user innovation projects. They may not be present in all projects, but they are more common than the exception. In this section, each characteristics of user innovation projects are first listed and are then explained shortly.

Not Hierarchical

In user innovation, the project teams consist of people who contribute voluntarily, and anyone can leave at any time. The extrinsic rewards or rules which can keep the user in the project are not many. The project management of a user innovation project is based on merit and not positional authority. One can

become a leading figure in a user innovation community by making intelligent,

value adding contributions. This feature is flowing from internet and its centerless

structure. Kao (1996) summarized internet culture:

> The internet culture is a jamming culture, it is nonhierarchical and
> centerless: its forms and formalities are purely occasional,
> opportunistic, experimental. Like jazz, it is profoundly democratic
> and egalitarian, a competitive/cooperative meritocracy of talent.
> ...Cyberspace is a jazz club for ideas, open all day and all night, with
> the universe for walls (p. 132-133).

Core Team for Convergence

In a user innovation community, there is always a core team of members

who manage the convergence phase. After ideas, solutions, and fixes are

submitted by community members, the core team goes through them sifting and

evaluating. A user can become a core member team only by merit and by the

level of her contribution to project.

Diversity

User innovation projects have members from very diverse educational and

experiential backgrounds, cities and countries. Users self select to contribute and

anyone can submit ideas and products. This ensures that all projects are staffed

with very diverse teams. Diversity is important because "the best collective

decisions are the product of disagreement and contest, not consensus or

compromise " (Surowiecki, 2004,p. 19). The most efficient user innovation

communities are those that link to the broadest range of information, knowledge,

and experience (Howe, 2006).

Decentralized Structure

In user innovation, the communities are decentralized. There is no centralized decision making, no on ground management or no central structures. With these features, the user innovation communities also show the features of a "wise crowd". Per Surowiecki (2004), a wise crowds' characteristics are: a) diversity of opinion (each person should have some private information); b) independence (not controlled as if in a company); c) decentralization (group members are able to specialize and use local knowledge unmanaged); and d) aggregation (a mechanism to collect and turn individual inputs to collective product or decision).

Modular Product Structure

Due to the nature of user innovation, products must be modular in design. Modular designs can be divided into many small pieces and each piece can be worked on by one individual without the need for interaction with others. This increases flexibility of the users and limits dependence on one participant.

Emergence

In most projects, original design or plans keep changing, and new innovations emerge. The members working on a user innovation have diverse backgrounds, diverse knowledge and diverse life experiences. This diversity leads to emergence of new ideas and innovations. When Johansson (2006) studied the dynamics of innovation throughout history, he arrived at the conclusion that innovations come from merging previously unrelated information in novel combinations.

Creative Environment

User innovation communities are packed full of individuals who contribute as it is one of the most creative things that they can do in their lives. Kao (1996) explained it well:

> Networks function, like gifted leaders, in facilitating creativity: They are firm but sensitive enablers of public conversations. They put people in touch with one and another and create unexpected linkages across established organizational boundaries. They champion processes that would otherwise, left to themselves, go nowhere. Information technology takes care of these functions at a basic level and thus permits leadership to focus on issues and concerns beyond the logistical. (p. 142) ....If a measure of creative intelligence is the ability to make novel connections, then one format of increased resources for creativity is the greater availability of diverse input provided by information technology. (p. 137)

Low Cost

User innovation projects are more likely to start in digital format instead of material. This is due to the low cost environment needed for voluntary works. User innovation affects all industries, however capital intensive industries are less affected by user innovation, because in order to innovate, users need to make prototypes and test them, which is more difficult for capital intensive industries as due to required investment.

Fast Feedback Loop

As users are spread all around the world working in different countries and different time zones, someone is always working on innovations, it is a 24/7 business. This enables user innovation communities to work, learn and implement faster.

Out in the Open

All transactions in user innovation happen in the open, the process is transparent. As an example, at the open source community www.sourceforge.net all communications of projects are kept in the archives that are accessible by anyone at anytime. All information is freely revealed. Von Hippel (2005) states that:

> Innovators often freely reveal because it is often the best or the only practical option available to them. Hiding an innovation as a trade secret is unlikely to be successful for long: too many generally know similar things, and some holders of the "secret" information stand to lose little or nothing by freely revealing what they know. (p. 10)

Low Commitment Requirements

Due to the modular structure of the user innovation projects, the contribution threshold is held low. As a result people can opt in or opt out anytime without disrupting the project. This way projects don't depend on a few people and are not affected if some users just leave the project.

Iterative Problem Solving

Instead of choosing one of the deductive or inductive problem solving techniques, most user innovation projects employ problem solving by brute force: iterations. All users are allowed to submit input in any subject, then all solutions are tested and the best working is implemented. This process continues until an optimum solution is found.

Why Do Users Innovate?

Users participate in user innovation for various reasons. I examined

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available literature to list the reasons for user participation. I also added used my

observations and reading from web sites. Although I took every care to make it a

list that covers most general reasons, there is definitely need for more research in

this area.

The reasons for user participation in innovation can be divided into three

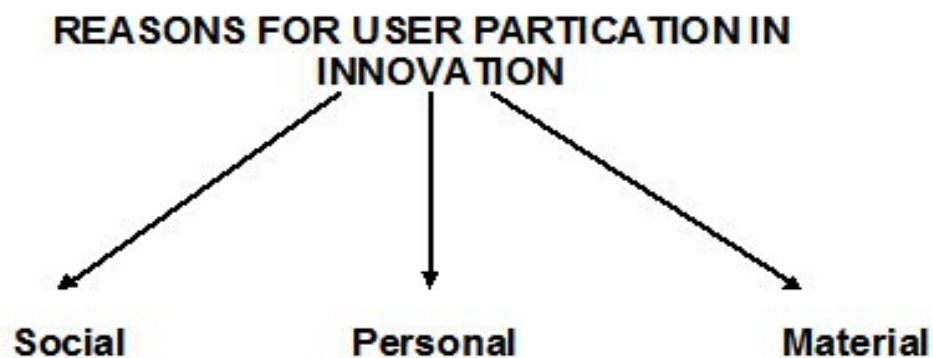main categories, with the reasons falling into one or more of them.

**REASONS FOR USER PARTICATION IN
INNOVATION**

Social   **Personal**   **Material**

Figure 4. Reasons for user participation in innovation.

Social Factors

Influence. Cialdiani (1984) studied how people are influenced by others

and how they are persuaded to make certain decisions. Cialdiani found that six

factors determine if someone can be persuaded in a certain way: 1) reciprocation

(does one get something in return for giving); 2) commitment and consistency (is

commitment to a decision or an action is consistent with one's own perception); 3)

social proof (do others in your social behave alike or approve); 4) liking (does one

like the other party or the action); 5) authority (is there an authority supporting the

action or decision); and 6) scarcity (can something become scarce as a result of

inaction). According to Cialdiani, the more factors are involved in a situation, the higher the likelihood of being influenced to make a certain decision. Most user innovation platforms at least have four or more of these influence factors at play. When users get involved, most of the time they have friends in the innovation platforms (social proof). When they give their time, they either get credit for it or the end product (reciprocation). When a user starts working on something, it is because she likes it (liking). There is a platform authority that controls the user innovation process (authority). When users start on innovation, they are doing something which is scarce in our society (scarcity). Finally when users participate in the process, they are known to be in the process, they want to be consistent with their commitments (commitment). It is normal that people want to get involved and continue the user innovation process, because the process of user innovation has the perfect blend of influence factors to recruit people for the cause of user innovation.

Human nature. Fukuyama (1995), Ridley (1998) and Diamond (1997), are prominent writers who studied human societies. In their writing, all three agree that trust is necessary for progress of any human society and that humans have an innate capacity for sharing and that sharing without asking for a return is an evolutionary survival strategy for the human race. User innovation gives one the ability to share his products with a large community.

Respect of peers. User innovation projects are good ways to get exposure, respect and reputation: When you perform in a user innovation project you may get more exposure than you can ever achieve by yourself. In a typical user

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innovation project, there are many contributors and a limited number of core group that decides which solution is implemented. A user starts as a contributor, only if he makes a good contribution or innovates enough, can he become a member of the core group. This can only be achieved through gaining respect of others.

Political reasons. Richard Stallman is the founder of free software movement and also founder Free Software Foundation. Stallman (2002) defends the idea that all software codes must be in the open, and people must be free to make changes on the software. He also states that software must not be copyrighted or patented. Stallman is fighting in political arena against copyright and patent in software. Free Software Foundation and a large volunteer pool are supporting Stallman in his political campaigns.

Interaction. Per Marc Smith, research sociologist at Microsoft, people keep sharing information with people that they might never meet face to face as they gain social network capital, knowledge capital and communion (Rheingold, 2002, p. 30).

Diversity. The user innovators are coming from all walks of life. This is a reason that user innovation works so well. This diversity of opinion and the increased chances of solving problems attracts more users to participate. Jane Jacobs (1961), in her seminal book, *The death and life of great American cities*, convincingly argued that long city blocks with strict zoning rules would make cities less friendly, less open to chance encounters (thus less empathetic) and less safe. She suggested that the more people meet, the more they could understand

each other, and that they would have more chance of having new ideas in cities and supported pedestrian-friendly city planning. The collaboration web sites are an online version of pedestrian-friendly cities which Jane Jacobs supported deeply. These web sites are diverse in nature without boundaries, giving the chance of encountering different ideas. The decentralized, centerless nature of the internet is the base that allows diverse conversations.

Personal Factors

Challenge. Users can choose to work on projects that they don't normally encounter in their lives. In some cases, they will participate in a project for the challenge of creating something they normally wouldn't or difficult to do.

Learning. For example, those who download software code from an open source project site can use it to learn to analyze the code and then revise it. The revised code might be posted to an open source project site where it will be reviewed by many programmers. This fast feedback loop speeds up the learning curve.

Experience. This is in connection with the previous reason. The contributions of users are filtered by more experienced core participants. This way users get more experience on a new subject and their mistakes are corrected by knowledgeable people. By participating in user innovation, one gets experience even if there are no opportunities in her own environment.

Fast return of invested time. A user innovator can see the result of his contribution much faster than in commercial world. If she is doing an innovation using material, she will see right away. If she is collaborating with others, she will

again have very fast feedback. In some open source projects like Linux it is usual to see more than one version in a day. There is no commercial project that can match this speed.

User innovators can manage what they contribute. Linus Torvalds explained well when he said " people just self-select to do the projects where they have expertise and interest" (Tapscott & Anthony, 2006, p. 69).

User innovators can manage when they contribute. Weinberger (2002) stated that internet time is asynchronous, so users are free to split their time as they like. There is no need to give undivided attention, it is the users' choice. This method of working is more convenient than working on one subject in a limited office.

Low commitment needs, users can enter and leave projects at will at any time. As user innovation is voluntary, anyone can drop from the project anytime they want. This is a positive factor for most user innovators because they are not under external stress to complete the project on time. They are only bounded by intrinsic rewards.

Because user innovation performs well. "We" are more intelligent than "each of us", and as a result the success rate of user innovation projects is high when compared to individuals. This encourages more participation. Sontag, Drew, and Drew (1998) told the true story of the search for a hydrogen bomb which was lost after a midair collusion in Mediterranean of the cost of Spain. The military officer running the search team gathered data and estimations of the whereabouts of the bomb from everyone on the team. After this, instead of trying the

possibilities one by one, he put them all together on a map and averaged the opinions. The result of this averaging process was a different position which was not estimated by anyone on the team. At the end the bomb was found exactly where the team's averaged estimations have totaled. The same principle applies to user innovation. Raymond (1999), one of the early pioneers of user innovation in software development, commented that the Linux project worked effectively:

> ...because adding more users adds more ways to stress the program... Each one approaches the task of bug characterizing with a slightly different perceptual set and analytical toolkit, a different angle to the problem (p. 9).

Better project results encourage more participants to join in user innovation.

Alternative platform for job satisfaction. It is an alternative platform for job satisfaction. People who can't get enough job satisfaction due to conditions at the work place can use their potential at user innovation projects, increasing job satisfaction. Lakhani and Wolf (2005, p. 9) found that 55% of participants in open source projects work on the user innovation project at company time. 38% of the supervisors were aware that engineers were using company time to contribute something that the company will not benefit from. This indicates that there is an indirect benefit: increased job satisfaction.

U*sers have the power to manage themselves.* Deciding to participate in a user innovation project is an individual decision, excluding company sponsored situations. In the workplace one may have a boss, and responsibilities for the social circle, however while in a project, one has to manage himself because

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there is no strict hierarchy or definite responsibilities.

Intellectual simulation. Enhanced chance of novel ideas. In the networked user innovation environment, one has more chance of meeting with different ideas and thus being able to produce novel products.

Intrinsic motivation. Studies of the motivations of user innovators of open source programmers have shown that these individuals too are often strongly motivated to innovate by the joy and learning they find in this work (Hertel, Niedner,& Herrmann, 2003; Lakhani & Wolf 2005). According to Benkler (2006), the networked information economy improves the practical capacities of individuals along three dimensions "1) it improves their capacity to do more for and by themselves, 2) it enhances their capacity to do more in loose commonality with others, 3) it improves the capacity of individuals to do more in formal organizations that operate outside the marketplace" (p. 8). In short, it gives more space for intrinsic motivation. These three factors listed by Benkler have positive effects on intrinsic motivation of the information workers and encourage more participation and production of ideas.

Creativity. User innovation is a creative process that encourages participants to be more creative. Amabile (1998) defined a creative work environment as having right amount of challenge, freedom for the means used in solving the problem, enough resources, good work-group features, supervisory encouragement and organizational support from entire organization. As seen from previous items, user innovation has all these six features. Lerner & Tirole (2002b) detailed how some user innovation projects recruited more volunteers by citing

creativity:

> The initial Linux operating system was quite minimal, on the order of a few tens of thousands of lines of code. In Torvalds' initial postings in which he sought to generate interest in Linux, he explicitly highlighted the extent to which the version would require creative programming in order to achieve full functionality. Similarly, Larry Wall attributes the much of the success of Perl to the fact that it `put the focus on the creativity of the programmer'. Because it has a very limited number of rules, the program has evolved in a variety of directions that were largely unanticipated when Wall initiated the project. (p. 221)

Indeed creativity is one of the most important reasons for user innovation's growth. Lakhani and Wolf (2005) studied the reasons why programmers contributed to user innovation projects. They surveyed 684 software developers who were contributing voluntarily to 287 user innovation projects. Lakhani and Wolf reported that:

> Respondents noted a very high sense of personal creativity in the focal projects...More than 61% of our survey respondents said that their participation in the focal F/OSS [user innovation] project was their most creative experience or was equally as creative as their most creative experience. (p. 10)

The importance of creativity for user innovation will not decrease over time, it will get even more important. Kao (1996) stated that the new age belongs the users who can user their creativity:

> Information technology confers leverage to creativity. By abolishing the advantage of scale, it has leveled the competitive playing field. It overturns the conventional wisdom that knowledge is power. It's really creativity, amplified, that creates power... Technology provides a powerful amplifier for creativity... In a world made accessible by the information superhighway, everyone has fingertip access to at least entry level of high quality information and expertise. Expertise previously available only through professional study and

apprenticeship, guild membership, or an accident of heredity is waning in significance as competitive factor. Such knowledge will soon become a mere commodity. The corollary is that creativity is more important than ever. (p. 134-138)

As a result, for the user innovation scene, the value of using creativity is greater than before. David Brooks, who in his book *Bobos in Paradise* made observations on changing social values of information workers, argued that creativity had become the important factor for employees when choosing a new job. He commented that "creativity is seen as the new key to productivity, having replaced the Organization Man's virtue, efficiency" (p. 132).

Flow. Cziksentmihalyi (1991) defined a state which he called "flow" where a person is fully engaged in what he or she is doing; enjoyment is maximized; this state is characterized by full involvement and heightened energy; a merging of action and awareness; increased confidence in one's ability; and the enjoyment of the activity itself regardless of the outcome. According to Csikszentmihalyi (1991), when someone is in completely in flow: 1) she has clear goals on what to achieve; 2) there is fast feedback about the work done; 3) the work at hand is not harder or easier than one can do; 4) person feels that she in control of the work; 5) there is much concentrating and focusing; 6) feeling of self-consciousness is lost; 7) time sense is distorted; 8) the focus is narrowed down to the work at hand and nothing else; and 9) the work is intrinsically rewarding. Lakhani and Wolf (2005) state that engineers contribute voluntarily to user innovation projects because they are in "flow".

It may seem puzzling to non-practitioners that software engineers

feel creative as they are engaged in writing programming code. As Csikszentmihalyi has shown, however, creative tasks often cause participants to lose track of time and make them willing to devote marginal hours to the task, a psychological state he calls flow. It appears that our respondents do experience flow while engaged in programming, ... indicates that 73% of the respondents lose track of time "always" or "frequently" when they are programming and more than 60% said that they would "always" or "frequently" dedicate one additional hour to programming ('if there were one more hour in the day'). (p. 11)

As seen in this example user innovation projects can provide flow for participants. A good designed user innovation project has 1) clear goals; 2) fast feedback; 3) participants voluntarily select the works so the work is neither hard nor easy; 4) if the participant doesn't want the work, she can always drop, so she has the control; and 5) as people self-select to participate, it is intrinsically rewarding. As a result items 6,7,8 can be achieved as well. This feature of user innovation motivates more people to participate in projects.

Material Factors

Cost. In user innovation, it is possible to get products much cheaper or free just by investing time on building the product. Total cost of ownership of user innovated software programs are typically 24%-34% less than commercial software (Wheeler, 2006, p. 44).

Necessity is the mother of invention. When users have needs that are not met by the available products, user innovators choose to take matters into their hands. Von Hippel (2005, p. 73) studied user innovation in mountain biking, he found that the main reason users innovated was unavailability of desired functions of the bikes in the marketplace.

Sticky information. Users have more accurate information on how they use a certain product, while firms have more accurate information on how to manufacture that certain product. Also some users have product usage information that they hold but simply are not aware of it. This kind "sticky" information is very costly to transfer as, it may not be transparent and it is contextual. User innovation solves the problem of sticky information by bringing production or production methods to the users (von Hippel, 1994, 2005).

Agency costs. A user can buy the product, innovate by herself or arrange for the manufacture of the product through another firm, agent. In the case of arranging for the manufacture of the product, there are generally conflicts of interest between user and the agent. As a start, the user wants lowest possible cost and the agent wants the highest possible one. Von Hippel (2005) stated that user innovation solves agency costs problem because users that innovate can develop exactly what they want, instead of depending on an agent. There is an additional benefit, agents are limited with their in-company information for the manufacturing process, while users can user innovation information freely shared by others.

Newness, control of leading edge technology. Some users, and especially sponsor firms, participate in user innovation to capture latest trends and control technology trends. Sun Microsystems released Java, a hugely popular programming language, as a proprietary program back in 1995. In November 2006, it opened parts of the code to public without protecting the intellectual property, under free software license GPL. Sun is planning to open the rest in

2007. There are reason behind this move: 1) more people will start using Java as it becomes free and they can see inside the code; 2) Sun will continue to get revenues from Java by customizing it per customer; and lastly 3) Java will benefit from thousands of user innovation community members innovating on this platform. At the same time, Sun will continue usual support of Java and simply will be at the leading edge by using the innovations made by user community.

Exchange of ideas. In the information age bits are much more important than atoms. While materials are rival goods, information is non-rival: when one gives information to another person, the value of the information isn't destroyed, the transferred information has the same value as the original one. Users need new ideas to implement in their own businesses as well. A user innovation community is a perfect place to exchange ideas.

Financial gain. Some can convert their contributions to user innovation money, by using their expertise to customize the tools or innovations for specialized purposes. There are companies like Red Hat which are doing business by selling services for user innovation products or customizing these products for specific uses. Experienced user innovators can continue to work for these companies as employees or subcontractors. In addition, some companies hire users to contribute into user innovation projects.

Advantages and Disadvantages of User Innovation

User innovation is a different way to innovate and requires different approaches in implementation and management of the innovation process. These differences of user innovation process have its advantages and disadvantages.

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The advantages of the user innovation vary across different applications. However there are some advantages that are generally common in all types of user innovation. They can be listed as:

1. Users are able to use their full creativity and potential which otherwise would go wasted.

2. A very large pool of talent ,which otherwise wouldn't be able to participate, is tapped.

3. Ideas in user innovation is harvested from diverse resources which increases the changes of novel connections and thus better innovations (Tapscott, & Anthony, 2006, p93).

4. User innovation communities provide access to cheaper information for companies, this in return decreases production cost of companies giving them competitive advantage.

5. User innovation contributes positively to the economy by increasing the chance of success of the products (von Hippel, 2005). Jeppesen and Molin (2003) stated that "When consumers carry out problem-solving activities, they save the firm a number of costly iterations...that are traditionally required to arrive at satisfactory product concepts " (p. 366). Better feedback from customers prevents expensive mistakes.

6. All participants and observers of user innovation process learn better and faster.

7. The firms using user innovation understand their customers

intimately. 83% of computer games have company established user communities. The input from these communities are directly used in game design (Jeppesen &Molin, 2003).

8. As users or firms understand the customers much better in a user innovation project, they design better products at cheaper costs which in return has a positive effect on environment.

9. Innovating in an area is no longer restricted to large companies, the process is democratized (von Hippel, 2005).

10. User innovation increases the demand for complementary offerings, opening new business areas and extending the economy (Mulgan, et al., 2005).

11. User innovation develops a support infrastructure for the products, even before they are on the marketplace. The user innovators will also be customers of the products, so a market for the product will exist as soon as it is available (Mulgan, et al., 2005).

12. Von Hippel (2005) and Lessig (2005) stated that user innovators need to go through less legal bureaucracy in some cases, and that users who innovate do not generally face legal risk if the product they develop fails and causes costs to themselves but not to others. This small point can make a large difference in exposure to liability by innovators versus firms.

The disadvantages of the user innovation also vary across different applications. Like in the advantages, there are some disadvantages that are

generally common in all types of user innovation. The disadvantages of user innovation can be listed as:

1. Some user innovation communities are small, and this can lead to small group think (Mulgan, et al., 2005).

2. Most user innovation communities have small amounts of money or no funding at all. This may slow down or kill the innovation process. This also may restrict the projects to digital forms and not to material innovations (Mulgan, et al., 2005).

3. All user innovation projects have a leadership in place for converging and aggregation (Surowiecki, 2004). If the leadership of the user innovation projects is not good, this will be reflected in the final product.

4. Because all information is in the open, user innovation projects may not be suitable environment where one needs to share private or confidential information. In the Mozilla web browser user innovation project, all parts of the code except the encryption and security is open for direct change by all user. Access to encryption and security is only given to trusted contributors.

5. Support of the product may be limited. Especially having a detailed user manual for a user innovation product can be challenging, as creating an innovation can be fun, but we can not say the same for the manual.

6. Continuity of the product is an issue when the interest in the product

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dies. For example, I had some user innovated software programs in my old computer for processing files. When I changed to a new computer, I wanted to re-load the same user innovated programs, however two of the web sites were not existing anymore. It has taken me some time to learn how to use those programs, and now the investment of time is wasted.

7. Ease of use may be an issue. As some user innovators are expert in the product, the products may have less user friendly features. A quick look at the user innovation community at www.sourceforge.net provides examples. It is not possible to install some of the completed user innovation products without in depth knowledge of software structures.

8. Problem solving process in user innovation consists of many iterations. This may be an advantage and disadvantage at the same time, if right solution is not found, this may waste valuable time on the wrong direction.

9. Learning from customers can be both an advantage and disadvantage. Per Christensen (1997), asking to customers may direct companies to wrong markets as customers can not always articulate what they need.

How To Encourage User Innovation?

User innovation offers many competitive advantages to the firms that support it. It is no wonder that firms like IBM, Oracle and Sun Microsystems are

actively supporting user innovation. In order to stay competitive, more firms will need to encourage user innovation in their domain. In this chapter, I will list the actions necessary to encourage user innovation. I can roughly divide the necessary actions to encourage user innovation to three: 1) actions related with users; 2) actions related with products; and 3) other actions.

User Related Actions

   Lead users. Lead users are the ones who will benefit first from a specific innovation. They have the need for the innovation months before ordinary users have (Lilien, Morrison, Searls, Sonnack, & von Hippel, 2002; von Hippel ,1988, 2005). They are trend setters; therefore they are more likely to innovate and that their products are more likely to be used by a large population of normal users. In a study done by Eric von Hippel and Glen Urban in 1988, the authors found that in PC-CAD industry, 87% of lead users made innovations in the programs they have used, while only 1% of ordinary users have done innovations (von Hippel,1988).

   Build innovation communities. Ornetzeder and Rohracher (2006), and Seybold (2006) suggested that user innovation can be encouraged by building user innovation communities. Then and then facilitating a climate where feedback is easily given will guarantee that users continue to innovate.

   Observe and ask to users. Seybold (2006) told about her system of listening to users for innovation and recommended that one of the best ways of encouraging user innovation was to ask the users about products they use. She added that it was also necessary to observe how the people used the products as the way they used might be different than what they said.

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Diversity. The distribution of user innovators shall reflect real life and how the product is used. Diversity increases the likelihood of novel products, so it is best to have user contributors from all ages and from all walks of life.

Product Related Actions

Modular design. Ornetzeder and Rohracher (2006) stated that opening the product design public and making it modular enables user innovation. Modularity is a common feature of all successful user innovation projects. This allows the user to enter and leave the project at will and complete the parts of the project with minimum time investment.

Easy to access. The product that will be worked on by the users must be easy to access and make changes (von Hippel, 1988). If users have limited access, user innovation project will commence slowly, if at all.

Simple tools. Ornetzeder and Rohracher (2006) suggested that user innovation should be easy to be implemented in the daily life of the user. User innovation should not require tools that aren't normally found in a user's environment, this would increase the cost of contributing in user innovation projects and would decrease participation.

Innovation toolkits or platforms. User innovators must have a base to start innovating: toolkits or platforms make sure that the user community speaks the same language. This is one of the best ways to harness user's innovation capabilities with a minimum effort (Seybold, 2006; von Hippel, 1988, 2005; Jeppesen & Molin, 2003). According to von Hippel (2005) a high-quality toolkit for user innovation will have five important attributes: 1) it will enable users to carry

out complete cycles of trial-and-error learning; 2) it will offer users an ability to cover the designs they want to create; 3) it will be user friendly; 4) it will contain libraries of commonly used modules so that users can use the standards; and 5) it will ensure that products designed by users will be producible on manufacturers' production equipment without modification by the manufacturer.

Other Actions

Less or no restrictions on intellectual property. Lessig (2001,2005), Benkler (2006) and Lerner (2002a) suggested that opening intellectual property to the public freely enhances the chances of new innovation by firms or users. Lerner (2002a) has investigated 150 years of patent protection in different countries and has found out that strengthening patent protection policies actually slightly decreases rate of innovation. Lerner hasn't found general positive effects of patent protection ,except in some limited industries such as pharmaceuticals, on innovation.

Get ideas from outside the company. Chesbrough (2003a) argued that old ways of innovation was now past and it was time to get ideas from outside the company. He suggested that companies change their research and development methods and use the company as an implementer instead of innovator.

<center>Future of User Innovation</center>

User innovation is just in its infancy. There will many changes in this new innovation mode. It is most likely that in near future we will experience four changes in the markets caused by user innovation: 1) niche user innovation markets will thrive; 2) user innovation products will get more competitive and will

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gain more market share; 3) research and development departments of firms will shrink as more investment goes to user innovation; and 4) user innovation will increase its scope to cover some of materials based production. Now, let's have a look at each item and the future possibilities.

Niche Markets

Anderson (2006) suggested that, due to extending power of networks, it was now easier to find customers for niche products. The networks allow selling less of a more diverse variety of niche products. User innovation products are perfect fits to fill in the niches, because the products are designed per the users for the users. The user innovation trend will be supported and enhanced by the evolution of better tools for online collaboration. Allaire and Austin (2005) argued that there would be less need for face to face communication, because the networked collaboration tools get better. This in return will result in more innovation moving to the networked world. In a network, things move faster as information is linked. Powell has stated that networks are especially useful for exchange of commodities whose value is not easily measured and that the open-ended, relational features of networks enhance the ability of societies to transfer skills and learn new technology over long distances (Miettinen, 2006, p. 176).

Competitiveness and Market Share

Coram (2002) studied life of the late Colonel John Boyd, whose work on military combat tactics enabled the U.S. Air Force to renew its war doctrine. Boyd represented all combat actions in a new model as an *observe-orient-decide-act* loop. Boyd's model is called *OODA loop* (observe-orient-decide-act) and is utilized

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in decision making in diverse situations. If an army, a firm or a community can complete the loop faster than its competitors, that means it can take decisions and evaluate the results of decisions faster than its rivals. In other words, the one with the shorter loop wins. When compared with the existing innovation techniques, user innovation has the shortest loop, therefore it will out-compete others under equal conditions. The feedback loop for user innovation is going to get even shorter as collaboration tools get better. Allaire and Austin (2005), and von Hippel (2005) share the same thoughts on future of collaboration. They believe that users' abilities to develop high-quality new products and services are improving radically and rapidly. We will continue to see increasingly capable and steadily cheaper tools for innovation that require less and less skill and training to use, which will increase the number of user innovators, pushing non-participant firms to a corner.

We can see a glimpse of the future for user innovation and its effects on competition by analyzing the competition between Google and Yahoo. Yahoo was the incumbent market leader for search for many years before Google. Yahoo's search engine was a centrally managed, closed software system. In order for Yahoo to add a site to its search engine, it needed to be added by its search software and then ranked for relevancy by using in-company processes. Google changed the game completely. Instead of relying on in-company processes for ranking sites, Google used the number of links which were added by other sites to the searched site as the main parameter (Brin & Page, 1998). Because users only link to a site that they like or find relevant, if a site is linked many times, this

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means that the site is more likely to have relevant data than a site with less links. The difference between Yahoo's and Google's search algorithm was: Yahoo managed and controlled the ranking internally and Google left it to the users. As a result of this choice, we all know how Google left Yahoo behind in a very short time. The same will happen in other areas, the businesses which can incorporate users into their inner workings will thrive and the businesses that don't will not survive long.

Research and Development Departments

Today networks allow firms to access to ideas and innovations which were not possible to access even in 1990s. With this easy and cost effective access to knowledge, it doesn't make sense for companies to keep all their R&D in house. Andrew Garman, managing partner of New Venture Partners (a New Jersey based company), has stated that " If twenty years ago most big corporate R&D spenders felt they could develop all the technology they needed on their own, very few believe that anymore. Instead many now see opportunities in a two sided exchange that allows intellectual property for some innovative idea to leave their labs, and equally important, for others to come in " (Blau, 2006, p. 4). To make things even worse, R&D researchers' skills are highly specialized to narrow domains of scientific inquiry, which makes them hard to train if and when business conditions change (Chesbrough 2003a). It is too bad for the R&D departments that we are living in fast changing world, because they will have to shrink and change shape. According to Chesbrough, there are four reasons that a company may still want to have its own R&D function in a bountiful free and external

knowledge environment: 1) to identify, understand, select from, and connect to wealth of available external knowledge; 2) to complete the missing pieces of knowledge that are now externally available; 3) to integrate external and internal knowledge; and 4) to sell knowledge to other companies. Other than these in many industries today, the logic supporting an internally oriented, centralized approach to R&D has become obsolete.

Materials Based Production

At the moment it is true that user innovation is more suited to bit products, but it's also true that many of the attributes and advantages of user innovation's bits products can be replicated for products made of atoms. If design and production of material products are designed to be modular then a large number of lightly coordinated suppliers can engage in designing and building components (Tapscott & Anthony, 2006). This trend is already alive in China where Chinese motorcycle industry is successfully competing against Japanese motorcycle manufacturers by dividing the design and production of motorcycles between many small sized firms. There are many people in various industries who are attempting to replicate the success of the user innovation in developing software programs. The user innovation model is now moving into industries in which final products are not digital form. Seybold (2006) indicated that they have found open source car design projects, open source biotechnology projects, open source industrial design projects, and there are bound to be many more. Gershenfeld (2005) was a scientist who studied setting up complex production environments at minimal cost at homes. He called these systems as desktop fabrication.

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Gershenfeld believed that innovating users might also want to learn whether and how to diffuse their innovations by becoming manufacturers. In future, this may be a fairly common practice in some fields. As the desktop factories that Gershenfeld still work on the MIT labs become more mainstream, we will start to see micro-manufacturers producing user innovated products at accessible costs.

Conclusion

In 1991, when Linus Torvalds posted an email that started the Linux user innovation community, nobody knew where this would lead. The increasing interest in user innovation projects is evidenced by numbers of participants in user innovation projects. Today, sourceforge.net has 1.55 million users, it had 750,000 users only 4 years ago. By 2002, Linux user innovation community has worked for 8000 man/years on the project voluntarily (Wheeler, 2002). And yet, this is only a start. In the networked world, possibilities are bigger than our imagination: there is only one possibility for user innovation, growth.

User innovation will not affect only the technology or products we use, it will be pervasive in all parts of our lives. Benkler (2005), a Professor of Law, told how he evaluated user innovation and its effects in the future:

> These newly emerging practices [open innovation] have seen remarkable success in areas as diverse as software development and investigative reporting, avant-garde video and multiplayer online games. Together, they hint at the emergence of a new information environment, one in which individuals are free to take a more active role than was possible in the industrial information economy of the twentieth century. This new freedom holds great practical promise; as a dimension of individual freedom; as a platform for better democratic participation; as a medium to foster a more critical and

self-reflective culture; and, in increasingly information-dependent global economy, as a mechanism to achieve improvements in human development everywhere.

The rise of greater scope for individual and cooperative nonmarket [user] production of information and culture, however, threatens the incumbents of the industrial information economy. At the beginning of the twenty-first century, we find ourselves in the midst of a battle over the institutional ecology of digital environment. A wide range of laws and institutions – from broad areas like telecommunications, copyright, or international trade regulation,....- are being tugged and warped in efforts to tilt the playing field toward one way of doing things or the other. How these battles turn out over the next decade or so will likely have a significant effect on how we come to know what is going on in the world we occupy, and to what extent and in what forms we will be able.. to affect how and others see the world as it is and as it might be. (p. 2)

How we all approach user innovation these days has the power to change the future of the society and the economy. So next time when you come across a user innovation project, please pay attention, and better yet, go ahead and participate.

SECTION FIVE: KEY LEARNINGS

In this project I examined literature and online resources about a new trend which gaining full momentum: user innovation. I summarized various information on user innovation. While doing these, I learned new information. I am summarizing my content and process learnings next.

Content

In this project I examined pertinent literature, online sites and forums. The challenge of the project was to combine user innovation information from various fields. User innovation is a new method for innovation and it is not wholly documented yet. Some types of user innovation don't have any academic studies done on them yet. The lack of research made finding information or interpreting the information sometimes difficult. This is why web sites were of great help to me. I also found information in forums where users discuss about products. In general, this type of work on content worked well for me. If there was more time for the project, I would go deeper on online collaboration, I touched barely tip of it with this project. I believe online collaboration will gain real importance in the very near future.

Process

User innovation is a diverse and upcoming area. Preparing this project took longer than originally planned, however it was needed to completely cover the subject because the user innovation area is diverse and has connections to other fields that must be understood well. This required examining the literature not only

on user innovation but in diverse subjects. I enjoyed the process of examining information from diverse subjects.

Conclusion

The purpose of this project was to examine the current literature, blogs and online forums to understand the dynamics of user innovation in order to answer the questions; what are the main characteristics of user innovation; why do users innovate; how do users innovate; what are the benefits of user innovation; and is there a future for this trend.

As a result of this project I, classified existing user innovation types, examined advantages and disadvantages of user innovation, listed main characteristics of user innovation, detailed the reasons for user innovation, shown the ways to encourage user innovation, and wrote on what future will bring for user innovation. User innovation has the power to change the society and the economy of the future. It is a trend that must be studied in more detail. This project only manages to scrape the surface of the whole user innovation arena. After completing the project, I am interested to learn more especially on how to encourage user innovation and how to set up good-performing online collaboration communities. I plan to continue examining these two areas.

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APPENDICES

Appendix A: Concept Paper

User Innovation: Why and How?

Name: Basar Kurtbayram   **Date Submitted:** 28 Feb 2007

Use a Skill/Talent to Improve the Quality of Life for Others:

What Is This Project About?

There is a new trend which started with the decrease of the cost of communications; new products or services are created in coordination with the end-users or totally by end-users. It is called by different names: user innovation, consumer innovation, customer innovation, community driven innovation, DIY innovation. This is a new phenomenon. Up to now manufacturing companies or service providers created and innovated without getting help from users. No more. In user innovation users are leading the problem solving and designing process. This is a new innovation method which is here to stay.

This project will examine the current literature, blogs and online forums to answer these questions;

- Why do users start creating their own solutions?
- How does user innovation work?
- What are the benefits of (if any) user innovation?
- Is there a future for user innovation ?

Rationale for Choice:

In my opinion, user innovation is application of CPS in a very large scale. It is collective creative problem solving. Users/consumers/customers who were -so far- out of problem solving organizations are now becoming embedded in the problem solving process. This is new territory that brings new opportunities for both individuals and companies. In a networked world, solutions can be found much faster and effectively than before. Problem solving need not to be limited to teams under the same roof.

I have been working in an organizational problem solving role lately. I have been

to many situations where I worked with internal teams to resolve issues. I am always on the search for better ways of solving a problem. I can see that if user innovation is managed properly, it can have a very positive effect in all problem-solving situations.

What Will be the Tangible Products or Outcomes?

The deliverables of this project will be literature review and documentation of;

- User innovation process as of today
- Types of user innovation
- Methods for user innovation
- Reasons/motivation for users to innovate
- Benefits (if any) of user innovation

What Criteria Will You Use To Measure The Effectiveness Of Your Achievement?

Please see evaluation.

Who Will Be Involved or Influenced; What Will Your Role Be?

Basar Kurtbayram: Collect, review and synthesize information on user innovation.

Mary Murdock: Guide through the project.

Andy Burnett: Sounding board partner, give opinion on the project.

Cohort: Support by giving new ideas, new resources for the project.

When Will This Project Take Place?

This project will take 12 weeks to complete, starting first week of February 2007 and ending first week of May 2007. It will consist of 3 phases.

Phase 1: Information gathering and reading: 4 weeks
Phase 2: Prepare the text, receive guidance from instructor, get support from SBP, write the text: 4 weeks.
Phase 3: Changes, corrections, additions, feedback loop and production of final text for approval: 4 weeks.

Where Will This Project Occur?

This project will be prepared in Buffalo, NY at State University of New York, Buffalo State College. In order to complete the project, telephone and on-line interaction with remote participants are required. These communications will take place as required.

Why Is It Important to Do This?

User innovation is a new trend that is just taking off. When managed properly, this new method can decrease creation time and, the cost of new products and services. In addition to time and costs savings, user innovation can mean much better products for consumers, less waste of resources, satisfied creative people who can use their creativity via this process and resolution of long waiting problems for third world countries. It is important to understand this trend so that we can start to manage it properly.

Personal Learning Goals:

I want to learn;

- Why do users start creating their own solutions?
- How does user innovation work?
- What are the benefits of (if any) user innovation?
- Is there a future for user innovation ?
- How to make a proper literature review?
- How to use synthesize information from a very diverse selection; academic papers, popular books, scholarly books, blogs and online forums.
- How can user innovation be applied personally if I want to work on it later on?

How Do You Plan to Achieve Your Goals and Outcomes?

I plan to start by doing a thorough review of relevant resources. I will use Butler library and on-line resources extensively for finding relevant information. I did a preliminary review of the resources available and already identified some resources which are present at the library. After finding the resources I will read them and possibly will need to go one level deeper. After reviewing
all relevant literature, blogs and online forums, I will start writing the text. During this time I will be in contact with the course instructor, my SBP and my cohort to get guidance and feedback.

Evaluation:

After I finish writing the script, I will send to Mary Murdock, Andy Burnett and our cohort for feedback. I expect the text to be read in one week and expect responses from Mary Murdock, Andy Burnett (both required) and one response (preferred, but not required) from the cohort. After reading the text, the respondents must be able to able to answer to these questions with ease;

Why do users start creating their own solutions?
How does user innovation work?
What are the benefits of (if any) user innovation?
Is there a future for user innovation ?

During Phase 1, I will get feedback on which resources to use. During phase 2, I will get guidance, recommendations, feedback on all parts of the study. Phase 3 will be the formal evaluation.

Prepare Project Timeline:

This project will take 12 weeks and about 150 hours to complete, starting first week of February 2007 and ending first week of May 2007. It will consist of 3 phases.

Phase 1: Information gathering and reading: 4 weeks, 84 hours.
Phase 2: Prepare the text, receive guidance from instructor, get support from SBP, write the text: 4 weeks, 40 hours.
Phase 3: Changes, corrections, additions, feedback loop and production of final text for approval: 4 weeks, 26 hours.

Identify Pertinent Literature or Resources:

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Appendix B: Examples of User Innovation Web Sites

www.mozilla.org

Home of Firefox web browser, Thunderbird email program and Sunbird calendar. All are open source, all are user innovated and all are free. According to industry experts, these programs are more secure and have more features than commercial ones, like Microsoft's.

www.openoffice.org

This project is prepared utilizing user innovated OpenOffice: word processing, presentation preparation, drawings, database, spreadsheets. All are free, these programs have more features than the commercial ones that we pay. OpenOffice has a new standard which is now accepted by Google and will be implemented worldwide. OpenOffice has 14% of large enterprise market.

www.wikipedia.org

Didn't you hear Wikipedia? Are you sure that you are alive? There is some controversy regarding reliability of the articles, however it is a good place to start searches as there always links to other original resources.

www.slashdot.org

So you want to know more about open source? The site calls it "news for the nerds". All news are created and evaluated by the users. All the latest tricks of technology + all the latest techie gossip.

www.ohmynews.com

World news by "user" journalists in English and for a change in Korean. Check the Buzztracker Map first to see where the news activities are for that day. Very good tool.

www.sourceforge.net

Feel like participating in a user innovation project? You will want to have a look here to be spoiled for choice: 146,000 projects at your fingertips.

www.topcoder.com

Want to make money from user innovation? Register and compete by developing programs in this site. It must be good, NSA is one their customers.

www.innocentive.com

Working at a day job and want to moonlight as a scientist at night? This site has problems that firms couldn't solve internally and offering up to $100,000 for a solution from users. Many successful users, many satisfied firms.

www.ninesigma.com

Matchmaker for user innovation. Firms looking for user innovation knock on the door of NineSigma. NineSigma finds the perfect outside "user" match to work the firms, fast.

www.marketocracy.com

Do you want your money to be managed by wisdom of crowds? This site has 60,000 portfolio managers as participant. The best performing ideas are harvested to manage funds in stockmarket.

www.hsx.com

Hollywood also got its share from user innovation: Hollywood Stock Exchange, HSX. User buy and sell virtual shares of new movies that are about to

be launched: the film with the highest share is likely to be a hit. This site received raves as its forecasts are beating industry analysts time after time.

www.biz.uiowa.edu/iem

Now that you decided on the next hit movie, why not decide the next president? In this electronic marketplace run by University of Iowa, users guess the next president. More accurate than any firm in the last 2 elections.

www.zopa.com

You need loan? But you don't like banks? Or they don't like you? Just borrow it from other users. This site matches users who need loans and who lend loans. Less interest rate for the borrower, more interest rate for the lender, of course the loser here are the banks, too bad, huh.

www.thinkcycle.com

Help underdeveloped communities by collaborating on designs that will be manufactured: cholera detection, electricity production with bikes and transportable refugee housing are few to name.

www.jonessoda.com

Need a drink but can't find what you look for on the market shelves. Well, don't be lazy, design it yourself at this site. You will have compete with other users though.

www.muji.com

Need that small thing that you can never ever find in the shops: design it then put it online on this retailer's site. If enough people pre-order it, it will be produced and you will get a design reward on top of it.

www.threadless.com

First design your own T-shirt and get it printed at threadless. All other users of the site can see your design and even order the same, you may get good money for your design idea.

www.mindstorms.lego.com

Design, change, rip, destroy, build the next Mindstorms products together with LEGO guys and fans.

www.istockphoto.com

Remember those pictures that you took at the last vacation, the ones that everyone liked? Well, upload them to this site with many other users. Firms come to the site like flies to the jam to buy photos, cheap. At last you get paid for your vacation photos.

www.mturk.com

Mechanical Turk is an "artificial" artificial intelligence site from Amazon. Firms that have small modular works that need to be done by people post works here, users get paid when done.

www.endtas.com

Download, revise, change, innovate, build, and upload boat and robot designs.

Www.blurb.com

No one publish your book? Then you do it on your own using the tools in this site, the site than can arrange the book to be delivered through online

retailers.

www.code.google.com

Use Google as a platform to build your own tools with more than 100,000 other users, then post your product through Google. Be careful though, if the product is good enough Google will recruit you or by your firm.