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ECONOMICS AND MANAGEMENT OF INNOVATION

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Contents

Chapter 01: 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 more quickly, greatly improving efficiency and productivity. This boost in efficiency and productivity enhances parallel operations, accelerating the development of new products and services. As a result, sales and revenues increase overall.

On the other hand, innovation can be costly for many firms, **risking** investing capitals in new projects, bringing uncertain returns and making some more resistant to change. Other things to consider are problems related to 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”]

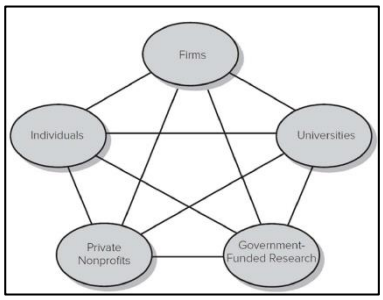
Note that the risk component is fundamental when talking about innovation, without the risk and a mindset open to change firms may fail in reaching innovation.

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.

Chapter 02: Sources of innovation

Innovation can arise from many different sources, such as:

- **Individuals**, as users who design solutions for their own needs.
- **Universities research**
- **Government-funded research**
- **Private nonprofit organizations**
- **Firms**: the primary engine of innovation. 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.



The most important source of innovation, however, does not arise from any one of these sources, but rather from 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.

CREATIVITY

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*. While these traits contribute to creativity, successful inventions often require a combination of inventive thinking, curiosity, and entrepreneurial traits. A willingness to question assumptions and engage in continuous ideation and experimentation is crucial for successful inventions.

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.

Leveraging individual's creativity is fundamental to reach the organizational creativity, letting people show their ideas. An example of firm that leverages the creativity of individuals is Google, which fosters creativity through initiatives like the 20% Time policy, encouraging

employees to spend a portion of their working hours on personal projects. Google's culture promotes exploration, risk taking, and collaboration, contributing to the overall creativity of the Company. Similarly, Facebook provides a range of benefits to its employees, fostering a conducive environment for creativity and innovation.

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

INNOVATION BY INVENTORS

The **inventors** have mastered the basic tools and operations of the field in which they invent. Inventors are curios and more interested in problems than in solutions, they question the assumption made in previous work in the field. Finally, they seek global solutions, not just local ones. 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. The main problem may come from disorganization, potentially being with limited resources and financial constraints, which might be limiting towards what can actually be achieved ideally.

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.

While firms may have possibilities, the main disadvantages may often come in terms of the firm mentality itself, being resistant to innovation, or even bureaucracy, being very much linked to laws and conditions which stifle away possibilities of new.

FIRM LINKAGES WITH OTHER SOURCES

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 simply exchange information/resources.

- **External and internal sources of information are complements**. Typically, firms exploit external collaboration networks just to complete their in-house R&D research and not as a substitute of their work. In fact, doing in-house R&D may help firms to build an ***absorptive capacity*** that enables them to better understand and 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. Anyway, many times this research is slow in generation and not profitable enough to be commercialized.
- **Governments** invest in research through their own laboratories; science parks and incubators; grants for other public or private research organizations; funding and vision. This comes "from above", so it may be "distant from reality", not properly understanding the market or even being potentially closed by bureaucracy itself.
- Many **nonprofit organizations** do in-house R&D, fund R&D to others. This may become socially useful, given the goal is nonprofit, so many organizations actually do this as a mean of more freedom, while at the same time putting time and resources in these ones. Often, they are mission driven, and collaboration may spark here in diverse ways. In fact, they may have limited funding or possibly even depending on donations, hence being overall extremely limited.

INNOVATION IN COLLABORATIVE NETWORKS

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.

This can foster the creation of **Technology Clusters**, 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.
- Possible 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 spill over is partially a function of:

- the strength of protection mechanisms, such as patents and copyrights;
- the nature of the knowledge base (e.g., tacit knowledge may not flow readily across firm boundaries);
- the mobility of the labour pool.

Chapter 03: 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 "***technology trajectory***". Technology trajectories help us to understand how technologies improve and are diffused.

PRODUCT VERSUS PROCESS INNOVATION

Product innovations refer 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

Radical innovations are groundbreaking and disruptive, often creating new markets or industries. 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. In fact, we can count more incremental innovations, made by small step on a previously existing technology, than the radical ones. **Radical innovation is disruptive**: it destroys what was previous leading and it leads to a new dominant design.

Incremental innovation	Radical innovation
continuous (linear improvement of value acquired by the customer)	discontinuous (with or without predecessor; essential, nonlinear improvement obtained by the customer)
based on old technology	based on new technologies
dominant design unchanged	leads to a new dominant design
does not lead to a paradigm shift	can lead to a paradigm shift
implies a low level of uncertainty	implies a high level of uncertainty
improvement of existing characteristics	introduces a whole new set of performance features
existing organization and qualifications are sufficient	requires education, new organization and skills
the result of a rational response or necessity	result of chance or R & D policy, not necessity
driven by market pull (important in the advanced stage of technology)	driven by technology (important in the early stage of technology)

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 render a firm's existing knowledge base obsolete.

- For example, electronic calculators rendered Keuffel and Esser's slide rule obsolete.

ARCHITECTURAL VERSUS COMPONENT INNOVATION

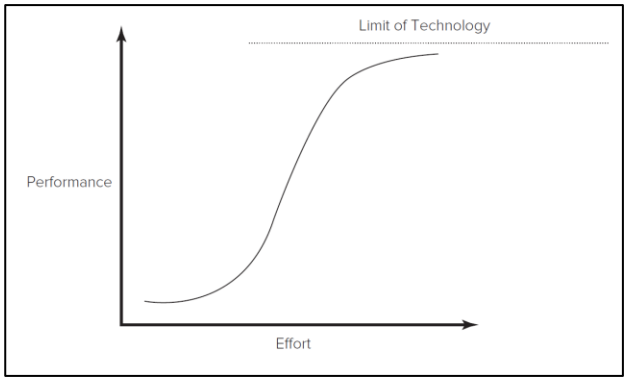
A ***component innovation*** (or modular innovation) entails changes to one or more components of a product system without significantly affecting the overall design. An example of a component innovation is adding gel-filled material to a bicycle seat to improve comfort.

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. An example of an architectural innovation is the transition from the high-wheel bicycle, with a large front wheel and a small rear wheel, to the safety bicycle, which had equal-sized wheels and a fundamentally different frame design.

S-CURVES

S-curves are tools that describe the *rate of a technology's improvement* and its *rate of diffusion*. Both metrics 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 its limits.

A famous example of a technology following this kind of plot is definitely microprocessors with Moore's Law, considering microprocessors have to improve their performance over time doubling in terms of resources and research.

Technologies do not always reach their limits and they may be displaced by new, ***discontinuous technology***.

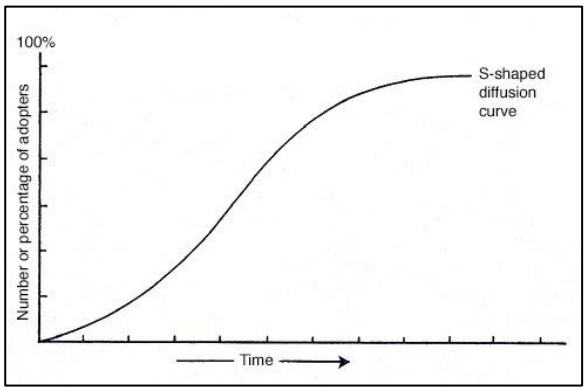
- A discontinuous technology fulfills a similar market need and it is shaped by a new knowledge base (e.g, carbon copying to photocopying, vinyl to compact discs).

- Technological discontinuity may initially have lower performances than incumbent technology (e.g., first automobiles were much slower than horse-drawn carriages).

  NOTE: 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.

The rate at which a technology improves over time is often faster than the rate at which customer requirements increase over time. If you think about that, it has sense: technologies tend to improve faster because there is a competitive advantage to be maintained by firms. This means technologies that initially met the demands of the mass market may eventually exceed the needs of the market. Furthermore, technologies that initially served only low-end customers (segment zero) may eventually meet the needs of the mass market and capture the market share that originally went to the higher-performing technology.

S-CURVES IN TECHNOLOGICAL DIFFUSION



1. Adoption is initially slow because the technology is unfamiliar.

2. It accelerates as technology becomes better understood.

3. 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

Mapping the technology's s-curve is useful for gaining a deeper understanding of its rate of improvement or limits. Anyway, 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

The emergence of a new technological discontinuity can overturn the existing competitive structure of an industry, creating new leaders and new losers. This process was defined as *creative destruction*.

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 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.

Factors influencing these cycles length are complexity of R&D but also how standards are made and rules to follow, which sometimes might be too strict. Also, consider market dynamics: not all sectors are the same and some move slowly than others, so consider how funding and capitals are available impacting technology cycle length and how competition further enables pressure between how much these cycles are long, often influencing nature of technology itself.

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 04: Standards battles and design dominance

Dominant design: a product design that is adopted by the majority of producers, typically creating a stable architecture on which the industry can focus its efforts.

Many industries experience strong pressure to select a single (or few) dominant design(s). There are multiple dimensions shaping which technology rises to the position of the dominant design. Firm strategies can influence several of these dimensions, improving the likelihood of their technologies rising to dominance.

WHY DOMINANT DESIGNS ARE SELECTED

One primary reason is that many industries exhibit **increasing returns to adoption**, meaning that the more a technology is adopted, the more valuable it becomes. Two primary sources of increasing returns to adoption are:

1. *Learning effects*: as a technology is used, producers learn how to make it more efficient and effective by accumulating **experience** and **sales revenues** that can be reinvested in further developments. So, the technologies adopted earlier than others are likely to become better developed, making it difficult for other technologies to catch up.
2. *Network externalities*: in markets with network externalities, the benefit from using a good increase with the number of other users of the same good. A technology with a **large installed base** attracts developers of complementary goods; a technology with a wide range of complementary goods attracts users, increasing the installed base ➔ a sort of self-reinforcing cycle.

GOVERNMENT REGULATION: sometimes the consumer welfare benefits of having a single dominant design and this prompts government organizations to intervene, imposing a standard (e.g., color standard in television). The goal is to ensure compatibility and a smooth user experience. ➔ **RESULT?** Winner-take-all markets (natural monopoly) and firms supporting winning technologies earn huge rewards; others may be locked out.

A dominant design can have far-reaching influence; it can shape future technological investigation in the area.

MULTIPLE DIMENSIONS OF VALUE

In many increasing returns industries, the value of a technology is strongly influenced by both:

- Technology's Stand-alone Value.
- Network Externality Value.

TECHNOLOGY'S STAND-ALONE VALUE

A technology's standalone value refers to the things it can do that are not due to its installed base or available complements. For example, a videogame console's standalone value might be a function of its speed, storage capacity, ease of use, or economical price, etc.

To help managers identify the different aspects of utility a new technology offers customers, a "**Buyer Utility Map**" has been developed. This map considers six different utility levers, as well as six stages of the buyer experience cycle, to understand a new technology's utility to a buyer. The stages they identify are *purchase, delivery, use, supplements, maintenance*, and *disposal*. The six utility levels they consider are *customer productivity, simplicity, convenience, risk, fun and image*, and *environmental friendliness*.

NETWORK EXTERNALITY VALUE

In industries characterized by network externalities, the value of a technological innovation to users is a function not only of its stand-alone value, but also of *the value created by the size of its installed base* and the *availability of complementary goods*.

NOTE: A new technology, that has significantly more standalone functionality, may offer less overall value than the incumbent technology because it has a smaller installed base or poor availability of complementary goods (e.g. NeXT Computers vs. Windows-based PCs – the first were extremely technologically advanced, the latter had the highest installed base value and complementary good value).

To successfully compete with an existing dominant technology, new technology should offer:

- **Dramatic technological improvement** (for example, in videogame consoles, it has taken 3X performance of incumbent).
- **Compatibility with existing installed base and complements**.

When users are comparing the value of a new technology to an existing one, they are weighting a combination of objective information, subjective information, and expectations for the future. Objective dimension can matter as much as the subjective one.

MODULARITY

In some market, modularity is used to create a **platform ecosystem** where many different firms contribute to the product overall system. The term "modularity" refers to the degree to which system's components can be separated and recombined. Modular systems are those that can be separated and recombined to alter their configuration, scale or functions.

In some product systems, modularity enables components from different producers to be recombined (for example, smartphones with different apps). In others only components from a single firm are recombined (for example, Ikea shelving systems).

In platform competition, it's important to encompass modularity as a mean to both increase market and customers' trust. We distinguish different means:

- **Traditional integrated product bundle**: provider tries to meet buyers needs itself. No customization, no external compatibility (e.g. Nokia E90).
- **Product bundle with third-party complements**: compatibility with third-party choices expands options for customers (e.g. Apple iPhones).
- **Product bundle with third-party components and complements**: customer has even greater range of configuration choices (e.g. Android device).

Most products are modular at some level, given they are always composed by other means.

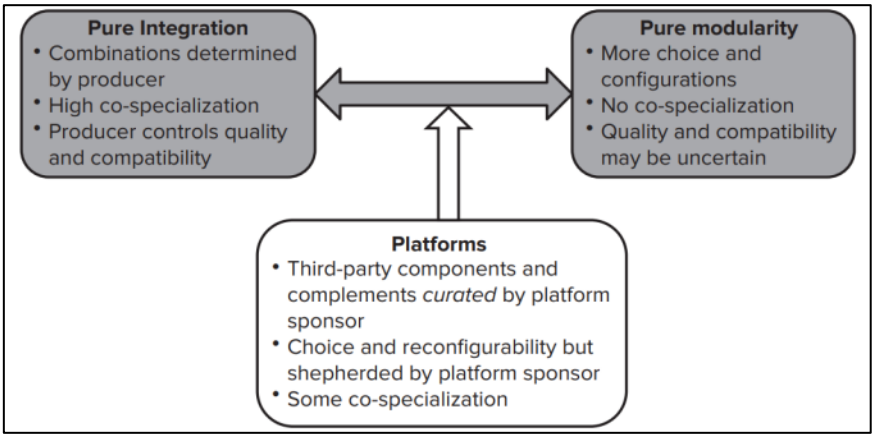
Tightly integrated (i.e., nonmodular) product systems have different kinds of advantages.

- A tightly integrated product system might have components that are customized to work together, which may enable a level of performance that more standardized components cannot achieve.
- The producer of a tightly integrated system also has more control over the end product, which can enable them to better monitor quality and reliability.

Modular products, on the other hand, often offer more choices over function, design, scale, and other features, enabling the customer to choose a product system that more closely suits their needs and preferences.

- Second, because components are reused in different combinations, this can achieve product variety while still allowing scale economies in manufacturing the individual components. This is known as economies of substitution.
- Modularity becomes increasingly valuable in a product system when there are (a) diverse technological options available to be recombined, and (b) heterogeneous customer preferences.

Platform ecosystems aim to balance pure modularity and pure integration:



Chapter 05: Timing of Entry

Increasing returns suggests that timing of entry can be very important. There are several advantages and disadvantages to being a first mover, early follower or late entrant. These categories are defined as follows:

- **First movers** are the first entrants to sell a new product or service category ("pioneers").
- **Early followers** are early to market but not first.
- **Late entrants** do not enter the market until the product begins to penetrate the mass market or later.

There are several factors that influence how timing of entry affects firm survival and profits including:

- **market related factors** such as availability of complementary goods, development of enabling technologies, degree of customer certainty;
- **firm specific factors** such as capital resources, prior experience and reputation.

FIRST MOVERS

Being a first mover can confer the advantages of:

- **Brand loyalty and technological leadership**. Consumers may consider the first firm to enter to be the technological leader. This reputation can enhance a company's ability to shape customer expectations (e.g. features, pricing, etc.) and can be sustained if the technology is difficult to imitate or is protected by patent or copyright.
- **Preemption of scarce assets** by the first mover can prevent later entrants from accessing key locations and important distribution channels, gaining government permits, and can make the development of relationships with suppliers more difficult.
- **Exploiting buyer switching costs** can enable first movers to keep their customers even if a later entrant offers a superior technology.
- A technology that is adopted early may rise to the dominance position exploiting **self-reinforcing positive feedback mechanisms**.

However, first movers often bear disadvantages also:

- **High R&D expenses**. Typically, the investments sustained by first movers are higher than later entrants' ones, which can exploit R&D efforts made by earlier entrants.
- **Undeveloped supply and distribution channels**.
- **Immature enabling technologies and complements**.
- **Uncertainty of customer requirements** can lead to great expense to learn what customers want.

STRATEGIES TO IMPROVE TIMING OPTIONS

To have more choices in its timing of entry, a firm needs to be able to develop the innovation early or quickly. A firm with **fast-cycle development** processes can be both an early entrant and can quickly refine its innovation in response to customer feedback. In essence, a firm with very fast-cycle development processes can reap both first and second mover advantages.

Chapter 06: Defining the Organization's Strategic Direction

A coherent technological innovation strategy leverages the firm's existing competitive position and provides direction for future development of the firm. Formulating a company's technological innovation strategy requires the firm to **assess its current position** and define its **strategic direction**.

ASSESSING THE FIRM'S CURRENT POSITION

To assess the firm's current position, it is helpful to analyse both **external** and **internal** environment of the firm. Both analyses provide a way to understand deeper the firm's environment made by its competitive position and internal capabilities.

EXTERNAL ANALYSIS

External analysis is frequently conducted by applying **Porter's Five-Force Model** and/or a **Stakeholder Analysis**.

Porter's Five-Force Model:

1. **Degree of existing rivalry**. Determined by number of firms, relative size, degree of differentiation between firms, demand conditions, exit barriers.
2. **Threat of substitutes**. Determined by number of potential substitutes, their closeness in function and relative price.
3. **Threat of potential entrants**. Determined by attractiveness of industry, height of entry barriers (for example, startup costs, brand loyalty, regulation, etc.).
4. **Bargaining power of suppliers**. Determined by number of suppliers and their degree of differentiation, it also depends on the degree to which the firms rely on one or a few suppliers which influences the ability to negotiate good terms.
5. **Bargaining power of buyers**. Determined by number of buyers, it also depends on the degree to which the firm is reliant on customers.

Recently Porter has acknowledged the **role of complements**. Must consider:

- how important complements are in the industry;
- whether complements are differentially available for the products of various rivals (impacting the attractiveness of their goods);
- who captures the value offered by the complements.

Stakeholder Analysis begins with the identification of all parties impacted by the firm, what their interests are and what resources they contribute to the firm. Stakeholders include stockholders, employees, customers, suppliers, lenders, the local community, government, and rivals.

INTERNAL ANALYSIS

Internal analysis revolves around SWOT (Strengths – Weaknesses – Opportunities – Threats) process, which brings and considers the competitive advantage of the firm.

The internal analysis is conducted by two steps:

1. **The assessment of a firm's strengths and weaknesses** in each part of the company's value chain. The value chain activities are often organized according whether they are primary (e.g. marketing, sales and service) or secondary (e.g. human resource management and infrastructure) activities.
2. The firm then identifies **which strengths** have the potential to be a source of **sustainable competitive advantage**: rare, valuable, durable, and inimitable (NOTE: the set of strengths that are rare, valuable and durable defines the competitive advantage).

Strength vs competitive advantage vs sustainable competitive advantage:

A strength is a positive attribute or a capability which can positively impact the performance or success of a firm, encompassing various aspects of a firm, generally bringing added values to other things. The competitive advantage, instead, is one or a set of attributes which can allow to outperform rivals, offering superior products/services, lower prices, better customer service, etc. The sustainable competitive advantage, instead, offers a more robust and enduring form of advantage, considering it cannot be easily replicated in the long run.

Resources are difficult (or impossible) to imitate when they are:

- **Tacit** (they cannot be easily codified in written form).
- **Path dependent** (they are dependent on a particular historical sequence of events).
- **Socially complex** (they arise through the complex interaction of multiple people).
- **Causally ambiguous** (it is unclear how the resource originates).

It is most important to emphasize what makes a competency a **core competency**. Core competencies differentiate a company strategically from its competitors and are usually a combination of different kinds of abilities (e.g. advertising, distribution, process design). It is the harmonious combination of abilities that makes core competencies difficult to imitate.

When firms excel at a particular activity or set of competencies, they can become over committed and inflexible (so-called risk of **core rigidities**). This can lead to a situation where the firm is overly reliant on its current strengths, making it challenging to adapt to changes in market conditions. With a well-developed knowledge, firms might be less flexible to change trajectory. However, **dynamic capabilities** provide a solution to this problem. They are a distinct category of competencies that enable a firm to **respond quickly and effectively to change**. For example, 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 resources quickly.

DEFINE THE FIRM'S STRATEGIC DIRECTION

A firm's strategic intent is an **ambitious long-term goal** (10 to 20 years in the future) that requires all levels of the organization to improve the firm's existing core competencies to close the gap between strategic intent and current position.

A firm's strategic intent takes the focus away from current markets and current customer requirements so that **the organization can focus on <u>future</u> markets and customer requirements**.

Chapter 07: Choosing innovation projects

Firms use a mix of **quantitative** and **qualitative** methods when selecting and managing innovation projects and each of these methods has its own strengths and weaknesses.

QUANTITATIVE METHODS FOR CHOOSING PROJECTS

Usually entail converting projects into some estimate of future cash returns and enable managers to use rigorous mathematical and statistical comparisons of projects.

Advantages and disadvantages:

- can provide concrete financial estimates that facilitate strategic planning;
- can explicitly consider the timing of investment and cash flows and the time value of money and risk (difficult to anticipate returns of the technology);
- can make the returns of the project seem ambiguous;
- discriminate heavily long-term projects or risky: may fail to capture the importance of the investment decision.

1) **Discounted cash flow methods**. These are methods for assessing whether the anticipated future benefits are large enough to justify expenditure, given the risk.

- **Net present value (NPV)**: given a level of expenditure and a level of cash inflows, discount rate decides what is the worth project. Here managers first estimate the cost of the project and the cash flows the project will yield: NVP = Present value of cash inflow - Present value of cash outflows, if this value is > 0 will generate wealth.
- **Internal rate of return (IRR)**: given a level of expenditure and the level of cash inflow, returns what is the rate of return that the project yield.

2) **Real options**

- **Based-stock options** is a financial model. A call option on a stock enables an investor to purchase the right to buy the stock at a specified price in the future. If in the future the stock is worth more than the exercise price, typically the investor exercises the option by buying the stock otherwise it will not. If at the time of the option is exercised, the stock is worth more than the exercise price but not more than the exercise price + the price paid for the original option, typically the investor will exercise the option but loses money (less if allowed the option to expire).

An investor who makes an initial investment in basic R&D or in breakthrough technologies purchases a true call option to later implement that technology should it prove valuable. This leads to some advantages and disadvantages:

- options are valuable where there is uncertainty, and because the technology trajectories are uncertain, an option approach may be useful;

- can lead to better investment decision;
- dynamics of technology investments may not conform to the same assumptions as financial market.

QUALITATIVE METHODS FOR CHOOSING PROJECTS

1) **Screening questions** are questions organized into categories for discussing about potential costs and benefits of a project, after creating the list will be a debate or a scoring mechanism. These methods do not always provide concrete answers but enable a firm to consider a wider range of issues that may be important int the firm's development decisions.

2) **R&D Portfolio**. This is a map according to degree of change and timing cash flows, managers can use this map to compare their desired balance of projects with their actual balance. There are four types of development projects:

1. **Advanced R&D projects** develop cutting-edge technologies, often no immediate commercial application.
2. **Breakthrough projects** entail revolutionary new product, typically oriented around a specific commercial application.
3. **Platform projects** are not revolutionary but offer fundamental improvements over preceding generations of products.
4. **Derivative projects** involve incremental changes in products and/or processes.

NOTE: **Derivative projects pay off the quickest** and help service the firm's short-term cash flow needs. **Advanced R&D projects take a long time to pay off** (or may not pay off at all) but can position the firm to be a technological leader.

3) **Q-Sort** is a simple method for ranking ideas on different dimensions. Individuals are given a stack of cards (each card is a development project) they put in order according to their assessment of how well each project performs on the criteria presented (e.g. technical feasibility, market impact, fit with strategic intent). These rankings are then used to structure a debate about the projects.

COMBINING QUANTITATIVE AND QUALITATIVE METHODS

Managers may use multiple methods in combination. May also use methods that convert qualitative information into quantitative form.

Conjoint Analysis estimates the relative value individuals place on attributes of a choice.

- Individuals given a card with products (or projects) with different features and prices.
- Individuals rate each in terms of desirability or rank them.

- Multiple regression then used to assess the degree to which an attribute influences rating. These weights quantify the trade-offs involved in providing different features.

Data Envelopment Analysis (DEA) uses linear programming to combine measures of projects based on different units into a hypothetical efficiency frontier.

- Projects can be ranked by assessing their distance from efficiency frontier.
- As with other quantitative methods, DEA results only as good as the data utilized; managers must be careful in their choice of measures and their accuracy.

Chapter 08: Collaboration Strategies

Firms must often choose between performing innovation activities: **alone** or in **collaboration**. Collaboration can enable firms to achieve more, at a faster rate, and at less cost and risk. However, collaboration also entails sharing control and rewards, and may risk partner malfeasance.

Reasons for Going Solo:

- Firm possesses all the capabilities and resources that it needs in house.
- The development of the new technology is an opportunity to develop new competencies.
- The risk of transferring knowledge to a partner is too high. The risk is greater when this knowledge constitutes a competitive advantage for the firm (e.g. proprietary solutions).
- The firm wants to control the trajectory of the technology's development.
- If an appropriate partner is not available.

Solo internal development is relatively **slow and expensive**, it is appropriate when a firm has strong competencies related to the new technology, access to capital, and is not under great time pressure.

Advantages of collaborating:

- *Acquiring Capabilities and Resources Quickly*.
- *Increasingly Flexibility* to reduce its asset commitment and enhance flexibility.
- *Learning from Partners*: transfer of knowledge from partners and creation of new knowledge that individual firms could not have created alone.
- *Resource and Risk Pooling*: sharing costs and risks of a project.
- *Building a Coalition around a Shared Standard*: development of a project with a collaboration that facilitates the creation of a shared standard.

TYPES OF COLLABORATIVE ARRANGEMENTS

1. **Strategic Alliances**: formal or informal agreements between two or more organizations (or other entities) to cooperate in some way.
2. **Joint Ventures**: a particular type of strategic alliance that entails significant equity investment and often establishes a new separate legal entity. It's a common approach when two firms seek to combine their strengths to pursue a common goal.
3. **Licensing**: a contractual arrangement that gives an organization (or individual) the rights to use another's intellectual property, typically in exchange for royalties. It's a strategic approach for organizations to leverage external technology without the need to develop them in-house.

4. **Outsourcing**: when an organization procures services or products from another rather than producing them in house. It's a strategic decision to focus on the core competencies of the organization while delegating non-core activities to specialized service providers.
5. **Collective Research Organizations (CRO)**: organizations formed to facilitate collaboration among a group of firms (e.g. involving universities). Their primary purpose is to foster R&D activities, pooling resources and expertise from multiple companies.

CHOOSING AND MONITORING PARTNERS

Partner selection is crucial to success. Key factors fall into two dimensions:

1. **Resource fit** (e.g. partner's relative size and strength, resources).
2. **Strategic fit** (e.g. alignment of goals and similarity of values and culture).

Successful collaborations require clear and flexible monitoring and governance mechanisms in choosing and monitoring partners.

- May utilize legally **binding alliance contracts**:
  - helps ensure partners are aware of rights and obligations;
  - provides legal remedies for violations.
- May also use **shared equity ownership**: that is, each partner contributes capital and owns a share of equity in the alliance.
- May rely on **relational governance**: self-enforcing governance based on the goodwill, trust, and reputation of partners. This reduces monitoring costs, facilitate more extensive cooperations, sharing and learning.

Chapter 09: Protecting Innovation

Firms must decide whether and how to protect their technological innovations. Protecting innovation helps a firm retain control over it and appropriate the rents from it. However, sometimes not protecting a technology is to the firm's advantage – it may encourage others to support the technology and increase its likelihood of becoming dominant.

Appropriability refers to 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.

HOW CAN FIRMS PROTECT THEIR INNOVATION

There exist some protective measures over innovation:

- **Patents**: given by governments, providing exclusive rights for a specified duration, preventing others from making, using, or selling the patented invention. They are often regulated by patent laws, which vary from country to country (famous ones include PCT or Paris Convention). They can create power between similar companies (patent thickets) or are just made to earn revenues (patent trolling).
- **Trademarks**: a word, phrase, symbol, design, or other indicator that is used to distinguish the source of goods. There exist systems able to simplify registration, for example the Madrid agreement or the Madrid protocol, providing treaties and systems to secure and manage protection efficiently internationally.
- **Copyright**: preventing from reproducing the work or creating some derivative ones. Registering copyrights provides legal rights to control the reproduction and distribution of the protected work.
- **Trade secrets**: basically, industrial secrets. This involves maintaining confidentiality around specific processes, formulas, or methods that provide a competitive advantage.

WHOLLY PROPRIETARY SYSTEMS VERSUS WHOLLY OPEN SYSTEMS

- **Wholly proprietary systems** are proprietary-owned and protected by patents, copyright, secrecy and other mechanisms. They are produced and improved only by their developers. They may be difficult to adopt easily by customers due to higher costs and the inability to mix components.
- **Wholly open systems**: here the technologies are not protected by patent or secrecy. Freely accessed, augmented and distributed by anyone.
- Many technologies are partially open: Here are used different degrees of control mechanisms. It permits to facilitate the development of the complementary goods provider (license them).

FURTHER CONSIDERATIONS ABOUT PROTECTION AND DISTRIBUTION

Protection has a few advantages:

- Proprietary systems offer greater rents appropriability.
- Rents can be used to invest in further development, promotion, and distribution.
- Give the firm control over the evolution of the technology and complements (architectural control).
- E.g., Microsoft's Windows with its rise to dominance inside the PC system.

Also, **Diffusion** has a few advantages:

- May entail more rapid adoptions if produced and promoted by multiple firms.
- Customer and complementary goods providers may perceive the technology as better or its future as more certain when multiple companies back it (better quality perception)
- Other firms (though external development poses its own risks) might improve technology through collective efforts.

Factors to consider when choosing a protection strategy:

- The **degree of protection needed**, for example via the usage of patents, trademarks, copyright, trade secrets.
- The **market and industry dynamics**, understanding how rapid the evolution can be and the possible challenges to achieve correct protection.
- **Correctly assessing the cost benefits and the risks**, which need careful employee training and careful selection in collaboration and partnership.
- Implement **specific systems of monitoring and surveillance** to detect possible infringements and unauthorised use.

Chapter 10: Organizing for innovation

Organizational structure and its use of rules, standardized procedures and controls **can impact an organization's ability to generate innovation**. Small and flexible structures are typically best suited to idea generation and structures with well-developed procedures and standards may entail better investment decisions and more efficient implementation.

SIZE AND STRUCTURAL DIMENSIONS OF THE FIRM

Small firms are often more flexible and entrepreneurial because they do not have the burden of a large bureaucracy or large investments in fixed assets. These firms often have shorter development cycles and a greater focus because they have much more limited resources than larger firms.

The firm's ability to be an effective innovator is influenced by the degree to which its structure is:

1. **Formalized**: the degree to which the firm utilizes rules and procedures to structure the behaviour of employees. Can substitute for managerial oversight but can also make firm rigid.
2. **Standardized**: the degree to which activities are performed in a uniform manner. Facilitates smooth and reliable outcomes but can decrease innovation.
3. **Centralized**: the degree to which decisional authority is kept at top levels of the firm. The decentralization of R&D activities enables divisions to develop new product or process that closely meet their needs. This maximizes the economy of scale. The disadvantage of this is that can be done many redundant activities, and the full potential may not be realized.

Mechanistic structures have high formalization and standardization.

- Good for operational efficiency, reliability.
- Minimizes variation → may stifle creativity.

Organic structures have low formalization and standardization.

- Encourages creativity and experimentation.
- May yield low consistency and reliability in manufacturing.

AMBIDEXTROUS STRUCTURE

Large firms often make greater use of formalization and standardization because as the firm grows it becomes more difficult to exercise direct managerial oversight. **Formalization and standardization reduce coordination costs but lead to a more mechanistic structure**. Many large firms attempt to overcome some of this rigidity by decentralizing authority, enabling divisions of the firm to behave more like small companies.

There are several methods by which firms can achieve some of the advantages of large size, and the efficiency and speed of implementation offered by mechanistic structures, while simultaneously harnessing the creativity and entrepreneurial spirit of small firms and organic structures. For instance, an **ambidextrous organization** is a firm with a complex organization that can collectively achieve both short-term efficiency and long-term innovation. Such firms might utilize mechanistic structures in some portions of the firm and organic structures in others. **R&D is typically a distinct division (organic structure) from the rest of the firm which is characterized by a mechanistic structure**. R&D teams may need to be isolated from the rest of the organization in order to explore new alternatives ➔ example: Steve jobs with the small team working at the project Macintosh.

MODULARITY AND LOOSELY COUPLED ORGANIZATIONS

Development and production activities are not strictly integrated but the aim is to achieve shared and common objectives through one's membership standard. This can enable components of a product to be produced by highly autonomous divisions of the firm, or even by multiple independent firms. The problem is that many activities reap significant synergies by being integrated and this is not possible with this kind of organization.

MANAGING INNOVATION ACROSS BORDERS

Bartlett and Ghoshal identify four strategies of multinational innovation:

- **Center-for-global**: all R&D activities centralized a single hub. Tight coordination, economies of scale, avoids redundancy, develops core competencies, standardizes, and implements innovations throughout firm.
- **Local-for-local**: each division does own R&D for local market. Accesses diverse resources, customizes products for local needs.
- **Locally leveraged**: each division does own R&D, but firm attempts to leverage most creative ideas across company. Accesses diverse resources, customizes products for local needs, improve diffusion of innovation throughout firm and markets.
- **Globally linked**: decentralized R&D labs but each plays a different role in firm's strategy and are coordinated centrally. Accesses diverse resources, improve diffusion of innovation throughout firm and markets, may help develop core competencies.

Chapter 11: Managing new product development process

Despite the intense attention paid to innovation, failure rates are still very high. More than 95% of new product development projects fail to earn an economic return. This chapter underscores the importance of identifying **the most effective processes for managing new product development** (NPD). NPD has different objectives: *maximize fit with customer requirements*; *minimizing development cycle time* (fast to market); *controlling development costs*.

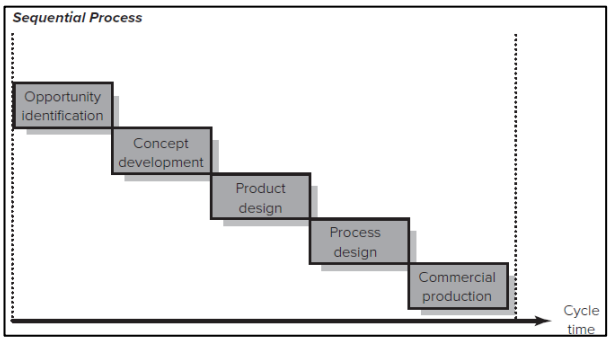
SEQUENTIAL VS PARALLEL MODEL

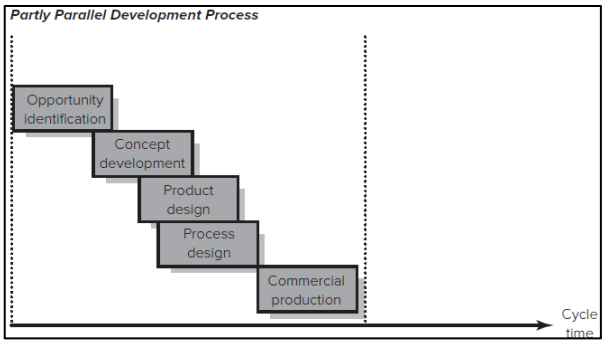
Before the mid-1990s, most U.S. companies proceeded from one development stage to another following a **sequential development**. The process included several gates at which managers would decide whether to proceed to the next stage, send the project back to a previous stage for revision, or kill the project.

Typically, R&D and marketing provided most of the inputs in the ***opportunity identification*** and ***concept development*** stages. R&D took the lead in ***product design***, and manufacturing took the lead in ***process design***. The final stage is ***commercial production***.

According to critics, one problem with such a system emerges at the ***product design*** stage when R&D engineers fail to communicate directly with manufacturing engineers. A sequential process has no early warning system to indicate that planned features are not manufacturable. Consequently, cycle time can increase as the project iterates back and forth between the product design and process design stages.

To shorten the development process and avoid costly iterations between stages of the development cycle, many firms have adopted a **partly parallel development** process. Product design is initiated before concept development is complete, and process design starts long before product design is finalized, enabling **much closer coordination between different stages**, and minimizing the chance that R&D will design products that are difficult or costly to manufacture.





PROJECT CHAMPIONS

Project champions are typically **senior executive**. Assigning a senior executive to champion an NPD project can shorten cycle time and ensure that the product attributes match customer requirements.

Risks of championing include the **loss of objectivity by the project champion** that can result in an inability to admit when a project has no future and if the champion occupies a senior level position in the organization others may be reluctant to express their real thoughts regarding the value of the project. To counteract these risks, firms may create the role of "anti-champion" to play devil's advocate.

INVOLVING CUSTOMERS AND SUPPLIERS

Involving **customers** and **suppliers** in the development process may ensure that products fulfil customer performance/price requirements and help control costs while speeding up development.

- Involving **Customers** often involves beta testing early version of a product to get early feedback. Customer is often best able to identify the maximum performance capabilities and minimum service requirements of new product.
- **Suppliers** can suggest alternative inputs that reduce costs or improve functionalities. Evidence shows firms that involve suppliers produce **new products in less time, at lower cost and with higher quality**.

A way to involve customers is through the **crowdsourcing**. Firms can open up an innovation task to the public through crowdsourcing, where people voluntarily contribute with their ideas or effort. Crowdsourcing challenges typically go through a four-step process:

1. ***Need Translation***: a clear, concise and compelling need statement is articulated (e.g., Request for Proposal).
2. ***Connecting***: the innovation challenge is broadcasted to the network of potential solution providers.
3. ***Evaluation/Selection***: proposals reviewed in depth, and the most interesting are selected.
4. ***Acquisition***: the firm engaged with the solution provider and negotiated an agreement to exchange knowledge, intellectual property, and compensation, adapting the solution to the needs.

TOOLS FOR IMPROVING THE NPD PROCESS

1) STAGE-GATE PROCESS

The Stage-Gate Process applies a **tough multi-functional review at the end of each stage of the design process** to ensure that only those projects demonstrating increasing certainty regarding success move forward. Prior to moving to the next stage, the project must pass a **Go/Kill decision point**, helpful to filter out bad projects. This is important since risks and costs increase as a project proceeds.

2) QUALITY FUNCTION DEPLOYMENT (QFD)

The QFD maps customer requirements against product attributes using a "house of quality" matrix. It provides a common language and framework, through which teams can **understand the relationship between product attributes and customer requirements**, identify design trade-offs, highlight the competitive shortcomings of existing products, and identify the steps to improve them.

3) DESIGN FOR MANUFACTURING (DFM)

Design for Manufacturing often involves **a set of design rules that reduce costs and development time, while boosting quality** by simplifying assembly processes and increasing labour productivity.

4) FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

FMEA is a method by which firms identify potential failures in a system, classify them according to their severity, and create a plan to prevent them.

- Potential failure modes are evaluated on three criteria of risk: severity, likelihood, and inability of controls to detect the failure.
- Each criterion is given a score (1-lowest, 5-highest).
- Composite score is used to prioritize development efforts.

5) CAD/CAM

Computer-Aided Design (CAD) and Manufacturing (CAM) are the use of computers to build and test product designs, reducing cycle time and development costs.

Chapter 12: Managing new product development teams

Many organizations now use **cross functional teams** to lead and manage the NPD process. There is considerable variation in how these teams are formed and managed. The **team size** may range from a few members to hundreds. Bigger teams are not always better; in fact, large teams create more administrative costs and communication problems. Large teams have also higher potential for social loafing.

Including in the **team composition** members from multiple functions of firm ensures greater coordination between different functional areas of the firm. It also gives the opportunity to leverage a wider knowledge base. However, cross functional teams increase both coordination and communication costs with a difficulty in building a cohesive team.

STRUCTURE OF NPD TEAMS

One well known typology of team structure classifies teams into four types:

1. **FUNCTIONAL**
   - Members report to functional manager.
   - Temporary, and members may spend less than 10% of their time on project.
   - Typically, no project manager or dedicated liaison personnel.
   - Little opportunity for cross functional integration.
   - Likely to be appropriate for derivative projects.
2. **LIGHTWEIGHT**
   - Members still report to functional manager.
   - Temporary, and members may spend less than 25% of their time on project.
   - Typically have project manager and dedicated liaison personnel.
   - Manager is typically junior or middle management.
   - Likely to be appropriate for derivative projects.
3. **HEAVYWEIGHT**
   - Members are collocated with project manager.
   - Manager is typically senior and has significant authority to command resources and evaluate members.
   - Often still temporary, but core team members often dedicated full time to project.
   - Likely to be appropriate for platform projects.
4. **AUTONOMOUS**
   - Members collocated and dedicated full time to team.
   - Project manager is typically very senior manager.

- Project manager is given full control over resources and has exclusive authority over evaluation and reward of members.
- Autonomous teams may have own policies, procedures and reward systems that may be different from rest of firm.
- Likely to be appropriate for breakthrough and major platform projects.
- Can be difficult to fold back into the organization.

MANAGEMENT AND LEADERSHIP OF NPD TEAMS

Team effectiveness is a function of how well-suited leadership and administrative policies are to team's structure and needs.

TEAM LEADERSHIP

Team leader is responsible for directing team's activities, maintaining alignment with project goals, and communicating with senior management. Team leaders impact team performance more directly than senior management or champions.

TEAM ADMINISTRATION

It should be designed to ensure that team members have a clear focus and commitment to project (e.g. project charter, contract book, etc.). **Project charter** encapsulates the project's mission and provides measurable goals. **Contract book** defines in detail the basic plan to achieve goals laid out in charter. It provides a tool for monitoring and evaluating the team's performance.

MANAGING VIRTUAL TEAMS

Virtual teams are teams in which members may be a great distance from each other but are still able to collaborate intensively via advanced information technologies such as videoconferencing, groupware, and e-mail or Internet chat programs. Virtual teams face a distinct set of challenges in promoting participation, cooperation, and trust. As a result, they require special consideration of the selection of team members and the team administration processes.

Chapter 13: Crafting a deployment strategy

Deployment is a key component of the innovation process because a new product has little value in and of itself. It is only when people understand the innovation, can access it, and utilize it regularly that the product is of value.

Best deployment strategies accelerate adoption by reducing uncertainty about the product. Some of the key elements of an effective deployment strategy include timing, licensing and compatibility, pricing, distribution, and marketing.

TIMING

Strategic Launch Timing is a function of many factors including **seasonal or business cycles** and the **availability of complementary goods**. Video game producers typically introduce new game consoles to coincide with the Christmas shopping season, but it is essential that complementary goods (to help create demand) and sufficient production (to meet demand) are available when the product is introduced. For products characterized by rapid technological change, new product introductions should not follow so closely after the previous generation that consumers are reluctant to replace.

OPTIMIZING CASH FLOW VS EMBRACING CANNIBALIZATION

Cannibalization: the scenario where a firm's sales of one product diminish its sales of another.

There are instances when it is in the firm's best interest to introduce new generations of technology while the current generation is still viable. Though this strategy will result in the new generation cannibalizing sales of the previous generation, it is more likely to keep consumers loyal to the product and prevent them from switching to another manufacturer.

➔ Traditionally firms managed product lifecycles to optimize cash flow and return on investment, **they would not introduce new generation while current generation selling well**.

➔ Often better for firm to invest in continuous innovation and **willing cannibalize its own products to make it difficult for competitors to gain a technological lead**.

LICENSING AND COMPATIBILITY

By making the new product compatible with existing products, the firm can take advantage of a large installed base. A firm with a large installed base for its own goods may choose to make its products incompatible with other technologies in order to prevent competitors from leveraging the installed base to create demand for competing products. Firms must also decide whether or not to make their products **backward compatible** with their own previous generations of technology. Sometimes backward compatibility conflicts with a company's

technology goals of the update, creating a difficult strategic decision about whether or not to offer backward compatibility.

PRICING

Pricing strategies influence a product's position in the market, the rate of adoption and the firm's cash flow.

A range of goals and corresponding pricing strategies are listed below:

- **Survival pricing** covers variable costs and some fixed costs and may be used in short run when there is over capacity or intense price competition.
- **Maximize current profit pricing** establishes the price to maximize cash flow or rate of return on investment in the short run.
- **Maximum market skimming pricing** usually begins with a high introductory price to signal high value and recover initial development costs. This approach assumes that demand is unrelated to price and may attract competitors to market.
- **Penetration pricing** sets the price as low as possible to attract customers in order to increase volume and decrease production costs. When an industry is characterized by increasing returns this can be a successful strategy because it can provide the firm with a powerful foothold as low-cost provider.
- Some firms use a "**freemium**" strategy whereby the core product is free or at a very low cost, but customers end up paying for add on features or services.
- **Pricing below cost** can be an effective strategy when a firm expects to generate profits from the sale of complementary goods.
- **Timing strategies** enable a firm to manipulate customer perceptions of price by changing how or when the purchase price is paid. Options include payment after a free trial period, leasing programs, or a give-away of the initial product with profits earned from follow-on services. In addition, introductory pricing allows company to test price points in the market.

DISTRIBUTION

Selling Direct versus **Using Intermediaries** is a function of the degree of control the company wants to maintain. Selling direct gives firm great control over selling process, price and service. On the other hand, selling direct can be expensive and/or impractical.

Otherwise, firms may use intermediaries as:

- **Manufacturers' representatives**: independent agents that may promote and sell the products of one or a few manufacturers.

- **Wholesalers**: firms that buy manufacturer's products in bulk then resell them (typically in smaller, more diverse bundles).
- **Retailers**: firms that sell goods to public.
- **Original Equipment Manufacturers** (OEMs):
    - A company that buys products (or components) from other manufacturers and assembles them or customizes them and sells under its own brand name. For example, Dell Computer.

Possible strategies for accelerating distribution are:

- **Alliances with distributors**: providing to distributors stake in product's success or exclusivity contract can motivate them to promote more.
- **Bundling relationships**: sell in tandem with product already in wide use.
- **Contracts and sponsorship**: provide price discounts, special service contracts or advertising assistance to distributors, complementary goods providers or large and influential end users.
- **Guarantees and shipping**: reduces risk to intermediaries and complements providers.

MARKETING

Marketing strategy must consider the nature of target market and the innovation in order to shape perceptions and expectations about the product's installed base and availability of complementary goods.

Major marketing methods include:

- **Advertising**: used to build customer awareness of a technological innovation through an effective advertising message placed in the advertising media most likely to reach the target market.
- **Promotions**: temporary selling tactics used at the customer or distributor level to stimulate purchase or trial.
- **Publicity and Public relations**: can be used to generate word-of-mouth recommendations, public awareness, and goodwill.

TAILORING THE MARKETING PLAN TO INTENDED ADOPTERS

Innovators and early adopters seek advanced technologies, are willing to take risks, and respond to technical content. Marketing to them requires emphasizing innovation and customization. Transitioning to the early majority involves focusing on product completeness, ease of use, and credibility. The challenge lies in bridging the gap between early adopters and the early majority. Targeting the late majority and laggards requires emphasizing reliability, simplicity, and cost-effectiveness through credible channels with reduced costs. Marketers leverage information spread targeting individuals for rapid adoption.

USING MARKETING TO SHAPE PERCEPTIONS AND EXPECTATIONS

- **Preannouncements and Press Releases**: heavy advertising, even for products with small actual bases, can create a significant mindshare. The concept of vapourware, pre-advertised products not yet on the market, is used by software vendors to build the impression of ubiquity, potentially driving rapid adoption when the product is available. This tactic also buys the firm time, delaying customer purchases until their product is introduced to avoid losing market share to competitors with a dominant design.
- **Reputation**: the market's expectations of success are influenced by the firm's track record in technological innovation, which serves as an indicator of the new product's functionality. Additionally, the firm's prior commercial success is crucial in signalling its ability to build and manage the support network required for the new technology, including distribution, advertising, and alliances, to generate momentum in the installed base-complementary goods cycle.
- **Credible Commitments**: a firm can also signal its commitment to an industry by making substantial investments that would be difficult to reverse.