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Creating “breakthrough” products and services

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Agenda

- Introduction
- Who really develops breakthroughs?
- Course Structure & Logistics

Who am I?

- Head of the Technological Innovation and Entrepreneurship Group (TIE) at Sloan
- You may find it comforting to know that I have 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

**Periodic MAJOR innovation is essential:
everything becomes a commodity eventually
– and may even be entirely supplanted.**

Hot and proprietary once – now commodities:

- 3M transparent “Scotch” tape.

Marginal improvements kept it going for decades:

>>Decorated “gift tape,” write-on tape, double-sided tape.

- Aspirin >> Buffered, coated, child-sized, liquid...

Once hot – now entirely gone:

- Battleships, record-players...

“Breakthrough” vs incremental innovation

- A “breakthrough” innovation, as we use the term, is the *first member* of a major new product line in a firm:
 - The first gas-chromatograph (GC)
 - The first masking tape
- “Incremental” innovations are improvements to existing product lines
 - Improved GC
 - Improved masking tape

Why a course on developing breakthroughs?

Because:

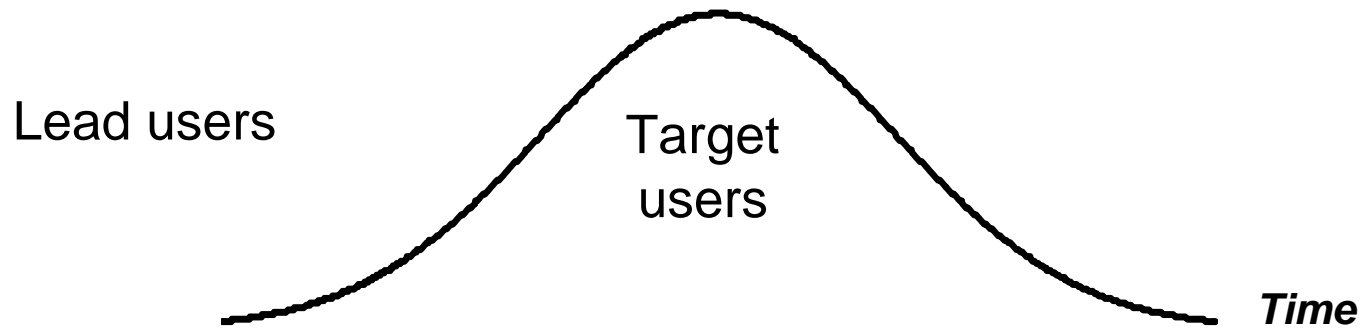
- Periodic breakthroughs are ESSENTIAL to firms
- Firms are (pretty) good at incremental innovation – but they don't know *how* to develop breakthroughs systematically
- Result: major innovations are often very rare and desperately sought by management:
 - In 5 3M Divisions studied less than 1 new product line introduced per Division every 2 years on average

Introducing major innovation is not easy even when you understand the principles: Innovation is both essential and *UNWANTED*

- Change is disruptive – to be avoided if possible
- Change obsoletes corporate expertise and production investments
 - Polaroid produces instant film and cameras – not digital!
 - Kodak produces film – not digital cameras!
- Change devalues personal “intellectual property”
 - I know Cobol – not C++!
 - I know tubes – not transistors!
 - I know manned aircraft – not drones!

Contrasting innovation methods

Need and market life cycle curve



New methods are based on finding / encouraging and commercializing **solutions** developed by users themselves

Traditional methods are based on “find a need and fill it”
(Target users provide **needs**;
Manufacturer develops solutions)

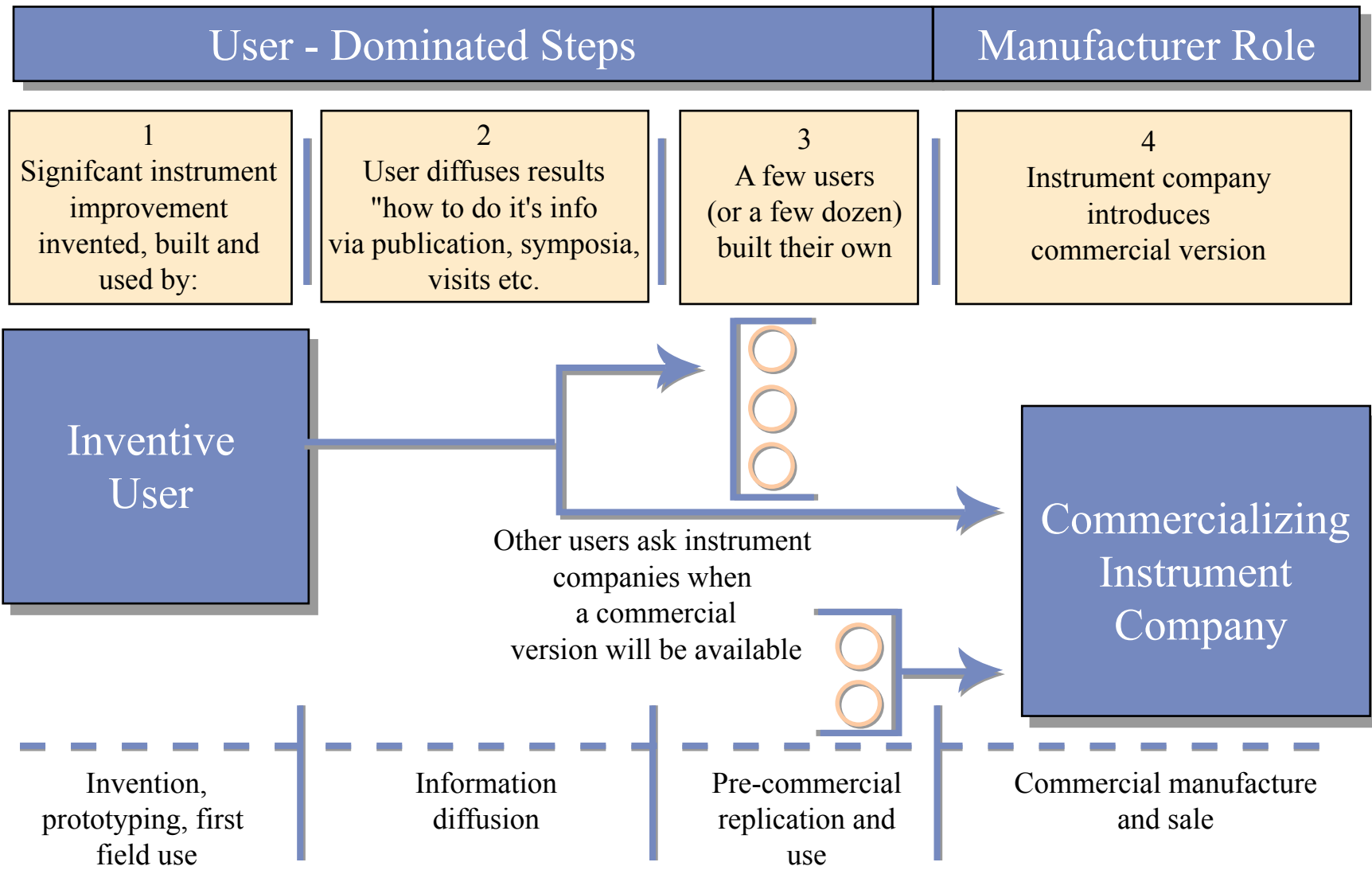
Essential Definitions

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

- An **INNOVATION** is anything new that is actually used (“enters the marketplace”) – whether major or minor.
- 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.

How we discovered that users develop many major new products

<i>Innovations Affecting</i>	First Device	Major Improvement	Minor Improvement
Gas Chromatography	1	11	-
Nuclear Magnetic Resonance Spectrometry	1	14	-
Ultraviolet Spectrophotometry	1	5	-
Transmission Electron Microscopy	1	14	63
Total	4	44	63



This diagram is based on: von Hippel, Eric. "The Dominant Role of Users in the Scientific Instrument Innovation Process." *Research Policy* 5, no. 3 (July 1976): 212-39.

**First device used in field
developed and built by:**

<i>Innovations Affecting</i>	% User	User	Mfg.
Gas Chromatography	83%	10	2
Nuclear Magnetic Resonance Spectrometry	80%	12	3
Ultraviolet Spectrophotometry	100%	6	0
Transmission Electron Microscopy	72%	44	17
Total	77%	72	22

Gammaflow:

A Completely Automated Radiomunoassay System

(This image is available in *Science*, Vol. 194, October 1976.)

(Photograph of a Washington state police car with a system of air tubes attached to it. It is a homemade, lead user solution to the problem of volcanic ash damaging its engine.)

- UPI Photo, May 26, 1980.

(Photograph of a unique method of irrigation
in Kufra, using a center-pivot system
that creates large circular fields.)

(Close-up photographs of the system that supplies water to fields using the center-pivot system.)

The World Wide Web

– A User Innovation

“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

Examples of Important Consumer Product Innovations

Category	Example
Health Products	Gatorade
Personal Care	Protein-base Shampoo Feminine Hygiene
Sports Equipment	Mountain Bike Mountain Climbing-Piton
Apparel	Sports Bra
Food	Chocolate Milk Graham Cracker Crust
Office	White-out Liquid
Computer Application Software	Electronic Mail Desk Top Publishing

Exercise: identify your own examples of user innovation

1. Think of your experiences in a firm.
 - Did a product modification by a **customer** come to your attention?
 - Did your firm modify a product sold to you or develop a new one for in-house use?
2. Think of your experiences as a consumer **in a field you really care about** (a sport? type of cooking?)
 - Did **you** ever modify a commercial product you bought?
 - Did **you** ever use a product in a new way?

History of “AOL Instant Messenger”

Instant Messaging is a User Innovation

- By 1987 MIT Lab for Computer Science had thousands of “Athena” workstations online and difficulties diffusing system admin info rapidly. Developed “Zephyr” instant message system.
- MIT students begin to use for general instant messaging.
- Other universities adopted Zephyr-like programs

First Commercial Product 9 years later

- 1996 Israeli firm Mirabilis put out comml product ICQ
- 1998 Mirabilis acquired by AOL

Ongoing evolution of Wi-Fi

User Activities to Date

- Users discover possibilities and begin free sharing of wireless networks
- Users Modify Wi-Fi antennas to greatly increase range
- Widespread implementation occurs – travelers find “hot spots” as they travel, can get Internet access, send e-mail from the highway etc.

Traditional Supplier Responses?

- No one will want it – no network security
- We think this might be service stealing... should stop.

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

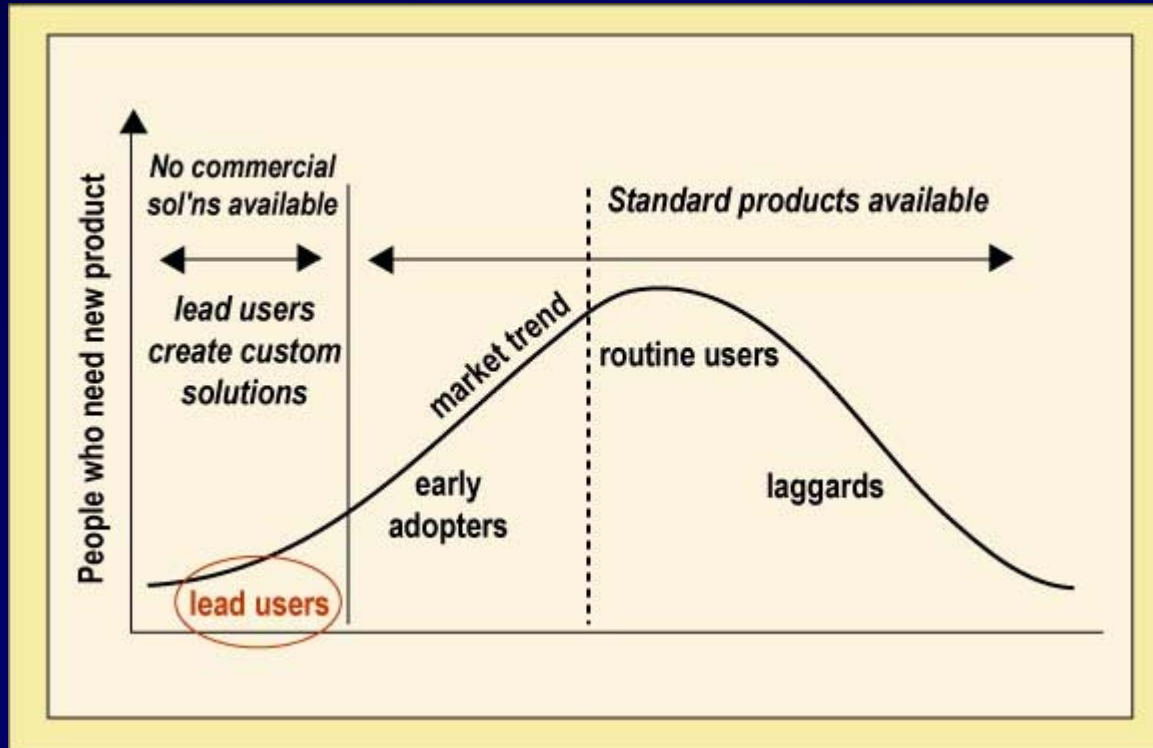
Users innovate when it pays... for them

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 at leading edge of curve



Adopter Categorization According to Innovativeness

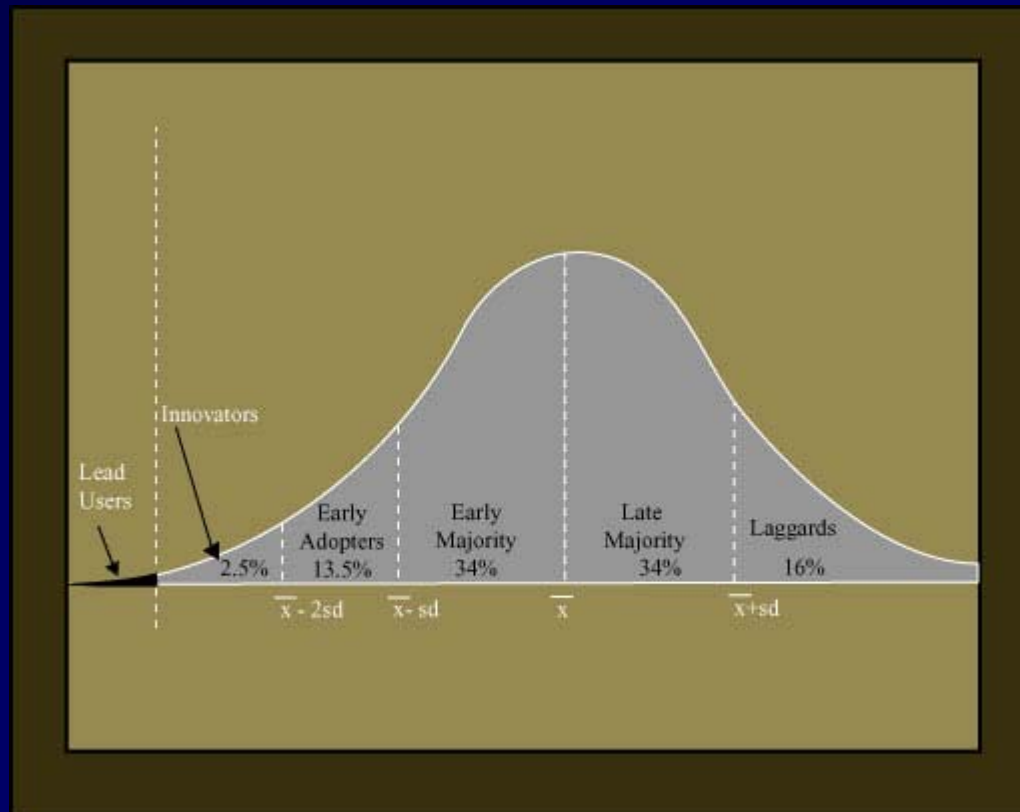


Diagram based on: Rogers, E. M. *Diffusion of Innovations*.
New York: Free Press, p. 182.

Course topics

- Where breakthroughs come from and why
- Finding lead users – and their innovations
- Conventional market research – the path to incrementalism
- Brainstorming and creativity
- Build it and they will come (MIT Media Lab)
- Ethnographic methods
- Why users reveal their innovations
- Toolkits for user innovation
- User innovation communities
- Resistance to innovation

Course logistics

- The Wait List
- Grading:
 - Class attendance and participation 50%
 - Two mini-papers (7 pages) 50%
- For each paper:
 1. Choose a topic covered in this class that especially interests you.
 2. Briefly explain topic 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. Expand in the direction of your interest. Fine to draw in your personal experience and views in addition to findings from extra reading on the topic.