Introduction to Business

TOPIC 7. Entrepreneurship & Innovation. Technology-based Companies

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Formulating and Implementing Technological Innovation Strategy

- Sources of Innovation

- Types and Patterns of Innovation

- Standards Battles and Design Dominance

Sources of Innovation

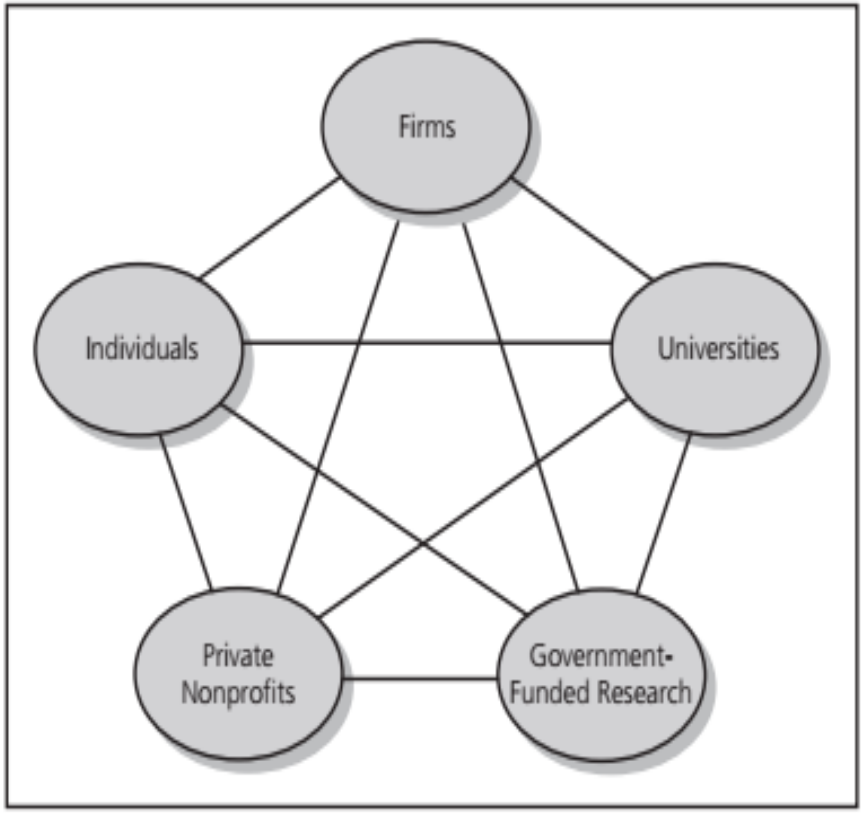
- **Innovation** can arise from many different sources. It can originate with individuals, as in the familiar image of the lone inventor or users who design solutions for their own needs. Innovation can also come from the research efforts of universities, government laboratories and incubators, or private non-profit organizations.

- Firms also face strong incentives to develop differentiating new products and services, which may give them an advantage over non-profit or government-funded entities.

Sources of Innovation

- Most important source of innovation: Linkages between the above mentioned players.

- Networks of innovators that leverage knowledge and other resources from multiple sources are one of the most powerful agents of technological advance. We can thus think of sources of innovation as composing a complex system wherein any particular innovation may emerge primarily from one or more components of the system or the linkages between them.



Sources of Innovation

Individual Creativity

- An individual's creative ability is a function of his or her intellectual abilities, knowledge, style of thinking, personality, motivation, and environment. The most important intellectual abilities for creative thinking include the ability to look at problems in unconventional ways, the ability to analyze which ideas are worth pursuing and which are not, and the ability to articulate those ideas to others and convince others that the ideas are worthwhile.

Organizational Creativity

- The creativity of the organization is a function of creativity of the individuals within the organization and a variety of social processes and contextual factors that shape the way those individuals interact and behave. An organization's overall creativity level is thus not a simple aggregate of the creativity of the individuals it employs. The organization's structure, routines, and incentives could thwart individual creativity or amplify it.

Sources of Innovation

Firms' Rank Ordering of the Importance of Sources for Research and Development Work, 1999

Source: E. Roberts, "Benchmarking Global Strategic Management of Technology," *Research Technology Management*. March–April 2001, pp. 25–36.

Rank Order of Sources of Research Work	Rank Order of Sources of Development Work
1 Central corporate research	Internal R&D within divisions
2 Internal R&D within divisions	Central corporate research
3 Sponsored university research	Suppliers' technology
4 Recruited students	Joint ventures/alliances
5 Continuing education	Licensing
6 University liaison programs	Customers' technology
7 Consultants/contract R&D	Continuing education
8 Joint ventures/alliances	Acquisition of products

Sources of Innovation

Percentage of Companies That Report Extensive Collaboration with Customers, Suppliers, and Universities

Source: E. Roberts, "Benchmarking Global Strategic Management of Technology," *Research Technology Management*, March–April 2001, pp. 25–36.

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

Sources of Innovation

Universities

To increase the degree to which university research leads to commercial innovation, many universities have established **technology transfer office**

Government-Funded Research

Governments of many countries actively invest in research through their own laboratories, the formation of **science parks** and **incubators**, and grants for other public or private research entities.

Private Non-profit Organizations

Many nonprofit organizations perform their own research and development activities, some fund the research and development activities of other organizations but do not do it themselves, and some non-profit organizations do both in-house research and development and fund the development efforts of others.

Sources of Innovation

INNOVATION IN COLLABORATIVE NETWORKS

Collaborative research is especially important in high-technology sectors, where it is unlikely that a single individual or organization will possess all of the resources and capabilities necessary to develop and implement a significant innovation.

Technology Clusters

Sometimes geographical proximity appears to play a role in the formation and innovative activity of collaborative networks. Example: Silicon Valley's semiconductor firms

Regional clusters of firms that have a connection to a common technology, and may engage in buyer, supplier, and complementary relationships, as well as research collaboration.

Technological spill overs

A positive externality from R&D resulting from the spread of knowledge across organizational or regional boundaries

Types & Patterns of Innovation

The path a technology follows through time is termed its **technology trajectory.**

Technology trajectories are most often used to represent the technology's rate of performance improvement or its rate of adoption in the marketplace. Though many factors can influence these technology trajectories some ***patterns*** have been consistently identified in technology trajectories across many industry contexts and over many periods.

Types & Patterns of Innovation

Product Innovation versus _Process_ Innovation

Product innovations are embodied in the outputs of an organization its goods or services. For example, Honda's development of a new hybrid electric vehicle is a product innovation.

Process innovations are innovations in the way an organization conducts its business, such as in the techniques of producing or marketing goods or services. Process innovations are often oriented toward improving the effectiveness or efficiency of production by, for example, reducing defect rates or increasing the quantity that may be produced in a given time.

Types & Patterns of Innovation

Radical Innovation versus Incremental Innovation

Radical innovation
An innovation that is very new and different from prior solutions.

Incremental innovation
An innovation that makes a relatively minor change from (or adjustment to) existing practices

Competence-Enhancing Innovation versus Competence-Destroying Innovation

Competence enhancing (-destroying) innovation

An innovation that builds on (renders obsolete) existing knowledge and skills. Whether an innovation is competence enhancing or competence destroying depends on whose perspective is being taken. An innovation can be competence enhancing to one firm, while competence destroying for another.

An innovation is considered to be ***competence enhancing*** from the perspective of a particular firm if it builds on the firm's existing knowledge base. An innovation is considered to be ***competence destroying*** from the perspective of a particular firm if the technology does not build on the firm's existing competencies or renders them obsolete.

Types & Patterns of Innovation

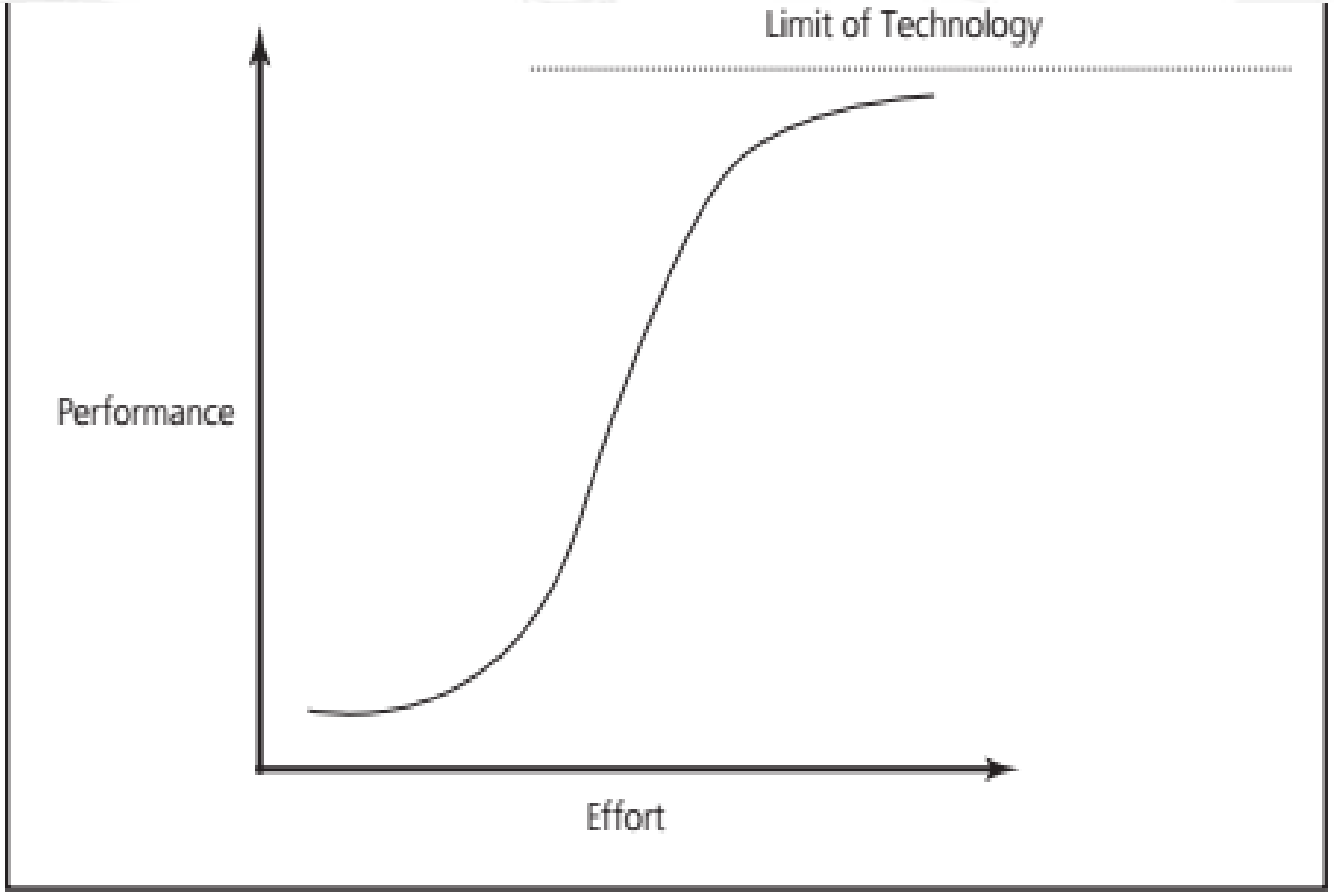
Architectural Innovation versus Component Innovation

Architectural innovation An innovation that changes the overall design of a system or the way its components interact with each other.

Component (or modular) innovation
An innovation to one or more components that does not significantly affect the overall configuration of the system.

Types & Patterns of Innovation

S-Curve of Technology Performance



Types & Patterns of Innovation

Discontinuous technology

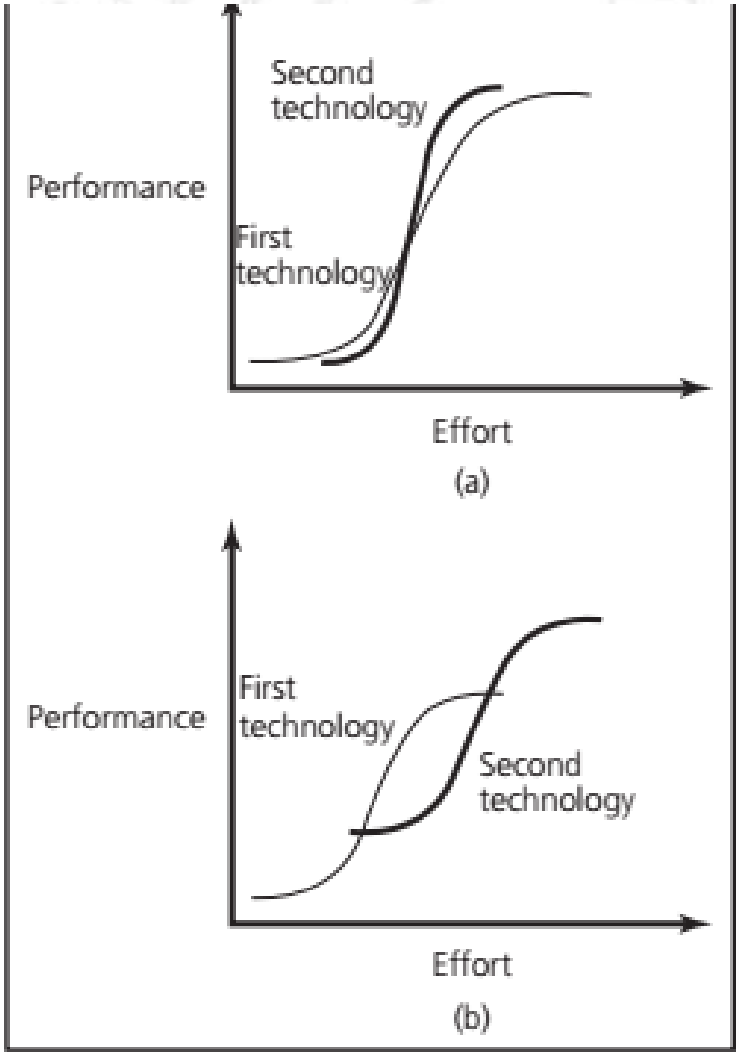
A technology that fulfils a similar market need by

building on an entirely new knowledge base.

Technology diffusion

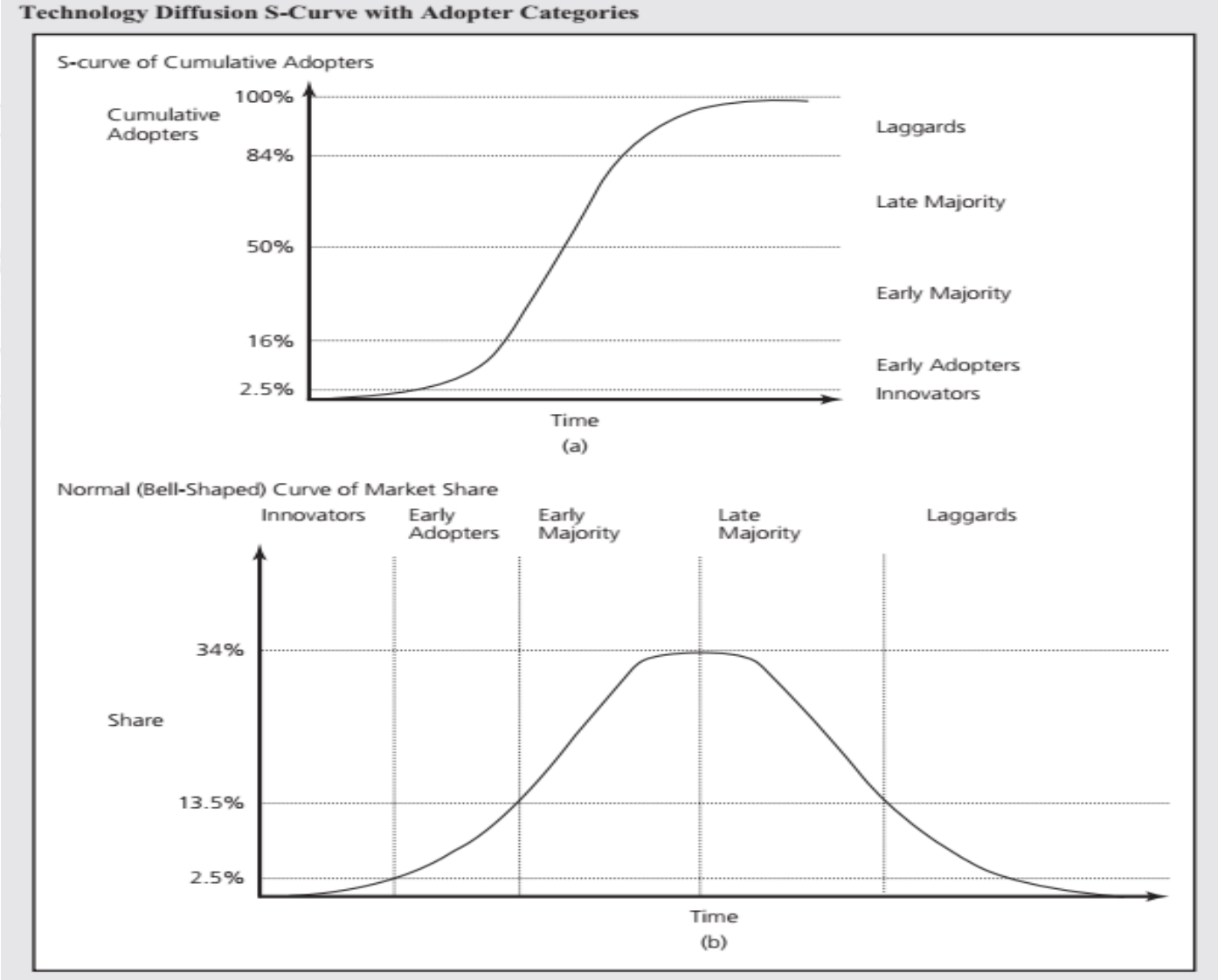
The spread of a technology through a population.

Technology S-Curves—Introduction of Discontinuous Technology



Types & Patterns of Innovation

- ***Innovators*** – These are risk-oriented, leading-edge minded individuals who are extremely interested in technological developments (often within a particular industry). Innovators are a fractional segment of the overall consumer population.
- ***Early Adopters*** – A larger but still relatively small demographic, these individuals are generally risk-oriented and highly adaptable to new technology. Early adopters follow the innovators in embracing new products, and tend to be young and well-educated.
- ***Early Majority*** – Much larger and more careful than the previous two groups, the early majority are open to new ideas but generally wait to see how they are received before investing.
- ***Late Majority*** – Slightly conservative and risk-averse, the late majority is a large group of potential customers who need convincing before investing in something new.
- ***Laggards*** – Extremely frugal, conservative, and often technology-averse, laggards are a small population of usually older and uneducated individuals who avoid risks and only invest in new ideas once they are extremely well-established



Standards Battles and Design Dominance

The technology cycle almost invariably exhibits a stage in which the industry selects a **dominant design (**Anderson and Tushman**)**.

Once this design is selected, producers and customers focus their efforts on improving their efficiency in manufacturing, delivering, marketing, or deploying this dominant design, rather than continue to develop and consider alternative designs.

Dominant design

A single product or process architecture that dominates a product category—usually 50 percent or more of the market. A dominant design is a “de facto standard,” meaning that while it may not be officially enforced or acknowledged, it has become a standard for the industry.

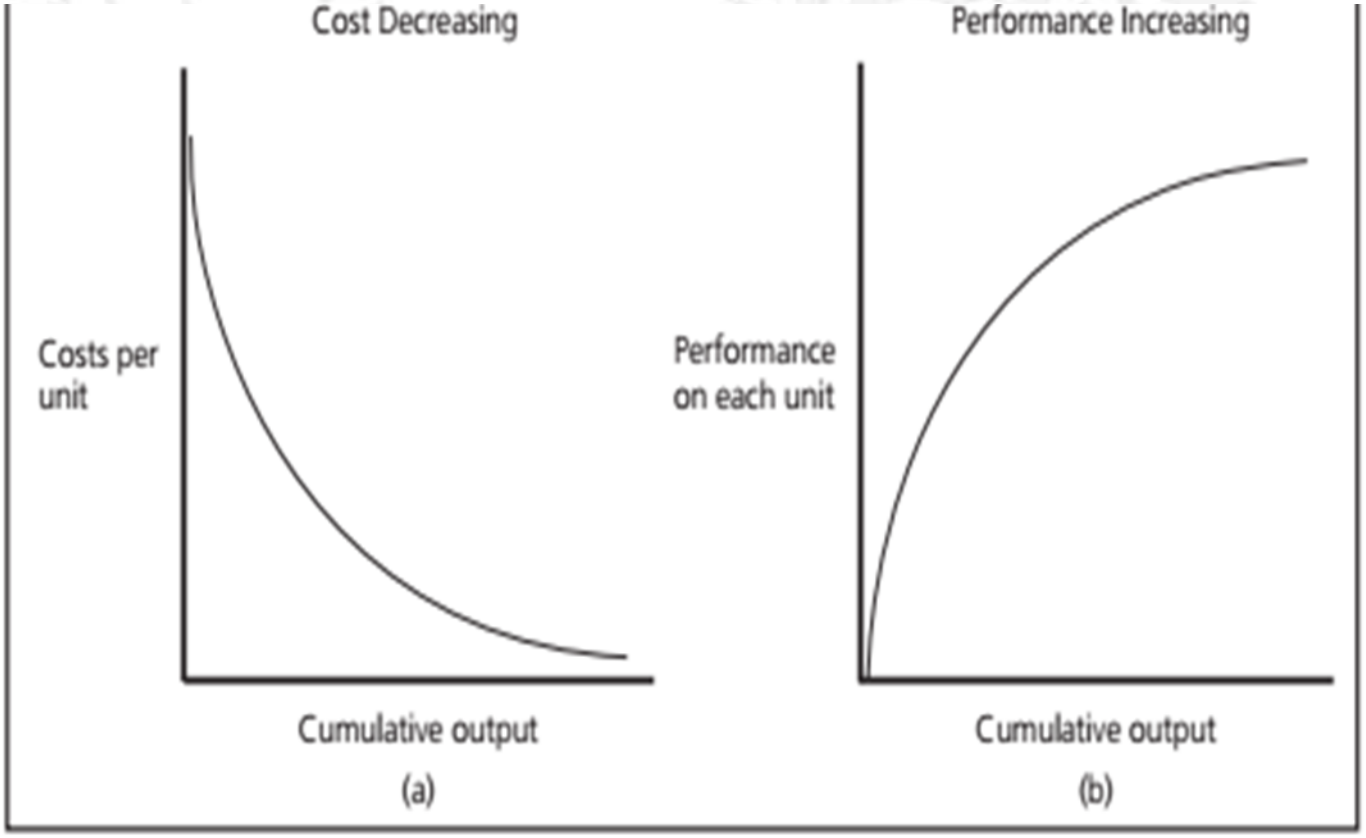
Standards Battles and Design Dominance

The more a technology is used, the more it is developed and the more effective and efficient it becomes. As a technology is adopted, it generates sales revenues that can be reinvested in further developing and refining the technology. Furthermore, as firms accumulate experience with the technology, they find ways to use the technology more productively, including developing an organizational context that improves the implementation of the technology . **Absorptive capacity** The ability of an organization to recognize, assimilate, and utilize new knowledge.

Standard Learning-Curve Forms

WHY DOMINANT DESIGNS ARE SELECTED

Learning Effects



Standards Battles and Design Dominance

Network Externalities

Also termed *positive consumption externalities,* this is when the value of a good to a user increases with the number of other users of the same or similar good.

- Installed base
The number of users of a particular good. For instance, the installed base of a particular video game console refers to the number of those consoles that are installed in homes worldwide.

- Complementary goods
Additional goods and services that enable or enhance the value of another good. For example, the value of a video game console is directly related to the availability of complementary goods such as video games, peripheral devices, and services such as online gaming.

*********The Result: Winner-Take-All Markets*********

All these forces can encourage the market toward natural monopolies. While some alternative platforms may survive by focusing on niche markets, the majority of the market may be dominated by a single (or few) design(s).