



TECHNOLOGY MANAGEMENT

Module 2



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Getting an Inside Look: Given Imaging's Camera Pill

- The Camera Pill: A capsule that is swallowed by patient that broadcasts images of the small intestine
- Invented by Gavriel Iddan & team of scientists
 - Iddan was a missile engineer – no medical background
 - Project initiated by Dr. Scapa, a gastroenterologist
 - Iddan applied guided missile concept to problem of viewing the small intestine
- Developing the Camera Pill
 - Many hurdles to overcome: size, image quality, battery life
 - Formed partnership with Gavriel Meron (CEO of Applitec) for capital to commercialize
 - Formed partnership with team of scientists lead by Dr. C. Paul Swain to combine complementary knowledge
 - Resulted in highly successful, revolutionary product.

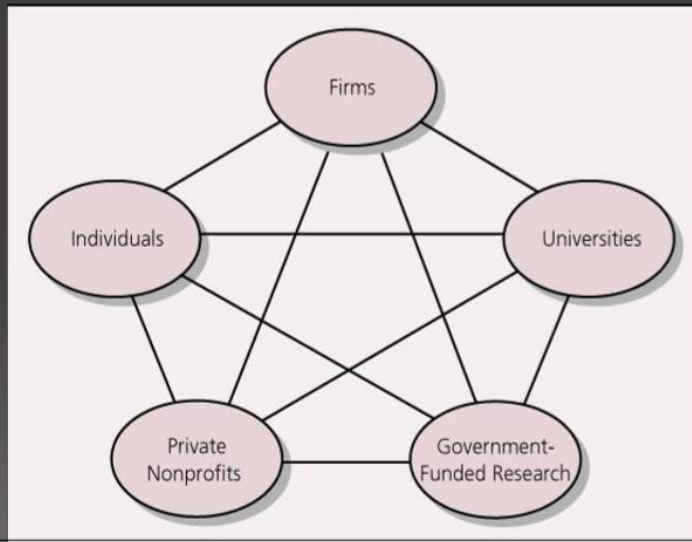
Getting an Inside Look: Given Imaging's Camera Pill

Discussion Questions:

1. What factors do you think enabled Iddan, an engineer with no medical background, to pioneer the development of wireless endoscopy?
2. To what degree would you characterize Given's development of the camera pill as "science-push" versus "demand-pull"?
3. What were the advantages and disadvantages of Iddan and Meron collaborating with Dr. Swain's team?
4. What were the advantages and disadvantages of Given being owned by Medtronic?

Overview

- Innovation can arise from many different sources and the linkages between them.



Creativity

- **Creativity:** The ability to produce work that is *useful* and *novel*.
 - Individual creativity is a function of:
 - Intellectual abilities (e.g., ability to articulate ideas)
 - Knowledge (e.g., understand field, but not wed to paradigms)
 - Style of thinking (e.g., choose to think in novel ways)
 - Personality (e.g., confidence in own capabilities)
 - Motivation (e.g., rely on intrinsic motivation)
 - Environment (e.g., support and rewards for creative ideas)

Creativity

- Organizational Creativity is a function of:
 - Creativity of individuals within the organization
 - Social processes and contextual factors that shape how those individuals interact and behave
- Methods of encouraging/tapping organizational creativity:
 - Idea collection systems (e.g., suggestion box; Google's idea management system)
 - Creativity training programs
 - Culture that encourages (but doesn't directly *pay* for) creativity.

Theory in Action

- Inspiring Innovation at Google
- Google uses a range of formal and informal mechanisms to encourage its employees to innovate, including:
 - 20% Time (all engineers are encouraged to spend 20% of their time working on their own projects)
 - Recognition awards
 - Google Founders' Awards
 - Ad sense Ideas Contest
 - Innovation reviews

Translating Creativity into Innovation

- Innovation is the implementation of creative ideas into some new device or process.
- Requires combining creativity with resources and expertise.
- **Inventors**
 - One ten-year study found that inventors typically:
 1. Have mastered the basic tools and operations of the field in which they invent, but they will have not specialized solely on that field.
 2. Are curious, and more interested in problems than solutions.
 3. Question the assumptions made in previous work in the field.
 4. Often have the sense that all knowledge is unified. They will seek global solutions rather than local solutions, and will be generalists by nature
 - Such individuals may develop many new devices or processes but commercialize few.

Theory in Action

- **Dean Kamen**
 - The Segway HT: A self-balancing, two-wheeled scooter.
 - Invented by Dean Kamen
 - Described as tireless and eclectic
 - Kamen held more than 150 U.S. and foreign patents
 - Has received numerous awards and honorary degrees
 - Never graduated from college
 - To Kamen, the solution was not to come up with a new answer to a known problem, but to instead reformulate the problem

Transforming Creativity into Innovation

■ Innovation by Users

- Users have a deep understanding of their own needs, and motivation to fulfill them.
- While manufacturers typically create innovations to profit from their sale, user innovators often initially create innovations purely for their own use.
- E.g., Laser sailboat developed by Olympic sailors; Indermil tissue adhesive based on Superglue; early snowboards

Theory In Action

■ The Birth of the Snowboarding Industry

- First snowboards not developed by sports equipment manufacturers; rather they were developed by individuals seeking new ways of gliding over snow
 - Tom Sims made his first “ski board” in wood shop class.
 - Sherman Poppen made a “snurfer” as a toy for his daughter – later held “snurfing” contests
 - Jake Burton added rubber straps to snurfer to act as bindings
- By 2014 there were approximately 7.3 million snowboarders in the United States

Transforming Creativity into Innovation

■ Research and Development by Firms

- **Research** refers to both *basic* and *applied* research.
 - **Basic research** aims at increasing understanding of a topic or field without an immediate commercial application in mind.
 - **Applied research** aims at increasing understanding of a topic or field to meet a specific need.
- **Development** refers to activities that apply knowledge to produce useful devices, materials, or processes.

Transforming Creativity into Innovation

■ Research and Development by Firms

- *Science Push* approaches suggest that innovation proceeds linearly:
 - Scientific discovery → invention → manufacturing → marketing
- *Demand Pull* approaches argued that innovation originates with unmet customer need:
 - Customer suggestions → invention → manufacturing
- Most current research argues that innovation is not so simple, and may originate from a variety of sources and follow a variety of paths.

Transforming Creativity into Innovation

■ Firm Linkages with Customers, Suppliers, Competitors, and Complementors

- Most frequent collaborations are between firm and their customers, suppliers, and local universities.

	North America	Europe	Japan
<i>Collaborates with:</i>			
Customers	44%	38%	52%
Suppliers	45	45	41
Universities	34	32	34

Transforming Creativity into Innovation

■ Firm Linkages with Customers, Suppliers, Competitors, and Complementors

- External versus Internal Sourcing of Innovation
 - External and internal sources are complements
 - Firms with in-house R&D also heaviest users of external collaboration networks
 - In-house R&D may help firm build *absorptive capacity* that enables it to better use information obtained externally.

Transforming Creativity into Innovation

■ Universities and Government-Funded Research

■ Universities

- Many universities encourage research that leads to useful innovations
- Bayh-Dole Act of 1980 allows universities to collect royalties on inventions funded with taxpayer dollars
 - Led to rapid increase in establishment of technology-transfer offices.
- Revenues from university inventions are still very small, but universities also contribute to innovation through publication of research results.

Transforming Creativity into Innovation

■ Universities and Government-Funded Research

- Governments invest in research through:
 - Their own laboratories
 - Science parks and incubators
 - Grants for other public or private research organizations

Transforming Creativity into Innovation

■ **Private Nonprofit Organizations**

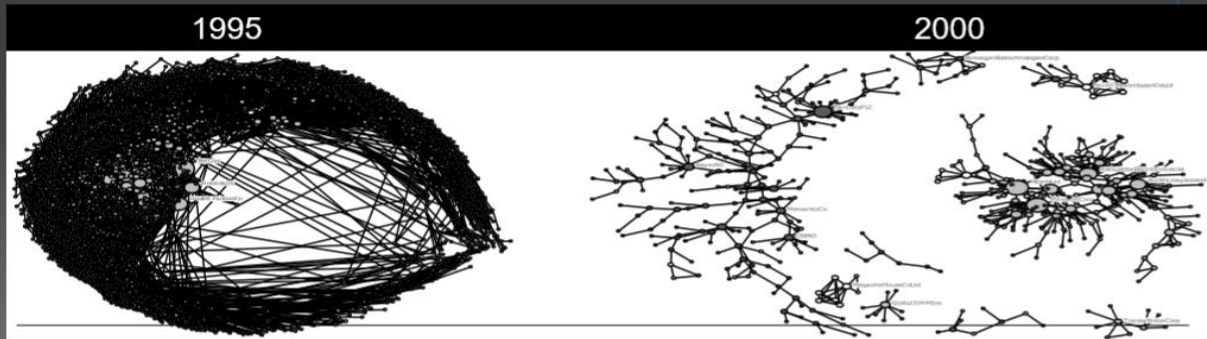
- Many nonprofit organizations do in-house R&D, fund R&D by others, or both.
- The top nonprofit organizations that conduct a significant amount of R&D include organizations such as the Howard Hughes Medical Institute, the Mayo Foundation, the Memorial Sloan Kettering Cancer Center, and SEMATECH.

Innovation in Collaborative Networks

- Collaborations include (but are not limited to):
 - Joint ventures
 - Licensing and second-sourcing agreements
 - Research associations
 - Government-sponsored joint research programs
 - Value-added networks for technical and scientific exchange
 - Informal networks
- Collaborative research is especially important in high-technology sectors where individual firms rarely possess all necessary resources and capabilities

Innovation in Collaborative Networks

- As firms forge collaborative relationships, they weave a larger network that influences the diffusion of information and other resources.
- The size and structure of this network changes over time due to changes in alliance activity.



Innovation in Collaborative Networks

- **Technology Clusters** are regional clusters of firms that have a connection to a common technology
 - May work with the same suppliers, customers, or complements.
 - Agglomeration Economies:
 - Proximity facilitates knowledge exchange.
 - Cluster of firms can attract other firms to area.
 - Supplier and distributor markets grow to service the cluster.
 - Cluster of firms may make local labor pool more valuable by giving them experience.
 - Cluster can lead to infrastructure improvements (e.g., better roads, utilities, schools, etc.)

Innovation in Collaborative Networks

- Likelihood of innovation activities being geographically clustered depends on:
 - The nature of the technology
 - e.g., its underlying knowledge base or the degree to which it can be protected by patents or copyright, the degree to which its communication requires close and frequent interaction;
 - Industry characteristics
 - e.g., degree of market concentration or stage of the industry lifecycle, transportation costs, availability of supplier and distributor markets; and,
 - The cultural context of the technology
 - e.g., population density of labor or customers, infrastructure development, national differences in how technology development is funded or protected.

Innovation in Collaborative Networks

- **Technological spillovers** occur when the benefits from the research activities of one entity spill over to other entities.
 - Likelihood of spillovers is a function of:
 - Strength of protection mechanisms (e.g., patents, copyright, trade secrets)
 - Nature of underlying knowledge base (e.g., tacit, complex)
 - Mobility of the labor pool

Research Brief

■ Knowledge Brokers

- Hargadon and Sutton point out that some firms (or individuals) play a pivotal role in the innovation network – that of *knowledge brokers*.
- **Knowledge brokers** are individuals or firms that transfer information from one domain to another in which it can be usefully applied. Thomas Edison is a good example.
- By serving as a bridge between two separate groups of firms, brokers can find unique combinations of knowledge possessed by the two groups.

Assignment (last date of submission is 8-04-2020)

1. What are some of the advantages and disadvantages of a) individuals as innovators, b) firms as innovators, c) universities as innovators, d) government institutions as innovators, e) nonprofit organizations as innovators?
2. What traits appear to make individuals most creative? Are these the same traits that lead to successful inventions?
3. Could firms identify people with greater capacity for creativity or inventiveness in their hiring procedures?
4. To what degree do you think the creativity of the firm is a function of the creativity of individuals, versus the structure, routines, incentives, and culture of the firm? Can you give an example of a firm that does a particularly good job at nurturing and leveraging the creativity of its individuals?