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THE OPEN-MINDED PROFESSOR

An Interview with Eric von Hippel

INTERVIEW BY **SCOTT WILSON**
> PHOTOGRAPHY BY **MATT LENNERT**

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An Interview with Eric von Hippel

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O pen source technology and lead user innovation: two subjects very much in evidence across a diverse number of business sectors today. But how can they help companies grow, and what can we learn from the likes of open innovators ranging from small communities of windsurfers to digital giant Google?

Professor Eric von Hippel of MIT's Sloan School of Management is known for pioneering research that has prompted a major rethinking of how the innovation process works. He is the originator of lead user theory and a leading voice on open methods of innovation development. Here he expounds on the benefits of open source technology, why users are at the center of the innovation process and how they can trigger major changes in both company business models and in government policymaking.

Von Hippel is the T Wilson Professor of Innovation at Sloan and also a professor of Engineering Systems at MIT. His academic research examines the sources and economics of innovation. He has founded and participated in start-up firms and is a founder of the entrepreneurship program at MIT. His most recent book is *Democratizing Innovation* (MIT Press). In the spirit of openness, copies of this and of his earlier book *Sources of Innovation* (Oxford University Press) can be downloaded free of charge from his MIT website at http://web.mit.edu/evhippel/www/democ.htm.

SCOTT WILSON: OVER THE LAST TEN YEARS, WHAT HAVE BEEN THE BIGGEST CHANGES IN MANAGING INNOVATION, AND HOW SUCCESSFUL HAVE COMPANIES BEEN IN MAKING THESE CHANGES?

ERIC VON HIPPEL: We are in the middle of a huge shift in our economy. It is a paradigm shift, really, from closed, IP-protected, manufacturer-centered innovation to an innovation system centered on "open" — intellectual property-free — innovation that is often developed by users. Manufacturers have to learn how to adapt their business models to this. Some companies are succeeding very well. For example, many manufacturers are now both developing and basing products on open source software — and making good profits.

SW: OVER THE LAST TWO DECADES YOU'VE FOCUSED ON INNOVATION IN SUCH DIVERSE AREAS AS EXTREME SPORTS RIGHT THROUGH TO SOFTWARE DEVELOPMENT. INDEED, A LOT OF YOUR EARLIER RESEARCH IN THE 1980s AND 1990s PIONEERED

WHAT PEOPLE TALK ABOUT TODAY WHEN THEY TALK ABOUT OPEN INNOVATION AND CROWDSOURCING AND THINGS LIKE THAT. DO YOU SEE A TREND WHERE COMPANIES ARE INCREASINGLY GOING OUTSIDE THE FOUR WALLS OF THE FIRM TO SOURCE INNOVATION AND BRING IT INSIDE RATHER THAN BEING VERTICALLY INTEGRATED IN R&D?

EVH: Yes, it is a major trend. But it is important to note that there are many different flavors to the notion of looking outside a company's four walls. Understanding of what is possible and effective is evolving very rapidly. There is also a lot of confusion on terminology right now. For instance, "open innovation" is a term that I use to mean innovation that is freely accessible by all via an information commons. That is how I use the term in this interview with you, and that is what people in open source software mean by the term. Others use that same term to refer to the buying and selling of closed, proprietary intellectual property among firms. Can be confusing unless you are careful.

> The challenge firms face is to make clear to their employees that they are still needed and can provide major contributions and have major job satisfaction in the new model.

SW: HOW SUCCESSFUL AND WILLING HAVE FIRMS BEEN AT TAKING THE LESSONS LEARNED FROM YOUR RESEARCH ON USER INNOVATION AND OPEN SOURCE DEVELOPMENT?

EVH: Basically I haven't seen an industry that changes from closed to open voluntarily. It is *very* difficult for firms to make that shift. Closed business models that have been in place and successful for a long time tend to become nearly unchallengeable. Things really have to fall apart before basic change is seriously explored. We are seeing this kind of disruptive situation nowadays among media companies, for example, and it has occurred elsewhere earlier.

For example, consider custom semiconductor design. In that field, the business model in the early 1980s was that manufacturers designed chips *for* users. Chip users were eager to design their own custom chips, but established firms in

that field like TI and Fujitsu were adamant about not giving design tools and design freedom to users. Finally a start-up company, LSI, did transfer design freedom to users, and customers flocked to work with that firm. Only when the larger firms saw this to be a serious challenge — and saw a successful new business model actually demonstrated by LSI - did they switch over to the new, user-centered design model that is dominant today.

SW: WHAT ARE THE TYPICAL CHALLENGES FACED BY FIRMS TRYING TO DEVELOP THOSE KIND OF INNOVATION CAPABILITIES, AND HOW DO THEY ACTUALLY OVERCOME THEM?

EVH: The chief problem is that there is a lot of investment bound up in a closed innovation model for firms that now use such models, and the investment is both individual and corporate. Much of this has to get thrown away or loses value when firms shift from closed to open innovation models.

People naturally and reasonably resist destruction of value they own, especially if it is personal. For example, R&D employees often resist being asked to look outside for innovations. They may well view the outside as a competitor; as a rival: "If we ask outsiders to help with our job, our managers may think that we are dispensable. Let's not do that!" Similarly, marketing research people who look for unmet user needs via surveys and focus groups find a lot of their tools are at risk of becoming obsolete if users become the innovators. And internal patent attorneys who are told that open IP can be more useful than patents — well, let's not even go there. [laughs].

The challenge firms face is to make clear to their employees that they are still needed and can provide major contributions and have major job satisfaction in the new model. Firms also need to provide a clear transition path. For example, internal product developers needs to know that there is a lot they can contribute even if their firm switches to outsourcing prototype development to innovation users. And this is the case. Internal developers are essential to help create user innovation toolkits to enable and improve user innovation relevant to their firm. Also, they are needed to convert user-developed prototypes into robust commercial products via product engineering.

Lego offers a good example of a smooth transition. Lego is a long-established Danish firm. Within that firm there were maybe about 20 people who were looking at a new, open model of new product development. Top management protected them, encouraged them, and they are managing to build within an old firm a new way of doing things that is gradually making a transition for the entire Lego company. But that's a really remarkably smooth and excellent transition. The transition to open can be done without major disruptions, but it's not easy.

SW: ARE THERE ANY INDUSTRY SECTORS WHERE USER INNOVATION WOULD BE DIFFICULT TO PUT INTO OPERATION JUST BECAUSE OF THE NATURE OF THE BUSINESS?

> Manufacturers don't have to jump to adopt new user innovations right away — they can wait to see which user innovations succeed. After all, the users are developing innovations at their own expense, not the manufacturers'.

EVH: It's not really a matter of sectors. It is more about: "the greater the investment in the old, closed model that is at risk, the more difficult the transition to new, open models." For example, if a firm has never had R&D or never had a major investment in patents and patenting, it does not face those retooling losses, and so will have an easier time switching to open.

SW: UNDER WHAT CIRCUMSTANCES SHOULD A COMPANY PURSUE OPEN LEAD USER INNOVATION VERSUS CLOSED INNOVATION? CONVERSELY, IS THERE A SET OF CONDITIONS THAT WOULD SUGGEST THEY SHOULDN'T DO IT?

EVH: Our research is showing that there are very few — maybe even no — conditions under which properly equipped users engaged in open innovation cannot outdo closed, manufacturer-based innovators. It is also true that users have their highest advantage over manufacturers in innovating in new and rapidly changing markets. Under these conditions lead users — users at the leading edge of markets — develop new products and services because they need them. They don't care if the present market is small — they are seeking to satisfy their own needs and not a market need. In

contrast, manufacturers don't tend to like small and uncertain markets — and that is what new markets are by definition. So manufacturers should especially look to users — and to open, user-centered innovation — to develop new product prototypes for new and rapidly changing markets.

Manufacturers don't have to jump to adopt new user innovations right away — they can wait to see which user innovations succeed. After all, the users are developing innovations at their own expense, not the manufacturers'. Some user innovations will succeed and some will fail. User communities will show which are the most promising ones via their adoption patterns. If many users pick up and copy a user innovation, it has commercial promise — if few do, there is probably little promise. Of course, the longer firms wait for the winners to become certain, the more costly to enter. It is a risk-reward trade-off.

SW: THERE'S BEEN A LOT OF DISCUSSION AROUND DISTRIBUTED INNOVATION OVER THE LAST FEW YEARS. ONE COMMONLY CITED FEAR ABOUT COMPANIES LOOKING OUTSIDE THEIR FOUR WALLS FOR INNOVATION IS THAT THEY LOSE CONTROL OF THEIR INTELLECTUAL PROPERTY. OR AT THE VERY LEAST, THEY INCREASE THE RISKS OF IP LOSS BY BEING TOO OPEN IN THEIR COLLABORATION WITH OTHERS WHO MAY WELL TURN OUT TO BE THEIR COMPETITORS IN THE FUTURE. I THINK, IN PARTICULAR, THAT IT SEEMS TO BE AN ISSUE IN AREAS OF THE WORLD WHERE IP IS NOT SO STRONGLY ADHERED TO AS IT IS IN THE WEST, I.E. MAYBE CHINA. DO YOU SEE IT AS A PROBLEM?

EVH: It is true that the most rapidly developing designs are those where many can participate and where the intellectual property is open. Think about open source software as an example of this. What firms have to remember is that they have many ways to profit from good new products, *independent of* IP. They've got brands; they've got distribution; they've got lead time in the market. They have a lot of valuable proprietary assets that are not dependent on IP.

If you're going to give out your design capability to others, users specifically, then what you have to do is build your business model on the non-design components of your mix of competitive advantages. For instance, recall the case

of custom semiconductor firms I mentioned earlier. Those companies gave away *their* job of designing the circuit to the user, but they still had the job of manufacturing those user-designed semiconductors, they still had the brand, they still had the distribution. And that's how they make their money.

It is also true that firms can *base* their new products on user-developed designs and still capture significant IP protection from internally developed improvements.

The recent buzz in other fields is coming about because all of a sudden everyone is realizing that all products are information products during design — and some are turned into hardware in the very last stage.

That is the pattern we found in research we did at 3M. Even when 3M developers sourced the basic idea for a new product line from users, they were able to capture strong IP by patenting their improvements to the user idea.

SW: DO YOU SEE ANY CHANGES IN TERMS OF GOVERNMENT POLICY IN THE UNITED STATES THAT ARE REQUIRED WITH REGARDS TO INNOVATION, R&D OR IP POLICY THAT MIGHT STIMULATE FIRMS TO ENGAGE DIFFERENTLY WITH THE OUTSIDE WORLD?

EVH: My colleagues and I are working now on government policies related to the new user-centered and open innovation paradigm. Companies should be in favor of new policies in this area. It is to their advantage to encourage the healthy growth of this free resource.

Users will innovate more as the infrastructure and support for this activity is improved. Examples of what is needed from government: encouragement of open standards, cheap collaboration tools, and cheap Internet that does not discriminate against user-developed content.

SW: ARE YOU CONFIDENT THAT SOMETHING WILL HAPPEN IN THIS ADMINISTRATION'S TERM TO SORT THAT OUT?

EVH: Well, the Obama administration is showing great interest in improving the Internet as important infrastructure. Interestingly, however, countries in Europe are ahead in implement-

ing many additional needed changes. The first country to embrace user innovation as official policy has been Denmark, and they're pushing a bundle of measures needed to support and encourage the new paradigm. Denmark understands they will never be able to compete with big countries like the U.S. on the R&D spending tech-push model, so they see an advantage in making their policy hospitable to the world's free user innovations. They want Danish firms to be the ones to quickly turn user innovations into products. I think the U.S. and other countries should follow their lead.

SW: OPEN SOURCE SOFTWARE HAS SHOWED HOW INNOVATION CAN BE DEMOCRATIZED. IT HAS HAD A BIG IMPACT ON THE PRACTICES AND BUSINESS MODELS USED IN THE SOFTWARE INDUSTRY. ARE YOU SURPRISED THAT OPEN SOURCE NOW SEEMS TO BE CREATING A BUZZ IN BROADER MANAGEMENT AND BUSINESS THAN IT HAS DONE PREVIOUSLY?

EVH: Software is an information product. This means users can democratize its innovation process easily because they don't need manufacturer cooperation. Manufacturers, as we discussed earlier, tend to resist the introduction of user-centered innovation processes. All the manufacturer-controlled choke points that exist in hardware manufacturing didn't exist in software. The result has been that open, user innovation practices have tended to be developed on software first. For example, Richard Stallman's brilliant idea of the general public license, the copyright-based GPL, to ensure openness was a brilliant stroke, and it was applied to software first.

The recent buzz in other fields is coming about because all of a sudden everyone is realizing that all products are information products during design — and some are turned into hardware in the very last stage. You can design almost everything in software nowadays, and you can distribute the designs around the world in software form as well, and so the open innovation rules designed for software can largely apply to hardware as well. In other words, a lot of the open innovation practices developed in software are turning out to be adaptable to broader uses.

SW: HOW CAN MANUFACTURERS WHO CHOOSE TO EMBED OPEN SOURCE SOFTWARE INTO THEIR HARDWARE CAPTURE VALUE FROM THE SOFTWARE IF IT'S AVAILABLE FOR FREE?

EVH: They can't. They have to capture value from what's called complements to that free software — other things related to the free software that people will want to buy. For example, Red Hat distributes Linux — free software — and makes money from the services it offers in addition. IBM gives away Linux. But it makes money from the server hardware it sells that Linux runs on and the proprietary software it sells that runs along with Linux.

SW: SO WOULD MORE MATURE COMPANIES WITH A MORE SO-PHISTICATED MANUFACTURING OPERATION OR SALES OP-ERATION INHERENTLY DO BETTER EMBEDDING AND USING OPEN SOURCE SOFTWARE THAN SMALLER STARTUPS WHO MIGHT NOT HAVE THE CAPITAL TO INVEST IN COMPLEMEN-TARY FUNCTIONS?

First Apple resisted apps developed outside Apple. Then iPhone owners hacked their iPhones to add 3rd party apps — often developed by users. Then Apple gave in to the tide and responded with an "approved apps" store.

EVH: Not necessarily. Recently there was some interesting research on companies that use embedded Linux software by my German colleague, Professor Joachim Henkel. Many of the companies using embedded Linux in their products are small firms, and the range of products these companies manufacture is quite broad. Some were making dishwasher controllers, for example, and others were making industrial process machines. They shared embedded Linux as a common free software plat-form, but each offered unique customer service to their custom-ers — and this was their proprietary value added from which they were able to profit.

SW: SO SIZE IN THIS INSTANCE DOESN'T HAVE AN IMPACT?

EVH: No. The only way size would have an impact is that often-times big companies have these economy of scale related ele-

ments such as big brands, big factories and so on. Those are strong complements to designs from which they can generate a lot of revenue.

SW: ARE THERE STILL CONCERNS AROUND SECURITY AND LICENSES WHEN EMBEDDING OPEN SOURCE SOFTWARE INTO A PRODUCT RATHER THAN USING PROPRIETARY SOFTWARE?

EVH: I don't think so. Open source software has been shown to be much faster than closed in responding to security threats. With respect to licensing, that problem has been pretty much solved. For example, there's a company called Black Duck. Their business, as I understand it, is to help firms keep proprietary code separate from open source code in product designs so legal risks are avoided.

SW: WHAT ABOUT OPEN SOURCE IN THE U.S. WIRELESS SECTOR. WHAT DO YOU THINK ABOUT GOOGLE AND THEIR ANDROID STRATEGY?

EVH: What's happening is that open and user innovation is progressively taking over things like the design of the applications. You see this illustrated with the history of the iPhone. First Apple resisted apps developed outside Apple. Then iPhone owners hacked their iPhones to add 3rd party apps — often developed by users. Then Apple gave in to the tide and responded with an "approved apps" store. Now Google and Android are offering options that are still more open. The trend is clearly towards openness and user empowerment.

SW: ON THAT, HOW DO YOU THINK GOOGLE WILL BE ABLE TO MOTIVATE OTHERS TO DEVELOP THEIR OPEN SOURCE CODE FOR FREE?

EVH: This is a fundamental question. It has an easy answer — but to get it, people have to understand what user innovation really is — it is innovation *by people who want to use what they develop.* Built into your question is the assumption that people have to sell something to benefit from it. If you're a user, you're benefiting from using what you develop — and that is a *very* powerful motivator to, as you say, "develop open source code for free." Eric Raymond (open source guru) said it very well: the best software is developed by those who do it to "scratch their own itch."

User motivation is a major reason why both individuals and firms build physical products "for free." If I build a mountain bike to use and it's an innovative mountain bike, I can benefit by riding — that is, using — the bike I built. If I am a manufacturer and build a process machine to use in my own factory, I benefit from using that machine. Users do not have to sell something to benefit from developing it — they benefit very powerfully from use.

SW: IF TYPICAL OPEN SOURCE SOFTWARE DEVELOPERS DON'T LIKE TO BE LED OR TOLD BY OTHERS WHAT TO DO, HOW WILL THAT WORK WITH, FOR EXAMPLE, GOOGLE'S ECOSYSTEM — WITH GOOGLE ESSENTIALLY TRYING TO ORCHESTRATE WHAT THEY DO?

EVH: Neither Google or anybody else is going to "orchestrate" user-innovators. What they do is *attract* them by offering good platforms and user development tools.

SW: ON THAT THEME, WEB 2.0 AND THE EXPLOSION OF SOCIAL NETWORKING AS YOU WERE ALLUDING TO WITH FACEBOOK: HAS IT HAD A TANGIBLE IMPACT ON LEAD USER COMMUNITIES?

EVH: Again it's a matter of tools. Web 2.0 offers even better free tools for users to use in communicating and innovating — and so potential user-innovators are attracted to these platforms as a place to set up their communities and activities.

SW: ON A RELATED TOPIC, I'VE READ RECENTLY THAT YOU'RE INTERESTED IN THE IDEA OF "OPEN HARDWARE". CAN YOU EXPLAIN EXACTLY WHAT OPEN HARDWARE IS AND WHAT THE POTENTIAL IMPACT TO THE MANUFACTURING INDUSTRY COULD BE?

EVH: Open hardware is a set of open platforms and tools to support people who want to design their own hardware. For example, the Arduino board is a basic electronics processing board with open specifications that anyone can copy and use in their own projects. People are proving that profitable firms can be set up around supplying hardware built to open specs.

SW I'VE HEARD YOU TALKING ABOUT BUG LABS. THEY SEEM TO BE LEADING IN THIS AREA ALSO. COULD YOU TELL ME A BIT ABOUT THAT?

EVH: The whole open source hardware movement has multiple layers. Some people are selling components like the Arduino board. Other people are selling systems that people can modify easily — and this is what Bug Labs is doing. Bug Lab supplies a set of attractively packaged hardware modules that can be linked in novel ways and that can be programmed with your own custom software. All the specifications for what they build and offer on the market are open and can be reproduced by anyone for free. Both individuals and firms are finding it very attractive to make the special products they need based upon open hardware platforms like that. But many choose to buy from Bug Labs, and so Bug Labs make a profit. The world of open and user innovation is growing like crazy in many varied ways — it is a very exciting time.

SW: WHAT'S NEXT ON YOUR RESEARCH AGENDA?

EVH: A major project right now is to help get government policy in line with the open, user-centered innovation paradigm. Our first step is to help governments to measure user innovation and its degree of openness better. At the moment they really don't do that — which means that user innovation is largely invisible to policymakers. I'm working with two excellent colleagues in the area of measurement — Fred Gault and Jeroen de Jong - and we're creating new measures. When governments adopt these new measurements — and we think that in the next year or two this will happen — policymakers and firms for the first time will be able to see that open and user innovation is *really* big and is growing very rapidly. In fact, we think it will be the dominant innovation process in the economy.

More generally, I am helping to push things forward by doing lots of research on user and open innovation with lots of excellent coauthors. The transition to the new, open, user-centered innovation paradigm is painful to some, but the end result will be very valuable and enhance possibilities for us all.

Scott Wilson is a senior manager and the U.S. lead for Technology, Media and Telecommunications research within Deloitte Research, Deloitte Services LP.