

How User Community Sponsorship Can Impact the Creation, Adoption and Dissemination of Innovation

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Abstract

Innovation often comes from users themselves. Efforts to involve end-users can be driven by the companies hoping to market innovations or by communities. We examine the economic factors relating to corporate driven test-beds and community-established laboratories. While innovation may be the main motivator in operating a test-bed, spreading knowledge and stimulating the use of new solutions is also valued. Our experience with the latter will be drawn from several Living Labs within Europe.

Keywords: End-user testing, user innovation, Living Laboratories

1. Introduction

Innovation in goods and services benefits individuals, firms, countries, and regions. Indeed, both firms and government agencies actively try to stimulate innovation. The Boston Consulting Group (BCG 2006) recently reported that 72 percent (an increase from the previous survey) of the executives they surveyed ranked innovation in the top-three strategic priorities. The European Commission (CEC 2006) states, "Europe cannot compete unless it becomes more inventive, reacts better to consumer needs and preferences, and innovates more."

Users are often the source of new products and services. These innovations can range from something as simple as a new t-shirt design (see threadless.com), to as in-depth as new uses for biosensors (see Harrison and Waluszewski 2008). For more complex products, von Hippel and Schrage (2007) state, "Ingenious leading-edge users not everyday consumers or profit-focused producers ... drive innovation".

User-innovators can be individuals or employees of firms. Once an innovation becomes well-enough known, firms may attempt to market the innovation. Firms can also attempt to stimulate user innovation by establishing settings where users can experiment with existing or proposed goods and services. As innovation benefits the population at large, government agencies also attempt to stimulate the development of new goods and services. The form of government stimulation addressed in this paper is public-private semi-permanent user communities, often referred to as Living Labs (see, for example, Corelabs). These communities usually have a strong regional focus.

While both firms and populations benefit from innovation, the strengths, economics, benefits, risks, and constraints of firm-based and public-sponsored environments will differ. We will examine environments that stimulate innovation and discuss the conditions as they impact private firms and public entities.

Groups of users can be helpful in other ways beyond innovating new products and services. The operator of a testing network may wish to test a new idea with a broader user group that may be more indicative of the mainstream user. They may also wish to educate potential users about new possibilities, or may wish to broaden the acceptance and use of existing solutions.

The three groups users identified above, innovators, early adopters, and mainstream users, can be seen as relating to different definitions of customer-driven quality as often discussed in operations management texts and literature. In operations management, quality can be described as:

1. Conformance to Specification
2. Fitness for use
3. Psychological Impressions

The first is often considered to be the designer's or engineer's view. The risk is that they wish to create products that do many clever things in clever ways. The customer often wants simple solutions for their main use. This mismatch between designer values and user desires can lead to problems such as the famous "flashing twelve problems" found on DVD and VCR players. A thorough description of this mismatch can be found in Cooper (1999).

The second can be attributed to the quality guru Joseph Juran (1999, p. 4.20). Juran is often quoted as saying quality is fitness for use. In our setting we must ask, "fit for whom?" While we are always concerned with fitness for the user, different categories of users defined above have different requirements and desires. An innovator is often on the leading edge of a trend and is willing to experiment with new, untested ideas. Early adopters like to use and be seen with new products, but not experimental. Mainstream users adopt products once their value has been demonstrated by early adopters or when the products have become trendy.

This leads to the third definition of quality. Often, once a product reaches the mainstream user, features that had high fitness for early users become style items that are no longer fit for actual use but are adopted because of image – a psychological consideration. The popularity of SUV's for so many family would be a recent example of this. Mini-vans (people-movers) beat SUVs in terms of fitness of (actual) use for the typical family, but for many families, SUVs broadcast a more desirable image.

The next section (2) discusses the life cycle of user driven innovation. Section 3 will deal with firms attempting to stimulate and exploit user driven innovation. This will be followed in Section 4 by a description of the European *Living Labs* approach. Section 5 will compare the conditions where one approach may have an advantage over the other. This section will also discuss particular innovations from both approaches, and the use of the Living Labs approach to spread knowledge and stimulate use of new solutions. Our conclusions, in Section 6, will point out areas where the public-private approach has and can benefit society, where corporate sponsorship may be agile, and recommend further efforts in this direction.

2. User Driven Innovation

Whether a development and testing environment is operated by a private company, a community of enthusiasts, a government sponsored entity, or a partnership, one of the goals is to stimulate creativity and new solutions. Firms may formally employ designers and research personnel in labs (such as General Electric's Global Research Center in Niskayuna, New York and the Philips High Tech Campus (formerly Natlab) in Eindhoven, the Netherlands). Governments may directly sponsor research labs, such as the Max Planck Institutes in Germany or the Centers for Disease Control in the USA.

However, firms and governments can also try to tap the creativity of users more directly. Jeppesen and Frederiksen (2006) point out that, "Many of the innovative users in the field of consumer products have turned out to be hobbyists... the field in which they innovate is not the field of their core occupation." Franke and Shah (2003) state that innovators are often individual end-users rather than user firms, but that they "are likely to require the assistance of others in developing their innovations." Rather than just waiting for innovation to occur, entities that hope to benefit can provide environments where this "assistance of others" is more easily available.

2.1. Development Life cycle: From user innovation to higher volume product

Private or public attempts to stimulate innovation have a range of activities in the development lifestyle to choose from. These steps include forming the initial idea, prototyping and experimentation, interacting with others interested in the same developments, bringing the idea to market, and use of the new product or service by early adopters.

Baldwin, et al. (2006) present the following model of user innovations becoming commercial products:

- 1) Users recognize a new set of design possibilities and start to innovate,
- 2) Users join communities to increase the efficiency of their collective information
- 3) User-manufacturers emerge, using high variable/ low capital cost production methods
- 4) As innovations slows, the market stabilizes sufficiently to support high-capital, low-variable cost manufacturing.

Baldwin, et al. focused on the life cycle of products, which causes the economic questions of variable and capital costs to be more important. However, the innovation of new services will have similar aspects. For example, users will still have a motivation to share information in groups, and commercial entities will resist addressing the emerging market in a large scale until innovation slows.

The Baldwin points identify several areas where innovation can be stimulated by providing an easier way for users to get together, share ideas, test concepts, and communicate the results with those than can bring these ideas into use. The model above focuses on creation. Adoption is also important for a new concept to become widely used. Besides stimulation idea generation and bringing them to market, those interested in stimulation need also be concerned with broadening the use of a new product or service. Here, sponsored communities can provide networks for early adopters (see McDonald and Alpert (2007) for a discussion of early adopters), easier access for trendsetters, and training for followers. Von Hippel (2007) points out that the difference between a lead user and an early adopter is that lead users are “typically ahead of the entire adoption curve in that they experience needs before *any* responsive commercial products exist – and therefore develop their own solutions.”

In the following sub-sections we will introduce the concepts of lead-users, innovator networks, and entities that can bring innovations into general use.

2.2. Lead-users

Baldwin, et al. (2006) define different categories of lead users, including user-innovators, user-purchasers, and user-manufacturers. The user-innovators are generally those that first see new design possibilities and start to exploit them. They develop these new designs “for their own personal use”. Marketing the innovation is usually not the goal. Baldwin, et al. define designing for use and testing as the “essential characteristic” of this group. Franke and Shaw (2003) cite several references that concur with this motivation, stating that “manufacturer-innovators expect to benefit from their innovations by selling them to others; user-innovators expect to benefit by direct use.”

Thomke and von Hippel (2002) have successfully developed a method to attract and select the so-called lead users; they are often highly skilled end-users who can express their ideas and experiences with a particular service or product. The feedback of these lead-users is then used to redefine the particular product or service.

However, it also clear that these lead –users do not represent the average user of a product or service, thus there is always a risk that the requirements raised by the lead-user are not of interest to the majority of users. Thomke and von Hippel also offer a scheme on how to select proper lead users. No matter how sophisticated this filter mechanism, it will never represent the average end-user and his requirements. The only way to overcome this problem is to integrate the real end-user into the innovation process.

2.3. Communities of users

The second step in the Baldwin, et al. model starts when isolated lead user-innovators form or join communities. These communities have included sports enthusiasts, software developers, firms using similar processes but not directly competing, and other settings. Franke and Shah (2003) studied communities of user-innovators and discovered that “the innovating community members do not innovate in isolation or secrecy.”

- They receive advice and assistance from other members of the community. This support is provided without charge and innovators generally share their developments with the community without charge.
- Monetary gain is not a key motivator. Fun and community social norms are motivators.
- Receiving assistance is necessary but not sufficient input toward the creation of a widely diffused innovation.

A key characteristic of these communities is the free exchange of information. Baldwin et al. state that this exchange lowers the cost of searching for better designs for all members of the community, and that for all members but one, the end design will be better than what they would have found searching alone.

The benefits of free exchange do require that the innovators are not rivals. If members are competitors, in sport, business, or for potential customers, they will have an incentive to withhold improved designs. Harhoff, et al. (2003) offers four reasons an innovator may share information:

- 1) it may induce improvements by others,
- 2) an advantageous standard might be achieved,
- 3) low rivalry conditions exist,
- 4) expectations of reciprocity and reputations effects.

While Baldwin et al. point out the improvement in search efficiency through joining a community, Frank and Shah emphasize the support received by the innovator from the community. As these communities are not market based, what motivates the other members to lend support, and what sort of support do they provide?

The Frank and Shah study of sport communities finds that most innovators receive assistance from other creative and innovative individuals that have complementary skills, and “often have expertise that was useful in developing the innovation.” They also report that besides offering assistance themselves, community members often refer innovators to “individuals they know outside of the community”, and that the most important assistance received is as likely to come from outside the community as from within.

Both the likelihood of innovators to share solutions and to give and receive assistance depend on the openness and lack of rivalry in the community. The next sub-section discusses open innovation communities.

2.4. Open Innovation Communities

An early example of communities openly supporting innovation is open innovation communities (see West and Lakhani (2008)). Here, anyone can contribute to the definition of a new service or products. In the communities discussed by Baldwin et al. and Frank and Shah, community members may provide support, but an individual development was still usually driven by one user-innovator.

The open innovation communities have a strong basis in the open source [software] communities, which not only innovate but also produce new services and products. The focus tends to be immaterial products or services. (e.g. software, software services, media, etc.). Open source examples, such as LINUX and Open Office, show that user driven innovation and production can be successful. Examples of open development of physical products are less common. Today, communities exist to build products such as an “open source car” (see OScar, 2009). However, in the case of material products, work usually remains in the area of engineering and design.

Driven by open source success, companies are currently trying to harvest ideas from communities related to their areas of interest. They may use consultants to build up open innovation communities for specific products or services. However, while the build up of an open community is more chaotic than the lead-user approach of von Hippel, again the question remains whether the typical community participant is the right source for general-purpose innovations around a specific product. The community participants expressing their opinion in an open innovation community usually by using the Internet, are only a small subset of the customers, and thus do not represent the opinion of an average user of a product or service.

Thus, a major drawback of both the user-innovator and open communities methodologies is that they do not represent the eventual average user of a particular service or product. In order to improve the methodologies in this direction there are two things that need to be achieved:

- An easy-to-use, dedicated communication channel has to be established between customer and the provider.

Here again the software industry can act as a role model, by applying strict registration procedures the software companies receive valuable information about their customers and how to reach them.

Software firms have a huge advantage over physical product makers, where the information about the customer and the product is usually lost the moment the product is sold. Thus, maintaining the link after the sale is a first step into a more transparent system.

- The motivation of the average user to participate has to be improved.

Once the communication channel is established between customer and supplier, the next question is how to stimulate the customer to provide his opinions and ideas about a product to the supplier. There are several ways to stimulate the user to take part in actively the innovation process. These incentives may be financial, quicker access to new developments, or prestige.

Some companies striving to integrate the user into the innovation process have found that financial incentives are sometimes less effective than other methods that trigger the end-user to participate, such as the opportunity to customize the product, or getting professional respect from the community (for example, miadidas).

2.5. Beyond innovation

While innovation is important, and may even be viewed as the top goal for these communities, it is not the only goal. Operators may wish to use an established testing network to spread new concepts or to increase the use of an existing service, product, or technology (Frank and Shah refer to this as diffusion) or to provide training to more typical users. Here, the involvement of average end-users, along with early adopters and trendsetters becomes more important. Frank and Shah (2003) found that, even within innovation communities, the characteristics of the innovators differ from the other community members. These differences would be even stronger when compared to the typical users once a product or service becomes widely used.

We discussed different view of quality in the introduction. Any involvement of users will allow a greater focus on fitness for use rather than conformance to specification. However, fitness for use *by whom* becomes important once we try to incorporate the ideas and needs of users into design. The way the lead groups use a product or service will often differ significantly from the mainstream. Much of the work cited above used emerging sport communities and software development as sources of innovation. A competitor in an emerging sport will be pushing the limits of the technology. If the sport becomes mainstream after a few years, the typical user will generally not use the product the same way. This can lead to at least two situations, the product can be further developed to better fit the needs of the majority, or the mainstream user can attempt to use a product that better fits the needs of the leading edge.

The evolution of Microsoft Windows can be taken as an example of the first case. Many of the changes introduced in newer versions of Windows are meant to make its use easier for an ever-expanding customer base of non-technical users. While this goal may be achieved, many more experienced users miss the more direct control they had in earlier version. The direct control did require knowledge, but they possessed it.

Mountain bikes are a good example of the second situation. Enthusiasts riding down mountain trails in California first developed mountain bikes. They adapted existing bicycles or fabrication their own solutions. Eventually, mountain bikes became 80% of the whole bicycle market in the US. Most of these bicycles were never ridden off pavement. Yet, the technology remained, including knobby tires, extremely low gear ratios, and handlebar positions suited for steep descents but not comfortable for around-town cruising. The bikes may have been bought for their image, rather than their fitness for use as the mainstream users actually used the product. This fits the third level of quality presented above: Psychological Impressions.

These adaptation, diffusion, and training uses will also be addressed in the following two sections, discussing private and public facilities respectively.

3. Business use and stimulation of user generated innovation

IBM (IBM Global CEO Study, 2006) found that the innovation is no longer primarily coming from research and marketing departments but that individuals in companies and customers contribute more innovations. Furthermore the study shows that companies that exploit external innovation more usually outperform their competition.

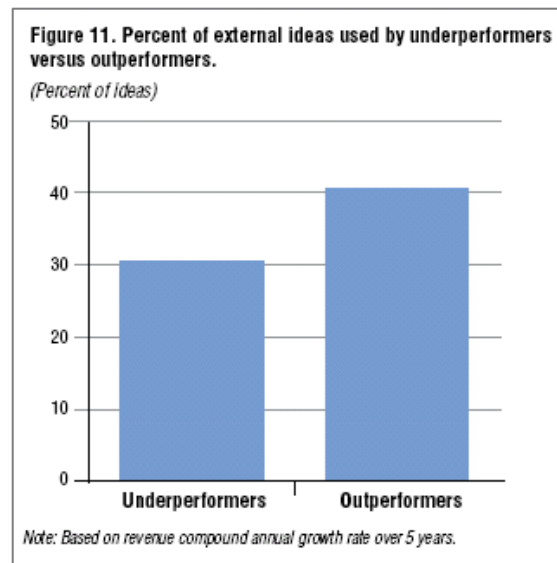
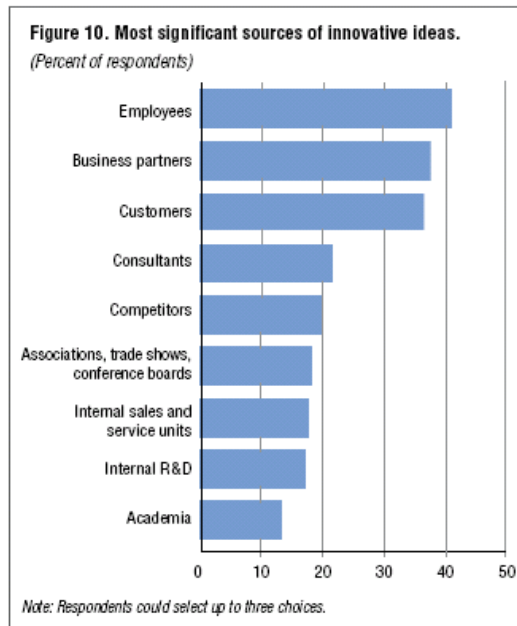


Figure 1 and Figure 2 (Figure 10. and Figure 11, IBM Global CEO Study, 2006, p. 22.)

However most firms have yet to institutionalize these innovation capacities in order to make best use out of it.

Our main interest in this paper is to compare the impact and effectiveness of company-hosted user communities with those sponsored by public agencies. However, we must recognize and discuss briefly several other methods companies use to solicit ideas from users besides firm-hosted user communities. Among these methods are:

- **Focus groups**
When a firm has something specific to test, it may draw several potential or existing users together to form a focus group. Often, the development of interest will be presented, the users will be allowed to test the concept, and then their opinions will be collected. This may not require bringing the users to a single site. For example, academic book publishers will often set up a teleconference to discuss a new book project. Those invited to participate may be current users of other texts addressing the topic; either the publisher's own offerings or competitors' products. While the focus group participants will share some characteristics with those in a user community, the time frame and development structure differ markedly. Focus groups usually address innovations already developed by the company, and the groups are usually brought together for a short time, just to address the specific innovation.
- **Beta testing**
Software firms often release versions of their products to selected users before the final product is ready. This allows them to gain feedback on the product while controlling the distribution. The beta version users will often be key or trusted users of the company's current products. For example, one of the authors previously worked as a systems analyst for a large aerospace company, as a simulation specialist. A major simulation software vendor would release beta versions of their products to this group to gauge usability and to solicit suggestions. The users were motivated by earlier access to newer products and the opportunity to have software that specifically addressed their concerns.
- **Sponsoring users, such as athletes, to use their products**
Manufacturers, of products such as sporting goods, will frequently sponsor key users, such as elite athletes, and give them access to their products under development. Besides the advertising value of having well-known personalities using their products, they can also test new developments under extreme conditions. This may not provide the most valuable feedback, in terms of developing a product for mainstream users. Competitors often use products in ways differing greatly from the average user. Innovations by enthusiasts practicing at the leading edge of personal use may provide more appropriate innovations.

- “Hot lines” allowing key users access to company developers
Similar to providing yet-to-be-released versions to key users, companies may provide a few key users more direct access to the developers, such as computer programmers, through the use of unpublished telephone numbers or email access. Again, this allows the firm to gain input and ideas directly from important users and provides the users with the chance to have their specific needs more directly addressed. One of us had this direct access to programmers as a simulation specialist.
- In-company representatives
In particularly large and expensive markets, a company may send a representative to work directly at a user's site, often as an advisor. Defense contractors will often have a representative work as a liaison with a branch of the military.

All of the above methods do allow a closer working relationship between firm and user, but a company sponsored user network can provide more. With most of the methods discussed above, the idea generation is still the role of the company. The users can test and give feedback, but the company is still the main source of innovation. A user network can allow ideas to come directly from the users.

3.1. Firm-hosted user communities

While the methods described above will solicit input from users, they may not yield new ideas. Communities of lead users have a high potential to generate innovative ideas, adaptations, and new uses for existing products and services. To stimulate this creativity, companies can sponsor user communities around their products and services. The most direct company motivation is to stimulate new ideas that they can then introduce and exploit in the marketplace. However, we do need to ask a few questions:

- How willing are creative users to participate in company-sponsored communities?
- Does company sponsorship limit creativity by, for example, limiting the range of ideas generated to those that exploit the company's offerings, or does the profit motive create a competitive atmosphere that has been shown to limit idea sharing?

Jeppesen and Frederiksen (2006) examine the motivation of contributors to firm hosted communities. They draw a distinction between industrial and consumer products. With industrial products, innovators from outside the firm are often professionals using the product or service in their work. With consumer products, innovators are often hobbyists, and their innovations do not stem from their core occupation. Their field study involved innovators in a firm hosted music software community. They found innovators were indeed more likely to be hobbyists than professionals. They also found that recognition of their innovation by the firm was a stronger motivator than peer recognition. Their study also was consistent with the findings that innovators tend to be lead users. Lead users expect to benefit directly from innovations and they need a given innovation earlier than the mainstream user. Fuller (2006) finds that there are six motivational factors leading to participation reported in his study of virtual new product development.

He finds that curiosity, intrinsic innovation interest, gaining knowledge, dissatisfaction with existing products, and showing ideas are the main drivers for engaging in virtual product development. He also points out that participation in virtual new product development will differ slightly from open source software and lead user developments because consumers can more immediately benefit their innovations in the latter.

In the preceding paragraphs we established that users can be motivated to participate in company-sponsored innovation networks. We now need to address the motivation of the company to see how this impacts innovation. Firms exist to profit. Companies forming communities of users must expect these to improve their profitability. User communities can improve profits in many of the ways described in the introduction. They can identify emerging needs, help find solutions for these needs, expand the uses for existing products or services, and help increase the use of existing products and services. These goals can also be those of communities not sponsored by firms but firm sponsorship can limit and influence the direction of these activities.

In identifying emerging needs, a firm will be interested to the extent satisfying those needs has the potential to improve profits. The easiest way for new need to improve profits would be if it leads to additional users for their existing products or services. Satisfying new needs through adaptation of existing offerings would also be desired.

Baldwin, et al. (2006) describe the economic conditions required for a firm to undertake new development to satisfy an emerging need. Essentially, the capital costs should be high enough to bar smaller firms and individual innovators from offering the product, the variable cost of production should be low enough so that there is an expected profit at the forecasted level of demand, and the pace of innovation must be slow enough for the firm to recoup its capital costs before the new product becomes obsolete

User communities can also help find new uses for existing products. Harrison and Waluszewski (2008) describe a producer developing a user network to find new uses for a biosensor after the initial application failed to pan out. Once a community is in place, participants may develop new uses even without direct company involvement. Jeppesen and Frederiksen (2006) present the case of community members creating new applications and modifications in the area of computer-controlled music instruments. They also point out that the firm “did not have to invest many resources in community development and communication.”

Firm sponsored user groups can also help increase the use of the firm’s existing products and services, Members of the community can and do help each other solve problems. Often this assistance can be quite a cost savings to the firm. Jeppesen and Frederiksen (2006) state, “Such user-to-user assistance in a related field (of computer games) has been found to outweigh several times the effort spent by a firm on supporting users”. Readdressing the two questions posed at the beginning of this section, several researchers have found that users will participate valuably in firm-sponsored communities. The examples given only discuss innovation that was of value to the firm. The question as to whether the firm’s sponsorship limited the range of ideas was not explored.

3.2. Innovation tool kits

To stimulate users, to guide innovation, and to make it easier for typical users to experiment with systems, test bed creators may provide an environment, templates, and tools. Thompke and von Hippel (2002) state, “The user-friendly tools, often integrated into a package we call a ‘toolkit for customer innovation’ deploy new technologies like computer simulation and rapid prototyping to make product development faster and less expensive”. They report toolkits in use in a range of industries from specialty food flavors, to plastics, semiconductors, and software. Prügel and Schreier (2006) discuss a range of toolkits, defined by scope, required skill, and flexibility. High-end toolkits require greater skill on the part of the user. These *expert* toolkits focus on innovation and new products. They attempt to allow a fair amount of design freedom. Low-end *basic* toolkits focus on allowing individualization within mature markets. Modifying software, when it requires programming, would be an example of the high end. Pick the combination of colors for the components of your sport shoes would be an example of the basic level.

Franke and von Hippel (2003), when discussing toolkits for software innovation, propose four needed capabilities, they must:

1. Enable users to complete cycles of experimentation.
2. Be user-friendly. Users should be able to operate them using their existing skills.
3. Contain libraries of designs. These components and modules have been tested and debugged, allowing users to adapt what already exists.
4. Contain information about the capabilities and limitations of the production process. This assures that designs will be producible.

Jeppesen and Frederiksen (2007) point out “Toolkits allow users to undertake innovative work in a way that is structured by the firm.”

The last two points of Franke and von Hippel, along with the comment by Jeppesen and Frederiksen indicate that toolkits often will have a limiting effect on what is being developed. Point 3 guides developers toward combining solutions already implemented in the firm’s products. The information in Point 4 would focus on the ability of the host firm to produce the solution. Finally, if the work is indeed “structured by the firm” it is doubtful that solutions that would be provided by others would be favored or supported.

4. Public-Private Partnerships for End User Involvement in Innovation

In the above section, we described environments where it was possible and potentially profitable for companies to sponsor user communities to stimulate innovation. This also revealed that there are situations where a company sponsor is not needed or may limit innovation. Also, as pointed out in the introduction, the innovation goals of society may differ from those of firms. Von Hippel (2007) points out three conditions are necessary for a user-only innovation community to function. He writes "... user-only innovation development, production, distribution, and consumption networks can flourish when:

1. At least some users have sufficient incentive to innovate,
2. At least some users have an incentive to voluntarily reveal information sufficient to enable others to re-produce their innovations,
3. User-self production can compete with commercial production and distribution.

With just the first two conditions, innovation and trial may occur within the user network, followed by commercial manufacture and distribution of innovations that prove to be of general interest. In this section, we wish to explore the possibility of a public entity assuring that adequate conditions are present for "innovation development, production, distribution, and consumption" to occur when all the conditions for user only networks are not present and when company sponsored networks may impose restrictions or limitations.

Ballon et al. (2007) describe several dimensions that can be used to differentiate what they term 'test and experimentation platforms' (TEPs). Among these are:

- Environments aimed at testing versus those aimed at design and development
- The level of maturity of the technology used
- The extent of user input.

We would add one more dimension; the extent of public sponsorship.

Ballon, et al. then describe six TEP types:

TEP Type	Definition
Prototyping platform	A design and development facility used prior to mass production and resulting in the first proof-of-concept of a new technology, product, or service
Field trial	A attest of technical and other aspects of a new technology, product, or service in a limited, but real-life environment
Testbed	A standardized laboratory environment used for testing new technologies, products, and services and protected from the hazards of testing in a live or production environment
Living Lab	An experimentation environment in which technology is given shape in real life contexts and in which (end) users are considered 'co-producers'
Market pilot	A pilot project in which new products or services that are considered to be rather mature, are released to a certain number of end users in order to obtain marketing data or make final adjustments before the commercial launch
Societal pilot	A pilot project in which the introduction of new products and services into a real-life environment is intended to result in societal innovation

Table 1: Typology of test and experimentation platforms (Ballon et al. (2007)

We will primarily deal with Living Labs in Europe in this section. Feurstein et al. (2008) state, Living Labs are collaborations of public-private-civic partnerships in which the stakeholder co-create new products, services, businesses and technologies in real life environments and virtual networks in multi-contextual spheres. They point out that a key aspect of the Living Lab approach is the focus on the individual "...in his or her role of as, for example, a citizen, a consumer or worker." By participating, "...he or she can act as much as a producer than as a consumer."

Comparing Living Labs to the other TEPs in Ballon et al.'s Table 1, we can conclude that testbeds and field trials will often be more focused on a particular solution.

Feurstein et al. state that, “a Living lab needs to bring access to state-of-the-art technology not of only one kind but often competing technologies delivered through different business models. Niitamo et al (2006) point out, “Typically the companies want to push a certain technology or business model, which is understandable as they [have] often invested [a] huge amount of money in development.

4.1. Examples of Living Labs

We will now describe a few Living Labs to give the reader a better understanding of the concept. We will include a description of the sponsor, the user population, and specific tests run. When available, we will also describe results of the test.

Testbed Botnia

According to Ståhlbröst and Bergvall-Kåreborn (2008), this community has 5800 end-users, referred to as test-pilots. It is sponsored by the CDT, Centrum för distansöverbryggande teknik, and has several industrial and academic partners. Focusing mainly on mobile services, it allows entities that wish to test a new idea access to many end users. This gives them information as to how well a proposed new product or service may be received by the general public.

Hungarian Rural Living Lab

Kallai and Bilicki (2008) describe this rural testbed where the end-users are 650 farmers located near Mórakert in the South-Great Plan region of Hungary. The consortium included local government, a Hungarian university, an Information Technology firm, and a farming co-operative representing the 650 family farms. This cooperation led to new product exchange application using emerging mobile and broadband technologies.

Kenniswijk (Netherlands)

Mulder and Velthausz (2006) and Barr (2006) describe this Dutch government (Ministry of Economics) sponsored project that had the participation of several major Dutch companies, municipalities and universities. One of the goals was to increase broadband uptake by non-users who did not have access to broadband service. The project solicited proposals from the community at large and received more than 1000 ideas, 300 of which became detailed proposals. Of these 116 were approved and subsidized.

Living Lab Vorarlberg

Withing the European eTEN project TELL-ME (TELL-ME 2010) the Living Lab Vorarlberg conducted three trials: Hofsteig-Ader, 360 Card, and Jahooda. The first was an e-Participation trial while the others were e-Service trials. The target group of the Hofsteig-Ader trial was the citizens of Wolfurt and Schwarzach, as they would be directly impacted by the modification of the L3, a main road in the area. Citizens were invited to view and discuss the 13 proposals for L3 modifications. By the end of the trial 32 users had registered, and made 46 contributions. An example of a design change due to end-user (Wolfurt residents in this case) input was the addition of a bus bay to avoid the need of transit buses to stop directly on the street.

5. Comparing the Two Approaches to Stimulating User Innovation

The above two sections discussed firm-sponsored test and experiment communities, and introduced Living Labs as a form of Public-Private community sponsorship. In this section, we will attempt to compare their relative strengths. While the range in each category is rather wide, we will attempt to highlight trends and concentrations. We will also attempt to describe where these strengths offer an advantage, in innovation, adapting existing solutions, and spreading innovation to the mainstream.

	Company Sponsored	Public (e.g. Living Labs)
Access to Lead users	Can be high	Generally users are mainstream
Flexibility of Solution (independence)	Usually tied to company offerings	Can use several competing solutions
Degree of focus	Usually focused on improving user experience with firm's solution	Focused on the needs of the target community
Representing average user	User group communities can be mainstream users <i>of the firm's solution</i>	Often designed specifically to test with average users
Ease of exploitation	Fairly easy if met through change in firm's solution	Requires agreement among business members
Stimulating diffusion	Only to interested members	Community can be formed with diffusion to mainstream as goal

Table 2: A comparison of public and privately sponsored experiment and test communities

We will now discuss the points highlighted in Table 2.

Access to lead users

Several of the references listed in Section 2 attested to the immense value lead users have in identifying emerging needs and new solutions. Lead users often have already formed their own communities. Is any sponsorship structure more likely to be able to connect with the lead user community? When a firm is a major supplier to members of the community, several authors have shown that members will participate in company-sponsored networks. Without this product connection, both private and public-sponsored networks would need to identify the lead users and find an incentive for them to join and participate in the community. From the literature, it seems that the private networks have an advantage here.

Even if private sponsorship seems to often have better access to lead users, we should point out that their goals would more readily need this access. Private firms are more often looking for new products and service to offer, the public networks we have discussed are more interested in identifying the needs of the mainstream and increasing their acceptance of new technologies.

Von Hippel (2007) points out that lead users may have a higher incentive to innovate than manufacturers, especially when the eventual development of the market is unclear. He writes, "...given that lead users experience needs in advance of the bulk of a target market, the nature, risks, and eventual size of that target market are often not clear to manufacturers. A community not linked to solutions offered by a particular business can more flexibly respond to however the market develops. However, these communities will also need to consider that lead user needs may never become mainstream.

Flexibility of solution

Firms are interested in their own profitability. Therefore, they are interested in solutions that they can exploit. It is unlikely that a firm will show a strong interest in helping a competitor improve its offering, even if this is what the community shows a preference for. It is also common for a firm to limit the range of experimentation to the use of its own products and possible extensions.

Public testbed often strive explicitly to include competing technologies. Though they may have corporate partners in their consortium, they are rarely tied in to any one firm's technology or product line.

Degree of focus

The profit motive does provide focus. A firm is looking for ways to expand and extend its business. This gives it a clear goal. The focus is on innovations that it can exploit for a profit, or ways to expand its market.

Public entities that sponsor test communities often have broader goals, and therefore less focused. They wish to improve the welfare of the society.

This can be accomplished by concentrating on a particular technology, such as Testbed Botnia's concentration on mobile technology, but often involves a range of technologies, such as the Hungarian Rural Living Lab using mobile and wired technologies. As the goal is societal benefit, which can take many forms, the range of solutions will also often be broader.

Representing the average user

Firms may desire to have lead users, mainstream users, or both, depending on their goal. If they desire to identify new opportunities, lead users would be more valuable. If the desire is to expand the use of existing offerings, mainstream users would be valuable. However, as current users of their technology often populate their networks, the average member of the population is often not represented. The average citizen could not, for example, modify the code for a web server.

Public networks are often set up to solicit input from the average person. If this population lacks the skills to use the technology, the consortium may provide it, as was seen with the Internet training provided by Kenniswijk.

Ease of exploitation

Firms have often structured their communities around their product line. The experimentation will therefore often be with their own products and the new developments take the form of modifications to their products. To exploit these developments they need only ask whether the potential new market justifies the cost of releasing the new or modified product.

If experimentation uses a firm-supplied toolkit, exploitation is even easier. As Jeppesen and Frederiksen (2007) pointed out, innovation was structured by the firm. Now they only need to incorporate the innovation into their product, and perhaps add it to the library offered in the toolkit.

Public-sponsored networks often try to allow experimentation with a range of technologies, offered by several vendors, or even not yet on the market. Once an innovation is identified, tried, and found to be desirable, the path to commercialization may not be clear. This may involve a joint venture among corporate partners in the consortium, or may even require the founding of a new business.

Stimulating diffusion

To the extent that a privately-sponsored network has members that are not current users of a company's offerings, it could be used to spread use of its products. More commonly, the members are users, but not necessarily of new developments. The firm can then promote its newer offerings to the community, made of current users of its existing products.

Spreading the use of emerging technologies is one of the explicit goals of many of the publicly supported communities. Non-users of existing technology are often sought for membership. The community will make an effort to teach the public how to use new technologies. To the extent that increased use is seen as a public benefit, increased use becomes a measure of success for the publicly sponsored test environment. This will be independent of whether the public eventually receives the technology from members of the public consortium.

6. Conclusions, and Further Research

Let us conclude by summarizing what we see as the strengths and shortcomings of the two main approaches of test and experimentation network sponsorship, where these serve the public interest, and what may be done to increase their usefulness. While, as we stated above, each of the two main classifications has a range within it, let us draw the following general conclusions.

6.1. Conclusions

Privately sponsored (firm) user networks

Networks supported by firms:

- are more likely to have 'lead' users and innovators
- have more focus on a specific problem
- have a clearer path to innovation

When the public, as well as the sponsoring firm, is well served through access to innovative uses and capabilities built upon the strengths of a given firm, these networks are valuable. The value to the firm is clear. The public gains access to better products and service.

Publicly sponsored user networks

Test and experimentation networks with at least partial public sponsorship, such as the Living Labs:

- are more likely to stimulate cooperation among application providers
- provide access to several different, often competing, technologies
- experiment with several business models
- can test several ideas due to their independence
- can spread knowledge to and increase use the ‘average’ user

The above advantages of the public networks are there by design. The goal of the networks is societal welfare. While the solutions available to the public networks are broader the risks are also greater. The needs identified by the average user may be difficult to supply. As the technologies and participation are spread across several entities, the path to exploitation is much less clear than it is in the case of firm sponsorship. However, if successful, the public gains access to developments that may have been too risky of beyond the ability of one firm to provide, and the participating firms gain new products and markets.

6.2. Further Research

The above identified the strengths of each approach. However, we can also read from it suggestions for further needs and research.

Privately sponsored (firm) user networks

Firm sponsorship can lead to new products and exploit the innovations of lead users, and even current users of their products and services. However, many innovations from lead users are inappropriate or rejected by the mainstream. How can private networks more easily attract input from the eventual “average” user, which is often a much larger market? Without direct input from the average user, is there a way for firms to better judge whether lead user innovations will meet with high acceptance from the larger community?

Publicly sponsored user networks

The strengths of the networks with at least partial public sponsorship and support are the ability to pursue a wider range of potential technologies, business models, and solutions, and to better represent the needs of the average user. However, this breadth and focus does lead to challenges. Can these networks find a clearer path toward exploitation of innovations discovered without limiting the range of solutions available? Can networks, such as Living Labs, which have been designed to solicit input from the average end user, also attract the interest and input of the lead users?

In summation, can the two approaches continue to do what they do best while learning from the strengths of the other?

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