Economics

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Contents

1 Source of innovation

Innovation can arise from many different sources. The most common are:

- **Firms**: well suited to innovation, they have greater resources than individuals and management system to control those resources towards a collective purpose. Firms face strong incentives to develop differentiating products and services (with respect to no-profit organizations and governments fundend entities);
- **Individuals**: as a loan inventor or users who design solutions to their own problems;
- **Private non-profit organizations**;
- **Universities and governments fundend research**: An even more important source arise from the link between universities and governments.

1.1 Creativity

The Creativity is the ability to generate new and useful ideas or the ability to produce work that is useful and novel.

- **Individual creativity**: is a function of the intelectual abilities, knowledge, personality, motivation, and environment;

- **Organizational creativity**: is a function of creativity of individuals within the organization plus social processes and contextual factors that shape how those individuals interact and behave.
  Methods of encouraging organizational creativity include:
  - Ideal collection systems: easy to implement, but only a 1st step in unleashing employee creativity;
  - Creativity training programs;
  - Colture that encourages creativity;

1.2 Creativity into innovation

The innovation is the implementation of creative ideas into new devices or processes (creativity + resources and expertise).

1.2.1 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.

1.2.2 Innovation by users

The users create solution for their own needs, and for their own use.

1.2.3 Research and development by firms

- **Research**: we've two types of research, the basic research which aims at increasing the understanding of a topic or field without an immediate commercial application, and the applied research which aims at increasing understanding of a topic or field to meet a specific need;
- **Development**: refers to activities that apply knowledge to produce useful devices, materials, or processes;

Two approaches to innovation are:

- **Science-push**: innovation proceeds linearly from scientific discovery, invention, manufacturing, and marketing;

- **Demand-pull**: innovation originates with customers needs, from customers suggestions, inventions and manufacturing;

1.2.4 Firm linkages with customers, suppliers, competitors, and complementors

- **External versus internal sources of innovation**: firms with in-house R&D are more heaviest users of external collaboration networks; And may help firms to build **absorptive capacity** that enables them to a better use of the information obtained from external sources;
- **Universities and governments fundend research**: Universities encourage research but have smaller resources, also contribute to innovation trough pubblication of the results. Governments do research through own laboratories, science parks, incubators, and grants for other public or private research organizations;
- **Private non-profit organizations**: in house R&D or fund R&D in other organizations or both.

1.3 Innovation in collaborative networks

It is important in high technology sectors, where individual firms rarely posses all necessary resources and capabilities to innovate. With a lot of relationships, can be that there are larger diffusion of information and resources. There are **technology clusters** which are regional clusters[1] or firms that have a connection to a common technology. Likelihood of innovation activities being geographically clustered depends on: the nature of the technology, the industry characteristics, and cultural context of technology.

Technological spillovers occur when the benefits from the research actievities of one firm spill over to other firms, and they are in function of strength of protection mechanisms, nature of underlying knowledge base and mobility of the labor pool.

2 Types and patterns of innovation

We've different dimensions that are often used to classify technology:

[1] group of individuals having same characteristics

- **Product Innovation**: it is the development of new products or the enhancement of existing ones. The success of many companies is often tied to their ability to innovate in the products they offer;
- **Process Innovation**: it is the implementation of a new or significantly improved production or delivery method. It can also involve substantial changes in techniques, equipment and/or software;

We can also distinguish them according to the impact they have:

- **Incremental Innovation**: it is the gradual improvement of existing products, services, processes or methods. It is often driven by customer feedback and is aimed at maintaining or improving a company's competitive position;
- **Radical Innovation**: it is the development of new products, services, processes or methods that are significantly different from existing ones. It is often driven by technological advances and can lead to the creation of new markets or the disruption of existing ones;

And according to the impact on the internal organization:

- **Competence Enhancing**: it is based on the firm's existing knowledge and capabilities, and aim to enhance and extend them;
- **Competence Destroying**: it is based on the firm's existing knowledge and capabilities, and aim to render them obsolete for replacing them with new ones.

We can take the products themselves and also categorize:

- **Component Innovation**: it entails changes to one or more components of a product system without significantly affecting the overall design;
- **Architectural Innovation**: it entails changing the overall design of the system, or the way components interact.

There are also entirely new fields of technology, like **social innovation** which is the development of new ideas, services, or models that better meet social needs and create new social relationships or collaborations.

2.1 Technological S-curve

S-curves describes two types of ratio:

- **Rate of a technology's performance improvement**: if the technology is very different from previous technologies, there may be no evaluation routines that enable researchers to assess it's progress or potential. Furthermore, until the technology has established a degree of legitimacy, it may be difficult to attract other researchers to partecipate in its development. The technology begins to reach it's inherent limits, the cost increase and the s-curve flattens; Technologies do not always reach their limits: they may be rendered obsolete by discontinuous technology[2]. **Disadvantages**: is rare that the true limit is known in advance.

- **Rate of technology's market penetration**: the s-curve is represented by the cumulative number of adopters against time. We have three phases:

  1. **Slow growth**: the technology is not well understood, and the potential adopters are not yet convinced of its value;
  2. **Rapid growth**: the technology becomes better understood, and the potential adopters become convinced of its value;
  3. **Mature phase**: the technology is well understood, and the market is saturated.

  Disadvantages: the shape of the curve is not set in the stone.

3 Standards battles, modularity, and platform competition

Dominant design: is a specific configuration, standard or a set of features that naturally becomes the dominant standard in the market. It represents a common set of design features that are widely accepted by the market and that are used by a large number of firms. Once a dominant design is established, the market becomes more predictable and stable, providing a foundation for the development of complementary products and services.

[2]it fullfills a similar market need, but until the construction of a new knowledge base

3.1 Why dominant designs are selected

Increasing returns to adoption: the more people use a product, the more valuable it becomes. Two of the primary sources of increasing returns are:

- **Learning effects**: the more a technology is used, the more it is developed and the more effective and efficient it becomes. Prior learning and absorptive capacity: a firms investment in prior learning can accelerate it's learning in the future and it's ability to absorb new knowledge (absorptive capacity[3]);
- **Network Externalities**: this is when the value of a good to an user increases with the number of other users of the same or similar good. The number of users of a technology is often refereed to as the installed base[4]. Network externalities also arise when complementary goods[5] are important.

3.2 Multiple dimensions of value

3.2.1 Technology standalone value

It refers to the things it can do or the sources of appeal that are not due to it's installed base or available complements.

3.2.2 Network externalities value

Value of the technological innovation to users will be a function not only on it's standalone benefits and costs, but also of the value created by the size of the installed base and the availability of complements.

3.3 Modularity and platform competition

Product may be made increasingly modular, both by expanding the range of compatible components and by uncoupling integrated functions within components. **Advantages**:

[3] the ability of an organization to recnogize, assimilate, end utilize new knowledge
[4] the number of users of a particular good
[5] additional goods and services that enable or enhance the value of another good

- Often offer more choice over function, design, scale and other features enabling the customer to choose a product suited to their specific needs;
- components are reused in different combinations, and can achieve product variety.

4 Timing of entry

A technology that is adopted earlier than others may reap self-reinforcing advantages:

- greater funds to invest in improving the technology;
- greater availability of complementary goods;
- less customers uncertainty.

But if there are a few users and the availability of complementary goods is low, the technology may not be able to reach the customer. We've 3 types of entrants:

- **First movers (pioneers)**: they are the first to enter a market;
- **Early followers**: early to the market, but not first;
- **Late entrants**: they enter the market after the technology begins to penetrate the mass market.

4.1 First movers advantages

- **Brand loyalty and technological leadership**: long-lasting reputation as a leader in that technology domain and this can help to sustain the company's image, brand loyalty and market share. Organization's position as a technological leader also enables it to shape customer expectations about form, features, etc. If the aspects are difficult for the competitors to imitate there can be a **monopoly rents**, otherwise the first movers has the opportunity to build brand loyalty before the entry of other competitors;

- **Preemption of scarce assets**: the enter can capture scarce resources like key location, government permits, patents, acces to distribution channels and relationships with suppliers;
- **Exploiting buyer switching costs**: if buyers face switching costs, the firms that captures customers early may be able to keep those customers even if technology with superior value is introduced by a competitor;
- **Reaping increasing returns advantages**: in a industry characterized by increasing returns, a technology that is adopted early may raise the market power through self-reinforcing positive feedbacks, mechanisms, culminating in its entrenchment as the dominant design.

4.2 First movers disadvantages

- **Research and development expenses**: the first movers tipycally bears the brunt of R&D expenses (technological paths that didn't yield a commercially viable product and complementary parts that are not in the market yet). Later entrants can also observe the market response to particular features and decide how to focus their R&D efforts;
- **Undeveloped suppliers and distribution channels**: at the beginning, often, no appropriate suppliers and distribution channels are available;
- **Immature enabling technologies and complements**: firms ofthen rely on other producers of enabling technologies, important complements may not yet be fully developed;
- **Uncertainty of customers requirements**: which features and at what price the customers will want the product. First movers can have an opportonity to shape customer preferences.

4.3 Strategies to improve timings options

A firm which want to early entry in the market needs a fast cycle development process. The development time can be reduced by using strategic alliances, crossfunctional teams, and parallel development processes.

5 Defining the organization's strategic direction

The first step of formulating technological innovation is to asses the firm's current position and define its strategic direction for the future (articulating on ambitious strategic intent). A coherent direction leverages and enhances firm's existing competitive position, and provides for the future the development of the firm. There are several standard tools of strategic analysis for analyzing external and internal environment of the firm.

5.1 External Analysis

5.1.1 Porter's five-force model

It define the attractiveness of an industry and firm's opportunity and threats, it identifies ways in which the external forces differentially affect the firm vis-a-vis, and its competitor. So the objective is to identify threats and opportunities for the firm:

- **The degree of existing rivalry**: depends on the number and relative size of the competitors, the degree to which competitors are differentiated from each other, the demand conditions and the high exit barriers;
- **Threat of potential entrants**: it's influenced by the degree to which the industry is likely attract to new entrants and the height of entry barriers;
- **Bargaining power of the suppliers**: depends on the degree to which the firms relies on one or a few suppliers which influences the ability to negotiate good terms, the amount of firm which purchaes from suppliers, switching cost and the fact that the firm can or not backword vertically integrate (produce its own suppliers);
- **Bargaining power of buyers**: depends on the degree to which the firm is reliant on customers, the diversity between products, the switching cost and if can threaten to backword vertically integrate;
- **Threat of substitutes**: substitutes are products or services that are not considered competitors, but fulfill a strategically equivalent role for the customer, this depends on how the industry is defined;

- **Role of the complements** which enhance usefulness or desirability of a good: depends on how are important are in the industry, whether are differentiate from the products of various rivals and who captures the value offerd by complements.

5.1.2 Stakeholder Analysis

Stakeholder models are often used for both strategic and normative purposes: they emphasizes the stakeholder management issues that are likely to impact the firm's finantial performance and help the firm deal with their ethical or moral implications. It consists in identyifing all the parties that will be affected by the behaviour of the firm: for each party, the firm identifies what that stakeholder's interests are and what resources contribute to the organization.

5.2 Internal Analysis

Often begins with identyifing firm's strength and weaknesses examining each of the activities (primary and support activities) of the value chain. Identifies which strengths have potential to be a source of sustainable competitive advantage and the resources must be rare, valuable, durable and inimitable. Some resources are not imitable:

- Tacit: cannot be codified in written form;
- Path dependent: depend on a particular historical sequence of events;
- Socially complex: arise through the complex interaction of multiple people;
- Casually ambiguous: it is unclear how the resource originates.

6 Choosing innovation projects

6.1 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 comparisors of projects.
Advantages and Disadvantages:

- Can provide concrete finantial estimates that facilitate strategic planning and tradeoff decisions;
- 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 heavilty long-term projects or risky: may fail to capture the importance of the investment decision.

6.1.1 Discounted cash flow methods

These are methods for assessing whether the anticipated future benefits are large enough to justify expenditure, given the risk. Take into: payback period, risks, time value of money.

- **Net present value (NPV)**: given a level of expenditure, level of cash inflows, discount rate decide 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.

6.1.2 Real options

- **Based-stock options** is a finantial model. A call option on a stock enable 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 exercise the option by buying the stock otherwise it will not. If a the time of the option is exercised, the stock is worth more then 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 breakthough technologies purchases a true call option to later implement that technology should it prove valuable.

Advantages and disadvantages:

- Options are valuable where there is uncertainty, and becouse 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 assumptiona as finantial market.

6.2 Qualitative methods for choosing projects

6.2.1 Screening questions

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 mechanisms. This 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.

6.2.2 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:

- **Advanced R&D**: necessary to develop cutting-edge strategic technology;
- **Breakthough**: involve developmentof products that incorporate revolutionary new product and process technologies;
- **Platform**: offer fundamental improvements in the cost, quality, and performance of a tecnhology over previous generations;
- **Derivative projects**: involve incremental changes in products and/or processes.

Companies that use this method categorize all their projects by resources they require and by how they contribute to the company's product line. This encourages the company to consider both short-term cash flow needs and long-term strategic momentum in budgeting and planning.

6.3 Combining quantitative and qualitative information

6.3.1 Conjoint analysis

Here we have a family of techniques used to estimate the specific value that individuals attribute to some attributes of a choice. It enables to derive strategically the weight to assess and a subjective assessment of complex decision to be decomposed into quantitative scores of relative importance of different criteria.

6.3.2 Data development analysis (DEA)

It's a method of assessing a potential project using multiple criteria that may have different kinds of measurment units.

7 Collaboration strategy

Firms with collaboration can achieve more, at faster rate, and with less cost or risk than they can achieve alone.

7.1 Reasons for going solo

- **Availability of capabilities**: the decision to collaborate depends on the degree to which it posses all of the necessary capabilities;
- **Protecting proprietary technologies**: working closely might expose the company's existing proprietary technology;
- **Controlling technology development and use**: firms desire to have complete control over their development process and the use of any resulting technology;

- **building and renewing capabilities**: challenge in developing new skills, resources and market knowledge.

7.2 Advantages of collaborating

- **Acquiring capabilities and resources quickly**;
- **Increasing flexibility**: collaboration reduces the company's capital commitment and increases its flexibility;
- **Learning from partners**: can facilitate both the transfer of knowledge between firms and the creation of new knowledge that individual firms could have created alone;
- **Resource and risk pooling**: share costs and risk;
- **Building a coalition around a shared standard**.

7.3 Types of collaborative arragements

The mode of collaboration influences success according to the intended goal and vision to achieve and on this we can find different types of collaborative arrangements

- **Strategic alliances**: whether formal or informal, emphasize combining complementary capabilities or transferring specific skills, fostering synergistic efforts, joint innovation and new market opportunities, both as individual alliances and network of alliances. The choice between one of them depends on the firm's objectives and has to be carefully managed;
- **joint ventures**: which require equity investment and the creation of a separate legal entity, allowing partners to share resources, risks and rewards. This necessitates a good degree of governance to navigate conflicts and possibly further enticing new modes of collaboration;
- **Licensing**: ensures that a party grants others the right to use an intellectual personal property and gives access to external technology, while providing clear contractual agreement and effective communication between licensor and licensee, allowing to gain access to valuable

technology or content. This achieves success when technologies have a good level of control and standardization;

- **Outsourcing**: means procuring services or good externally from an in-house production, offering efficiency and cost savings while also needing a careful management to prevent overreliance, compromising the firm's core competencies. The success in this relieson selecting reliable partners and maintaining a strategic focus on core activities;
- **Collevtive research organizations**: collective research organizations facilitate collaboration across multiple firms, hinging success only when open communication, shared goals and effective resource management and pooling is employed.

7.4 Choosing and monitoring partners

Gaining access to another firm's skills or resources is through collaboration is not without risk.

7.4.1 Partner selection

A number of factors can influence how well suited partner are to each others, we consider two dimensions:

- **Resource fit**: degree to which potential partners have resources that can be effectively integrated into a strategy that creates value (often complementary and supplementary resources);
- **Strategic fit**: degree to which partners have computable objectives and styles.

7.4.2 Partner monitoring and governance

- **Allaince contracts**: legally binding contractual agreements to ensure that partners are fully aware of their rights and obligations in the collaboration and have legal remedies should a partner breach the agreement;
- **Equity ownership**: each partner contributes capital and owns a share of the alliance's capital;

- **Renational governance**: self-enforcing governance is based on the goodwill, trust and reputation. This reduce monitoring costs, facilitate more extensive cooperations, sharing and learning.

8 Protecting innovation

8.1 Appropriability

The appropriability is the degree to which a firm can capture the rents from its innovation. In general is determined by how easily or quickly competitors can imitate the innovations. The knowledge underlying the technology may be rare or difficult to replicate(skills or talent) if is tacit or socially complex.

8.2 Patents, Trademarks and Copyrights

8.2.1 Patents

Patents protect innovations, they provide exclusive rights for a specified duration, preventing others from selling, making or using the patented invention and usually requires creating something novel, useful and effective, while at the same time being not obvious. To protect such, different kind of patents exist to be more granular according to the specific context, but also patent laws, designed to protect and harmonize priorities or reached countries.

8.2.2 Trademarks

Trademarks protects words or symbols. Trademarks distinguish different sources of goods from one party from goods of another and establish legitimate use of marks and registration of such; 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.

8.2.3 Copyrights

Copyright protects an original, asrtistic or literary work. It is usually granted to works of authorship, prohibiting others from reproducing something in any way. This is usually granted for something like 70 years after 1978

inventions and there exist levels of protection like Berne Convention which recognizes automatic protection upon creation and differentiated treatment for exceptions and limitations.

8.3 Trade secrets

Trade secrets are confidential information belonging to the company and are generally unknown to others, allowing classes of assets and assets to be protected and shared in disclosure. This is particularly useful for complex technologies, such as reverse engineering ones, but also others that require particular production/commercial processes. They can have an infinite lifespan, as something is simply held internally and requires no formality contract or registration. They can also be useful for protecting non-technical information such as business practices and be exploited to gain a competitive advantage, so they can be useful for protecting unique assets practices that meet particular criteria.

8.4 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 aumented 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 techonologies are not protected by patent or secrecy. Freely accessed, augmented and distribuited 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);

8.5 Advantages of protection and diffusion

- **Protecion** offer a freater rent of appropriability. Architectural control: ability to determine the structure of the technology, and its compatibility with other goods and decide the rate at which the technology

is upgraded or refined. If the technology is chosen as dominant design influence over the entire industry;

- **Diffusion** May accrue more rapid adoptions: can stimulate the growth of the installed base and availability of complementary goods. Open technologies can also benefit from the collective development efforts of those external to the sponsoring company, the risks here are:
  - lack of coordination of internal development;
  - if improvements get incorporated into the technology and disseminated to other users can be very problematic;

  Given the range of advantages a firms must carefully consider the following factors in deciding whether, and to what degree it should protect its innovation:
  - Production capabilities, marketing capabilities and capital;
  - Industry opposition against sole-source technology;
  - Resources for internal development;
  - Control over fragmentation;
  - Incentives for architectural control.

9 Organizing for innovation

9.1 Size and structural dimension of the firm

Large firms are better able to obtain financing for R&D projects, they have larger sales volume over which they can spread the fixed cost of R&D would experience higher return. There are bettere complementary activities, scale and learning effects and are in better position to take a large or risky innovation project. The disadvantages are:

- R&D efficiency might decrease;
- Is less innovative, the size can make less nimble and responsive to change;
- More people means more communication problems.

Many firms have found ways of making even large firms feel small by breaking it in subunits (virtual organization).

9.2 Structural dimension of the firm

- **Centralization**: degree to which decision-making authority is kept at top levels of the firms. The decentralization of R&D actievities 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;
- **Formalization**: degree to which the firm utilizes rules, procedures, and written documentation to structure the behaviour of individuals (or groups). This may stifle employee creativity and innovation but ensure activities within the firm run smoothly and yield predictable outcomes;
- **Standardization**: degree to which the activities in a firm are performed in a uniform manner.
- **Mechanistic structures**: Formalization + Standardization, here we have efficiency but this is unsuitable for innovation;
- **Organic structures**: Are more free-flowing, there is a low level of formalization and standardization;
- **Ambidextrous organization**: is a complex organized form, composed by multiple internally inconsistent architectures that can collectively achieve short-term efficiency and long-term innovarion. Mechanistic + Organic.

9.3 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 indipendent firms. The problem is that many activities reap significant synergies by being integrated and this is not possible with this kind of organization.

9.4 Using culture and norms to foster innovation

- By creating norms of meritocracy, flexibility and autonomy we know where whether the employees are empowered to challenge assumptions and come up with new ideas, or are expected to adhere to the current way of doing things. If we have flexible roles there is more creativity;
- Eliminating norms of consesus: requiring consensus can force people to prematurely converge on mediocre ideas;
- Solo ideation vs Brainstorming groups: people in groups may be less creative due to both evaluation apprenhension (judgement of others) and production blocking (people whose speak later may forgot their ideas). To be creative people need to work alone before the group effort begins;
- Lowering price of failure;
- Cultivating idealistic goals.

9.5 Managing innovation across borders

Strategies for leveraging technological innovations into multiple markets allowing innovation activities to become completely autonomus:

- **Center-for-global**: Conducting all innovation activities at centralized hub, then innovation are deployed globally throughout the company. Here the innovation may not closely fit the needs of foreign markets and may also not be deployed quickly or effectively;
- **Local-for-local**: Each national subsidiary uses its own resources to create innovations that respond to the needs of its local market. Here we have redundacy in activities and a lock of scale in R&D activities;
- **Locally leveraged**: Attempts to take the most creative resources and innovative developments from division and deploy them across the company;
- **Globally linked**: Entails creating a system decentralized R&D divisions that are connected to each other.

10 Managing the new product development process

10.1 Objective of the new product development process

Must simultaneously achieve three sometimes-conflicing goals:

- **Maximizing fit with customer requirements**: product need to have greater quality or more attracting pricing than competing profucts but it's not easy to achieve;
- **Minimizing development cycle time**: a product can fail if the firm takes to long to bring it to the market;
- **Controlling development cost**: the costs have to be not only effective but also efficient.

10.2 Sequential vs partly parallel development processes

A **sequential process** has no early warning system to indicate that planned features are not manufacturable and the cycle time can lengthen as the project iterates back and forth between the product design and process design strategies. To shorten there are **partly parallel development processes** where the product design is initiated before the concept development is complete and the process design is began long before product design is finalized. The last one can, in some situations, substantially increase the risks or costs of the development process.

10.3 Project champions

Senior project champions have the power and the authority to support and fight for a project, allocates human resources and stimulates communications and cooperations between different functional groups. The risk is that the champion may cloud judgment about the true value of the project.

10.4 Involving customers and suppliers in the development process

The end customer is often the one most able to identify the maximum performance capabilities and the minimum service requirements of a new product (through beta testing for example). In the **agile development** the product is divided into many smaller features or functionalities ⇒ MVP ⇒ presented to the customer for feedback, enabling rapid incremental adoption. There can be co-creation with the customer. Firms should focus on the input of **lead users**: customers who face the same general needs of the marketplace but are likely to experience themmonths or years earlier than the rest of the market and stand to benefit disproportionately from solutions to those needs. Also suppliers can contribute ideas for product improvement or increased development efficiency (alternative input for example).

10.5 Crowdsourcing

Firms can also open up an innovation task by directing an innovation challenge to third parties such as the general public, or specific, targeted groups of innovators from different networks. For crowdsourcing challenges we have four steps:

1. **Need translation**: a clear, concise and compelling statement of need is articulated that minimizes industry jargon and brings the challenge back to its most basic science;

2. **Connecting**:the innovation challenge must be broadcast to the network of potential solution providers that have been selected as most suitable to respond;

3. **Evaluation/selection**:submitted proposals get an in-depth review, and the most interesting solution proposals get selected and collated in the form of a report;

4. **Acquisition**:the firm engages with the solution provider and negotiates an agreement to transfer knowledge, a license, patent, and so on. This usually involves a monetary or other compensation scheme. It may also be necessary to adapt the incoming solution to the specific needs of the firm.

10.6 Tools for improving the new product development process

10.6.1 Stage-Gate processes

Go/kill decision ponts have been implemented to avoid the support given to a project even if their expected value has turned negative Stage-Gate processes is one of that model which incorporate these points and provides a blueprint for moving projects through different stages of development.

1. Idea generation;
2. Scoping;
3. Build the buisness case;
4. Development;
5. Testing and validation;
6. Launch;

For every stage the firm have to see if it's possible to continue with the project.

10.6.2 Quality function deployment (QFD)

Tool for the improvement of communication and coordination among engineering, marketing and manufacturing personnel.

10.6.3 Design for manufacturing

Another method of facilitating integration between engineering and manufacturing, and of bringing issues of manufacturability into the design process as early as possible, is the use of design for manufacturing methods (DFM). The purpose of such design rules is typically to reduce costs and boost product quality by ensuring that product designs are easy to manufacture. The easier products are to manufacture, the fewer the assembly steps required, the higher labor productivity will be, resulting in lower unit costs.

10.6.4 Failure modes and effects analysis

is a method by which firms identify potential failures in a system, classify them according to their severity, likelihood, and detectability, and put a plan into place to address them.

10.6.5 Computer-Aided Design/Computer-Aided Engineering/Computer-Aided Manufacturing

Computer-aided design (CAD) and computer-aided engineering (CAE) are the use of computers to build and test product designs. Arecent incarnation of computer-aided manufacturing isthree-dimensional printing.

10.7 Tools for measuring new product development performance

10.7.1 New product development process metrics

Many firms use a number of methods to gauge the effectiveness and efficiency of the development process. These measures capture different dimensions of the firm's ability to successfully shepherd projects through the development process. To use such methods, it is important to first define a finite period in which the measure is to be applied in order to get an accurate view of the company's current performance

10.7.2 Overall innovation performance

Firms also use a variety of methods to assess their overall performance at innovation. These measures give an overall view of the bang for the buck the organization is achieving with its new product development processes.

11 Managing new product development teams

11.1 Constructing new product development teams

11.1.1 Team size

New product development teams may range from a few members to hundreds of members. Bigger is not always better: larger teams can create more

administrative costs and communication problems, leading to costly deleays. Further, as the size of the team increases, the potential for **social loafing** also increases. Social loafing occurs when, as the size of the team increases, individuals perceive that they will not receive full credit (or blame) for their contribution to the group effort and so their effort and commitment decrease.

11.1.2 Team composition

Cross-functional teams include members drawn from more than one functional area, such as engineering, manufacturing, or marketing. This can solve the lengthening of the cycle time due to the lack of communication. Teams that are composed of people from diverse backgrounds have several advantages over teams that are drawn from only one or a few functional areas. A greater variety of specialists provides a broader knowledge base and increases the cross-fertilization of ideas. Having specialists from different areas also allows the project to draw on a wider mix of information sources in the environment through scanning activities.
Diversity of team members, however, can also raise coordination and communication costs. Individuals tend to interact more frequently and more intensely with other individuals whom they perceive as being similar to them on one or more dimensions. This phenomenon is known as **homophily**.

11.2 The structure of new product development teams

- **Fucntional teams**: members remain in their funcitonal departments and report to their functional manager. Functional teams are more likely to be appropriate for derivative projects that primarily affect only a single function of the firm;

- **Lightweight teams**: Employees remain within functional departments but project manager provides cross-functional integration. Such a team structure might be appropriate for derivative projects where high levels of coordination and communication are not required;

- **Heavyweight teams**: Project manager provides cross-functional integration, the team members are collocated but still report to functional managers also. This type of team structure offers a significant improvement in communication and coordination over functional teams, and it is typically considered appropriate for platform projects;

- **Autonomous teams**: Project manager provides cross-functional integration, team members are collocated and report only to project manager. The independence of heavyweight and autonomous teams may prompt them to pursue goals that run counter to the interests of the functions.

11.3 The management of new product development teams

- **Team leadership**: The team leader is responsible for directing the team's activities, maintaining the team's alignment with project goals, and serving as a communicator between the team and senior management. Attributes of the team leader (seniority, authority, multilingual skills) must match the team type for teams to be most effective;

- **Team administration**: Many firms have teams develop and sign a project charter (encapsulates the project's mission and atriculates exact and measurable goals for the project) and contract book (defines in detail the basic plan to achieve the goal laid out in the project charter) to ensure that all team members have a common understanding of the project's goals and possess a sense of ownership and commitment to the project's success;

- **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.

12 Crafting a deployment strategy

12.1 Launch timing

12.1.1 Strategic launch timing

Generally, firms try to decrease their development cycles in order to decrease their costs and to increase their timing of entry options, but this does not imply that firms should always be racing to launch their products as early as possible. A firm can strategically use launch timing to take advantage of business cycle or seasonal effects, to position its product with respect to previous generations of related technologies, and to ensure that production capacity and complementary goods or services are in place.

12.2 Optimizing cash flow versus embracing cannibalization

For firms introducing a next generation technology into a market in which they already compete, entry timing can become a decision about whether and to what degree to embrace cannibalization[6] If a firm's current product is very profitable, the firm will often delay introduction of a next generation product until profits have begun to significantly decrease for the current product.

12.3 Licensing and compatibility

If a firm completely opens its technology, other producers may drive the price of the technology down to a point at which the firm is unable to recoup its development expense. If competition drives the price down so no producer earns significant margins on the technology, no producer will have much incentive to further develop the technology. Finally, opening a technology completely may cause its underlying platform to become fragmented as different producers alter it to their needs, resulting in loss of compatibility across producers and the possible erosion of product quality. Firms must also decide whether or not to make their products **backward compatible** with their own previous generations of technology. Sometimes backward

[6]When a firm's sales of one product (or at one location) diminish its sales of another of its products (or at another of its locations).

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

12.4 Pricing

Price simultaneously influences the product's positioning in the marketplace, its rate of adoption, and the firm's cash flow. A **survival price** strategy prices goods to cover variable costs and some fixed costs. It is a short-run strategy, however; in the long run, the firm will want to find a way to create additional value. For new technological innovations, firms often emphasize either a maximum market skimming objective or a maximum market share objective. To maximize market share, firms often use **penetration pricing**: the firm will set the lowest price possible hoping to rapidly attract customers, driving volume up and production costs down. The key to making this strategy pay off is to be able to control compatibility with complements, and to be able to offer complements at a sufficient range of price and quality to meet customer needs.
Firms can also influence cash flow and the customers' perception of costs through manipulating the timing of when the price of a good is paid. For instance, while the most typical pricing model requires the customer to pay the full price before taking ownership, other pricing models enable the customer to delay paying the purchase price by offering a free trial for a fixed time. Another way to manipulate consumers' perception of the costs is through a **"freemium" model**, where the base product is free, but additional features or capacity have a price.

12.5 Distribution

12.5.1 Selling direct versus using intermediareies

Firms can sell their products directly to users through their direct sales force or an online ordering system or mail-order catalog. Alternatively, firms can use intermediaries such as manufacturers' representatives, wholesalers, and retailers. Selling direct gives the firm more control over the selling process, pricing, and service. In many situations, however, selling direct can be impractical or overly expensive. Intermediaries provide a number of important services that can make distribution more efficient. Intermediaries also provide

a number of other services such as transporting goods, carrying inventory, providing selling services, and handling transactions with customers. Many intermediaries also offer greater convenience for customers by offering geographically dispersed retail sites. **Original equipment manufacturers** (OEMs) provide an even more crucial role in the distribution process: An OEM buys products from other manufacturers and assembles them into a product that is customized to meet user needs. In some industries, advances in information technology have enabled **disintermediation**[7] or a reconfiguration in the types of intermediaries used.

12.5.2 Strategies for accelerating distribution

- **Alliances with distributors**: Firms introducing a technological innovation can use strategic alliances or exclusivity contracts to encourage distributors to carry and promote their goods. By providing a distributor a stake in the success of the new technology, the firm may be able to persuade the distributor to carry and promote the new technology aggressively. Firms that already have relationships with distributors for other goods are at an advantage in pursuing this strategy; firms without such relationships may need to cultivate them, or even consider forward vertical integration to ensure that their product is widely available;

- **Bundling Relationships**: Bundling enables the new technology to piggyback on the success of another product that already has a large installed base. Once customers acquire the new product in tandem with something else that they already use, switching costs may prevent customers from changing to a different product, even if the different product might have initially been preferred. As customers become familiar with the product, their ties to the technology (for instance, through the cost of training) increase and their likelihood of choosing this technology in future purchase decisions may also increase;

- **Contracts and Sponsorship**:Firms can also set up contractual arrangements with distributors, complementary goods providers, and

[7]When the number of intermediaries in a supply channel is reduced; for example, when manufacturers bypass wholesalers and/or retailers to sell directly to end users.

even large end users (such as universities or government agencies) to ensure that the technology is used in exchange for price discounts, special service contracts, advertising assistance, or other inducements;

- **Guarantees and Consignment**: If there is considerable market uncertainty about the new product or service, the firm can encourage distributors to carry the product by offering them guarantees (such as promising to take back unsold stock) or agreeing to sell the product on consignment.

12.6 Marketing

Marjor marketing methods:

- **Advertising**: Doing so requires that the firm craft an effective advertising message and choose advertising media that can convey this message to the appropriate target market. In crafting an advertising message, firms often attempt to strike a balance between achieving an entertaining and memorable message versus providing a significant quantity of informative content.

- **Promotions**: Firms can also use promotions at the distributor or customer level to stimulate purchase or trial (for example offering samples or incentives).

- **Publicity and Public Relations**: Many firms use free publicity to effectively generate word of mouth. **Viral marketing** is an attempt to capitalize on the social networks of individuals to stimulate word-of-mouth advertising. Information is sent directly to a set of targeted consumers that are well-positioned in their social networks in some way. The objective is to spark rapid spreading of the information through social networks, akin to a viral epidemic.

12.6.1 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.

12.6.2 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 vaporware, 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 signaling 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.