**Immagine che contiene testo, Carattere, Elementi grafici, logo

Descrizione generata automaticamente**

**Master’s Degree in Computer Science**

**Academic year 2023/2024**

**ECONOMICS AND MANAGEMENT**

**OF INNOVATION**

**Prof. Silvia Rita Sedita**

**Prof. Amir Maghssudipour**

Written by Michael Amista’

Based on “Strategic Management of Technological Innovation (Seventh Edition) –

Melissa A. Schilling”

**Contents**

[**Chapter 1: Introduction** 3](#_Toc158198544)

[**Chapter 2: Sources of innovation** 5](#_Toc158198545)

[**Chapter 3: Types and patterns of innovation** 8](#_Toc158198546)

[**Chapter 4: Standards battles and design dominance** 12](#_Toc158198547)

# **Chapter 1: Introduction**

**Technological innovation** is now the most important driver of competitive success in many industries.

* Many firms earn over one-third of sales on products developed within last five years.
* Product innovations help firms protect margins by offering new, differentiated features.
* Process innovations help make manufacturing more efficient.

**Advances in information technology** have enabled a faster innovation (CAD/CAM systems).

The importance of innovation and advances in information technology have led to:

* Shorter product lifecycles (more rapid product obsolescence).
* More rapid new product introductions.
* Greater market segmentation.

Innovation enables a wider range of goods and services to be delivered to people worldwide.

However, may result in negative externalities: for example, pollution, erosion, antibiotic-resistant bacteria.

[**Externalities**: “in economy environment is the set of effects, negative or positive, caused by a production or consumption activity of a subject”]

Successful innovation requires **strategies and implementation processes**. Most innovative ideas do not become successful new products; many projects do not result in technically feasible products and, of those that do, many fail to earn a commercial return.

The content of the course is divided into three parts:

1. **Part One: The foundations of technological Innovation**.

* C02: Sources of innovation.
* C03: Types and patterns of innovation.
* C04: Standards battles and design dominance.
* C05: Timing of Entry (non-attending students).

1. **Part Two: Formulating Technological Innovation Strategy**.

* C06: Defining the organization’s strategic direction.
* C07: Choosing innovation projects (non-attending students).
* C08: Collaboration strategies.
* C09: Protecting innovation.

1. **Part Three: Implementing Technological Innovation Strategy**.

* C10: Organizing for innovation (non-attending students).
* C11: Managing the new product development process.
* C12: Managing new product development teams.
* C13: Crafting a deployment strategy (non-attending students).

Immagine che contiene testo, schermata, diagramma, Parallelo

Descrizione generata automaticamente

# **Chapter 2: Sources of innovation**

Innovation can arise from many different sources, as:

* **individuals**, as users who design solutions for their own needs;
* **universities research**;
* **government-funded research**;
* **private** **nonprofit organizations**;
* the primary engine of innovation is **firms**. Firms have greater resources than individuals and they also face strong incentives to develop differentiating new products and services, which may give them and advantage over nonprofit or government-funded entities.

Immagine che contiene cerchio, diagramma, testo, linea

Descrizione generata automaticamenteThe most important source of innovation, however, does not arise from any one of these sources, but rather the **linkages** between them. **Networks of innovators** that leverage knowledge and other resources from multiple sources are one of the most powerful agents of technological innovation.

Innovation begins with the generation of new useful ideas, what is called **creativity**. Novel work must be different from work that has been previously produced and surprising (not so intuitive).

An **individual’s creative ability** is a function of his/her *intellectual abilities, knowledge, personality, motivation,* and *environment*.

**CREATIVITY**

The creativity of the organization (**organizational creativity**) is a function of creativity of the individuals and a variety of social processes and contextual factors that shape how those individuals interact and behave.

The methods to encourage organizational creativity are:

* idea collection systems (e.g. Google’s idea management system);
* creativity training programs;
* culture that encourages.

**Innovation is the combination of a creative idea with resources and expertise able to transform the idea in a useful form**.

One 10-year study of **inventors** concludes that the most successful inventors possess the following characteristics:

1. They have mastered the basic tools and operations of the field in which they invent, but they have not specialized solely in that field.
2. They are curious and more interested in problems than solutions.
3. They question the assumptions made in previous work in the field.
4. They often have the sense that all knowledge is unified. They seek global solutions rather than local solutions.

Such individuals may develop many new devices or processes but commercialize few.

**INNOVATION BY USERS**

Innovation often originates with those who create solutions for their own needs.

Users have a deep understanding of their own needs, and motivation to fulfil them. While manufacturers typically create innovations to profit from their sales, user innovators often initially create innovations purely for their own use.

**RESEARCH AND DEVELOPMENT BY FIRMS (R&D)**

**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 or processes.

There are two approaches for R&D by firms:

* *Science Push* approaches suggest that innovation proceeds linearly:

Scientific discovery → invention → manufacturing → Marketing.

* *Demand Pull* approaches argued that innovation originates from customer needs:

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.

Firms often form **alliances** with customers, suppliers, universities, and even competitors to jointly work on an innovation project or to exchange information/resources. **External and internal sources** of information are complements. In fact, firms exploit external collaboration networks just to complete their in-house R&D research and not as a substitute of their work. Doing in-house R&D may help firms to build an ***absorptive capacity*** that enables them to better use the information obtained externally.

Many universities encourage research that leads to useful innovations. Revenues from universities inventions are still very small, but universities can also contribute to innovation through publication of research results.

Governments invest in research through their own laboratories; science parks and incubators; grants for other public or private research organizations.

Many nonprofit organizations do in-house R&D, fund R&D to others, or both.

**Collaborative research** is especially important in high-technology sectors where individual firms rarely possess all necessary resources and capabilities. As firms forge collaborative relationships, they shape 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.

**TECHNOLOGY CLUSTERS**

Technology Clusters are regional clusters of firms that have a connection to a common technology (e.g. Silicon Valley’s); they may work with the same suppliers and customers.

🡺 **POSITIVE ASPECTS**:

* 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 labour pool more valuable by giving them experience.
* Cluster can lead to infrastructure improvements (for example, better roads, utilities, schools, etc.).

🡺 **NEGATIVE ASPECTS**:

* Increased competition.
* Knowledge leakage.
* Congestion.
* Pollution.

Agglomeration economies depend on the nature of the technology, industry characteristics and the cultural context of the technology.

**Technological spillovers** occur when the benefits from the research activities of one firm (or nation or other entity) spill over to other firms (or nations or other entities). Spillovers are thus a positive externality of R&D efforts. Evidence suggests that technology spillovers are a significant influence on innovative activities.

Whether R&D benefits will spill over is partially a function of the **strength of** **protection mechanisms** such as patents and copyrights. The likelihood of spillovers is also a function of the nature of the **knowledge base** (e.g., tacit knowledge may not flow readily across firm boundaries) and the **mobility of the labour pool**.

# **Chapter 3: Types and patterns of innovation**

Several dimensions are used to **categorize innovations**. These dimensions help clarify how different innovations offer different opportunities.

The path a technology follows through time is termed its ***technology trajectory***. Many consistent patterns have been observed in technology trajectories, helping us understand how technologies improve and are diffused.

**PRODUCT VERSUS PROCESS INNOVATION**

*Product innovations* refers to the outputs of an organization, its goods or services.

*Process innovations* are innovations in the way an organization conducts its business, such as in techniques of producing or marketing goods or services.

Product innovations can enable process innovations and vice versa.

What is a product innovation for one organization might be a process innovation for another.

* For example, UPS creates a new distribution service (product innovation) that enables its customers to distribute their goods more widely or more easily (process innovation).

**RADICAL VERSUS INCREMENTAL INNOVATION**

The *radicalness of an innovation* is the degree to which it is new and different from previously existing products and processes.

*Incremental innovations* may involve only a minor change from (or adjustment to) existing practices.

The radicalness of an innovation is relative; it may change over time based on different observers. Radical innovation creates less companies, less economy, than the incremental one; we can count more incremental innovations, made by small step on a previously existing technology, than the radical ones. Radical innovation is destructive: it destroys what was previous.



**COMPETENCE-ENHANCING VERSUS COMPETENCE-DESTROYING INNOVATION**

*Competence-enhancing innovations* are built on the firm’s existing knowledge base.

* For example, Intel’s Pentium 4 built on the technology for Pentium III.

*Competence-destroying innovations* renders a firm’s existing competencies obsolete.

* For example, electronic calculators rendered Keuffel and Esser’s slide rule expertise obsolete.

**ARCHITECTURAL VERSUS COMPONENT INNOVATION**

A *component innovation* (or modular innovation) entails changes to one or more components of a product system without significantly affecting the overall design.

An *architectural innovation* entails changing the overall design of the system or the way components interact. Most architectural innovations require changes in the underlying components also.

**S-CURVES**

Both the rate of a technology’s improvement, and its rate of diffusion to the market typically follow an s-shaped curve.

**S-CURVES IN TECHNOLOGICAL IMPROVEMENT**

1. Technology improves slowly at first because it is poorly understood.

2. Then accelerates as understanding increases.

3. Then tapers off as approaches limits.

Technologies do not always get to reach their limits. May be displaced by new, *discontinuous technology*.

* A discontinuous technology fulfills a similar market need by means of an entirely new knowledge base (e.g, carbon copying to photocopying, vinyl to compact discs).
* Technological discontinuity may initially have lower performance than incumbent technology (e.g., first automobiles were much slower than horse-drawn carriages.).

Firms may be reluctant to adopt new technology because performance improvement is initially slow and costly, and they may have significant investment in incumbent technology.

**S-CURVES IN TECHNOLOGICAL DIFFUSION**

Adoption is initially slow because the technology is unfamiliar. It accelerates as technology becomes better understood.

Eventually market is saturated and rate of new adoptions declines.

Technology diffusion tends to take far longer than information diffusion.

* Technology may require acquiring complex knowledge or experience.
* Technology may require complementary resources to make it valuable (for example, cameras not valuable without film).

**S-CURVES AS A PRESCRIPTIVE TOOL**

Managers can use data on investment and performance of their own technologies or data on overall industry investment and technology performance to map s-curve.

While mapping the technology’s s-curve is useful for gaining a deeper understanding of its rate of improvement or limits, its use as a prescriptive tool is limited.

* True limits of technology may be unknown.
* Shape of s-curve can be influenced by changes in the market, component technologies, or complementary technologies.
* Firms that follow s-curve model too closely could end up switching technologies too soon or too late.

**TECHNOLOGY CYCLES**

Technological change tends to be cyclical. Each new s-curve ushers in an initial period of turbulence, followed by rapid improvement, then diminishing returns, and ultimately is displaced by a new technological discontinuity.

Utterback and Abernathy characterized the technology cycle into two phases:

* The *fluid phase* (when there is considerable uncertainty about the technology and its market; firms experiment with different product designs in this phase).
* After a **dominant design** emerges, the specific phase begins (when firms focus on incremental improvements to the design and manufacturing efficiency).

Anderson and Tushman also found that technological change proceeded cyclically. Each discontinuity inaugurates a period of turbulence and uncertainty (era of ferment) until a dominant design is selected, ushering in an era of incremental change.

Anderson and Tushman found that:

* A dominant design always rose to command the majority of market share unless the next discontinuity arrived too early.
* The dominant design was never in the same form as the original discontinuity but was also not on the leading edge of technology. It bundled the features that would meet the needs of the majority of the market.

During the era of incremental change, firms often cease to invest in learning about alternative designs and instead focus on developing competencies related to the dominant design.

This explains in part why incumbent firms may have difficulty recognizing and reacting to a discontinuous technology.

# **Chapter 4: Standards battles and design dominance**

…