15.352:
Managing Innovation: Emerging Trends

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Agenda

- Introduction

- Course Structure & Logistics

- Overview of course content

Who am I – What do I study and write about?

- Head of the Technological Innovation and Entrepreneurship Group (TIE) at Sloan

- Prior to MIT, real-world innovation experience as a venture co-founder and R&D manager

- Research focus: The "fuzzy front end" of the innovation process – how it works, how to make it better.

- Studies in: Industrial products (like semiconductors); consumer products (sports equipment); OS software

Why a course on "emerging trends" in innovation management

Because:

- Major changes are happening – the Internet and "user innovation toolkits" are increasingly shifting innovation from manufacturers to "user innovation communities."

- You need to understand what is going on and why – the new patterns will come into full force "on your watch" as managers.

Democratizing Innovation turns much of how we think
about innovation economics on its head.
von Hippel has provided us with a fascinating book
that will challenge innovation theorists and businesses alike.
-- Professor Yochai Benkler, Yale Law School

Primary course
reading…
On Server
Free on Web
after April 1, 05

The research on democratizing innovation is a group effort

Patterns in user innovation

- Professor Nikolaus Franke
- Professor Cornelius Herstatt
- Karim Lakhani
- Professor Chistian Luthje
- Professor Pam Morrison
- Professor Glen Urban

Economics of user innovation / free revealing

- Professor Dietmar Harhoff
- Professor Joachim Henkel
- Professor Georg von Krogh

Course logistics

- **Grading:**
  - **Class attendance and participation   30%**
  - **Two mini-papers (7 pages)   70%**

- **For each paper:**
  1. <u>Choose a topic</u> covered in this class that especially interests you.

  2. <u>Briefly explain topic</u> Devote 1-2 pages to this. No extra reading needed here: derive from class lectures and discussions, assigned readings and other sources of information that you may already have.

  3. <u>Expand in the direction of your interest</u>. Fine to draw in your personal experience and views in addition to findings from extra reading on the topic.

"Democratizing Innovation" means that users are increasingly able to innovate for themselves

The mainstream "manufacturer-centered" view:

- Manufacturers are the developers of new products.
- They protect their innovations as intellectual property

The new, user-centered view:

- Users are the actual developers of many / most new products – both physical *and* information products
- Users generally freely reveal their innovations.
- User-developed innovations are a major feedstock for products commercialized by manufacturers.
- User innovation is a "good thing" that increases social welfare.
- User innovation is steadily increasing as enabling computing and communication technologies improve.

The current view that freely-revealed user innovation might be plausible and important

- Open source software projects first brought the phenomenon to serious academic attention:

- As Lerner and Tirole (2002) put it: "Why should thousands of top-notch programmers contribute freely to the provision of a public good?"

Essential Definition

The "functional" source of innovation depends upon the *functional* relationship between innovator and innovation:

- An innovation is a **USER innovation** when the developer expects to benefit by USING it;

- An innovation is a **MANUFACTURER innovation** when the developer expects to benefit by SELLING it.

Many users innovate

Industrial products	n	% innovating
Printed Circuit CAD Urban and vH	136	**24.3%**
Pipe Hanger Hardware Herstatt and vH	74	**36%**
Library IT Systems Morrison, Roberts, vH	102	**26%**
Software security features Franke and vH	131	**19.1%**
Surgical Equipment Luthje	262	**22%**
Consumer products	n	% innovating
Outdoor Products Luthje	153	**9.8%**
"Extreme" sports equipment Franke & Shah	197	**37.8%**
Mountain biking equipment Luthje, Herstatt, vH	291	**19.2%**

Why do so *many* users want custom products? Because they have "custom" needs

- 2 Meta analyses of market segmentation studies show heterogeneity of need is generally high:

  - 5.5 segments specified on average: 46% within-segment variation remaining (Franke and Reisinger, 2003)

  - 3.7 segments specified on average: 54% within-segment variation remaining (Franke and von Hippel, 2003)

User innovation is widely distributed in the case of physical (as well as information) product development:

Few users developed more than one major commercialized innovation

Innovation Type	Number of users developing this Number of major innovations					
	1	2	3	6	na	(n)
Scientific Instruments*	28	0	1	0	1	32
Scientific Instruments**	20	1	0	1	0	28
Process equipment***	19	1	0	0	8	29
Sports equipment****	7	0	0	0	0	7

* Source, von Hippel 1988, Appendix: GC, TEM, NMR Innovations
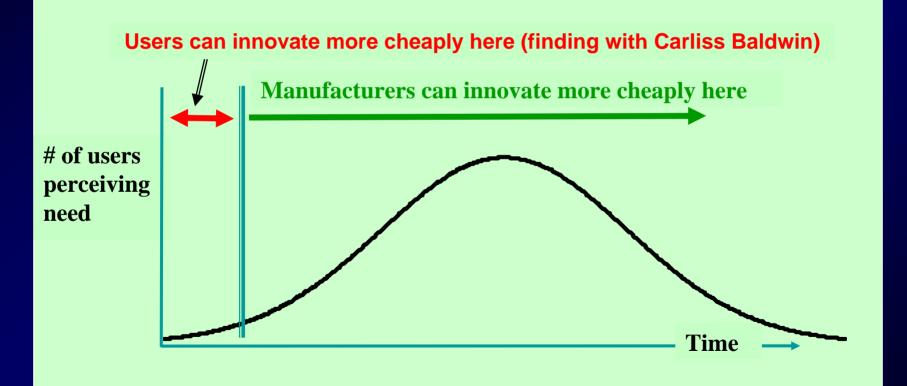** Source, Riggs and von Hippel, Esca and AES
*** Source, von Hippel 1988, Appendix: Semiconductor and pultrusion process equipment innovations.
**** Source, Shah 2000,

Innovating users tend to be "lead users:"
- experience needs ahead of others
- have a strong need for a solution

- Innovations developed by lead users have high commercial value – Morrison and several other authors

- Commercial value of innovations users develop goes up as "lead user" characteristics of innovators intensify – Franke & vH

Users tend to innovate at the leading edge of markets – where demand is small and uncertain. SO - lead user innovations offer a product feedstock for manufacturers

Users can innovate more cheaply here (finding with Carliss Baldwin)

Manufacturers can innovate more cheaply here

# of users perceiving need

Time

Users are the major sources of commercial products in some fields

Innovations Samples:	User	Manufr	Suplr	Other	NA	Total (N)
Scientific Instruments	77%	23%	-	-	17	111
Semicon & PC Crd Process	67%	21%	-	12%	6	49
Pultrusion Process	90%	10%	-	-	-	10
Tractor Shovel Related	6%	94%	-	-	-	11
Engineering Plastics	10%	90%	-	-	-	5
Plastics Additives	8%	92%	-	-	4	16
Industrial Gas-Using	42%	17%	33%	8%	-	12
Thermoplastic-Using	43%	14%	36%	7%	-	14
Wire Stripping Equip	25%	75%	-	-	2	8
Connector Attaching Equip	4%	13%	83%	-	-	12
Sports Equipment	58%	27%	-	15%	-	48

Example of a user innovation that became a major commercial product – automated radioimmunoassay

Another example: The World Wide Web

"Berners-Lee did not set out to invent a contemporary cultural phenomenon; rather, he says, "it was something I needed in my work." He wanted to simply to solve a problem that was hindering his efforts as a consulting software engineer at CERN.

Berners-Lee's innovation was to apply hypertext to the growing reality of networked computers. He expanded the idea he had developed at CERN and made it available on the Internet in the summer of 1991.

Technology Review, July 1996, p.34

The first WebCam:
Watching a coffee pot at the
U of Cambridge

"Convenience was the mother of invention."

User and Manufacturer Innovations Differ

Users tend to develop **Functionally Novel** innovations:

- The first sports-nutrition bar
- The first scientific instrument of a new type

Manufacturers tend to develop **Dimension of Merit Improvements:**

- A better-tasting sports-nutrition bar
- Improvements to an existing type of scientific instrument

Users tend to develop *Functionally Novel* innovations – Mfrs develop *DOM improvements*

Example – Scientific Instrument Innovations

Type of improvement provided by innovation	% of Innovations developed by users
(1) New functional capability	82%
(2) DOM improvements	13%

Total innovation sample size: n = 64
Source Riggs & von Hippel (1994)

Lead users are…

Only "Lead User" innovations form the basis for new products and services of value to manufacturers.

"Lead Users" are users that:

1. Have needs that *foreshadow general demand* in the marketplace;

2. Expect to *obtain high benefit* from a solution to their needs. (Such users are more likely to innovate – "Necessity is the mother of invention!")

Lead users often innovate collaboratively in communities

- Franke and Shah found that sports innovators within user communities
  - Were "lead users" (high need – leading edge users)
  - Got assistance with their innovation development from others in their community

- Lakhani and others document the same phenomena in Open Source software projects

Empirical studies find innovating users often *freely* reveal their innovations to other users and/or to suppliers

- Improvements to Open Source software
- Improvements to iron furnaces (Allen)
- Improvements to mine pumping engines
- Improvements to Technicon clinical chemistry analyzers
- IBM copper interconnect technology
- Improvements to library information systems (OPACs)
- Information from user-participants in Lead User studies

User innovation communities can *supplant* product development by manufacturers

EXAMPLE: Zeroprestige.org

"We are interested in furthering kite-powered sport by enabling an 'open source' (shared knowledge and documentation) approach to kite-building and things kite-powered in general."

"You are encouraged to post and add comments and knowledge to any of the postings."

Users develop and post kite designs - often better than designs by kite manufacturers

EXAMPLE: Super high AR mountain board kite
"From Sebastian in Argentina..
a super high AR inflatable
design for mountain boarding…"

RESULT: User Innovation Communities may drive kite manufacturers right out of product design – innovation is being "democratized"

- **HAS BEEN** An industry of manufacturers that develop and sell kites of their own design.
- $100mm in equipment sales in 2002 – growing fast.

- **TODAY** – some firms are moving to a "build only" specialization – leaving product innovation to the user community (Firms are starting to download and build user designs instead of creating their own kite designs.)

Policy Implications

User-centered innovation is increasing as computing and communication costs drop.

- **User-centered innovation increases social welfare. Should be supported by – or at least not discriminated against – by policy.**

    - IP is being used in ways that favor major holders (e.g., patent thickets) Since user-innovation is distributed, each innovator will have little IP – is at a disadvantage.

    - Digital Millennium Copyright Act is aimed at illegal copying – but also causes collateral damage to user innovation. Affects users' ability to modify and improve what they buy.