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

- Globalization has increased competitive pressure
- Advances in information technology have enabled faster innovation
- Many firms earn more over new products

**Technology Clusters(技术集群)** are regional clusters of firms that have a connection to a common technology, and may engage in buyer, supplier, and complementor relationships, as well as research collaboration.

• The benefits firms reap by locating in close geographical proximity to each other are termed **agglomeration economies.**

- May work with the *same suppliers, customers, or complements*.
- 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.)

Producers of complementary goods or services (e.g., for video game console producers such as Sony or Nintendo, game developers) are **complementors.**

**Tacit knowledge -** Knowledge that cannot be readily codified (documented in written form).

**Radical innovation** – very new and different from prior solutions (high risk).

**Incremental innovation** – makes a relative minor change from existing practices (low risk)

An **architectural innovation** entails changing the overall design of the system or the way components interact.

***Discontinuous technology*** - fulfills a similar market need by means of an *entirely new knowledge base.*

• Discontinuous technologies can prevent existing technologies from reaching their limits.

• Technological discontinuity may initially have lower performance than incumbent technology.

• The new disruptive technology is likely to displace the incumbent technology when it has a *steeper s-curve and/or a higher performance limit.*

**Absorptive Capacity: 吸收能力**

Absorptive Capacity refers to the ability of an organization to recognize, assimilate, and utilize new knowledge.

Absorptive capacity also has effects at the industry level.
As the number of firms learning about a technology increases and/or the number of firms creating complementary technologies increases, the more effective and efficient the original technology will become.

**Externalities(外部性)**:Costs (or benefits) that are borne (or reaped) by individuals other than those responsible for creating them.

**Network Externalities(网络外部性/网络效应)** (network effects, positive consumption externalities)– the value of a good to a user increases with the number of other users of the same or similar good. 一种商品对用户的价值会随着相同或类似商品的其他用户数量的增加而增加。

• *Direct network externalities*: the utility of a product to each user in a network depends on the number of users. (源于互操作要求) 一个产品对网络中每个用户的效用取决于用户的数量。

• *Indirect network externalities*: a positive link between the utility to a customer and the number of other users of the product by expanding the range of *complementary products* (互补产品/配套产品).

Network externalities are common in industries that are physically networked.

The **installed base(用户规模)** – the number of users of a particular good.

**Complementary goods(互补产品/配套产品)** – additional goods and services that enable or enhance the value of another good.

Many industries exhibit **increasing returns** to adoption**(**采用规模收益递增**)**: the more a technology is adopted, the more valuable it becomes.
Two primary sources of increasing returns:

- Learning effects(学习效应)
- Network externalities(网络外部性)

**First movers (先发者)** are the first entrants to sell in a new product or service category ("*pioneers*")

**Early followers** (**早期跟随者**) are early to market *but not first*.

***Enabling technology*(赋能技术/使能技术)*:** *Component technologies that are necessary for the performance or desirability of a given innovation.)*

***Entry barriers*(进入壁垒)**: Conditions that make it difficult or expensive for new firms to enter an industry.

***Vertical integration*(纵向/垂直一体化)**: Getting into the business of one's suppliers or one's buyers.

**Core Competencies (Core Capabilities)**: A set of *integrated and harmonized* abilities that distinguish the firm in the marketplace.

- Competencies typically combine multiple kinds of abilities.
- Several core competencies may underlie a business unit.
- Several business units may draw from same competency.

**A core competency should fulfill three key criteria:**

- It is a significant source of competitive advantages. (价值性)
- It is not easy for competitors to imitate. (不易模仿性)
- It can be leveraged widely to many products and markets. (延展性)

**Dynamic capabilities:** A set of abilities that make a firm more agile and responsive to change. E.g., firm may develop a set of abilities that enable it to rapidly deploy new product development teams for a new opportunity; firm may develop competency in working with alliance partners to gain needed resources quickly.

**R&D Intensity**, the ratio of R&D expenditures to sales, varies considerably across and within industries.

**Discounted payback period**(动态投资回收期): The time required to break even on a project using discounted cash flows.

**Internal Rate of Return** (IRR，内部收益率): The discount rate that makes the net present value of investment zero.

**Strategic Alliances**

- Can be formal or informal relationship
- Require a significant investment in time and resources

- Gain access to capabilities not available in house, leverage their capabilities by combining their efforts with another firm
- Achieve innovation goals faster, at a lower cost and with less risk.

**Alliances** can also provide a firm with the flexibility to pursue various opportunities for innovation or access different types and scale of capabilities, important in rapidly changing markets.

**Joint Venture(合资/合营企业;或合资/合营项目):** A partnership between two or more firms involving a significant equity stake by the partners and often resulting in the creation of a new business entity.

- Formal alliances requiring a significant equity investment and commitment from each partner.
- Usually involve the creation of a separate legal entity.
- Follow carefully constructed contractual arrangements.

**Licensing:** A contractual arrangement granting a licensee the rights to an asset (proprietary technology, trademark, copyright, etc.) owned by the licensor.

- Licensor can penetrate a wider range of markets than it could on its own.
- Licensing to potential competitors can preempt them from developing their own technologies. But the knowledge transferred to licensees may enable them to develop their own proprietary technology.
- For the *license*, licensing is typically less expensive and less risky than in-house development. But licensee will lose the technology as a source of sustainable competitive advantage.

**Appropriability**: The degree to which a firm is able to capture the rents from its innovation.

- Appropriability is determined by how easily or quickly competitors can *copy the innovation*.
- Some innovations are *inherently* difficult to copy (tacit, socially complex, etc.)
- Firms may also attempt to protect innovations through patents, trademarks, copyrights or trade secrets.

**Architectural control:** the ability of a firm to determine the structure, operation, compatibility, and development of a technology

**Mechanistic Structures** have *high degree of formalization and standardization*, causing operations to be almost *automatic or mechanical, usually with high degree of centralization in decision-making*.

- Good for operational efficiency, reliability.
- Minimizes variation → may stifle creativity
- *Suitable for routines and repetitive work*

**Organic structures** have *low degree of formalization and standardization*; described as "*free*

*flowing*", *usually making decisions in decentralized ways.*

- Encourages creativity and experimentation
- May yield low consistency and reliability in manufacturing.
- *Suitable for work with great uncertainty*

***Formalization*:** The degree to which the firm utilizes rules, procedures, and written documentation to structure the behavior of individuals or groups within the organization.

- Can substitute for managerial oversight but can also make firm rigid.

**Ambidextrous organization(双元组织):** The ability of an organization to behave almost as two different kinds of companies at once.

Different divisions of the firm may have different structures and control systems, enabling them to have different cultures and patterns of operations.

- Some divisions (e.g., R&D, new product lines) may be *small and organic*.
- Other divisions (e.g., manufacturing, mature product lines) may be *larger and more mechanistic*.
- Can also *alternate through different structures* over time.

***Centralization*:** The degree to which decision- making authority is kept at top levels of the firm **OR** the degree to which activities are performed at a central location. (两层含义:无形的决策权的集中和分散，与有形组织的集中和分散)

**Cannibalization**: when a firm's sales of one product (or at one location) diminish its sales of another (or another location).

Whether to make product compatible with own previous generations ("**Backward Compatibility**")

If installed base and complements are important, backward compatibility usually best – leverages installed base and complements of previous generation, and links generations together. Can be combined with incentives to upgrade.

**Penetration Pricing** (very low price or free,渗透定价策略)

- Accelerates adoption, driving up volume
- Requires large production capacity be established early
- Risky; may lose money on each unit in short run
- Common strategy when competing for dominant design

Common pricing strategies for technological innovations include market skimming and **penetration pricing.**