

Innovative Users in a Firm-Established User Community:

The characteristics of users co-developing “computer-
controlled music instruments”

Paper submitted 5. January 2004 for
the DRUID, PhD Winter Conference, Aalborg

Draft

Comments solicited

Lars Bo Jeppesen

&

Lars Frederiksen *

lf.ivs@cbs.dk

Copenhagen Business School,
Department of Industrial Economics and Strategy,
Solbjergvej 3, 3 floor, DK-2000 Frederiksberg, Denmark.
Telephone: +45 3815 2993

* Learning Lab Denmark,
Emdrupvej 101, Dk-2400 Copenhagen NV, Denmark.

Abstract:

We study the professional status, user competencies, and main motivations of innovative users located in a firm-established online user community. The function and potential benefits of such communities remains to be studied and understood. The specific setting under investigation in this paper offers insights on a number of issues concerning user innovation that earlier studies (for good reasons though) have not been able to study.

Analyzing data derived from a web-based questionnaire generating 442 answers using a multivariate regression analysis we find that innovative users are most likely to be hobbyists (not professionals), to comprise lead user characteristics, and to respond to recognition from the product-developing firm (not only from peers) for participating in the user community. These findings are substantiated and discussed in the light of an extensive set of complementary data derived from interviews, a web-log, and archives. Besides, we assess the value of the innovations produced. Finally, are drawn out a few implications for management of product innovation and the use of online user communities.

Acknowledgements:

Keld Laursen, IVS, Copenhagen Business School is appreciated for comments and discussion. Additional remarks acquired from PhD in progress seminar in November 2003 at Sant'Anna School of Advanced Studies are valued. Possible errors rely on the authors

“Many enhancements of our current products are a direct result of end-user feedback.”
(www.propellerheads.se).

1. Introduction

The quote above clearly illustrates the important role played by users concerning innovation¹. The quote also illuminates the fact that in the innovation studies literature in general (Schumpeter 1934, Tidd. Et al. 2001) we discover a somehow yawning gap concerning the interpretations of the drivers of innovative processes between producers and users. This released an emerging interest.

There has been a considerable interest in the innovation that appears as a result of sources external to the firm. A prominent example originates from studies of user activities concerning innovative processes (i.e. sometimes labeled demand side driven innovation) (Rothwell, 1974, Rosenberg 1976, von Hippel, 1976, von Hippel, 1988). The need to increase our knowledge about this phenomenon coincides with the rapid spread of the phenomenon itself, recently, as a consequence of the important surfacing of the Internet and enhanced connectivity among agents involved in innovative activities. Recent studies of user driven innovation, examining particularly activities of user located in communities (Shah 2000; von Hippel, 2001; Franke and Shah, 2003), suggest that the innovative potential of such communities may create important economic values. However, few studies have investigated the situation in which an online user community intersects with, and spillover on, an established firm. Thus, while it has been recognized that users do innovate and cooperate, relative little is still known about what firms can actually do in an online setting, for example, in terms of strategy, to organize user innovation processes and how efficiently they can capture such innovations, and their related benefits.

This paper is concerned with a form of business organization for innovation that is founded on users co-development of products in a firm established online-based user community. Our interest lies with how this type of organization that we term “co-development with users in firm-established user communities” works and with issues concerning the significant characteristics of the main player in such communities namely: the users.

We are motivated by the following questions: (1) are users that innovate typically professionals that innovate “on the job” or are they hobbyists who innovate “investing own funds”; (2) are users as the literature, suggests users at the leading edge of their fields, and if so, do they create important valuable innovations; (3) what motivates users to innovative behavior?

¹ We apply a concept of innovation, which do not rigidly make use of the Schumpeterian distinction between invention and innovation processes.

The phenomenon of user innovation is interesting because, under the right conditions firms may gain a competitive advantage from the effects of having a network of users connected (Jokish, 2000; Jeppesen and Molin, 2003). Put, for example, in the framework of the resource-base view of the firm (Wernerfelt 1984, Barney 1991) a user community may turn into a strategic asset: an imperfectly imitable resource that can hardly be purchased but have to evolve. However, all communities may not be equally helpful in terms of generating innovation. User communities might be innovative but occasionally they make no difference or possibly they are even destructive to a firm's innovation process. The relevance of this study is that it investigates the main elements leading to innovation in such communities: some key characteristics of innovative users. Therefore, we study some of the attributes turning a user community into an asset for the firm in the first place.

Empirically, we are concerned with innovation produced by an online user community established by the Swedish firm Propellerheads, which is a leading manufacturer in the product field of so-called "computer-controlled music instruments" (i.e. software for creation, processing, producing and recording of music mainly used within the genres of electronica, house, techno, modern jazz² and soundtracks for film and commercials). We observe that the firm's innovation process is guided and enhanced by the establishment and ongoing interaction with its online user community. In this user community setting the end-users play an important role in the innovation process, by creating different sorts of innovative inputs that complement (not substitute) the products of the firm. By keeping an open attitude towards user's ideas and real innovations the firm in question has been able to improve their products and benefit from a large number of new applications to their product created by users.

Although currently found occurring mainly in industry environments such as computer games (Jeppesen, 2002), we believe that this form of co-development with users or extended use of external sources of innovation – open innovation (Chesbrough 2003) - will become a pathway chosen by firms in a number of industries in their attempts to advance their products. Hence, we see a need to know more about the particular features of this organizational arrangement, not setting out from the traditional firm-based perspective but rather pay special attention to those individuals who deliver the main input - the users – and the potential value produced. This study is an initial strive of generating insights into some fundamental questions concerning such phenomenon. To meet these objectives our study draws on data from a variety of sources: interviews, web log data and (most importantly) data obtained from a web-based questionnaire yielding 442 responses. On the basis of the study we seek to progress the current knowledge in fields such as innovation management.

² Examples include: the top chart band Chemical Brothers (electronic music) as well as the jazz artist Herbie Hancock use Propellerhead products in their creative efforts. Furthermore, advertising and movie score producers also frequently employ Propellerhead products in their work. An example is the soundtrack for the Oscar award-winning movie: *Gladiator*, which was partly done by Propellerhead products.

The paper is structured as follows. Section 2 delivers an introduction into the field of user driven innovation. In section 3 we present our research questions and subsequently in section 4 the empirical setting of the study is offered. Section 5 outlines methodology and data collection, while section 6 brings results. In the final section 7 we discuss the results and conclude the paper. Implications for innovation management are drawn out.

2. The origins of innovation

It is not a novel thought within the literature of technological and organizational change that extramural sources to the firm of information and knowledge are in flux and such sources constitute important economic variables. Accordingly, the abilities for firms to search for, absorb and deal productively with these sources may have an important effect on the firms' performance (Cohen & Levinthal 1990). Despite Schumpeter's idea of the lonely entrepreneur and implicitly the notion that innovation happens mainly due to the producer initiated activities based internally in an organization (Schumpeter 1934), and the later Schumpeter's idea of innovation as mainly taking place via efforts of R&D laboratories related to larger firms (Schumpeter 1942), the importance for firms of supplementing their knowledge base with that of an external organization was recognized already by one of the founders of modern economics, Alfred Marshall (1925). Of course Marshall's argument - in principle an evolutionary one about learning - emphasizes the development of positive externalities through a market-based organization is connected to the accentuated importance for firms to create variation, as it "is a chief cause for economic progress" (Marshall 1925:335).

As regards innovation, these outside sources of innovation should be considered crucial partly because a major share of innovation produced by firms generally results from borrowing rather than invention (March and Simon, 1958). Therefore, Tushman and Katz (1980) emphasize: "organizational systems must collect and process information from outside sources in order to keep informed about relevant external developments and technological innovation". These insights have been supported by extensive empirical research on the sources of innovation, stressing the important role of outside sources of knowledge and information (e.g. Hamberg, 1963; Johnson and Gibbons, 1975; von Hippel, 1988; Leonard-Barton, 1998).

The field of 'demand side' user driven innovation, constituting a sub-division of interest in innovation appearing outside firms, has for three decades studied the potential of innovation by users. While the major part of the contributions following this line of work has focused on innovation by users where users are interpreted to be firms and mainly within the product area of manufacturing, there has recently been a surge of interest and attempts to uncover whether the phenomenon of user innovation could be extended to fit to include end-user hobbyists and areas of consumer goods. This approach suggests an

increasingly mixed picture in which innovation by users covers the range from being professionals to being private hobbyists.

Table 1: The product area and the organizational sources of innovation in the cases where users are professionals located in firms

Product Area	Source of Innovation			<i>n</i>
	<i>User</i>	<i>Mfr.</i>	<i>Other</i>	
Petroleum processing <i>Enos (1962)</i>	43%	14%	43% ³	7
Computer innovations 1944-1962 <i>Knight (1963)</i>	26%	74%		161
Chemical processes and process equipment <i>Freeman (1968)</i>	70%	30%		810
Scientific instruments <i>von Hippel (1976)</i>	76%	24%		111
Semiconductor and electronics subassembly manufacturing equipment <i>von Hippel (1977)</i>	67%	21%	12%	49
Wire stripping and connector attachment equipment <i>VanderWerf (1982)</i>	11%	33%	56%	20

Table 1, Abstracted from Shah (2003)

Table 2: The product area of innovation in consumer products and the fraction of user hobbyist reporting having innovated within each area.

Consumer Products	<i>Fraction of innovators</i>	<i>n</i>
Hiking equipment <i>Luthje (2000)</i>	37%	153
Snowboarding, sailplaning, canyoneering, and handicapped cycling equipment <i>Franke and Shah (2003)</i>	38%	197
Mountain biking equipment <i>Luthje, Herstatt and von Hippel (2002)</i>	19%	291

Table 2, Abstracted from Shah (2003)

The two tables allegedly maintain, first the fact that user innovation is indeed taking place across a number of different product fields (i.e. Table 1). Ranging from the industrial user firms to individual end-consumers we find proof that these innovate in their respective field of use. Secondly, Table 2 accentuates that a relative large fraction of end-user as consumers in an industry field innovates. The economic effect of user innovation is not a topic that has been studied intensely, but one may assume that user innovation might have an economic

³ Attributed to independent inventors/invention development companies.

importance if introduced into the economic system through either sharing or commercialization of innovations. Although there is modest evidence on the economic effects of user innovation it has been shown that user generated product innovations, which can compete with in-house generated innovations sometimes are extremely valuable to firms (Lillien et. al, 2003) and that firms may benefit concerning innovation in user communities (Jeppesen and Molin, 2003). To gain further insight into the phenomenon it is important to examine some key characteristics of the users who generate this potential in a setting where firms try to connect and benefit from this source of innovation via the firm-user interface established by an online community.

Clearly, not all users are innovative hence not contributing equally to this potentially beneficial process of value creation. If this is the case some type of users will be more directly relevant for the process than others and therefore possibly more important to the firm to interact with. The aim of this paper is to identify and discuss the characteristics of the innovators under such outlined conditions. An improved understanding of user characteristics and motivations will be relevant knowledge to innovation managers to rely on as well as useful information when trying to recognize users as a source of innovation.

3. Research questions

From the platform established above we have chosen to concentrate on three central ideas regarding users involved in co-development of commercial products. From these aspects proliferate our research questions related to the professional status, leading edge competencies, and motivation of innovative users located in a firm-established user community.

- 1) Are innovative users professional users⁴ or are they hobbyist users?
- 2) Are innovative users lead users?
- 3) What motivates innovative users to participate in innovative consumer communities?

Additionally, we seek qualitative to assess the value of some of the innovations developed by users.

3.1 Professional users vs. user hobbyists

Reviewing the literature on matters of user innovation one detects immediately a separation among the empirical studies carried out on professional users (as contained in a firm) and user hobbyists as private end-users. As highlighted in Tables 1 and 2, typically the earlier part

⁴ The idea of professional users hinges upon with activities users earn the majority of their income from. The aspect of professionalism in user activities clearly depends on the interpretation of the product and its primary arena of use.

of the literature focused on firms whereas more recent contributions emphasize the activities of hobbyist's innovators.

A distinction separating these two categories of users seems reasonable for the reason that we want to be able to predict the sources of innovation. Knowing where innovations originate from (von Hippel, 1988) is important in that it may hold serious implications for policy that we prescribe at several levels and importantly at the level of strategy for the firm. Also, the differences in propensity between the two categories to share their innovations may appear another obvious reason why we want to know more about who innovate. The potential welfare benefits of user innovation (Henkel and von Hippel, 2003) will be affected importantly by the sharing behavior of user (especially those that innovate). There are strong forces that drive professional users (firms) to innovate, which may make one assume that this group is the major source of innovation in the user domain: 1) professional users in a business context derive important economic benefits from using an innovation, 2) firms may be able to defend competitive positions from in-house use of a user innovation or they may gain later by commercializing it on the market. Moreover, on the individual user level, the professional user employed by firms will typically also be in a good position to appropriate both monetary and career-related benefits from innovating. There are nonetheless still reasons to assume that user hobbyists will sometimes innovate.

Although hobbyist innovators typically do not benefit in monetary terms from innovating, reasons that "go beyond the dollar" (Pheffer, 1990) may play an equally important role. The 'in-house' use argument has been offered as a reason for hobbyists to innovate by Shah (2003) and von Hippel (1988). Strong drivers to be mentioned for hobbyist users are non-monetary intrinsic rewards (Deci, 1975), such as satisfaction through fun (Henkel and Thies, 2003) and learning benefits.

3.2 Lead users

The importance of establishing whether users that innovate comprise lead users characteristics arise from considerations about the type and quality of the innovations one would expect to appear from user activities. The notion of the "lead user" and provided evidence spell out that these scarce individuals had sometimes helped firms to a faster and more accurate definition of future demand, hence speeding up the advances in product development (von Hippel, 1986). Lead users are defined as users of a given product or service type that combine two characteristics: a) they expect attractive innovation-related benefits from a solution and so are motivated to innovate, and b) they experience the need for a given innovation earlier than the majority of the target market. Essentially the latter point that lead user are ahead of their field and hence, are able to envisage and sometimes develop artifacts by recombination that represent future demands (i.e. coming wishes and needs of customers) - is important to our study. Because, if part of the users in a population are lead users one would expect to see a number of user innovations that appear to be valuable in terms of novelty. The main argument put forward is that innovation from lead

user represents a better commercial potential than from non-lead user's ideas. This argument is supported by extensive empirical evidence (Urban and von Hippel, 1988; Herstatt and von Hippel, 1994) and most substantially by Lillien et al, (2002) who found ideas of lead users to perform better in the market respective to other-type innovations.

3.3 Motives for innovation

A number of studies take interest in reputation as being a motivating driver of innovative efforts in a user community setting. The contribution that initiated the interest of organizational economists was the phenomenon of open source software development. Particularly Lerner and Tirole (2002) spurred the interest by trying to explain the behavior and related activities of open source software programmers – why are they working for free? Peer recognition as reputation-based rewards leading to enhancement of opportunities in the job market was the key explanation offered by the authors concerning the motives for innovation efforts and free-revealing behavior of the open source software programmers. Although Lerner and Tirole (2002) suggest both social and economic based arguments as being prime motivators for innovation (especially in a user setting with high visibility among users in an Internet-based user community), recent evidence from a number of surveys carried out in user populations of open source software (Hars and Ou, 2002; Lakhani and von Hippel, 2003; Krogh, et al. 2003), sports equipment (Franke and Shah, 2003), and simulator software (Henkel and Thies, 2003) shows alternative results. These findings point to a complex of intrinsic motivations (e.g. fun, learning) as being an equally important motivator behind innovative efforts, yet not discarding the peer recognition and in some cases career concerns as being the main motivator. Nonetheless, the reputation-based rewards story has not hitherto been thoroughly unfolded. Therefore, in our study we seek possible alternatives, yet still reputation-based explanation motives for innovative efforts and participation by users. These aspects of motivation are central in terms of the scope for management and inducement for innovation in the manufacturer context. If users respond to firm-recognition according to the way in which the firm “allocate recognition” to users, it will, we stipulate, most likely have an effect on users' tendency to innovate and thus, effect the performance of the firm.

4. The setting – the product developing online user community for computer-controlled music instruments

This section of the paper informs about the investigated firm, the special product characteristics and the attributes of the user community examined. As reported in this paper, some firms currently have succeeded in establishing communities of users in which these

deliver a vast amount of innovations that are complementary to firms' own products and from which the firms appropriate a number of important inputs⁵.

The central empirical element of the setting that we study is a firm-established online user community hosted by the Swedish firm: Propellerheads. The firm was founded in 1994 - the same year as it released its first product - and is now a leading force in its particular market segment. The three founders own the firm and hold a constant staff on about 25 persons, mainly software developers. Propellerheads develops and manufactures so-called computer-controlled music instruments. Computer-controlled music instruments are specific commodities for performing sound producing and processing as well as functioning as recording software. Computer-controlled music instruments refer to software technology that provides the artist (musician, producer, etc.) with a virtual rack located on a PC or laptop. This rack comprises: (1) sound producing modules (e.g. drum machines and synthesizers), (2) sound effects, (e.g. reverb, delay, distortions, etc.), and (3) sound organizing elements (mixers, samplers, recorders, and sequencers). The products are used for various aspects of sound production mainly for music, games, movies, and advertising. The products of Propellerheads are somehow intended to support substitution of the need of a physical sound recording studio for recording, producing and organizing sound.

The computer-controlled music instruments of Propellerheads are in sum three special technologies put into five different products⁶. The products are attractive for users with diverse skills and resources. Due to the products relative accessibility (it is distributed via Internet download), its relatively low price (prices range from 100-500 USD), and good interface opportunities to other technologies, the products of Propellerheads are used by a range of music creators ranging from highly skilled professional musicians, producers and sound studio technicians to users without noteworthy prior knowledge concerning sound creation and production. We may say that the products contain low entry barriers, low creation barriers but supposedly a relative high level of intrinsic satisfaction.

4.1 The proliferation of user driven moderations of Propellerhead product - mods - and of the online user community

Following the 1999 release of Propellerheads Rebirth product a number of users, joined in a internet-based chat hub involved with sound production, managed to 'hack' the Rebirth software and began to integrate their own sound samples and graphics design: "It was a form of friendly competition among us' as one of the interview respondents argued.

⁵ Firms may also benefit from online user communities related to reduced costs regarding: customer support functions as users learn from community activities and advice from each other, debugging help from the community as well as prolonged product life time benefits since a given product often obtains extended interest and thus, increased sales due to users' innovative activities.

⁶ The Propellerhead products hold a high degree of 'modularity' and the firm have gained their success (apart from developing unique and quality products) partly because of their products' relative easy interface with other products on the computer-controlled music instruments market and partly because their products exactly offer to create interface options and a control point between products manufactured by other producers of computer-controlled music instruments, which earlier on were not compatible.

When information about the hacking activity and modification efforts being made to their products reached 'the firm management Propellerheads was 'overly surprised' that someone would spent the 6-8 month altering their product'⁷. As the CEO and founder of Propellerheads says: 'we were really excited about this'. Due to the open and pleased attitude from the firm to the product modifications, the firm decided to start supporting users' innovative efforts and agreed to open up parts of the product code to users who wanted to moderate - make so-called mods - to their products. Besides, the firm made an effort in the product technology for the product to be more suited for sharing the mods among users. The firm now openly encourages user innovation with the following words on their web-site:

"Mods. A celebration of creativity. Here at Propellerheads we're crazy enough to let users take our precious ReBirth (Propellerheads product) and redesign it any way they like. If you're skilled in graphic design and you have a bunch of cool drum samples you've always wanted to share - make a mod, mail it to us and maybe, just maybe, we will make sure it reaches every corner of the world" (www.Propellerheads.se).

Along with the releases of the first products in Propellerheads' product line emerged an initially self-organized community of users. Simultaneously a number of additional "satellite communities" originated⁸. Seeing this happening Propellerheads determined to set up an official online user community on their own web site to host a part of this growing activity from the community of users of their products. Today the Propellerheads host the major user community related to their product portfolio. The community comprises approximately 3850 members⁹ generating approximately 150 – 200 interactions (question and answers) per day that involve approximately up to a 100 users. In the community a large number of activities occur related to Propellerheads' products – among them interaction amongst innovative users that support, discuss, advice and review each other's creations.

An illustrative example of how users collaboratively interact about problem-solving procedures somehow related to innovative behavior in the Propellerhead community is presented in the gray box below:

⁷ Information on the duration to make a new mod was received during interview with innovative users.

⁸ A brief survey on the Internet and information from our web-log data revealed that at least 10 such satellite communities exist. Many of these are directly linked and acknowledge by the Propellerhead firm and the main bulk of the satellite communities are to be characterized as spin offs from the Propellerhead hosted communities.

⁹ There are a high degree of influx and outgoing of users in the community. Hence, newer estimates from Propellerheads suggest that around 3000 participants are a more accurate figure. The main part of these community goers (approximately 90%) post only one or two messages (information achieved through our web-log data).

Christofer: RV700 (19 May 2003, 19:14:35):
How do you use this device as an EQ without having any Reverb effect. Obviously this a much better EQ device than the other one. I'm trying to EQ vocals but i don't want any reverb on them.

Ceffe: (19 May 2003, 19:46:36): in response to [RV700](#) posted by [christofer](#) on 2003-05-19 19:14:35. :
I think what you want is not possible. According to the manual (p237) the EQ affects the wet reverb sound only. I guess, then, this EQ is for shaping the sound of the reverb. Try out the Vocoder as EQ instead!

Gnorpf: (19 May 2003, 23:59:49) 'Here is how...' in response to RV700 posted by christofer on 2003-05-19 19:14:35.

It's actually possible to use the RV7000 as an EQ with a little bit of tweaking, and here's how:

MAIN UNIT
EQ Enable: On
Gate Enable: Off
Decay: Min
HF Damp: Min
Hi EQ: Middle
Dry - Wet: Max (Wet)

REMOTE PROGRAMMER
Algorithm: Echo
Echo Time: 10ms (Min)
Diffusion: 0
Tempo Sync: Off
LF Damp: 20 Hz
Spread: 0
Predelay: 0ms

CABLING
Obviously, you need to make the RV7000 an insert effect (place it between your sound source and the mixer).

The trick is basically to create a reverb that sounds like the original, because you can only apply the EQ to a processed reverb signal. Note that this solution introduces a 10 ms lag, and I've found no way around it. But for slow stuff like voices etc, you should barely hear the lag. And if you hate it, just introduce a DDL1 into all the other tracks to compensate for it. Cheers!

For illustration of the product modifications (mods) discussed, the picture below shows one such outcome of user innovation of Propellerheads products. It is a mod for an already existing product that Propellerheads have launched on the market.

Illustration 1



(Please see appendix 1 for a more detailed description of the nature and qualities of innovations appearing in the Propellerheads online user community).

5. Methodology and data collection

We apply a partly inductive approach to uncover key dynamics of this emerging phenomenon. An explorative case study method is utilized and complemented by additional data and overlapping research styles. A grounded-theory line of attack inspired us in terms of methodology (Glaser and Strauser 1967). Theory becomes grounded when the theory is emergent - discovered in the data and thus, the main categories, properties and processes evolve from the empirical work. We do not test or falsify existing theories: we rather try to make use of these as guidelines for investigation. As prescribed by the grounded theory approach we remain closely connected to the empirical reality.

We chose a case study approach since this is particularly well suited for research in emerging fields as ours, Eisenhardt (1989) claims. An explorative case study is an "empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin 1993:13).

5.1 Use of multiple methods and data sources:

We employ multiple data sources to systematically investigate individuals, groups, and organizations, as it is a preferable method when one seeks to understand or explain a phenomenon (Wimmer and Dominick 1994). The use of the overlapping research approaches as tools for data gathering and analyses: triangulation is by Denzin (1978) broadly defined as: "the combination of methodologies in the study of the same phenomenon". Analogous to navigation and military strategy triangulation can be said to use multiple viewpoints to locate an objects position (see. Smith, 1975) and may be used by the organizational researcher to enhance the precision of his conclusions by collecting different data related to the same phenomenon (Jick, 1979). Employing this method is adequate as we are studying an emergent phenomenon in a field in which prior knowledge is scarce but where multiple data sources are available. In the study we use 'netnographic' (Kozinets, 1998), interview, survey (questionnaire) and, archival (web-log) data. This allows us to crosscheck produced data and hence to validate, compare and control our results and ultimately to get a better interpret the phenomenon of interest.

5.2 Choice of case

The choice of the Propellerhead's community as the study object was made primarily for two reasons. First, it allowed us to study a setting in which both professional users and hobbyist users are present. The Propellerhead community attracts users that employ the music tools for professional work-activities as well as users that utilize the tools for hobbyist activities - that is, private joy related activities. Only in such a setting would we be able to assess our idea concerning innovating users being mainly professional or hobbyists. Secondly, the community was established by the product development firm: Propellerhead and thus, controlled by them and not as often the case created and regulated by the participating users.

5.3 Sources of information - four kinds of data - Getting background, nailing the phenomenon

1) Congruent with the exploratory nature of the research we initiated the study by using "netnographics" (Kozinets, 1998). Netnography is described as the textual output of Internet-related fieldwork and is in essence an interpretive methodology. By observing and participating in the community context we attempted to gain sufficient insight of the conventions, value and beliefs expressed through the practices and text of the Propellerhead online community. This was done to avoid major misunderstanding as we progressed into more delicate parts of the study. Therefore, we were involved in the communication and interaction on the Propellerheads online communities approximately one hour per day during a four-month period from January through May 2003. This effort provided us with vital insight and background needed to do well in studying our type of phenomenon and to gain access to the users and to communicate appropriately with them. We became aware of the "local language" of the community, the norms of communication, main user interests, current "hot" discussion topics etc.

2) A web-log was produced containing data about different quantitative aspects of the online communities such as: usernames, the activity of users, the interaction frequency between users, and which types of discussions users were involved in. As we had acquired the usernames of respondents for the web-based questionnaire that we initiated later, we were able to cross-check their past appearances and interaction frequency through analysis of the web-log data. This archival data was collected for a period starting 18 July 2002 through 10 March 2003 and hence, contains information for a period of roughly nine months.

3) Throughout the period of the study we conducted a number of interviews with both managers and administrators from Propellerheads and community involved users of Propellerhead products. The interviews were semi-structured denoting that for each interview the interview guide was adapted to take into account the particular context and position of the respondent. Initially, we consulted a musician and a colleague familiar with computer-controlled music instruments to put us on the right track from the very beginning.

The main bulk of interviews were carried out in May 2003 in parallel with the initiation of our web-based questionnaire. We had subsequently had correspondence with the majority of our respondents to gain additional information and to verify our inferences from our ongoing study. We carried out interviews with 9 individuals.

Table 3 – Interviews

Respondents	Number of interviews	Date of interview	Length of interview
CEO	3	March 2003	1,5 hour
		May 2003	30 min
		Nov. 2003	30 min
Firm's online community management	2	May 2003	30 min
		May 2003	30 min
Lead user	6	April 2003	3 hours
		May 2003,	45 min
		May 2003	30 min.
		May 2003	1 hour
		May 2003	30 min
		June 2003	1 hour

Two interviews with the same person were conducted to crosscheck answers received in earlier and other interviews. The interviews were carried out in order to get a deeper understanding of the functionality of the communities, the users' values, activities and incentives for participation, and the technicalities of the products as well as of the firm in question. The initial interviews of persons from the Propellerhead firm served as an important source of information since these provided data on: the nature of innovation related work by users, the way in which firm perceived the online communities and their function, data on the history and daily management of the communities and general firm strategies of innovation.

4) After gaining the necessary insights informed by interview and presence in the community we unleashed a web-based questionnaire to the Propellerheads communities. The questionnaire was launched 14 May 2003 and continued through to 18 June 2003 appearing on Propellerhead user community. The objective of the survey was to collect data on user characteristics particularly regarding innovative users.

The object studied: innovative users located in an online community, practically determined the choice of a web-based survey method a priori since our target group could not have been reached in other ways. The community goers were asked questions about: their background, community participation information, on community motivation, and subjects related to economic and innovation related issues. The questionnaire appeared in a separate pop-up window, when a registered community participant locked in to the online community for answering or posting questions. When completed the respondent submitted the questionnaire directly to our database. Due to consideration of the media and the social

context of the community we constructed the questionnaire to be short containing only 25 questions allowing respondents only to reply with 1-7 (Likert scale-type) answers or yes/no-type of answers¹⁰.

As indicated by Cobanoglu & Cobanoglu (2003) a non-cash incentive can be of use to enhance the response rate for questionnaire surveys. To enhance the response rate for our questionnaire we therefore in collaboration with the firm initiated a competition, where a number of participants who returned a filled out questionnaire could win a special Propellerheads t-shirt.

We are aware that a web-based survey design holds a number of possible biases. Roztocki (2001) notes particularly: multiple responses from the same person and various forms of empty or incomplete responses. To counter one such potential response bias we tested for the non-response problem that user innovators due to their general concern with the field might find it more interesting to participate in the survey than non-innovating users (Armstrong & Overton 1977). To exclude this possible response problem we examined if the earliest answering respondents compared to the later group of respondents diverged on significant variables. For example, we tested if we found a higher frequency of innovative users answering within the early part of respondents, which might imply an over-representation of innovators in our sample and thus, a general bias between our sample and the population of the community. No, such bias was discovered.

On the basis of the questionnaire survey we identified 34 innovative users, with whom we conduct a follow-up investigation. This was designed as a very brief questionnaire survey. 31 October 2003 we distributed questionnaires to 28 innovators identified through the first survey and whose email addresses could be obtained. The aim was to substantiate our findings on innovator's characteristics from the first questionnaire.

6. Background data and results - descriptive statistics, ordered Probit model, t-test, and assessing value of user innovations

Prior to analyzing the research questions we present below some background data derived from the questionnaire:

6.1. Descriptive statistics

6.1.1 Response rate

The questionnaire had a response rate of 62.7%. This informs us that out of all the community goers who were offered the questionnaire 62.7 % chose to respond. The total number of responses was 442 of which only 345 answers where valid for the multivariable

¹⁰ One variable of the questionnaire was however pure textual asking for concrete description on certain matters of innovation.

analysis due to missing values and internal consistency. For other statistical exercises 395 answers were found useful.

6.1.2 Innovativeness

User developed innovations proved on a first glance to be a limited phenomenon observable in the sample. Yet, about 8% answered yes to having innovated. This figure indicated that users do innovate and hence, act as co-developers in the product development processes. Further, 13 of these innovative users (3% of the total sample) said that their creation was new to the world at the time of revealing it. More than half of the users of the sample responded positively to the question; if they would like to make additional improvements to the products (54.8%), hence suggesting that there is a stronger wish to innovate than actually innovative behavior. In general the users' satisfaction level with the Propellerheads software instruments is high - more than 90% were content with the products. This implies a strong and allegedly loyal user base that appreciates the feature and functionalities of the company products.

6.1.3 Do users find it useful to participate in the community and how much time is spent there?

In the sample containing all users 52% find that 1 out of 2 serious questions are answered in a way that helped to solve a particular problem. More than 50% of the users find that 'Belonging to the community helped them to find people contributing to my ideas', and 37% indicate that they usually received assistance from people in the community. 66% of the users reported that they would ask the community again if they had a similar problem. 45% find that the single most important sources of information were the community of Propellerhead relative to sources of: manuals, other sources, face-to-face interaction and FAQ's. These results indicate that users generally rate the community as an important aspect concerning their use of the product. Finally, we were informed by the survey sample that most persons spend between 5-10 hours a week (35%) or 'more than 10 hours but less than 30 hours per week' (32%) interacting with Propellerhead product.

6.1.4 Income deriving from activities related to computer-controlled music instruments

From the analysis of the sample we learned that the majority of participants from the full sample (54.3%) do not earn money from their activities with Propellerheads instruments (i.e. sound production and processing), 24.2 % answer less than 25% of their income is generated from such activities. However, 10.4 % of users answered that they are professionals indicating that the activities of the Propellerhead products is part of their main source of income. More than 12% of the users claim that they work as salaried programmers and 15% that they are students. However, 57.7% of the users state that they have another occupation than within IT related programming or music/sound production. Almost 46% of the users of the survey maintain that they work as hobby musicians or sound producers.

6.2 Statistical method and variables

The focus here is the relationship between various variables of our survey. Given that data are discrete and inherently ordered we apply an ordered probit regression model as analytical tool in the estimation. On the basis of the qualitative work we had obtained a quite good sense of how we - in the terms of product-related community - should phrase and hint to what could be regarded an innovation.

6.2.1 Dependent variable:

Our dependent variable is user innovation¹¹. This variable is discrete and is constructed as follows. To test whether users had at some stage innovated they were first asked: have you developed modifications, add-ons or extras to Propellerhead's products? The following question was: "...If yes, do you think that your modification, add-on or extra was "new to the world" at the time it was developed? The respondent thus had to consider if they were innovative, and if yes, whether their innovation was of a novel nature.

Asking in this manner we were able to establish innovation as a discrete variable: If no innovation was reported innovation = 0. If users had innovated, but innovation was not new to the world innovation = 1. If a user reported having made an innovation that was "new to the world" innovation = 2. Hence, there are degrees of innovative performance in our model¹².

6.2.2 Independent variables:

Professional status

The degree to which a user can be considered professional or hobbyist was measured simply on user's reported income from the activities related to using computer controlled music instruments.

The question asked was: "How large a share of you income do you generate from activities of sound production and processing?" Answers could be provided on a scale containing 4 possible answers: 1) none, 2) less than 25%, 3) less than 50%, or 4) I am a professional, this is my main job.

Lead users

The variable Lead user is built from the Lead User Construct (Morrison et al., 2000) and entailed 3 questions identifying leading edge status of the users: 1) "I usual find out about

¹¹ Our proxy for innovative users is quite rigid as we only consider existing and completed devices as innovations. Users that "only" contribute with ideas, advice and insights is thus, not counted as innovative user in our sample. The choice to have a strict innovation proxy helps explain why our share of innovative users not high compared to other studies of user innovation present in Table 1 + 2.

¹² More than 75% of innovations claimed to be made by the innovative users identified in our survey, we cross-checked via our interviews and through search on the Propellerhead homepage and on the Internet to perform some kind of validity test regarding of the answers on innovative behavior from our sample. All the answers from our sample on innovation that we checked qualified as innovations.

new products and solutions earlier than others”, 2) “I have benefited significantly by early adoption and use of new products” and 3) “I have tested prototypes versions of new products for manufactures”

Each of these questions could be answered using a seven point Likert scale. The three items are then clustered into one single variable. As our independent variable - Lead user - was constructed from three variables we chose to perform a standardized Cronbach’s Alpha test. This test measures how well a set of items (variables) measures a single uni-dimensional latent construct (if the inter-item correlations are high, then there is evidence that the items are measuring the same underlying construct). Since the standardized Cronbach’s Alpha is 0.67 the variable has an acceptable degree of internal statistical validity - i.e. good reliability.

Sources of recognition

The variable for recognition was built from simple binary questions - users were two such questions: 1) “Is recognition from other community goers is my greatest reward? 2) “Is recognition from the Propellerhead company a great reward? Answers could again be provided on a 7 point Likert scale.

6.3 Results – Probit regression analysis

The table below (4) presents the results of the ordered probit analysis of the relation between user innovation and characteristic of users in the Propellerhead user community.

Table 4: Regression analysis results explaining innovative activities at the level of the individual user of the Propellerheads community (n=345).

Variable	Coefficient	Standard Error	P-value
Constant	-3.660	0.917	0.001
Professional	-0.308	0.131	0.019
Lead user characteristics	0.860	0.032	0.008
Reciprocity belief concerning assistance	0.685	0.092	0.458
Critical for my business	0.883	0.056	0.875
Enhance career opportunities	0.529	0.080	0.510
Peer recognition	0.674	0.077	0.381
Firm recognition	0.174	0.074	0.019
Log likelihood	-106,159		
Restricted log likelihood	-118.805		
P-value for log likelihood test	0.00067		
Pseudo R square:	0.11		

With regard to the first question guiding our research, the findings show that innovating users are not likely to be professional users. The coefficient for a relationship between professional user and being innovative is negative and significant at the 2 per cent level.

The coefficient of lead users related to innovation by users is positive and significant, suggesting that users that reported having innovated are likely to be of the type “lead users”. Hence, users that comprise lead user characteristics will be more likely to innovate than ‘ordinary’ users in the same population. The estimation for a relationship between Lead user characteristics and being innovative is positive and highly significant at the 1 per cent level.

The coefficient of user innovation being related to peer-recognition is positive but not significant, hence not lending support to the notion that innovative users are likely to be responsive to peer-recognition. However, the coefficient of user innovation being related to firm-recognition is positive and significant, suggesting that users that innovate to a certain degree are driven by the desire to get recognized for innovative behavior by the firm rather than by peers. The coefficient for a relationship between peer-recognition and being innovative is not significant (p-value 0.381), while the coefficient for a relationship between responsiveness to firm-recognition and being innovative is positive and significant at the 2 per cent level.

Beyond the results mentioned above, the impact of control variables on the performance was largely as expected. An additional analysis of the marginal effects of the model (see Appendix XX) found interestingly that innovative users are most likely to generate mainly incremental-type-innovations, not new-to-the world radical innovations.

6.4 Differences between innovator and non-innovators – t-test

For the two user groups focused on: non-innovators and innovators, we discovered a few additional interesting aspects augmenting our analysis of the characteristics and behavior of innovative users. We used t-test for independent samples for this purpose.

By performing t-tests we discovered the following statistical significant relations between the user groups:

Table 5: Selected results of t-test of relationships between the answers from the two groups of the survey sample: innovators and non-innovative users (Innovators: n= 34; non-innovators: n=395)

Statements and questions	Mean for innovators	Mean for non-innovators	P values
I would like to make improvements to the Propellerhead product	0.76 (0.44)	0.55 (0.50)	0.02
I would use Propellerhead products if it could not be modified or customized	0.59 (0.50)	0.78 (0.42)	0.02
Belonging to the community helped me find people contributing to my ideas	5.21 (1.84)	4.29 (1.97)	0.01
I usually have received assistance from people in the community when improving or developing products	4.53 (1.72)	3.72 (2.06)	0.031
Reason for participation; to answer posts	0.65 (0.49)	0.40 (0.49)	0.005
Reason for participation; for fun	0.82 (0.39)	0.66 (0.48)	0.05
Participating in the community gives me a feeling of accomplishment	4.97 (2.00)	4.19 (1.88)	0.02
My experience gained in the community raises my skill level of programming	4.19 (2.09)	3.19 (2.18)	0.013

Standard deviation presented in parentheses.

6.4.1 Interpretation of t-test results:

As it is well known the t-test is not as robust a statistical tool as the multivariable regression analysis in determining relationships between groups. However, interesting quite strong insinuations about group differences appeared when this type of test was performed between the innovators and the non-innovators on selected variables.

We established that there is a statistical significant relationship at the 2 per cent level between the innovators and non-innovators regarding the wish to make improvements to the products. When comparing the means of the groups we come to the result that innovators are more inclined to improve the product than non-innovators. This may not come as a major surprise, but is nevertheless an important result showing that those who want to innovate is generally also those who have proven capable to do so.

Innovators and non-innovators also have a weak relationship on whether they would use Propellerhead product if it could not be modified or customized. The results suggested that innovators value having a modifiable product higher than non-innovator do.

An interesting finding is that there is statistical significant relationship at the 1 per cent level considering how positive an attitude they present towards the statement: 'belonging to the community helped me find people contributing to my ideas'. The means reveal that a larger number of innovators relative to non-innovators recognized "belonging" as important. Hence innovators seem to be more positive about the community as a source of ideas and problem-solving than do non-innovators. The need for collaboration and active partaking in the user-community is also supported by the result of the t-test between the two user groups concerning the validating the statement: 'I usually have received assistance from people in the community when improving or developing products'.

A somehow similar result can be interpreted from looking at the statistical supported difference between the groups regarding reasons for participation in the community. Innovators rate the reason to answer posts from other users of the community higher than non-innovators. In consequence, innovators can be interpreted to value reciprocity and mutuality higher than non-innovating participants.

Also, we find the same tendency supported by regarding the answers of participating in the community for fun. Here again there is a statistically significant difference between the groups, where innovators score a bit higher than non-innovators on the positive side. In sum these findings underlines our perception that innovators in general are more involved and at least put a higher value on the interaction with the community and its related activities.

For all users the user community functions as a space for getting the latest information on the product and the use of it but also as a space for various forms of learning processes to unfold. For the innovative segment of users the Propellerhead community operates as a meeting place for advice and exchanges of experiences on how to solve certain mainly technical problems and thus, as a mechanism for reassembling of dispersed knowledge. This seems not to be as important in the case of non-innovators.

Furthermore, innovators and non-innovators differ statistically significant at the 1 per cent level on their view on the experience and skill enhancement gained through the community. This lends support to an underlying idea that innovators generally obtain more innovative capabilities by participating in the community, and generally that this group associate enhancement of their skills more with the community than non-innovators do.

6.5 Innovative users' characteristics – findings from the follow up questionnaire

From our second qualitative survey 28 questionnaires were sent out on email as well as an attachment. We received 13 completed questionnaires¹³, thus adding up a response rate of roughly 46%. The Figure 1 below outlines the results of the second questionnaire on innovative user characteristics:

Figure 1: Background and characteristics of the innovative users: Main output of the second questionnaire survey

- Average age of the innovative users: 29 years (min: 17, max: 40)
- Educational level, minimum: 6 persons holds a bachelor or university degree, 4 persons a high school or college degree and 3 persons a lower, other or non education.
- Jobs types: 4 persons are students & teachers, 4 persons hold IT related jobs, 2 persons have artistic related jobs, and 2 persons hold business jobs, one person has a job out of these categories.
- Share of income from music production: 1 person above 90%, 1 person above 10% and 11 persons less than 5%
- Share of income from software programming: 3 persons above 90, 1 person above 10% and 9 persons less than 5%
- All the users rate both: user to user, firm to user and user to firm interaction as significantly important for achieving g and supporting user innovation
- All innovative users have been in contact with the firm by personal email and some also by fax (1 person) and face to face (1 person)
- 5 of the innovative users state that they have developed innovations for other products than Propellerheads
- Innovative users are motivated by enjoyment and additional needs of feature from the product they deny to be motivated to make innovations by money or reputation concerns
- All but one of the innovative users would develop innovations for the firm on demand
- 6 of the users rates specifically firm recognition as an important motivation for them
- All but one of the innovative users have shared their innovation with others but 31% claim that they innovate basically to serve their own needs.
- Only 2 of the innovative users have received money or sold their innovative efforts
- The users rate negatively if their contribution has been integrated into Propellerhead products but rate positively that they wish their innovative contribution is integrated later
- The innovative users rate negatively that they develop innovations because the Propellerhead products lack certain features
- Users share their innovation mainly with the Propellerhead community
- 4 innovative users claim that they have created their innovation on the earlier work of other users

6.5.1 Interpretation of the second questionnaire findings

The first observation we make from our second survey is that all innovating users are young males that are involved with the educational system or working information technology jobs.

¹³ Two users did not receive the emailed questionnaire, one did not want to participate, and twelve have not (yet) responded.

They are generally well-educated - 33% hold a high school or college degree and 46% a bachelor or university degree.

The findings show that users are generally not working professionally in areas such as music production or music tools development. However, an important share does work in jobs concerning information technology – a factor that may explain innovative ability in this strong IT related field – many innovative users hold a profession within software programming rather than within the music field.

A surprising finding is that 39% of the innovative users have also developed innovations for other products than Propellerhead's. This may indicate that a large share find the innovative act natural may be more of a personal characteristic than triggered by interest for Propellerhead's products only. They also report mainly innovating for the fun of doing so and for serving their needs for additional product features. Hence, innovative users seem to like developing innovations, but they seem not to be faithful to innovating only to one product – their innovative efforts are not solely reserved for the Propellerhead products.

The innovative users innovate not only because the Propellerhead products lack special features but also because it is a hobby and because innovative work is enjoyment - innovation is generally not for economic benefits. Only a minor share of the population (13) has received monetary compensation in return for innovative efforts. This is generally in concordance with earlier findings from the Open source software movement (Hars and Ou, 2001, Lakhani and von Hippel, 2003). However, additionally innovative users of our sample indicate their willingness to innovate on demand to serve manufacturers. They generally respond to recognition from the firm, and they would rather than not see their innovations integrated in a commercial product.

Significant to this form of organization, innovative users indicate vast willingness to share their innovations with other. This of course makes it possible for others to enjoy their innovation, but what is more it also enables others to build on existing innovations – almost one third innovating users respond having build their innovation on earlier work by other user innovators.

6.6 Assessing the value of user innovations

We have developed a qualitative assessment of the worth of innovations partly based on assessment statements from the firm. We learned from interviews that user innovations are highly valued by the firm and by other users because they create both useful complementary features and hence generates additional value for the original product but also, initiate productive discussions on the online community. User innovations also prolong the product-life, since users tend to interact with the product for a longer time due to the new and enhanced options.

An innovative user have, for example, developed a software application that makes the computer-controlled music instrument (Reason) able to work in sync with living pictures (i.e. movies, TV, etc.). In this way user innovation has dramatically expanded the scope of

the product and possibly opened up new potentials for Propellerhead. However, such type innovation is of the radical kind, which users do not typically produce.

More frequently, value comes in form of incremental-type user innovation that fits within the boundaries of the traditional music/sound production product field of Propellerheads. An example is the invention of the so-called mouse wheel control application (for the product Rebirth), which substitutes the music keyboard as the main control unit for product. The mouse wheel application has been incorporated as a standard feature of the later product Reason and will properly remain a component in future Propellerhead products.

These are a few of numerous examples illustrating how a firm obtains important innovation without directly investment in product development.

To make a value assessment of the innovations studied, we compared the user innovations (mods) to the same type of innovation however, developed in-house by Propellerhead to accompany their release of the second version of the product Rebirth.

According to a firm manager it took an experienced Propellerhead product developer approximately 100 – 150 hours to create a mod comparable to the user innovations. The average salary for privately employed software developers in the Nordic countries is approx. 30 Euro per hour¹⁴. The time consumed to create a mod may then be calculated to wage per hour and as such exchanged into a monetary measure summing up to about 3000 – 4500 Euro per mod developed. Approximately between 50-100 mods has until now been created by users and mainly just for one of the three main Propellerhead products (Rebirth) indicating both an important value creation process embarked on by innovative users as well as an latent potential related to users modifying or augmenting the scope of use for other Propellerhead products.

Again according to a manager, the firm deliberately tries not to do product changes in the field taken over by the user innovations, to not compete with users - the firm rather focuses on other aspects of product development. It was furthermore articulated that a large number of innovations by users are regarded as an extra spice on the Propellerhead products and hardly any of these innovations would be developed intentionally in-house.

7. Discussion and conclusion

We have analyzed qualitative data and survey data on a user community and the connection to a firm in computer-controlled music instruments development. The study setting was well suited to for our purposes of studying user characteristics as there were innovative users present of both professional and hobbyist types. We studied questions of user characteristics in a setting in which a commercial manufacturers host an online community for users, and hence is able easily to tap into the vast innovative efforts carried out in the context of its user

¹⁴ This information was acquired 19. Nov. 2003 from the Danish labor union for IT employees (Sam-Data).

environment. The efficiency of such organizational form for product development as R&D may be highly sensitive to the questions that we have dealt with. Especially, we were interested in the characteristics of those who deliver the innovative content in user communities – namely the users.

Recall briefly the three research questions: 1) Are innovative users professional users or are they hobbyist users? 2) Are innovative users lead users? 3) What motivates innovative users to participate in innovative consumer communities?

Professionalism did not seem to have a relation to that of being an innovative user. Our analysis of the characteristics of user based in a firm-established user community points out that innovative performance by users do not correlate with being a professional. Although one may argue that professional user (typically employed in firms) would have significant economic gains from innovating one might on the basis of our results rather expect innovation to appear from communities in which hobbyists make up the majority of users. The economic benefits that professionals might derive from in-house use of an innovation do not seem to beat innovation investing by hobbyist in fulfill their own needs. What seems to be appearing is that hobbyist users fill small niches in the periphery of the market where firms have not acute interest or incentive to invest in. In doing so user created innovations sometimes - useful to the firm - are developed. The firm has an “easy pick up place” via the community in where users will typically present and share their innovations. Such options for the firm clearly assume a degree of capabilities for identifying and integrating the productive bits of innovations ‘flowing’ in the user community. Furthermore, all innovators of our sample have report having a tight contact to the firm indicating that information flows relatively frequent between the two domains.

We find that innovative users often are at the leading edge of their field – they are *lead users*. As mentioned such users are ahead of the market in terms of discovering new product concepts, opportunities and connection to other products and may therefore be considered of major importance to the quality progression of the innovations produced. That this should not only be assumed can be interpreted from the value assessment in which firm personal states that the value of the user innovation surfacing in the community may be of a high importance. This significance applies for both incremental type innovations and for innovations of a radical character.

Additionally, one needs to take note that the high quality of user innovation may be a double-edged sword in cases where user innovation becomes a substitute rather than a complementary add-on to the manufactures product. When the former is the case firms may become unable to capture rent from their future developments. In other words user innovations will possible block firm’s profits. When the latter is that case (i.e. user innovation is complementary to firm products) then user innovation may be of great value. Our findings show that the firm in question wisely do not compete with user innovation, but encourage user-type innovation to happen in selected areas such as in the mod-field described. Such consideration may be refined in real strategy in which the firm decides

exactly in which areas it wants to “open up” products to user innovation activities and in which areas it will eventually take hackers to court. Such strategy may also contain a number of considerations about how to structure product technology in the best way in order to obtain the most beneficial degree of openness – that invite consumers to undertake certain tasks and not others for the firm. User toolkit for innovation (Thomke and von Hippel, 2002) is a concept developed to capture such firm structuring strategy and intention.

We found no significant correlation between being an innovative user and being motivated by a wish for *recognition from peers*, as suggested by Lerner and Tirole (2002). However, there was a relation between being an innovative user and the wish for *recognition from the firm*. First of all, this sort of finding would not be found in the open source software movement, as no firms are directly involved in the manner described in this paper. The finding is interesting in the sense that it opens up a new perspective for motivation in a setting where a firm is more openly involved in the evolution of the community. Besides, it opens up a scope for management in terms of how the firm chose to provide valuable recognition. That is how the firm may choose to allocate its valued, but “free” (to the firm), recognition to motivate users.

But the question remains, why is recognition from the firm so important to innovators? We believe that innovative user may have career concerns and entrepreneurial visions, which are more likely to come true if the user innovator has been acknowledged individually by the firm in front of a crowd of fellow product users. However, reputation need not come directly from the firm – recognition from a respected user, which has already a good reputation in the firm domain, can be valuable exactly because of this user’s status as reputed by the firm. In this sense reputation is interpreted as a transitive element. However as we did find no evidence of peer recognition being important to innovative users, we believe that users may perceive direct recognition from the firm, which is visible to other users, as the most effective source of reaching higher-level status as innovator. In other words the firm is “the mother of reputation” in front of whom “career concerned” users will like to show off their innovations, get recognition and become reputed among peers for having achieved firm recognition.

Inferred from the findings of our case this form of organization seems to contain a large, yet unrealized potential, embedded in the many users that report willingness to undertake innovative work but do not currently do so. The innovative potential thus seems to extend far beyond those that actually do innovate. Different support features from the firm would possibly be needed for these users to upgrade their innovative competencies. One promising feature of this organizational arrangement is the abundant willingness especially by innovative users to respond and support other users – ‘end user level horizontal learning’.

The story told in this paper fits with the broader level observation that knowledge production in the society at large is becoming increasingly distributed, complex and diversified (Gibbons et al. 1994). Thus, the external sources of innovation are increasing in importance for firms for building competitive advantages. Nevertheless, the observation of

especially users adding to the innovation process of the online communities in question somehow challenge the assumption that that innovation solely take place in the context of the institutions of the firm and in networks of firms. The point of a distributed somehow self-organized innovation process was made by von Hippel (1977). However, we have focused on a deliberately organized form of such an innovation process through a firm initiated establishment of a user community and on some of the most important question about the characteristics of user driving this organization towards innovation.

7.1 Limitations and implications for further research

First, clearly we are limited in making wide generalizations by only studying one case of user innovation. Secondly, the particularities of the products, modes of production and use of media (i.e. the Internet) within the industry and the software industry in general may also represent a limit to generalization of the insights generated in this paper. Further research should fruitfully address the differences between the Internet setting and physically based communities – hence adding to Franke and Shah, and Luthje’s research on user communities but go a step further and identify the effects on the industry firms which products are being innovated. Studying the phenomenon of user driven innovation in a setting located outside the software industry would potential show where variations might be identified.

References:

- Armstrong, S. J. and Overton, T.S., 1977, Estimating Non-response Bias in Mail Surveys, *Journal of Marketing Research* 14, 396-402
- Barney, J. 1991, Firm Resources and Sustained Competitive Advantage in *Journal of Management* 17, 1, 99-1221
- Chesbrough, H.W., 2003, The Era of Open Innovation in *MIT Sloan Management Review*, Spring, 35-41
- Cobanoglu, C. and Cobanoglu, N., 2003, The effect of incentives in web surveys: application and ethical considerations, *International Journal of Market Research* 45,4, 455-488
- Cohen, W. M. and Levinthal, D.A., 1990, Absorptive capacity: A new perspective on learning and innovation, *Administrative Science Quarterly*, 35, 1, 128-153
- Deci, E. L., 1975, *Intrinsic Motivation* (Plenum Press, New York and London).
- Denzin, 1978,
- Eisenhardt, K., 1989, Building Theories from Case Study Research, *Academy of Management Review* 14, 4, 532-551
- Enos, J.L., 1962, *Petroleum Progress and Profits: A History of Process Innovation*, (MIT Press, Cambridge, MA).
- Franke, N. and S., Shah, 2003, How communities support innovative activities: An exploration of assistance and sharing among end-users, *Research Policy*.
- Freeman, C., 1968, Chemical process plant: Innovation and the world market. *National Institute Economic Review*, 45, 2957.
- Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., and Trow, M., 1994, *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies* (Sage, London).
- Glaser, B.G. and Strauss, A., 1967, *The Discovery of Grounded Theory: Strategies for Qualitative Research* (Aldine Publishing Co, Chicago, IL).
- Hamberg, D., 1963, Invention in the industrial research laboratory, *Journal of political economy*, 71, 95-115.
- Hars, A. and Ou, S., 2002; Working for Free? Motivations for Participating in Open-Source Projects. *International Journal of Electronic Commerce*, 6, 3, 25-40

Henkel, J. and Thies, S., 2003, Customization and Innovation - User innovation Toolkits for Simulator Software, in: Proceedings of the second Interdisciplinary World Congress on Mass Customization and Personalization, Munich, Germany.

Herstatt, C. and E. von Hippel, 1992, From experience: developing new product concepts via the lead user method: a case study in a low "tech" field, *Journal of product innovation management*, 9, 213-221.

Jeppesen, L. B., Molin, M.J. 2003, Consumers as Co-developers: Learning and Innovation Outside the Firm, *Technology Analysis & Strategic Management*, 15, 3, 363-84.

Jeppesen, Lars B., (2002). The implications of user toolkits for innovation, Working paper WP-02-09, Copenhagen, Copenhagen Business School.

Jick, T. D. 1979, Mixing Qualitative and Quantitative Methods: Triangulation in Action, *Administrative Science Quarterly*, 24, 4, 602-12.

Johnson, R. and M. Gibbons, 1975, Characteristics of information usage in technological innovation, *IEEE transactions on engineering management*, 27-34, EM-22.

Jokish, 2000,

Knight, K.E., 1963, A study of technological innovation: The evolution of digital computers, unpublished Ph.D. dissertation, Carnegie Institute of Technology, Pittsburgh, PA. (cited in Morrison, P.D., J.H. Roberts, and E. von Hippel, 2000, Determinants of user innovation and innovation sharing in a local market, *Management Science* 46, 1513-1527).

Kozinets, R.V., On netnography: Initial reflections on consumer research investigations of cyberculture, *Advances in Consumer Research*, 1998, 25, 1, 366-72.

Lakhani, K. R. von Hippel, E., 2003, How open source software works: "free" user-to-user assistance, *Research Policy*, 32, 6, 923-943.

Leonard Barton, D., 1995, *Wellsprings of knowledge: building and sustaining the sources of innovation*, (Harvard Business School Press, Boston)

Lerner, Josh & Tirole, Jean, (2002), "Some Simple Economics of Open Source," *Journal of Industrial Economics*, Vol. 50, No. 2, pp. 197-234.

Lilien, G., Morrison, P.D., Searls, K., Sonnack, M.. and von Hippel, E., 2002, Performance assessment of the lead user generation process for new product development, *Management science*, 48 (8), 1042-1060.

Lüthje, C., 2000, Characteristics of innovating users in a consumer goods field, forthcoming in *Technovation*.

Lüthje, C., Herstatt, C. and von Hippel, E., 2002, "The dominant role of "local" information in user innovation: The case of mountain biking" MIT Sloan school of management working paper (July).

March, J.G. and Simon, H. A., 1958, *Organizations*, (Wiley, New York).

Marshall, A., 1925, *Principles of economics*, (Macmillan, London).

Morrison, P.D., Roberts, J.H. and von Hippel, E., 2000, Determinants of user innovation and innovation sharing in a local market, *Management Science* 46, 1513-1527.

Pfeffer, J., 1990, Incentives in organizations, in: O. Williamson (Editor), *Organization Theory*, (Oxford University Press, New York) 72-98.

Rosenberg, N., 1976, *Perspectives on technology*, (Cambridge University Press, New York).

Rothwell, C., Freeman, C., Horlsey, A., Jervis, V.T.P., Robertson, A.B. and

Roztock, N., 2001, Using internet-based surveys for academic research: opportunities and problems, in: *Proceedings of the 2001 American Society of Engineering Management (ASEM) National Conference*, Huntsville, AL, pp. 290-295.

Schumpeter, J. A., 1934, *The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest and the Business Cycle* (Harvard University Press, Cambridge, Mass. US)

Schumpeter, J. A. 1942, *Capitalism, Socialism and Democracy* (Harper & Borthers, New York, US)

Shah, Sonali (2000) Sources and patterns of innovation in a consumer product field: innovation in sporting equipment, Sloan working paper #4105.

Shah, Sonali K. 2003, *Community-Based Innovation & Product Development: Findings From Open Source Software and Consumer Sporting Goods*, Chapter:1, Ph.D.-thesis Massachusetts Institute of Technology, Cambridge, MA

Townsend, J. 1974, Sappho updated – project Sappho phase II, *Research policy* 3, 3, 258-291.

Tushman, M.L. and Katz, R.. 1980, External communication and project performance: an investigation into the role of gatekeepers, *Management science*, 26 (11), 1071-1085.

Urban, G., and von Hippel, E., 1988, Lead user analyses for the development of new industrial products, *Management science* 35 (5), 569-582.

Vanderwerf, P, A., 1990, Product tying and innovation in U.S. wire preparation equipment, *Research Policy*, 19, 1, 83-96.

von Hippel, E., 1976, The dominant role of users in the scientific instrument innovation process," *Research policy* 5, 3, 212-39.

von Hippel, E., 1988, *The Sources of Innovation*, (Oxford University Press, New York).

von Hippel, E., 2001, Innovation by user communities: Learning from open-source software, *MIT Sloan management review*, 42, 4, 82-86.

von Krogh, G., Spaeth, S., Lakhani, K. R., 2003, Community, joining, and specialization in open source software innovation: a case study, *Research Policy*, 32, 7, 1217-1241.

Wernerfelt, B., 1984, A Resource-based View of the Firm in *Strategic Management Journal* 5, 171-181

Wimmer R. D. and Dominick, J. R., 1994: *Mass media research an introduction* (Wadsworth, CA)

Yin, R., 1993, *Applications of case study research*, (Sage Publishing, Beverly Hills, CA)

Insert Appendix 1

The nature of the user created innovations

To add substance and details to what kinds of innovations, we examine table XX below was created. Also, presented is a small selection of various innovations made by users identified by our questionnaire.

All innovations are differently related to activities concerning sound production, processing and organizing using computer controlled music instruments. The innovations can be classified into three main groups:

- 1) Innovations related to content (i.e. song or sound production and process for example samples or refills).
- 2) Innovations referring to technological elements (i.e. patch files, mods or applications for design or other add-on features, for example mods for the product Rebirth, which combine sound samples and design aspects or minor programmed applications as; specialized calculators for the product called Reason or 'Pattern Master for Rebirth to edit ReBirth patterns'.
- 3) Innovations developed to solve problems of interfaces or hardware/interface connections (i.e. rack modules or 'creative use of hardware').

A rough interpretation and classification of the comments from innovative users on the content and style of their innovations reveals that 6 of the comments refer to category 1 innovations whereas 15 comments can be categories under group 2, while 5 comments are placed in category 3. This emphasizes that the user created innovations are quite different in content attributes from each other but that the main bulk of the innovations have a technical nature rather than artistic element to it.

Furthermore, the table contains a list of 28 comments made by the innovative users¹⁵. The illustration highlights qualitative topics such as: 'if the innovators consider their efforts as innovative, how they describe their achievements, as well as why they have done the innovation. Such pieces of information are addressed implicitly in the paper.

Table 6: Categorization of achievements of innovative users' efforts and their related comments


Community user name of innovators	Innovation category	Statement on the character of the innovation
Wwwobbler	2	Uh, jag började faktiskt att rita ett skin till en ny modul. Bara för att se om jag skulle kunna matcha den grafiska standarden som gäller idag. Raytracade animerade knobs, hittade på en logotyp å så.. ja, lekte mest iofs =>
Abraxis	3	Additional Useful "Rack Modules"
Niklas	2	Home made modifications that were for my pure entertainment only.
AndersPier	3	It is not really a mod. I use MidiOX, and have found a method to get my 13 knobs - mapped to 1664 (by using program changes). So now "I can use knobs all over" Reason, wv though I only have 13 physical knobs on my keyboard :-)
DJDM	1	Custom patches for the Malstrom (Reason Synth).
Divstah	2	Rebirth mod for Rebirth 2.1. Both graphic and sounds. Graphic: light and blurry. Sounds: many pads and stabs. Mainly for ambient.
nitro2k01	2	A midi arpeggiator that was never public
Flashmofo	3	creative use of hardware and midi implementation
Robotovat/jonyo	2	MIDI input remapping application for use with Reason


¹⁵ All quotes laid forward in the table are adopted directly from the questionnaire and thus, presented without any correction for the innovators own use of signs or spelling.


Johnpil	2	Small applet to temporarily set dual monitor setup to 800x600 or other preset res while in Reason, then restore on exit.
Vector	1	A lot of refills and sound banks.
Peff	2	I created the first official ReBirth Mod :-)
Ninjadog	2	Someone showed me a homemade Tape Ecco Effect. It was very complex and I still can't replicate it from scratch, but I made a few cool fx by trying.
RykThekreator	2	All 3 of my inventions are currently residing under the care of Propellerhead Software. Once I know whether either will be used or not, shall I then be able to release them. 2 of them had been built into modular synthesizers by me, between 1996 and 1998.)
Janvc	2	Reason 1.0 javascript LFO-sync calculator (does that count or didn't i understand the question?)
Beatmincer	2	LFO setting --> BPM calculator for reason 1.0
Lawbreaka	1	Various Refills with Song Templates and Sampler Implimentations
Einzelganger	2	ReBirth Mods
Supraphonic	1+3	Additional samples, rewiring Reason
DJVampeal	1	Ripped samples from my cousins synthesizers, and put them into ReFill format.
Jonas	2	Rebirth mods
Tunein	1	new samples/loops.
Suma	2	Rebirth mods
Aenforever	1	I've just made a few drum mods for rebirth, stansard loop chopping stuff.
Mschill	3	Pattern Master for Rebirth to edit ReBirth patterns in a piano roll view. http://www.mschill.com/patternmaster
zx81	2	rebirth mod with own sounds


What are user-developed innovations – really?

The examples below exemplify concretely what kinds of innovations for Propellarheads products we discuss. Please note that some innovations presented at the Propellerheads homepage are created by minor commercial firms mainly set-up by entrepreneurial users often as laptop firms only having a web-page as their window towards a possible market.

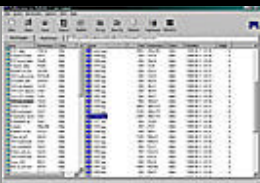
<p align="center">QWERTY Note Input v1.1 by Robotovat</p> <p>This little program lets you play MIDI notes from your Mac's computer keyboard. You can use OMS's IAC to transmit notes to Reason. QWERTY Note input is Freeware.</p>	
---	---

<p align="center">ReVision 1.1 by Granted Software</p> <p>Makes soundtrack composition a bit more convenient by allowing a QuickTime movie to be played in sync with Reason. The latest version of ReVision holds new features such as tempo and time signature changes at the marker locations. It's also got AIFF and Movie export and better timecode handling.</p>		<p>Get it from the Granted Software website</p>
---	--	---

<p align="center">Digalog By Einzelgänger.</p>		<p>Long time board veteran Einzelgänger has made this very electronic sounding and synthetic looking mod. The interface is a very plastic blue and the sample set offers lots of bleeps and synthetic percussion sounds.</p>
---	---	--

<p align="center">minimod By Peff.</p>		<p>The house producers toolbox! Peff's minimod has an excellent sample set that includes house organs, house basses, house pianos, stabs, bleeps and much more. The beautifully crafted GUI makes you think of a certain old synth brand...</p>
---	---	---

<p>Extra interface utilities - Pattern Master 1.01 by Matthias Schill</p> <p>Are you confused by the 303 programming interface? Wish you could edit 303 patterns visually? Now you can! Pattern Master is a tool to program 303 patterns using a piano roll view. The program can save and open .rbs files so that you can edit songs made in ReBirth.</p>		<p>ETP-Sweden (267 kb)</p>
---	--	--

<p align="center">ReNovator 2.0 by Florian and Rob1</p> <p>ReNovator is a tool that assists you in creating mods by keeping track of all the files needed in your mod. It also has an image viewer and a very handy tool that lets you preview your mod without actually building it. A must if you build mods on a PC!</p>		<p>ReNovator homepage</p>
--	--	---

Insert Appendix 2 - Remains to be done!

- Appendix IIa: The parts of the questionnaire related to the results presented:
- Appendix IIb – The complete questionnaire posted to the Propellerhead Community

Insert Appendix 3

Table 7 shows the marginal effects for the ordered Probit model

Variable	INNO=0	INNO=1	INNO=2
Constant	0.4152	-0.2616	-0.1537
Professional	0.0350	-0.0220	-0.0129
Lead user characteristics	-0.0098	0.0061	0.0036
Reciprocity belief concerning assistance	-0.0078	0.0049	0.0029
Critical for my business	-0.0010	0.0006	0.0004
Enhance career opportunities	-0.0060	0.0038	0.0022
Peer recognition	0.0076	-0.0048	-0.0028
Firm recognition	-0.0198	0.0124	0.0073