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INNOVATION MANAGEMENT

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INTRODUCTION

The definition of innovation used by Schumpeter (1954) first related to the driving force of economic growth. At this time, a Hungarian engineer, Lajos Galamb, who was working at the Ford Plants, was working on developing the famous T-model further.
The engineer and economist being active and working simultaneously were linked together by the process of innovation.
This concept has led to the emergence of a new field of science. Here organized monitoring, analysis, associated methodologies of the conception of creative ideas and the features of their implementation and widespread market dissemination phenomena will be dealt with separately. Following the innovation management expert, new trends, new schools have evolved and have had a decisive influence on the world's economic development processes in the twentieth century.
Today, the economic actors tend to wait for a paradigm shift. There exist promising professional cultures. Nano-technology, genetics and rapid prototyping all incorporate the decisive technological change of the future: it can be a driving force of the development of new and innovative professional sectors.
The curriculum of innovation management summarizes the conceptual system, theories and methodologies of innovation management as we know them today.

MODULE 1: DEFINITION AND PROCESS OF INNOVATION

The term of innovation is connected to Joseph Alois Schumpeter (1934): "The introduction of new goods (…), new methods of production (…), the opening of new markets (…), the conquest of new sources of supply (…) and the carrying out of a new organization of any industry" (Joseph Schumpeter).

Schumpeter's theory emerged when business cycle analysis was popular. He also referred to innovation in his book 'Capitalism, Socialism and Democracy' (published in 1942) as "creative destruction".

In his works innovation is usually connected to the ideas of development and novelty.

"Technologically as well as economically considered, to produce means to combine the things and forces within our reach. Every method of production signifies some such definite combination. Different methods of production can only be distinguished by the manner of the combination; that is either by the objects combined or by the relation between their quantities. To produce means to combine materials and forces within our reach. To produce other things or the same things with a different method means to combine these materials and forces differently. In so far as the „new combination" may in time grow out of the old by continuous adjustment in small steps, there is certainly change, possibly growth, but neither a new phenomenon nor development in our sense. In so far this is not the case, and the new combinations appear discontinuously, then the phenomenon characterising development emerges."

Development in our sense is then defined by carrying out new combinations. This concept covers the following five cases:

1. The introduction of a new kind of goods – that is one with which consumers are not yet familiar – or of a new quality of goods.
2. The introduction of a new method of production; that is one not yet tested by experience in the branch of manufacture concerned.
3. The opening of a new market that is a market into which the particular branch of manufacture of the country of question has not previously entered, whether or not this market existed before.
4. The conquest of a new source of supply of raw materials of half manufactured goods, again irrespective of whether this source already exists or it has first to be created.
5. The carrying out of a new organization of any industry, like the creation of a monopoly position (for example through trustification) or the breaking up of a monopoly position."

Schumpeter, J., The Theory of Economic Development, Harvard University Press, Cambridge, Mass., 1934.F1

It is relevant to differentiate scientific and technological innovation. Scientific innovation is for better understanding while technological innovations stand for better utilization.
The definitions quoted give a good description of the duality of the concept of innovation when they separate the processes and the achievement (improvements) of the innovation focusing mainly on the processes.
The early, limited – product centred – interpretations of innovation have been modified and broadened using the term for services and procedures as well.
The four basic types of innovation mentioned nowadays are summarized in Table 1.1.

The wide use of this interpretation of the concept is shown by the following definitions as well, where in addition to the original (primary) innovations, adaptive (secondary, tertiary) innovations are also considered.
At the same time the relativity of the concept of innovation is declared and a framework of a multi-stage concept (continent, country, branch, corporation, etc.) of innovation is drawn up.
Innovations may appear in different ways in space and time resulting in different novelties:

- for the market: the first Xerox photocopier,
- for the manufacturer: photocopiers by Lumiprint,
- for the distributor: a company which is the first distributor of 3M photocopiers,
- for the customer: the office receives a new photocopier.

TABLE 1.1

INNOVATION	
TYPE	***GOALS***
1. Product innovation innovation in the companies' marketable performance	survival, increasing profits, increasing market share, expansion by key-accounts increasing prestige creating new jobs,
2. Process innovation Innovations in the production or managerial processes of the product or service provided also include the new methodologies	reducing costs, increasing productivity, material efficiency, energy efficiency, accident prevention, environment-friendliness, automation,
3. Social innovation innovations by the human capital, innovations in the social controlling systems,	* training, training system development, * improving the workforce retention capacity, * improving social conditions, * stimulating internal mobility, * widening social benefits, * new organizational forms,
4.Structural innovation - innovations in the distribution system, - innovations in the purchasing or sales	* new markets, * new suppliers, * new sales channels,

markets	* new procurement strategy,(make or buy) * new R+D alliance,

Table 1.2 displays the levels and differences of the two selected interpretations.

Table 1.2

Interpreting the levels of innovations

Levels	By Valenta	By Bucsy
0	✓ Regenerational changes	✓ Simple change of quantity
1	✓ Simple change of quantity	✓ Extensive development, new markets
2	✓ Simple change of structure	✓ Improvement in the composition of production, intervention in the organizational methods
3	✓ Simple change of quality	✓ Appearance of intensive elements
4	✓ Quality change, partial functional changes and new variants	✓ Quality leaps
5	✓ Significant change of quality, changing functions ✓ Significant change of quality, change of principles	✓ Levels of cooperation: changing functions, complex market relationships
6	✓ Radical change, new principles	✓ Principles remain unchanged, but a new conception of realization arises
7		✓ New principles, complex market assessment systems

1.1 Innovation and economic cycles

The final conclusions of the different researchers investigating the temporal distribution of inventions show significant similarities. The temporal distribution of primary inventions and real innovations represent special accumulations in time. (This means that in a given period of time more inventions appear than usual.) However, there is no correlation or causal relationship between innovation accumulations and invention accumulations. The accumulation of the appearance of inventions does not ensure the accumulation of primary innovations. The distribution of inventions in the different technology areas represents normal distribution. However, innovations are strictly connected to changes in the economy and follow the basic trends. The analysis of long economic cycles for the planning of organization strategy is inevitable. These super-cycles (or long waves) are named K-waves after their identifier Nikolai Kondratiev. Within one super-cycle characteristic innovation events recur due to what are called basic innovations. The cycles – in different surveys of the history of science and technology – have revealed powerful technological changes.

In their work Systems of Innovation, Martin and Dodgson write about technological paradigm shifts. The waves of technological changes can be always connected to particular products and technologies which established the era's key branches that became the engine of growth. After the establishment of the key branches new trade sectors arise creating the knowledge base for future key branches (Figure 1.1).

According to the opinion of experts, there is a demonstrable interaction between temporal distribution, intensity and accumulation of new products and technologies and long economic cycles. We can assign typical innovation events to the different phases of the K-waves.

Improvement:

Attributes:

- Numerous technological innovations appear. They are concentrated in space and time.
- Using new materials and technologies throughout the whole branch.
- New markets develop.
- Several secondary innovations appear (accumulation after the period of basic innovations).

Prosperity:

Attributes:

- New capacities of production are created, based on new technologies.
- Because of cost reduction, more and more scattered technological improvements are accomplished.
- Beginning of the transfer of new technologies.
- The innovation leaders compete against each other's international standardization.
- The differentiation of costumer needs enforces secondary innovations**.**

Recession:

Attributes:

- R+D expenditures fall.
- Product range decreases.
- Price competition

Depression

Attributes:

- Awaiting new technology.
- R+D expenditures rise progressively, research activities accumulate.

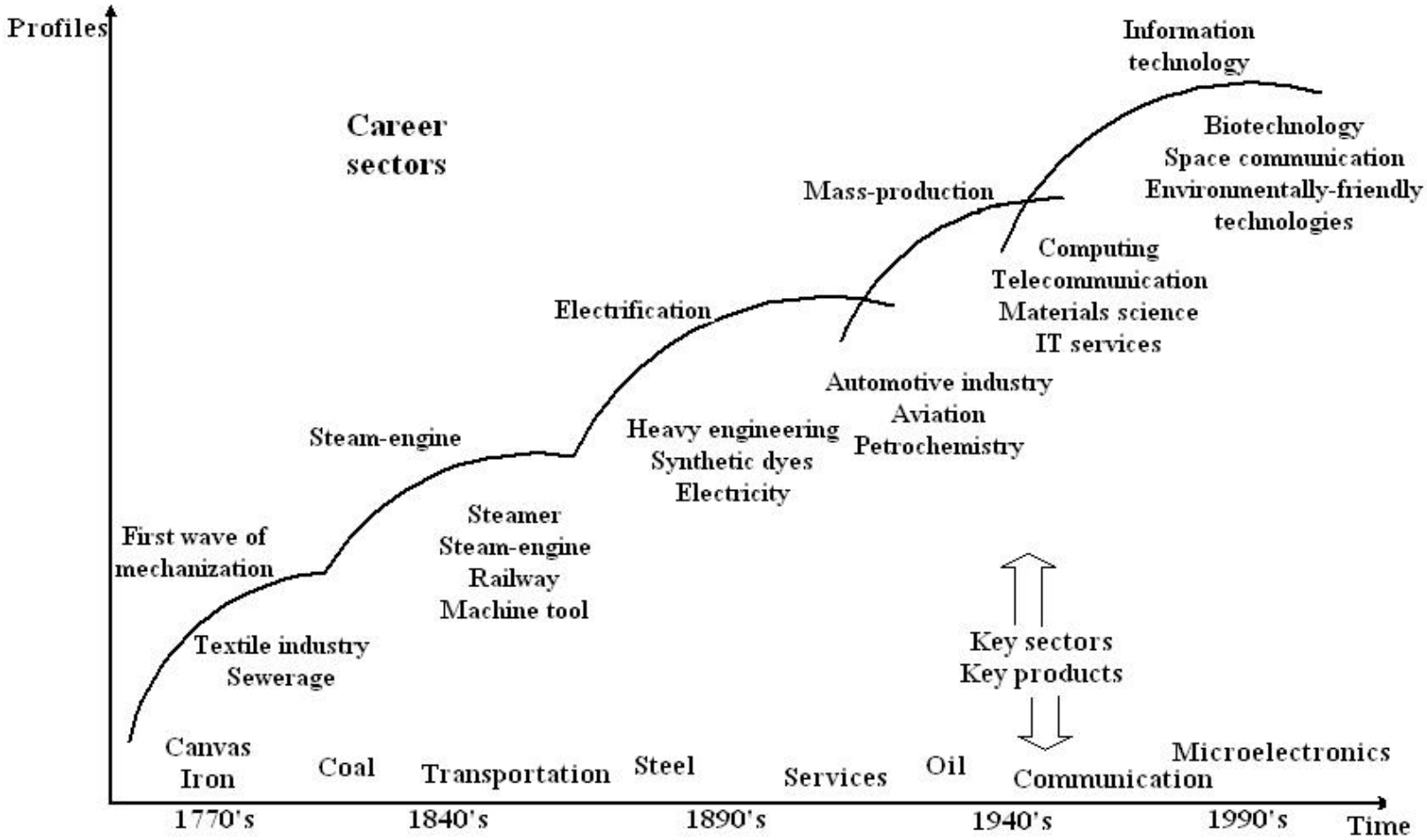


Figure 1.1: Waves of technological development /Martin and Dodgson, 1997 /

1.2 Different levels of innovational change

Different levels of innovational change can be identified. These levels can be ranked by their contents.
Simai (1998) defined four different levels of innovational change:

Continuous innovations:

- are innovations which can be found in almost every branch of the economy distributed normally in time and space,
- are innovations enforced by the production and supply chains,
- are innovations enforced by the diversification/segmentation strategy.

Radical innovations:

- are based on planned and conscious R+D activity,
- accumulate at the end of a K-wave (different materials or procedures),
- enforce significant investments and create a wave-effect,
- are creating several secondary innovations,
- their formation is affected by the:
  - R+D potentials,
  - size limit of investments,
  - scale of production,
  - and sales volume limits.

The acceptance of innovation, its adaptation and transfer potentials are high. Companies use their own capital to reinvest in R+D activities to achieve their goals.

New technological system:

through a radical technical change new organizational and managerial structures are created,
they affect several branches and also new sectors and production cultures are created.

Paradigm shift:

- all the actors of the economy are affected,
- is based on the radical change of knowledge,
- has a complex mechanism of action and effectuation,
- radical and continuous innovations are accumulating as an after-effect,
- forces not only the economic but the social environment as well to change,
- fluctuations in new fields of science,
- provides facilities to change the infrastructure to a large extent.

1.3 Factors influencing the structure and character of innovation

A rich variety of models is available in the professional literature to describe innovation processes. Each of these models represents the specific idea of the researcher and focuses on the elements which were highlighted at that time. Every model is based on the logical structure and characteristics of the innovation processes.

Table 1.3

Logical framework of innovation processes

Activities	Tasks
1. ***Definition:*** Start-up: approved basic assumptions Completion: approved idea and goal	* Collecting basic data, * Defining goals, * Determining program parameters (requirements, performance, functions, conditions)
2. Planning: Completion: approved programs	* Defining program contents, * General program - scheduling, * Detailed plans (division of labour), * Determining resource requirement
3. Preparation: Completion: realization plan	* Writing scenarios, * Setting up a team, * Building up an organization, * Budgeting, * Ensuring conditions
4. Realization: Completion: goal of innovation achieved	* Problem solving, * Monitoring, * Coordination, * Reporting, * Evaluation
5. Aftercare: Completion: accepted innovation	* Delivery - receipt, * Acceptance, * Control, * Rating

1.4 R+D – Technological development

After getting acquainted with the definition of innovation we must describe the ideas of R+D activities and technological development. These categories help to handle innovation from a methodological point of view. The definitions for these categories are the following:
Technological development is an activity to develop new products or to upgrade the earlier ones, to develop and introduce new procedures, to modernize fixed assets, to improve the production processes and to use new scientific achievements in all the fields of the organization concerned. Product and production development is part of the technological development. In a broader sense applied and technological research is also part of technological development. This last idea is called R+D activities including all the activities mentioned here.

1.5 Push and pull effects – The technological and demand sides

With regard to the primary R+D intentions, we distinguish demand generating and demand following innovations.

Demand generating innovations:

- focus on latent or unknown needs,
- demand generating is a part of successful introduction,
- enable the conscious utilization of research achievements,
- accumulate in 'innovation boom' periods,
- primary innovations are usually a result of demand generating developments,
- the innovator influences the characteristics of the new technology.

Demand generating developments are the results of the technology push. This kind of 'push strategy' is determined by R+D institutions, the government and the management of the companies involved. The customers have limited or no effect at all on the new technology. These developments facilitate the intensive creation of new technologies. The innovator can influence the demand for the technology and its characteristics (quality, quantity, formation, etc.)

Demand following innovations:

- want to meet existing needs,
- enable the conscious utilization of development achievements,
- in order to meet customer needs rapidly, technology transfer has priority over own research,
- usually performed between two 'innovation booms',
- often appearing as pseudo-innovations
- customers have great influence on the development processes.

The 'demand pull strategy' is based on the demand following philosophy in order to meet existing needs. This strategy prefers technological adaptations and knowledge transfer. Customer needs influence the features of the product or service. The customer is not a passive observer but an active contributor in the process of innovation.

The classic models of innovation processes explain the laws of the creation and spread of innovation as a result of technology push and demand pull. Concerning the strength of 'push' and 'pull' effects, we can describe the dynamics of innovation (accumulation in space and time, deceleration time, etc.).

1.6 Controlling innovation processes

The specialties of the organizations performing R+D tasks can be derived from the attributes of the linear-functional organizational form and the project organizational form (Figure 1.3). (We can say that these organizations are somewhere halfway between these two forms.) The most important features of an organization performing R+D tasks which can differ from the organizations involved are the level of differentiation and the management system applied. One of the extreme solutions is an organization with traditional functions, where development tasks are done by independent functional units or coordinating departments with a slight focus on innovation. These departments do the creative work of brainstorming, and gathering and analyzing suggestions. The other extreme solution is the project organization where the innovational processes (according to the company goals) are in the

center of activity. These processes and related structures form the organization and management hierarchy. The most developed solution (of the above) is the temporary matrix organizational form where parallel hierarchies can be found in the organization. These organizations are created and dissolved according to time and staff limits to perform a specific task. The different organizations between the two forms (functional or project organizational forms) depend on the level of (de)centralized management of R+D activities, the position of the R+D manager in the hierarchy and the schedule of the teams involved (full-time, part-time involvement).

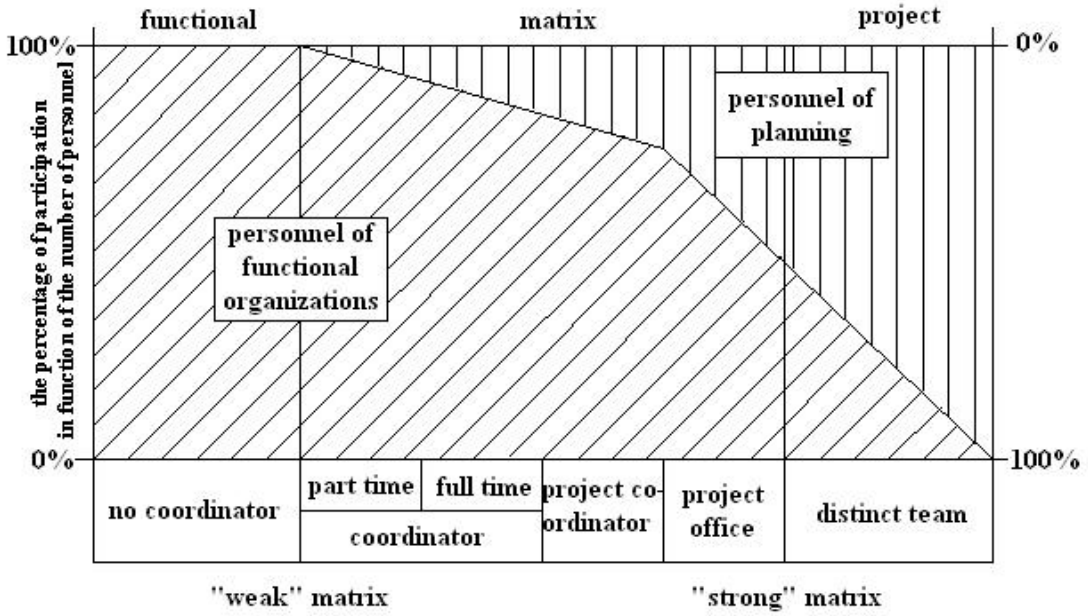


Figure 1.2: Basic organizational forms and controllers

Simple forms of these organizations are based on coordination by the leader of a functional unit. Execution is done by the unit managed or various working groups from the organization. These groups can be managed by a person responsible or supervised by a committee. The linear-functional idea leads to a process-orientated organization and management-system. Matrix organizations are special transitions between the linear-functional and the project organizations. The different principles of the division of labour are represented in the dimensions of the matrix. One of these dimensions is program management and coordination (in terms of products, markets, branches and functions) and the other is functional management and coordination (functional units of logistics, accounting, sales, etc.). Tasks can be found in the intersection points of these dimensions. Persons and groups can be delegated to these points to perform the tasks. Conflicts are common in matrix organizations; therefore a competent person is to be chosen to handle these situations. In organizations project leaders are responsible for the resources and budgeting. Resources are allocated by the project leader to different programs. The use of resources is linked to program milestones.

Linear-functional organizations are useful when we want to introduce innovations and put them into practice. Companies prefer the simpler and stable organizational forms irrespective of other possibilities. There are several possibilities to create a different organization with consideration of the complexity and size of the task, the time limits and the staff involved.

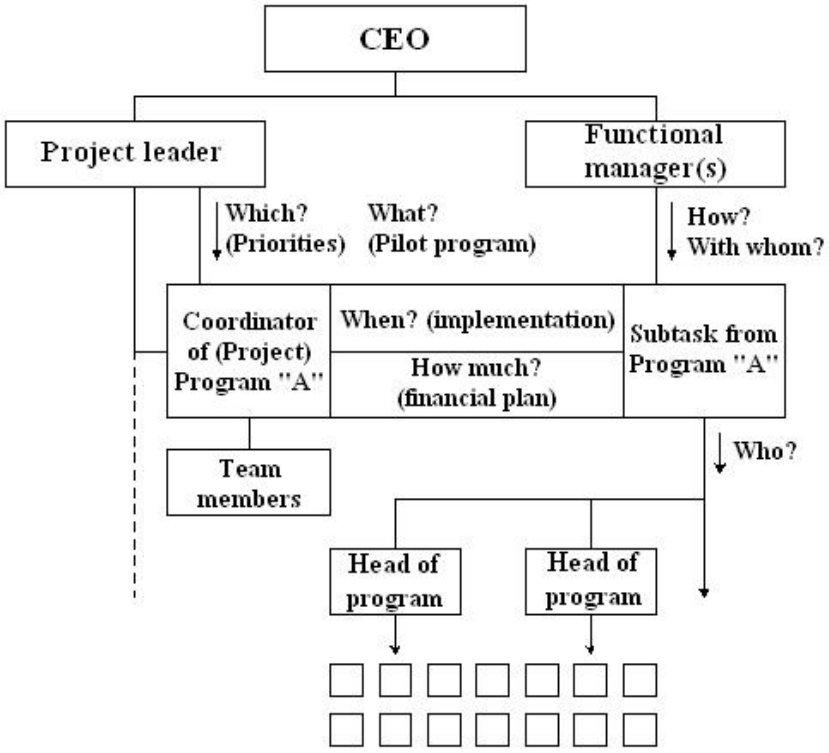


Figure 1.3: Division of labour between the key actors of the innovation process

Project leader:

- designing program plans, defining priorities,
- informing the organizations/persons involved,
- arranging personnel conditions,
- appointing the project coordinator, control and reporting activity,
- preparing submissions for decision-making boards,
- providing resources,
- setting up temporary organizations,
- communicating with senior management,
- dismissing staff at the right time.

The leader of an innovation project is not a specialist first of all, but an open-minded manager with technical and managerial knowledge leading the assigned staff.

Head of project:

- scheduling subtasks and individual programs,
- up-to-date monitoring and trouble-shooting of the progress,
- leading and supervising the program,
- ordering resources directly,
- registering expenditures,
- assigning tasks,
- reporting,
- controlling work schedule.

Questions:

1. Describe the concept and basic types of innovation.
2. Describe the different events of innovation which can be linked to the phases of long economic cycles (K-waves).

3. Which are the different levels of innovational change? (Definition by Simai)
4. Which are the elements of the multi-level model of innovation chains?
5. What is the difference between technological development and R+D activities?
6. What is the difference between the 'push' and 'pull' strategies?
7. Define the tasks of the actors in an innovation project.

References:

MODULE 2: SPREAD OF INNOVATION

2.1 Diffusion of innovation

The Schumpeterian trilogy that divides the process of technological change into three stages is as follows:

- invention (generating new ideas),
- innovation (developing ideas into marketable products and processes) and
- diffusion (new products and processes spread across the market).

The idea of diffusion can be interpreted without the idea of innovation as well. In this case it is appropriate to describe the phenomena of receiving and accepting knowledge as a result of the transfer processes. Diffusion is a concept describing the acceptance of the innovation but, on the other hand, also the name of the processes of the spread of innovation in space and time. Diffusion phenomena can be tracked easily. The intensity of the processes can be proved by a variety of self-apparent economic statistics. Two different approaches have become accepted in particular:

a. Product innovation:
Market share of the new product; the summation of the number of purchased new items based on sales data.

b. Process innovation:
Increase in the number of producers using the new technology/processes; increase in the number of products manufactured using the new technology/processes.

There are some methodological difficulties involved:

- it is hard to find the new product's position in the market (first mobile phones),
- the new product influences the consumption of other complementary products (fridge-ice box combinations),
- more durable products, new kind of application influencing consumption (fluid detergent, concentrates),
- the new procedure is more complex than the previous one so it is harder to identify the new users (new chemical methods);
- the new processes and substances apply new competences (plastic injection replaces molding technology).

Table 2.1: Spread of using PCs by SMEs in 1979 – 1985 Wheelwright (1992)

Size of the company	**Time**		
(headcount)	1979	1982	1985
1-19	2.5 %	9.1 %	26.9 %
20-99	22.7 %	34.7 %	47.8 %
100-250	48.3 %	59.6 %	62.8 %
250-499	50.8 %	71.9 %	73.0 %
Number of Experts	648	1213	1739

The indicators are usually compared with two thresholds.
30 % threshold: The integration of the innovation is stable and receptive customers and users want to use the new product or process.

60 % threshold: Vacillating and waiting users and also imitators would like to use the innovation as well.

The concept of diffusion is not limited only to the wide-range use of the innovation but it refers also to the change, expansion and growth of knowledge. In the reception and use of the new product or process the producer and the customer consider technological and application benefits. The speed of employment of the innovation is based on the perceived and identified costs and benefits of the application. These factors determine the spread of the innovation.

Situation-oriented factors influencing the spread of innovations:

- ***Relative advantages:***
  - Obvious benefits (use/value) of the new product (black and white or color television)
- ***Compatibility:***

  Pressure for change in the customer's lifestyle or habits. Radical innovations require essential change from the customer. This can be uncomfortable, costly, or annoying.
- ***Complexity:***
  - This factor refers to the difficulties of recognizing the advantages of the innovation at first sight. When we are faced with something completely novel, perception can be superficial or inadequate. The benefits can be hidden for the customer (new pesticides).
- ***Experience:***
  - The customer's own experience about the innovation before purchasing it. The customer can compare their own experience with the declared benefits. (software shareware, demo or beta version).
- ***Introducibility:***
  - The difficulties regarding the new experience concerning the new product. (A new TV can be easily introduced in the shop but a new dietary supplement cannot.)

2.1.1 Diffusion models

Describing the behavior of the companies and individuals in connection with the diffusion of innovation we can distinguish five basic diffusion models:

Gravity model

- Similarly to Friedman's growth model, the gravity model describes the spread of innovation by examining the speed and spatial expansion of the adaption. This model operates on the presumption that adaption depends primarily on the density (number and ability to use the innovation) of potential adaptors in the region and secondly on the distance of the examined region from the centers of the population. The model assumes indirectly that the population and the distance between the settlements is an inverse indicator of communication.
- This model is highly successful in interpreting social innovations, but unable to explain manufacturing innovations where the relations between the industries result in different types of spreading. The empirical verification was introduced by Hägerstand (1986). According to his investigations, physical and social barriers (as information structures) block the spread of innovation.

Epidemic model

The model's basic assumption is the following: The spread of innovation is highly affected by the customer's knowledge. The information dispels uncertainty and encourages making a decision. In the early periods it is easy to find pioneering users. Later on the intensity of diffusion decreases. The first wave consists of the first pioneers and the well-informed customers. The actors of the next phase represent the decreasing intensity of the diffusion.
Different types of epidemic models are introduced in the literature: (Schupler, 1998)

i. Expansion diffusion:
   - ✓ Information spreads in a spiral around the diffusion centres in a widening range. The range of potential users becomes wider (live propaganda).

ii. Relocation diffusion:
   - The innovation 'breaks down' after the start-up point and moves randomly or consciously into a new region or structure (spontaneous population movements or aid programs).

iii. Hierarchic diffusion:
   - Innovation spreads across the social, economic and regional hierarchy. The dynamics of diffusion is altered by the filters of these hierarchies. This kind of diffusion is present when non-technical innovations spread across informal channels in parallel and selectively (institutional publications).

iv. Bi-Phase diffusion:
   - In the first phase only a small circle gets information about the innovation. Later on they pass the information on to others but with their own experience attached.

v. Focused diffusion:
   - Information flows from one source (governmental organizations, trade unions, etc.) creating change in the environment (governmental regulations).

vi. Exploding diffusion:
   - Information explodes from the source to every possible receiver (advisors plan this diffusion in cooperation with the potential receivers)

Equilibrium model

This model reflects neoclassical economics using the assumption that companies are led by rational decision-makers choosing optimal solutions. According to this idea when an innovation is beneficial, the company will adapt it. When the adaptation is delayed, the company waits for the optimal time to introduce it with the maximum revenue with an optimal investment.

Forecasting consumer behaviour

This model is based on the assumption that a customer is able to purchase a product or make an investment when the product's income-generating capacity exceeds a critical threshold. (This depends also on the customer's own perception.) The threshold is generated by the product's quality, performance, price and the customer's perception. The threshold depends on:

- the adequacy of the customer's need and the function of the product,
- scale of advantages,
- costs of adaption.

Utilizing 'early bird' advantages

This model examines the advantages of the so-called 'Boston-effect'. This means that corporations prefer entering the market early. Those who gain experience sooner can reduce costs rapidly and get into a better market position. Those who enter the market later cannot get the same benefits, but the process of experience-based cost reduction persists while it is advantageous.

Table 2.2: Comparison of diffusion models

Model Attributes	Gravity model	Epidemic model	Equilibrium model	Forecasting consumer behaviour	Utilizing "early bird" advantages
Approach	– Built on Friedman's model of growth	– Measures the level of awareness of the novelty	– Rational decision-maker seeks optimal choice;	– Assessment of income-generating ability	– Mobilization force of 'Boston'-effect
Parameters	– Accumulation of potential adopters, – Center-periphery relationship	– Information deficit, – Number of knowledge owners, – Attributes of saturation	– Cost - benefit, – Transition costs	– Consistency of price and performance;	– Beneficial effects of the experience, – Cost sensitivity
Weakness	– Describing procedure innovations, – Traditionally asymmetrical effects	– Informal phenomena, – Early saturation	– Non-quantifiable benefits	– Original innovations, – Early phases of life cycle	– Simple copy, – High entry barriers
Utilization	– Describing social innovations	– Linear and spiral spread, – Isolation symptoms, – Hierarchical spread	– Product innovation, – Production procedures	– Mature product or procedure, – Significant employment of the results	– Branches based on scale of economy

2.1.2 The trigger effect

The trigger effect (pinball effect) is the impulsive process of innovation in technological systems which can be identified through the chain-reaction-like spread in other fields as well. An impulse in one scientific field creates a change and a reaction in other scientific fields as well. This spread into other fields is not incessive and controlled but rather like a vibration affecting other disciplines while generating knowledge transfer through cross-links. (Figure 2.1 F17)
This phenomenon is common in basic technologies, such as material processing and electronic unit manufacturing. The trigger effect is created by accidental factors but can also be generated by conscious knowledge transfer. This effect can be well-timed when it is based on market considerations.

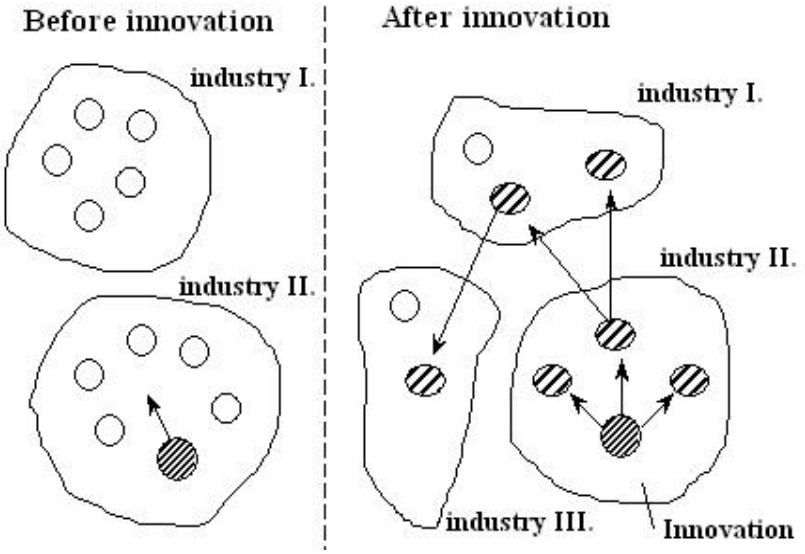


Figure 2.1: The trigger effect

In his book 'The Pinball Effect', Burke (1996) describes this phenomenon and its mechanisms using great discoveries as illustrative examples.

2.2 Basics of developing an innovation strategy

When we would like to plan and develop our innovation strategy, we must answer the following basic questions:

- Where?
- When?
- How?

The following fields should be examined in order to answer the above questions:

- analyzing the market environment:
  - current market position of the product or service,
  - trends of customer needs,
  - actions of (potential) competitors,
- analyzing corporate development potentials:
  - evaluating knowledge, staff, technical background of the research,
  - ensuring funds,
  - investigating the opportunities to fill the knowledge gap and prepare for adaptation.

2.2.1 New products

As mentioned before, the idea of innovation is relative so the rate of innovation should be interpreted in this context. Figure 2.2 shows a different point of view for interpreting innovation with consideration of the influence of the market. On axis X the rate of innovation is measured. It starts with uncertain elements and basic systems (investigated only in experiments) and goes through different development phases to the mature product while the rate of innovation decreases. In these development phases sequences of incremental and modular innovations follow each other. As the concept of the product begins to be clarified, the development framework of new product variants is created. In this process the elements of the new knowledge are created and fixed (e.g. Otto-engine improvements). Expansion to new markets to win new customers is built on the new elements of knowledge. This can be done while the customer needs fitting into this fixed conceptual framework. When we cannot meet the customer's needs any more, a new conception is formulated. (However, the process of the formulation of the concept is the same – axis Y in Figure 2.2 (e.g. electric cars)). As a product's grade of maturity increases, the accumulated knowledge about the elements and system (of the new product) also increases. This leads to an expansion of knowledge. From another point of view the field of knowledge narrows because we create new knowledge only within the concept (development of combustion engines). The change of customer habits can generate knowledge expansion. This new force requires the developer to find new solutions (size of computers – laptops, palmtops, smartphones). The successful solution is usually found by new manufacturers entering the market.

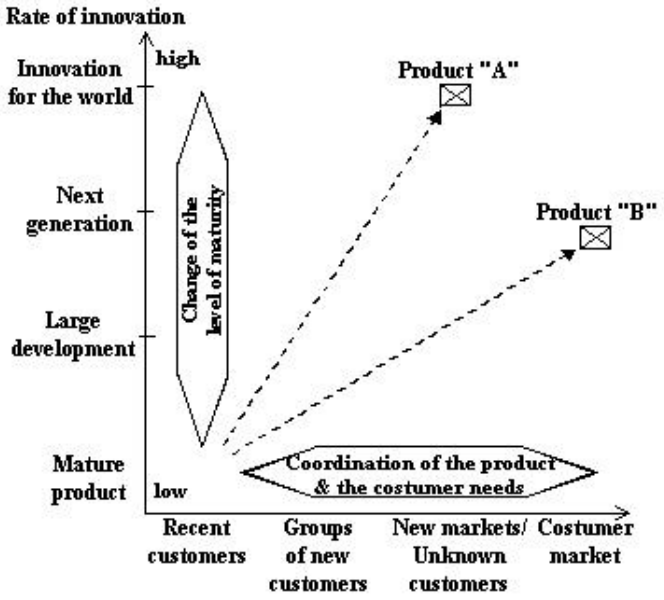


Figure 2.2: Gradation of the implementation of a new product

The push from the customer side is an essential motivating factor in this model. Experts say that a progressive company must have three types of customers:

- the loyal ones,
- 'newcomers' increasing sales volume,
- customers with special needs enforcing innovation.

2.2.2 Orientations of product development

The concept of innovation – according to the rate and source of innovation of the products or services – can be examined based on the orientation of the development (Figure 2.3).

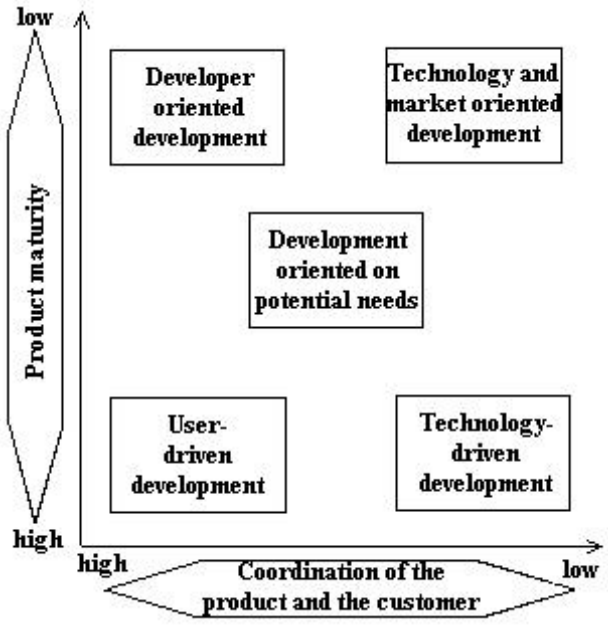


Figure 2.3: Orientations of product development (Barton, 1995) Leonard-Barton, Dorothy (1995). Wellsprings of Knowledge: Building and Sustaining the Sources of Innovation, Boston, MA, Harvard Business School Press.

The orientations of development can be derived from the assessment of the following factors:

- maturity of the product:
  - from the new product to → the mature product
- coordination of the product and customer:
  - expressed needs of the customer → new opportunities available due to technology.

A comparison of the different stages enables a study of the development concepts.

2.2.3 Empathic design

Sometimes a company must design a product or a platform to introduce the innovation to the market in order to meet unknown or latent customer needs. In these cases market analyses give little support so we must find a new methodology for product development. This method is called empathic design. The foundation of empathic design is the simulative modeling of unexpressed customer needs while we develop a new product or service.

Empathic design uses intuition, empathy and understanding to recognize latent customer needs. This process has two major elements:

- The product concept is created using the observed customer behavior. The potential customer is observed during the usage. The observer wants to investigate how the customer's behavior changes in the new situation.
- Goal:
  - Observation of the users (individuals, groups, company, company units) Complex recognition of the users' interaction with their environment (lifestyle, leisure activities, working activities).
  - Initiating a role-play of development. The developers try to play the role of the customer. This approach is based on the verifiable assumption that series of successful innovations were started as a self-made (self-used) improvement. Later it appeared that a great number of people and organizations tried to solve the same problem only they did not have enough resources (time, knowledge, courage) to perform it. The mental strategy of 'I help my neighbor' helps to recognize such demands.
  - New utilizations of the available technology should be investigated while we check the customers' behavior.

2.2.4 Product testing methods

In the case of the market launch of a new product, gathering the customers' opinion about the new product is very important. The testing method is a tool for gathering customers' opinion. The tests are usually performed with the first sample of the products or with the prototype. The classical way of testing is an examination of the targeted customer group. The model assumes that the customers are able to recognize all the products and formulate all their expectations of the products. This information can be used as a background for designing a system of requirements which can be used for product development. This model can be upgraded when we use a well-known product and the new prototype as well. During the test we record the first reactions of the customers in a structured form.

User tests

User tests are great tools to measure the successfulness of the product after manufacturing the prototype and completing the development. The investigations regarding the penetration of this tool showed the following. In case of failures of new products user tests were neglected or simply there were no tests.
These tests consist of the following:

- testing functional fit,

- ❖testing effectiveness of adoption,
- ❖testing price sensitivity,
- ❖examining the spontaneous reactions of the customers.

These tests are cheap and easy to perform. Nevertheless, they are highly important because they can reveal the imperfections of the development so they can be fixed before market launch. These tests are also suitable for making a survey of probable market adoption. Therefore it is useful to include user tests in the early phase of product development.

Testing market acceptance

The market launch strategy can be checked in two ways. Both of the methods are experimental, cheaper and less risky than assessment after the introduction of the product. These methods provide acceptable information about the acceptance of a market launch, so the possible shortcomings can be identified and fixed. The following two methods can forecast market share and sales data. One of these tests is pre-testing which is used to test consumer goods. The other test (market test) is more extensive and more expensive but provides more information for the developers. Usually companies manufacturing means of production use these tests.

Pre-testing

Pre-testing is a relatively cheap and surprisingly useful tool to forecast the market share of the new product. There are different types of pre-tests performed by the marketing consultancy companies. The difference between these tests is the focus on the different parts of the development process. All of these tests concentrate on a small part of the development involving only a small sample of customers. The testers present concepts and advertisements of the new product to the test subjects. Next the participants/subjects receive a certain number of coupons which can be used free of charge. Naturally, the new products can be purchased as well. Later on the participants are interviewed about the factors influencing their consumption and about the products they buy. In other cases the participants receive samples or prototypes to test the new products. They have to draw up a list of their experience (first impressions, pros-cons, comparison with the old product, needs, etc.) which will be used in the interviews later. Pre-testing provides important information about the application and effectiveness of the product. First the effectiveness of the ads and the packing are tested. The second part is an assessment of experience, adaptation, approval and the intention of repeated purchase. Finally pre-tests provide information on market segmentation (demographic data, habits of the participants, etc.) The method is fast and this is its main advantage. Pre-tests can be performed parallel with the development and preparation of manufacturing. Compared with other tests, pre-tests are really cheap. As a result, pre-tests are highly popular because small enterprises can perform them as well. Experience shows that the data collected in the tests are acceptable. These tests can be done in secret (the competitor will not find out our intention), so the reaction of the competitors will not influence the results of the survey. The only disadvantage of the test is its adaptability. The test is not a suitable tool for products requiring complex know-how but is perfect for testing cheap and simple consumer goods.

Market test

The final test of the new product before releasing is the market test. Market tests are the best controlling tools before full distribution. This method is a planned experiment performed on a large sample. There are subjects, methods and control groups just as in every experiment. The subjects are a representative group of customers who will be tested about all parts of the marketing mix. Their experience (level of acceptance of the product) will be recorded in a structured way. (For different groups different marketing mixes can be used.) The control

group reviews the level of acceptance, the specific considerations and the change and dynamics of customer behavior experienced by the subjects. (Comparing customer behaviors in metropolitan and rural areas about a new product.) There are two basic purposes of performing market tests. The first one is to determine the expected market volume. These tests provide reliable forecast information and can be the foundation for making decisions. If the results of the market test are weak, the project can be rejected or changed. The decision-makers can redefine the market strategy as well. The other purpose of performing a market test is to select the most successful marketing launch method. However, market tests are expensive and therefore they are not popular for the purpose mentioned. Just like pre-tests, market tests are suitable for achieving a better market positioning for our new product.

2.2.5 The predominant product

Predominant products play a major role in the change of product life-cycles and innovation waves. New innovative products are usually offered by new companies (proven by statistics). When the new innovative product is well-accepted in the market, the old-established producers also renew their product portfolios. Meanwhile new companies enter the market with diverse product portfolios to widen the supply range in the market. In this initial phase there are no barriers to limit market size and market share. Neither the competing companies dominate the technology (so they are unable to block the distribution channels), nor the customers have a vision about the ideal product. The customers cannot formulate real functional or performance needs about the product due to a lack of experience. The customer in the initial phase is busy finding and learning the use of the product and thus has no critical opinion. The manufacturers and the customers are in the phase of learning and they have an introspective perspective.

Fields where the customer has to learn:

- learning new ways of using a product (washing machine),
- learning new roles (instant coffee),
- accepting new values ('green' washing powder),
- accepting new mechanisms (microwave oven),
- learning new behavior (mobile phone).

After finishing the initial (learning) phase, the manufacturers and the early users become extrospective and based on their experience try to enforce their interest vigorously. The manufacturers are keen on having their new product or technology adopted and accepted in a wide range. Early users, based on their experience, try to find the right manufacturer who is willing to apply their ideas and needs in mass-production. These parallel processes create the predominant product and the predominant technology through a very strong internal selection method. When the predominant product appears, the competition changes almost magically. The diverse and autonomous development trends and product-lines become uniformed. From now on the functional/performance requirements and prices are deduced from the attributes of the predominant product. The predominant product becomes the standard for the customers to base their opinions on.

2.2.6 Green products

We are talking about a green product when the negative environmental impact during the manufacturing, use or recycling of the product is lower than the negative impact of other substitute goods. Characteristics of the new or modified green product in the life-cycle are:

- inputs:

- manufacturing with material- and energy-saving methods,
- the materials and energy used are recyclable or retrievable;

❖ use:

- minimal emission or lower than the emission of familiar solutions,
- use is based on renewable energy or regenerative materials,
- use does not cause long-lasting environmental damage;

❖ outputs:

- destruction of the product does not cause additional environmental damage,
- the technology of recycling is well-known and environmentally friendly.

Questions:

1. List the situation-oriented factors influencing the spread of innovations.
2. Describe the basic diffusion models.
3. Give some examples to explain the trigger effect.
4. How can we interpret innovation during product development?
5. List the basic concepts of product development.
6. What is the basic idea of empathic design?
7. What kind of information must be gathered to perform user tests?
8. Describe the phases of the creation of a pre-dominant product.
9. What are the principles considered when developing a green product?

References:

MODULE 3: SUPPORTING METHODS OF DESIGNING AND ANALYSING AN INNOVATION STRATEGY

Elements of strategic planning regardless of different methodologies: (Imperatori, 1982)

1. Resuming the corporate vision (goals and behavior); declaring corporate credo;
2. Environmental forecasting, investigating the factors which can influence corporate vision;
   exploring the strengths and weaknesses of the company in the present and in the future:

- list of responsibilities,
- product,
- technology,
- market,
- and the competitors.

Corporate philosophy is a brief and clear concept of the company's image, function and global mission (considering the environment, society and economy) which goes beyond the time horizon of the company's strategy.
According to the principles of corporate philosophy, we can define the company's policy and the company's strategy. When forming the company policy the leaders are to create clear objectives for

- social activities,
- asset management,
- leadership and
- performance management.

The concept of performance must be introduced in details. The model of expected performance refers to the following fields:

- product and market policy,
- marketing policies,
- development policy,
- production and logistics policy.

The corporate strategy is based on defining the operating range, technological range and production profile. The corporate strategy is always adjusted to the corporate philosophy and company policy. The goals, resources (also the redistribution of the resources), working methods and priorities can be deduced from the basic elements mentioned (corporate strategy, philosophy and policy). Strategic plans are turned into an action plan which includes the goals defined in the company policy and shows the way to achieve these goals. Mid-term technical and development plans and activities can be defined using the strategic plans and forecasts and analyses used in the strategy forming process. The following part of this module introduces the modern methods, applications and development tools of strategy formulation focusing on the performance requirements. These performance requirements determine the goals and tasks of technological development:

- requirement: reducing price
  - goal: low price
- requirement: diversification
  - goal: improving different levels of performance, designing basic product modules and product groups

Important parts of planning:

- ❖ designing the operating range,
- ❖ designing the technological range,

- ❖ defining the product strategy.

According to these factors and the internal and external driving forces of planning, the company has to define the directions of growth/decline/maintaining strategy. According to the basic and structural investigations, two essentials tasks must be performed:

- supporting the systematic creation of a database for strategy assessment,
- defining the cycle of strategy assessment (fitting to strategy and conformity).

Concerning the cycles of strategy assessment no ultimate rule can be given because this time-period depends on the intensity of development in the specific industry. This question is highly important, which was the conclusion of an investigation at a company: The investigation shows some peculiarity. The employees of the company have an unrealistic image of our products. In every three-four years companies should face their development problems and perform self-examination and describe the development tasks of the future for the employees. Sources of information for innovation strategy assessment are presented in Figure 3.1. This incomplete list shows how time-consuming and labor-intensive the task is.

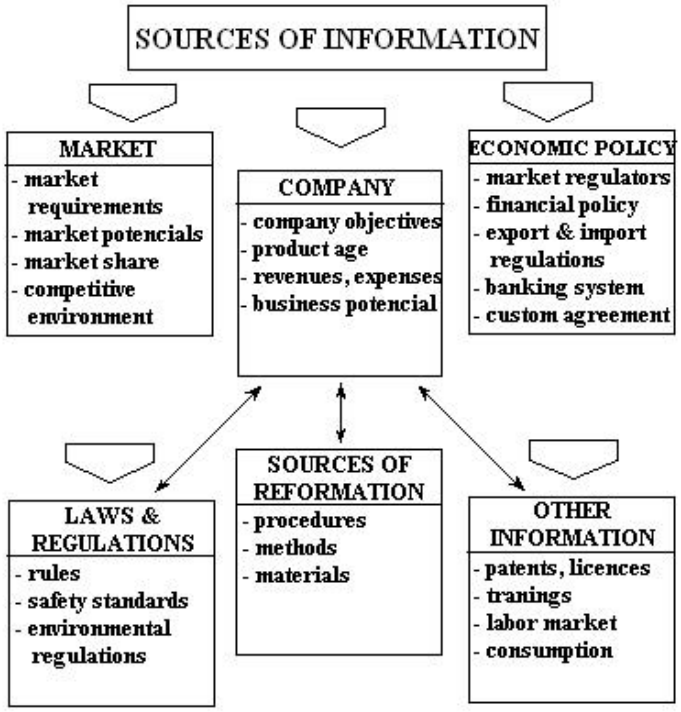


Figure 3.1: External and internal information for the formulation of the product innovation strategy

3.1 Primary analysis

3.1.1 Analysing influencing factors

The assumption of this method is that the influencing internal and external factors inspiring change and development (occasionally creating barriers) can be systemized and their cumulative effect can be forecast.

First steps of the method:

- ❖ Specifying influencing factors
- ❖ Classifying factors:
  - ➢ external powers,
  - ➢ internal powers.

Defining the directions of the powers (positive or negative, motivating or restrictive).

Guidelines and decision-supporting methods must be created to take advantage of the positive forces and eliminate the negative forces influencing the strategy.

Discovering the strengthening and weakening interdependent relationships between the factors. The goal of this technique is to recognize and separate the factors and learn to manage their effects. This technique is based on an analytical point of view and is useful in discovering the basic factors influencing strategy formation.

3.1.2 Analyzing experience curves

The idea of analyzing experience curves is based on the cost analyses of the Boston Consulting Group. The result of the experience effect analyses (performed by several companies in different industries) revealed the so-called 'Boston-effect'. This means that each time the production volume doubles unit costs (fixed unit costs as well) decrease by 20-30 %. This means that a company with a relatively high market share will decrease its costs faster than companies with a lower market share. This effect is a result of being more experienced in manufacturing. The versions of the strategy to be considered are:

- High market share:
  - rapid market growth: investments to expand in the market, long-term profit is ensured, market barrier for other companies is high;
  - slow market growth: ensuring market position, profit must be used for rationalizing investments;
- Low market share:
  - rapid market growth and lack of resources: withdrawal from the market;
  - slow market growth: maintaining investments and continuing manufacturing while it is profitable.

When the company has a low market share, segmentation strategies should be considered. Concentration in the markets can lead to advantages.

Steps of analysis:

i. Describing product groups
ii. Temporal analysis of the complete market and of the specific market
iii. Quantifying costs, production volume and their relationship
iv. Experience curves
v. Forecasting market change considering the company's
   a. market share,
   b. cost reduction
vi. Forming a strategy.

The results of this method can be proved by empirical data. It facilitates making a comparative analysis of different companies and industries. The limitations and difficulties are summarized according to Lorange and Barakonyi (1991).
The benefits of experience cannot be used without limitations. Cost reduction can be influenced by other tendencies:

- inflationary effects, market saturation, limitations to increase production volume,
- similar interventions by other companies,

- movements of prices and costs are not synchronized,
- prices are also influenced by many external factors; the market realizes that cost benefits are limited.
- new entrants with new or upgraded technology/products change positions in the market.

3.1.3 Designing technology forecasts

Technology forecasting means the process of identifying future technological competences and fundamental streams and tendencies (Besenyei–Nováky–Gidai, 1975).
Defining the field and elements of new knowledge is an essential part of technology forecasting. This model is represented in Figure 3.2.

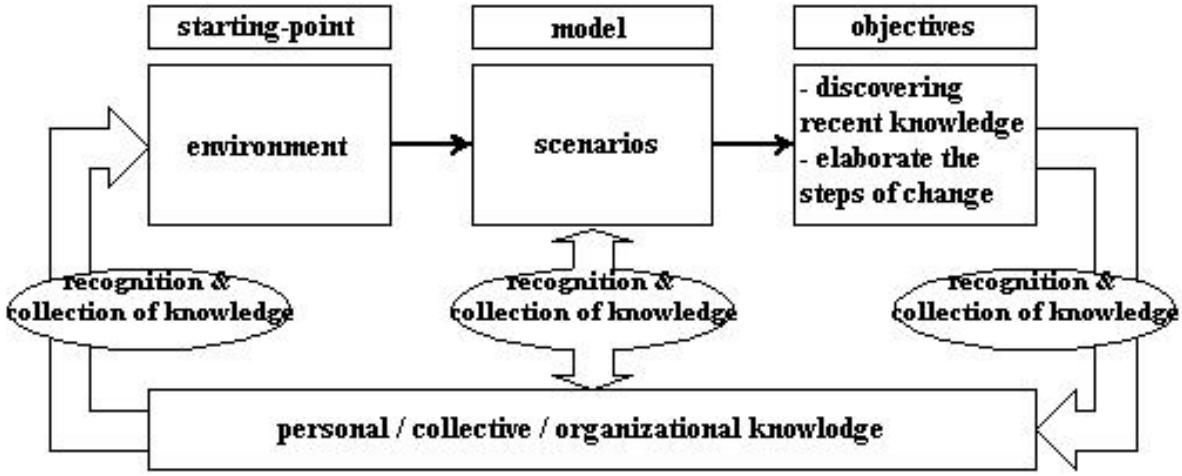


Figure 3.2: Model of technology forecasting

Features of knowledge-based scenarios:
- ❖ collectively created knowledge models,
- ❖ describing alternative future situations,
- ❖ illustrating complex topics and making them more transparent,
- ❖ promoting alternative visions of thinking and thus reactivity,
- ❖ participants change through commitment to the new model.

There are some clearly recognizable limitations of knowledge models:
- ➢ Security level of the forecasting groups falls when the old (experimental and scientific) beliefs are abandoned. Participants become more critical about the new technology.
- ➢ Experts must use unusual methods (e.g. estimation). This limits creative thinking.
- ➢ Experts may be reluctant because of using scenario writing methods.

3.1.4 *Strengths vs. weaknesses*

This method is about designing checklists and assessment levels. With these tools parts of the strategy can quickly and easily be represented and analysed. We have designed two tables: one for the checklist and one for the assessment. In the assessment conceivable and inconceivable factors are taken into account and assessed. To support the assessment, sometimes a detailed explanation and background information are attached.

Table 3.1

Checklist

Evaluation factors	**Assessment levels**				
Technical elements	***Insufficient***	***Sufficient***	***Satisfactory***	***Good***	***Excellent***
Patents	No patent	Unknown		Limited	Unlimited
Technological advantage	No technological advantage	Low		Limited	Breakthrough
Performance	Low	Can be increased		Appropriate	Outstanding
Reliability	Low	Uncertain		Limited	High
Manufacturing process	New	Novel		Known	Routine
Equipment	Obsolete	Aging		New	Modern
Warranty costs	Increasing	Fluctuating		Stagnating	Decreasing
Modernity	Obsolete	Aging		Novel	New

Table 3.2

Evaluation factors and scales

Evaluation factors	**Assessment levels**				
Market and trade items	**Insufficient**	**Sufficient**	Satis-factory	**Good**	**Excellent**
Market growth	Decreasing	Stagnating		Increasing	Dynamic
Market share	… %	…		…	…
Market share of the main competitor	… %	…		…	…
Integration of the market	Undeveloped	Low		Appropriate	Increasing
Advantages of the product	No	Low		Appropriate	Outstanding
Appearance of the product	Tasteless	Ordinary		Stylish	Conspicuous
Servicing	Limited	Difficult		Available	Easy
Price relative to the competition	High	Non-competitive		Competitive	Distinguished

The advantage of this method is that it forces decision-makers to form opinions. This method can be used quickly and easily to identify critical points and to provide a complex solution when handling numerous factors. The assessment levels set out the development directions and the potential strategic goals as well.
Background information to understand the tables:

- ❖ strategic potentials (capacity market, resources)
- ❖ identifying competitors and strategic potential.

3.1.5 Multi-scenario method

This method is useful in creating several alternatives for the innovation strategy. The multi-scenario method (using the information basis of forecasting and influencing factors (focusing on the external factors)) aims to develop different scenarios which concern the consequence and interdependence of the factors. Scenarios are models for forecasting future events. Scenarios always focus on events which have a major impact on the company's future. These events are interpreted through the external factors in the company's environment. Scenarios are results of a deduction made by experts. Accordingly, the quality of scenarios depends on the experience, expertise and views (optimistic or pessimistic) of the experts. The implementation can be done by means of several methods using different resources. Technology foresight and forecasting programs usually use the Delphi-method.

3.2 Analysing life-cycle curves

Life-cycle curves show the stages of a product or a service from its introduction to its decline in the market. These models are used in a wide range.
Figure 3.3 shows how a product's full life-cycle can be presented. The cycle includes the R+D processes and introduction of the product into the market and all after-market-introduction (expansion - positioning - decline) phases as well. This is a general model because the life-cycle of a product or service is influenced by several factors:

- o periodicity of product changes,
- o market position of the competitive or substitutable products,
- o changes in market regulation (dumping, quotas, etc.).
- o the dynamics of changes in the cost of production,
- o saturation of the market,
- o development of new markets, and
- o establishment of new uses.

The product's life-cycle can change significantly if the product is a spare part and for some reasons manufacturing must be continued.

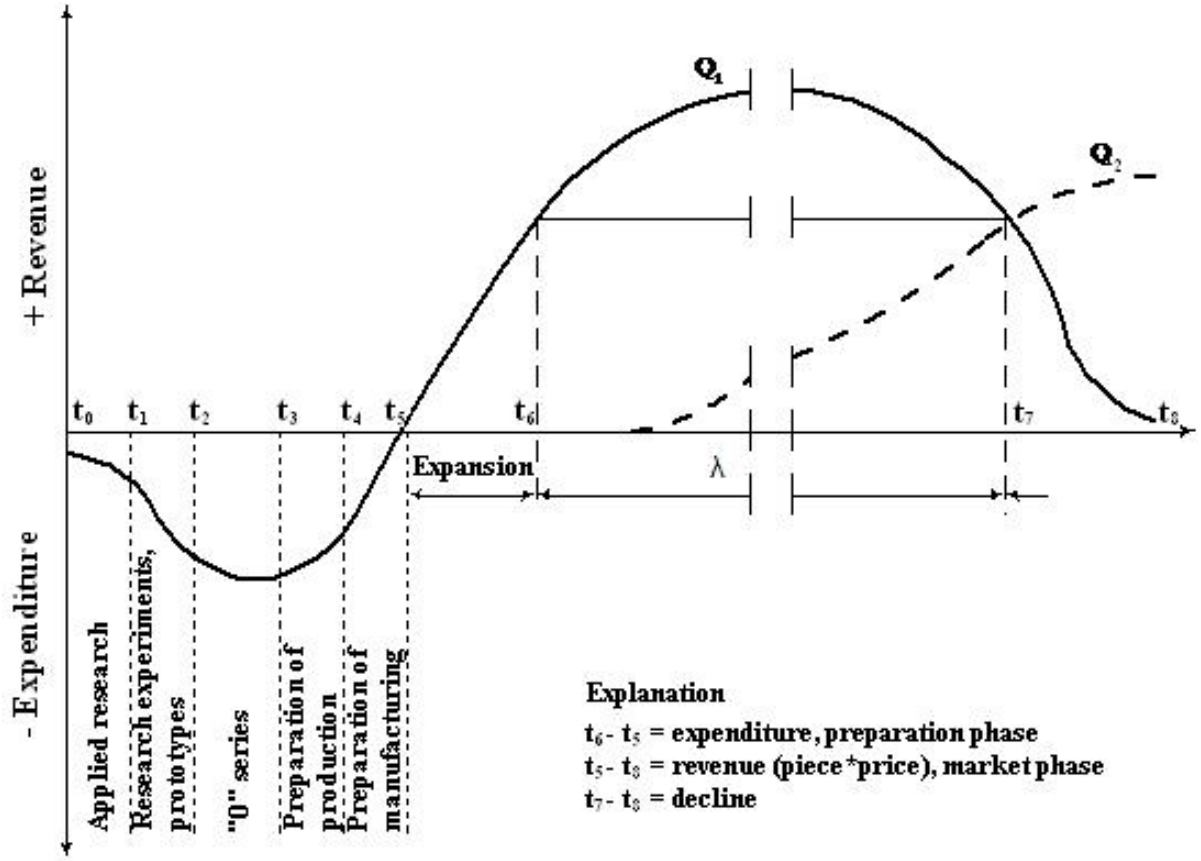


Figure 3.3: Typical phases of the life-cycle (Bucsy, 1976)

Regarding life-cycle phases, some typical parameters are highlighted in Table 3.3.

Phases of the life-cycle:

- introduction,
- growth,
- maturity,
- decline

can be patterns to support decision-making (marketing, distribution, manufacturing, market entry, etc.) and strategy forming using the data of market volume and share.

Table 3.3: Parameters of life-cycle

CYCLE LIMITS	PARAMETERS							
	Producer	**Customer**	**Focus of innovation strategy**	**Market strategy**	**Prices**	**Marketing strategy**	**Distribution**	**Costs**
1. Expansion	Innovators	Susceptible to change	Exploiting temporary monopoly	Finding key-customers	Introductory prices	Convey information	Customary channels, market tests	High unit costs
2. Gaining position	Early adopters	Adopter	Outsourcing production	Diversification	Differentiated prices	Positioning product brand	Existing channels	As volume increases, costs proportionally decrease
3. Holding position	Late adopters	Brand-fan	Manifold technology transfer	Segmentation, searching for new markets	Price reduction	Convey know-how information	Construction of direct channels	Depending on transfer options
4.Losing position	Laggards	Brand-loyal, conservative	Finding new areas, planning withdrawal	Holding market position, withdrawal	Inelastic prices	Customer-service information, company information to improve good-will	Focusing on direct channels	Forced cost savings

Life-cycle curves are classical marketing-oriented tools of product analysis. However, more and more publications question the utility and validity of these models.

We would like to summarize the limitations and the utility of these models below. Positive and negative remarks about the life-cycle model are listed as follows:

Pros:

- The life cycle theory is a well-defined conceptual framework for strategic decisions,
- Using the data of turnover, rates of sales volume, rates of profit or loss, etc., the phases of the life-cycle model can be determined accurately,
- The model gives a true illustration of the product's timeline and the relationship of market growth and time (confirmed by experience),
- Used together with forecasting methods, life-cycle analysis is suitable for setting milestones for the innovation cycle.

Cons:

- The curve can be plotted only retrospectively. The product's life-cycle is influenced by the concurrency and the behavior of the customers so it is not suitable for forecasting. Extrapolations using past market data are not suitable for taking into consideration the basic characteristics of the innovation process (uncertainties and variations) or the barriers to diffusion (conservative customers, waiting for returns of previous investments, etc.).
- Some products do not 'behave' as the life-cycle forecasts (evergreens and market flops – these are products with an intensive start-up and a quick disappearance).
- Phases are not strictly demarcated, the length of a cycle is based on the actors of the environment (customers, competitors), and therefore the forecasts are inaccurate.
- Phases of introduction and decline are overrated in the model, so it stresses excessive growth and early termination.
- The advantages of the different phases of a life-cycle can be exploited only by the dominant actors of the market, so weak competitors cannot get benefits from potential advantages.
- The theory does not differentiate between products with weak or strong market positions and always offers the same strategy.
- Customers react with a delay to sudden high-tech tools (because maybe their previous investments in other products do not give a proper return), so the phases forecast can be longer than in the model.
- Market entry and exit barriers can change the positions of the actors and can restrict the freedom of their choices.

Modern life-cycle theories consider the problems mentioned and aim to solve them in two ways:

- ensuring reliability by involving strategy planning and forecasting methods, innovation processes and tools of innovation,
- increasing the factors involved and analyzing their relations (development - manufacturing - sales) and offering opinions as a result of a many-sided investigation.

Life-cycle is investigated from three different focuses:

Sales strategy:

- adjusted to the four phases;

Competition strategy

- maximizing strategy for introduction and growth to support sales,
- minimizing strategy for maturity and decline to reduce costs,
- mixed strategy (substitution and expansion) to minimize market saturation;

Development strategy

- achieving a high level of innovation by the product to open the market,
- innovation of technology to optimize unit costs,
- mass production to reduce costs radically.

3.3 The S-curves

The S-curves represent the relationship between product or technology efficiency and the level of innovation efforts, investments and expenses (Figure 3.4). Regarding the fact that efficiency enhancement options are limited, the phases where extra effort no longer creates real improvement can be introduced with this model.

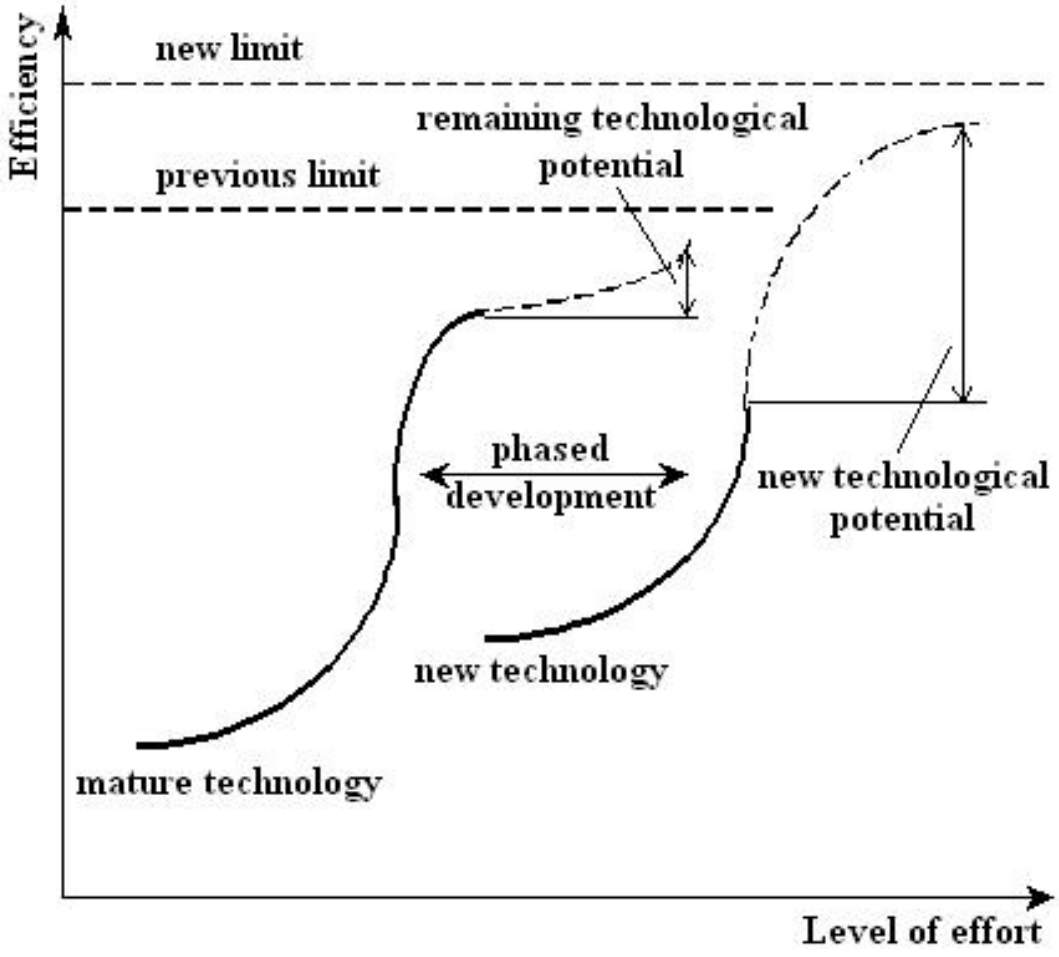


Figure 3.4: S-curves

S-curves can be used to illustrate the upper barrier of development where intensive investments create only a limited change in performance. Early recognition of obsolescence can lead to a well-timed decision of transferring innovation efforts to another field or product. This transfer creates discontinuity and sets the interval when a complete rearrangement can occur in the market. Trend detection allows the experts to

- define the shift points in technology development and
- prepare the organization for the shift and transfer.

Early recognition of this kind of discontinuity can lead to a huge advantage in the market (electronic cash registers replaced the electromechanical machines in 4-6 years).

These changes in the development of technology can occur as an increase or decrease of competences.

Changes in competence increase are based on the previous technology know-hows. They focus on an exploited part of the know-how trying to amplify unrevealed potential synergy.
Changes in competence decrease make the previous know-how obsolete. Competition is based on a framework of the new technology and professional culture. New actors enter the market (suppliers, users, distributors, financers) while a vigorous selection process for survival begins between the previous actors. Changes in competence decrease generally start outside the industry and are generated by new actors. Changes in competence increase come from an actor of the industry in question as a result of the effort to find a new field of use for their product or technology. Forecasting based on S-curves gives basically three different solutions.

Substituting technology

We must distinguish the technology under consideration from a particular parameter of the technology. The goal of substitution is to create a new standard or achieve better results than using the old parameter. Usually the new technology expands the limits of this parameter and allows achieving a maximum of the parameter faster or in a cheaper way. The goal of technology forecasting is to track the limits of the parameter and to estimate the potential puffers according to this parameter. When the new (substitute) technology is introduced and the old technology is still used, several changes can appear in the use of these technologies. It depends on the size of the puffer (natural barrier of technology development) of the old product. If there is a puffer in the old technology, the reaction is extensive development in order to reach the natural barrier of the old technology as soon as possible (or sooner than the new technology reaches it). This happens also when the natural barrier becomes higher because of the new technology. The extensive development of the old technology deprives the new technology of resources and slows down the development. As a result of the slow-down, the new technology will reach the natural barrier later and the old technology's value will be overrated. This slower shift and substitution in the technology allows the innovators to prepare for a well-timed conscious outsourcing of the old technology or to find a new field of use for the old technology (black-and-white photo material focused in the market of manufacturers).

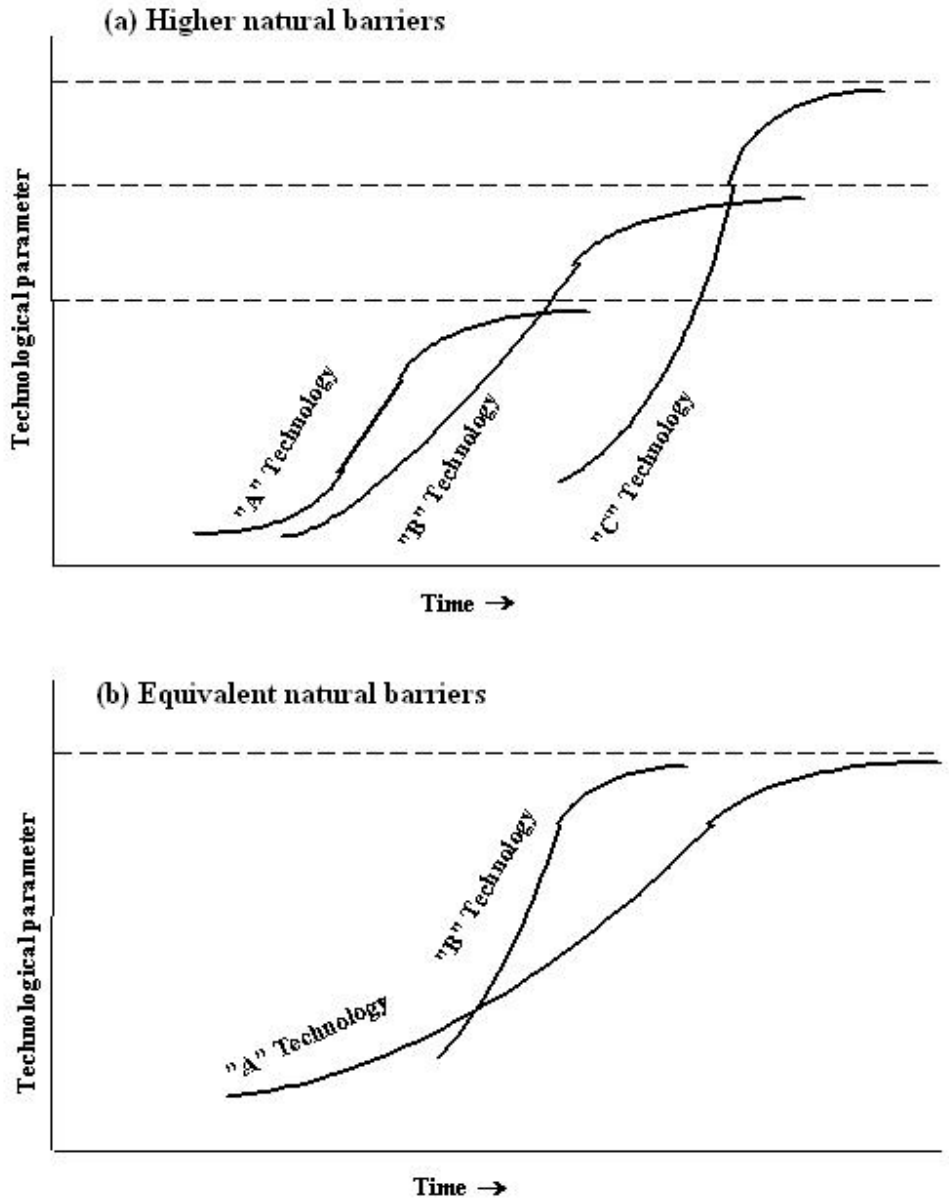


Figure 3.5: Substitution by alternative technology

Finding analogy

Investigating the history of science has proved that different fields of technologies have common trends in their developments. These common trends and links are not always recognizable and the strength of relationship can change from time to time. Also new interdependencies can occur. For this reason a result of a discipline can only be transferred to another with delay. Because of the time-lag, analogy forecasts must be performed. The first step of this analysis is to find the links between the different disciplines. Later on analogies can be identified between the fields.

Such analogies based on cross-references can occur for several reasons:

i. Primary user is insensitive to costs,
ii. Development is based on retained knowledge,
iii. Difference in susceptibility of different market regions,
iv. Time difference of individual and mass utilization,
v. The pull-back effect of conservative users,
vi. Lack of transferable know-how,

vii. Finding no analogy.

Changing priorities

Customer needs change the priorities of the innovation in many cases. New scientific results can highlight forgotten technical parameters. Figure 3.6 shows three technical parameters and the S-curve of a product. The three parameters (A, B and C) are in different situations depending on the natural barriers. Different development tasks are connected to the different strategies which aim to reach the natural barriers of the parameters. Different ideas lead to different solutions with alternative performance structures. Changing priorities can be a basis for product diversification. These data can be mined from internal sources when technological breakthrough points are shown by the forecasts of the researchers. We can use external sources using customer behavior analysis to change priorities. When allocating future resources and expenditures, products with a possible peak performance must be considered (watches and clocks: accuracy vs. shape, color; detergent manufacturing: disinfection capability vs. color, scent, protection of the fabric).
Examples of changing priorities (as a regular phenomenon):

- defense technologies in civilian practice,
- segmentation / diversification goals change,
- evergreen products are updated, re-created,
- commercial product differentiation with simple interventions,
- change in operating conditions, meeting special needs,
- designing cost-saving and prestigious, expensive products.

We can consider the case of armored vehicles as a typical example. These vehicles were compared by the following parameters:

- speed of movement,
- armor thickness,
- caliber of the guns.

Offensive tactics identified the same threats (missiles and projectiles) for all types of vehicles. For tanks, armored vehicles and self-propelled guns, the same S-curves were evaluated and can be ranked.

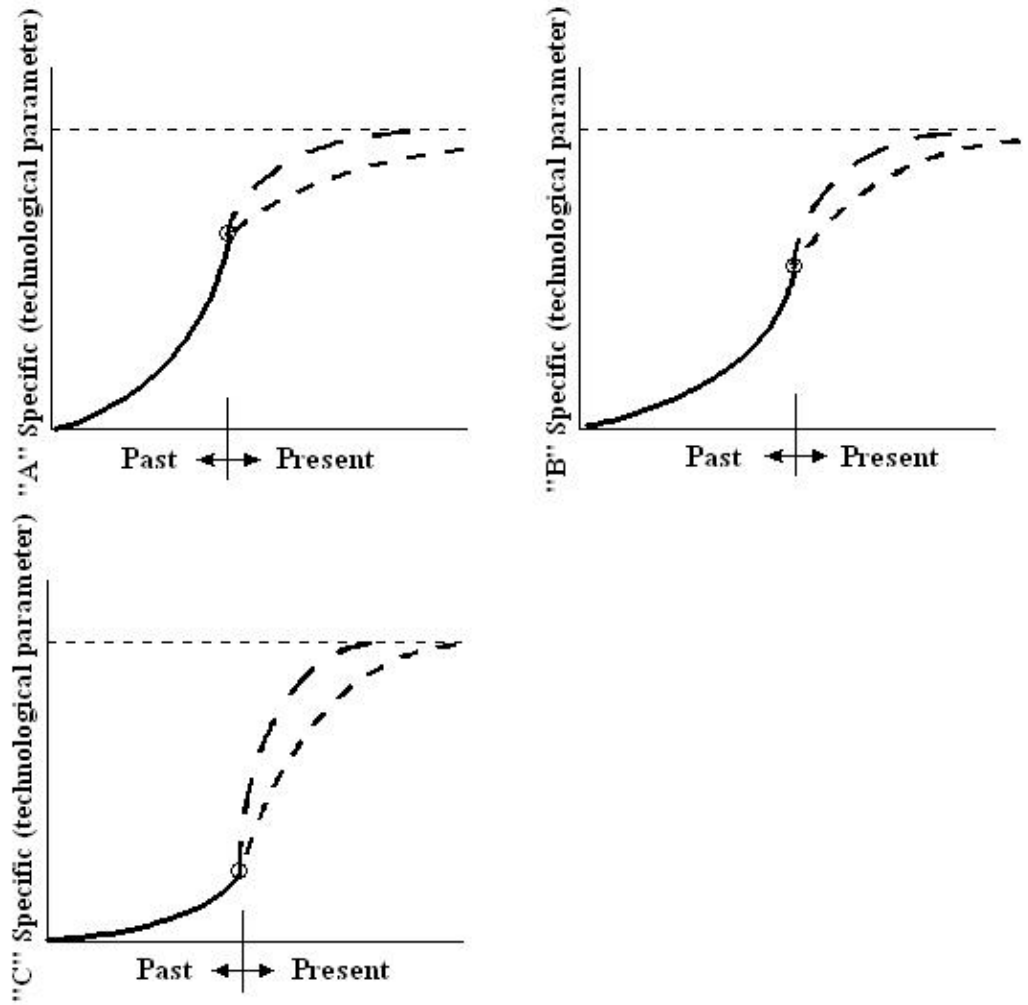


Figure 3.6: Change of priorities

Product substitution

Manufacturers create not only primary (radical) innovations but also widen their product (service) portfolios. The new products are substitute goods for the old ones. The substitute goods are intended to create new barriers to entry. Two types of substitution are well-known in the literature:

a) Total substitution: The old technology is obsolete. Total substitution is used for new technology processes (chemical industry). The difference appears in the technological methods, not in the characteristics of the products. The goal of the substitution is cost reduction. A good example is the replacement of organic materials with artificial ones.
b) Partial substitution: The market share of the old monopoly product decreases. This kind of substitution is used by the service industry and for goods sold by item. Shopping habits change only slowly. The substitute will be able to enter only some market segments. (Car sales → SUVs.) The substitution phenomenon is stronger in markets where the effects of fashion are strong.

Classical situations of change:

- propeller − jet airplane;
- black and white − color TV;
- petrol engine − diesel engine;
- diagonal − radial tires.

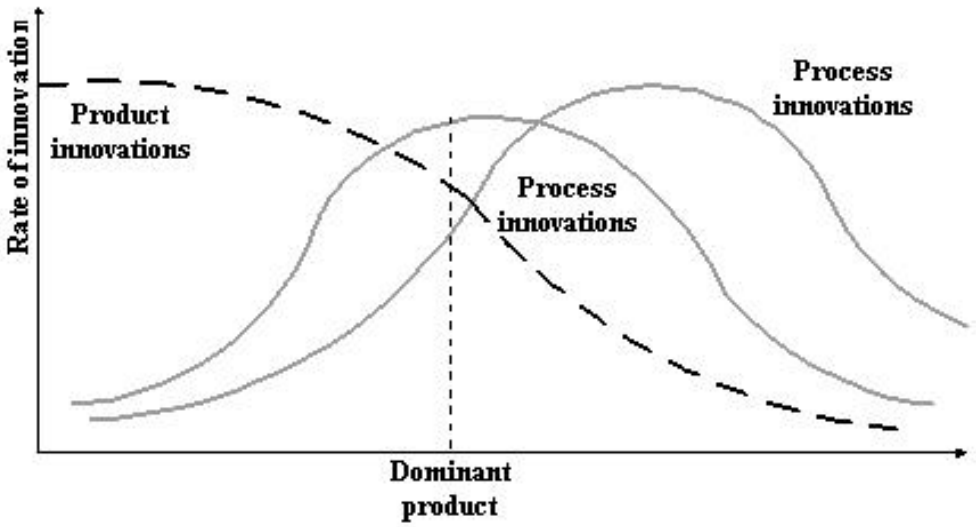


Figure 3.7: Connection between product and process innovations

3.4 Product and technology portfolios

The name refers to the classic strategy planning tool. The portfolio analysis can be adapted to the tasks of innovation management and a new specific method can be developed.
Possible directions of product search:

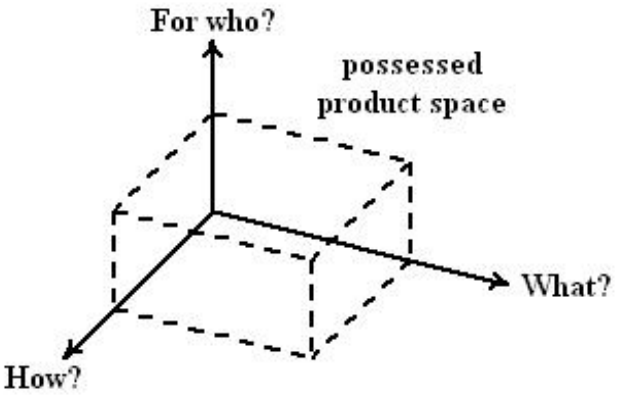
- based on the type of the product,
- services provided by the end users,
- according to the technology used,
- groups of internal end users.

Using only one of the approaches can lead to incorrect results:

- focusing only on the product can make the product obsolete,
- focusing only on the market can create isolated developments and fragmented technology structures,
- focusing only on technology creates isolated market segments.

The foundation of a successful development is provided by connecting the three levels of thinking and the three actors (Figure 3.8):

- consumer groups to be served (who for?)
- consumer needs (what?);
- technology to create the suitable product (how?).



- **Figure 3.8: Dimensions of product search**

Relying on the life-cycle model, portfolio models and our experience, we designed a unique hybrid model which is based on the combined analysis of three dimensions. Factors are assessed in group work. Due to the nature of factors (conceivable, inconceivable, etc.) the assessment has to be performed in several steps. For the assessment separate assessment sheets are to be prepared for every product or product group (Figure 3.9). The assessment sheets summarise the different data (results of life-cycle and market analysis) and specific features of the products. All the analysts of the working group use the same data and the operationalization of the results becomes easier.

Name of the product or product portfolio		Name of the market	Type of factors	
Factor			Score	Weighted score
S.	name	importance		
1.	volume of sales	9	6	54
2.	sale price	8	10	80
-	-			
-	-			
-	-			
-	-			
-	-			
-	-			
n	profit	10	5	50
		total	---	---
weight: 1-10 points score: 0-10 points				

Figure 3.9: Assessment sheet of product portfolio

Questions:

1. List the different methods of primary analysis.
2. List the phases of life-cycle and describe the typical events of innovation which can be connected to these phases.
3. What are the dimensions of product/technology portfolio?

MODULE 4: DEFINING INNOVATION STRATEGY

Innovation strategy is not just a part of the company's and business unit's strategy but a fundamental strategic factor as well. After defining innovation strategy, this module provides a summary of

- basic strategies,
- industrial specialties,
- different options of innovation introduction.

In our case, innovation strategy is formed by using Porter's Five Forces model:

- rivalry among existing firms,
- threat of new entrants,
- threat of substitute products,
- determinants of supplier power,
- determinants of buyer power. **F30**

4.1. BASIC STRATEGIES

Three major strategies can be defined for companies. From these strategies companies can create their unique combinations of strategy:

- offensive,
- defensive ,
- counter-strategy.

Offensive strategy

An offensive strategy can be applied when the company can take advantage of the benefits of an innovation. Customers must be convinced very soon about the advantages of the product (service) for the success of this strategy. The strategy is executed step-by-step in every market segment so the competitors do not realize the threats. An offensive strategy requires fortitude to wait for the reactions of the customers, especially in situations when a demand-creating innovation is introduced. Great efforts must be made to satisfy the customer and support market acceptance. The company must prove that the new product (service) is unique with specific values. The company must assure the customers that it will share all the knowledge about training and applications of the new product (service). Applying an offensive strategy needs broad-minded staff to handle early problems and make corrections possible. An offensive strategy is about creating primary innovations so the risk-level of this strategy is higher than that of the others. The early problems must be handled as a necessary part of the development and not as failures. A good example for an offensive strategy is Sony's walkman. After the early refusal the company created a brand new portable music experience.

Defensive strategy

A defensive strategy is based on the following:

- risk-level of innovation
- threats of new entrants into the market share.

Activities of the companies using a defensive strategy are:

- activities to maintain market presence,
- activities to increase market barriers.

A defensive strategy can be risky when a technology becomes outdated and the actors are using an offensive strategy in new markets or in new fields of innovation. In this case new

entrants can pose a great threat for the defensive unprepared actors who are unable to change. The new actors rearrange the market and change the competencies used for innovation as well. A purely defensive strategy can be adopted only for some product groups temporally. Otherwise a defensive strategy can lead to obsolescence and vulnerability can cause cumulative losses. This strategy is used parallel with new developments to hold the position of the old product before a new product enters (black and white vs. color TVs).

Counter- strategy

A well-timed counter-strategy can be successful against both the offensive and defensive strategy. This strategy is based on exploiting the weaknesses of the rivals.
The most common fields of counter attack are:

- starting a price competition,
- developing hybrid products or technologies,
- acquisition of innovative companies with low assets,
- starting developments in brand new fields,
- enticing the rival's experts.

The result of the counter-attack depends on the priorities and the unexpectedness of the attack. Counter-attacks are sometimes enforced by an aggressive movement of the competitors (the Boeing 700 jet-family was a result of this kind of counter attack).

In order to help with choosing from the basic strategies, some observations in connection with innovations are presented here:

- Companies with several products (services) must define a field for the innovation strategy to be performed in. Do not use a risky innovation in the whole range of a product portfolio.
- Great risks are taken by the innovator when development is started in a brand new field or adapted to new markets and there is no experience or support.
- Successful innovators transfer their experience into new innovative fields. This gives them self-confidence and a higher impact on the market.
- Uncertainty in the new market can be reduced by proper segmentation and focused resource allocation.
- In order to handle innovation risks, we must operate an efficient financial and management system.
- A precisely designed and conveniently used resource reserve system can ensure the feasibility of the innovation strategy.

All the three strategies mentioned above (offensive, defensive, counter-attack) summarize the tasks and actions used to change or secure market position. Porter defined three generic strategies which represent different targets:

the cost leadership strategy,
the differentiation strategy ,
the segmentation strategy.

When adopting a specific strategy (which fits our company) generic strategies can be used as guidelines to set strategy requirements.

Diversification and segmentation
When modifying or developing the product (service) structure of the company, two paths can be followed:

- diversification and
- segmentation.

Basic directions can be derived from the Ansoff-matrix (Figure 4.1).

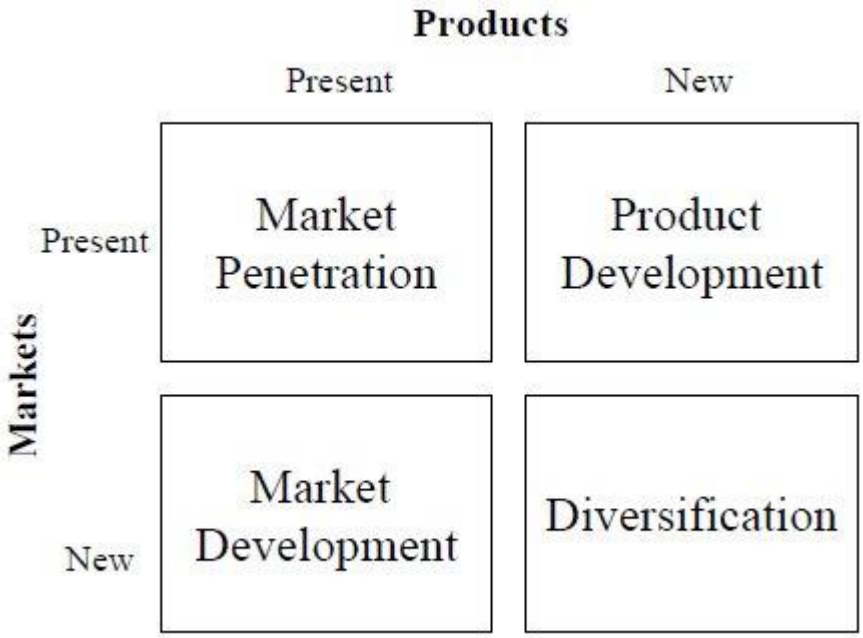


Figure 4.1: The Ansoff-matrix

This matrix presents four categories linking different markets with different products. Companies with new products (services) can be divided into three groups according to their relations with the market:

- traditional actors,
- new entrants and
- integrators.

Integrators combine the new products and services in rearranging the market and destroying market boundaries (pension funds and insurance companies launched new combined joint venture bonds). The safety of the market actors is based on the information about the market and the technological knowledge they possess. These factors can be interpreted as the level of maturity of the products or technology and the way we understand customer needs. These two factors influence market positions and set up the directions of development and knowledge-gain as well as the dominant provinces of existing competencies.

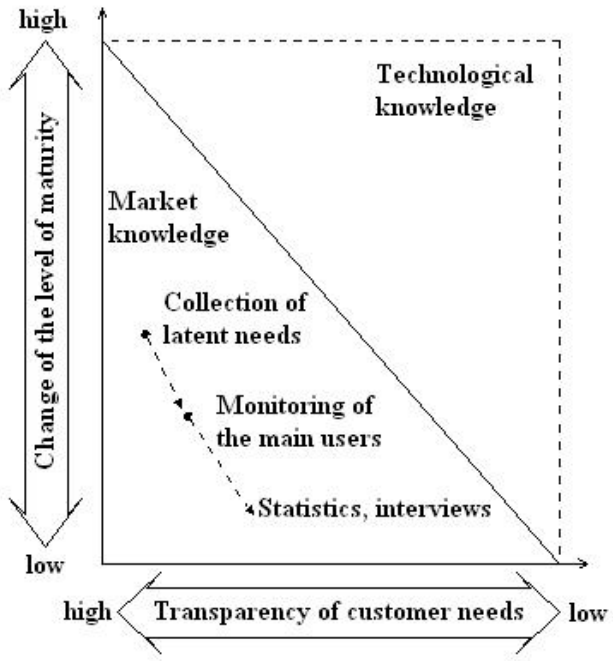


Figure 4.2: Methods of market knowledge acquisition

4.2. Diversification and segmentation

Diversification is the reaction of the companies to constraints of performance enhancements such as customer needs and rival actions.

Types by Varsányi (1998):

- *Full-line diversification*

  By diversifying the functions and parameters (size, performance, etc.) of the products, new product lines are designed. New products can also be developed by different price/performance ratios.

- *Horizontal diversification*

  New features and services are linked to the old product (service) but the essential competences do not change.

- *Concentric diversification:*

  Without abandoning the basic competences, the range of use of the technology expands.

- *Vertical diversification*

  Radical change in the function and the core competencies. Backward and forward integrations can be used. Know-how and the range of use change radically.

4.3 Specialties of innovation strategies in different industries

Industrial specialties must be taken into consideration when forming an innovation strategy. Simai recognized a typical feature in the processing industry which can homogenize or differentiate strategies in general.

Supply dominated industries

Typical fields include: leather and footwear industry, textile industry, timber industry, household appliance manufacturing

The source of innovation is basically the technical background of the manufacturing or a new processed material. Innovations come from outside the industry. The results of the innovation can be measured at the end-point of the application. The internal renewal of these industries is connected to the acceptance of the supporting technologies.

Characteristics:

- ❖ strong technology orientation,
- ❖ innovation begins at the suppliers and spills over later.

Industries based on the scale of economies

Typical fields include: machine construction and metal processing, food industry, building and construction industry

Process and product innovations are performed simultaneously. The production systems and products are also complex. The critical production mass associated with the economies of scale can occur at several levels.

Characteristics:

- complex products,
- large production capacities,
- complex manufacturing systems,
- parallel development of products and technology,
- strong internal R & D,
- strong individual innovation,
- innovations appear at the suppliers as well.

Specialized producers

Typical fields include: precision engineering, advanced engineering

These industries manufacture machines and equipment for other industries to use. The companies collaborate with the potential users so the innovations serve the needs of their partners. In these companies innovation affinity is high and they can respond fast to external ideas. Usually these kinds of innovation are carried out to fill technological gaps or to meet special individual needs. Production size can vary from customized manufacturing to mass production.

Characteristics:

- based on external sources of innovation,
- consumer-oriented and goal-directed,
- supports the development of the users of technology,
- dissemination and technology transfer are limited.

R+D intensive industries

Typical fields include: electronics, pharmaceuticals, transport equipment manufacturing

Innovations are connected to internally developed scientific results and to new paradigms. Changes occur in several industries in a wide range. Diffusion of innovation is limited (to limit the exploitation of innovations) by means of legal, regulatory tools. In this sector large, well-capitalized, diversified companies are the typical actors.

Characteristics:

- ❖ powerful basic and applied research,
- ❖ long lead time (also R+D lead time),

- ❖ many patents,
- ❖ expensive lab work,
- ❖ high capacity levels,
- ❖ the resource footprint of critical R+D activities is extremely high.

In the 21st century classes have also changed. Among the traditional component manufacturing, assembly plant, and logistics companies the so called contract manufacturer (CM) type of company was born. This company manufactures the components or products of another (hiring) firm. The activity of CMs is based on the installation and maintenance of modern high-quality technologies. The hiring firm approaches contract manufacturers with a design or formula and requests quotes from multiple contract manufacturers. Contract manufacturing is a type of outsourcing. CMs follow the developer companies when enlarging their distribution network or outsourcing the production. CMs offer their production capacities to the potential hiring companies (Flextronics is a CM and a partner of Nokia, Ericson and Sony at the same time). These companies must operate a special innovation strategy.
Characteristics:

- ❖ no end-user products are manufactured,
- ❖ owning high-quality equipment and technology,
- ❖ competitiveness is based on high-tech manufacturing machines and production systems,
- ❖ no private R+D activity, using patents, know-hows,
- ❖ strategy is based on production expansion and investments to follow the partners,
- ❖ in technology parks it provides administrative, logistic and HR services beyond manufacturing,
- ❖ the main objective is the worldwide intensification of diffusion processes.

4.4 Introducing innovations

In recent years products and services have changed due to four dominant forces. These forces have changed customer needs and created new industries and market segments (Table 4.1). The trends also changed the customer's behavior and judgment about products and altered the practice and methodology of the introduction of innovations.

Table 4.1: Key fields of innovation

Changes	**Novelty**
1. Changed customer:	***2. New competition:***
- aging consumers	- globalization
- dual-income families	- monopolizing competences
- young and older singles	- destroying information barriers
3. Changed regulation:	***4. Technological breakthroughs:***
- co-operative arrangements	- 'taboo' research
- unification	- resource abundance
- world conventions	- standardization
	- strategic alliances

Four typical situations and characteristic strategies can be derived from the different barriers in the market (Figure 4.3).

		Consumption barrier	
		High	Low
Business barrier	High	SLOWLY but SURELY	MODIFY but RETAIN
	Low	HIGHLIGHT and PROTECT	GRIP and INCREASE

Figure 4.3: Innovation strategies and impeding factors

.

Strategy variants

Slowly but surely (SBS)

Start-up: High barriers for the customer and for the firm as well
Options: Strong and precise market segmentation and positioning are needed.
At the beginning of implementation the company must focus on customers with low price sensitivity, who are willing to pay a higher price for the product. These customer groups (and the whole segment) should be expanded step-by-step. Price sensitivity is really important when focusing on different customer groups.
Conditions: To protect this new group or segment, high barriers should be created. Precise forecasts are needed to plan the introduction and to select the customers involved. These new customers will transfer information to potential clients and customers. Companies with a monopolistic situation in their field of competence, great innovators and young customers with a high income are important actors in this strategy. Companies implementing a SBS strategy must be convinced that the innovation introduced in the market will start up in a protected situation. It is necessary to measure the position of substitute products especially if the use of the new technology also requires a change from the consumer. The SBS strategy is suitable for rapidly returning the high costs of R+D and manufacturing activities. These innovations can quickly resolve latent problems of the customer (such as security systems for the production of aircraft and spacecraft).
The strategy can be implemented in situations where the product has no predecessor or substitute goods. In the market of machine tools we must focus on companies or sectors with an innovational attitude. In the market of consumer goods young, mobile consumers with a high income should be targeted.

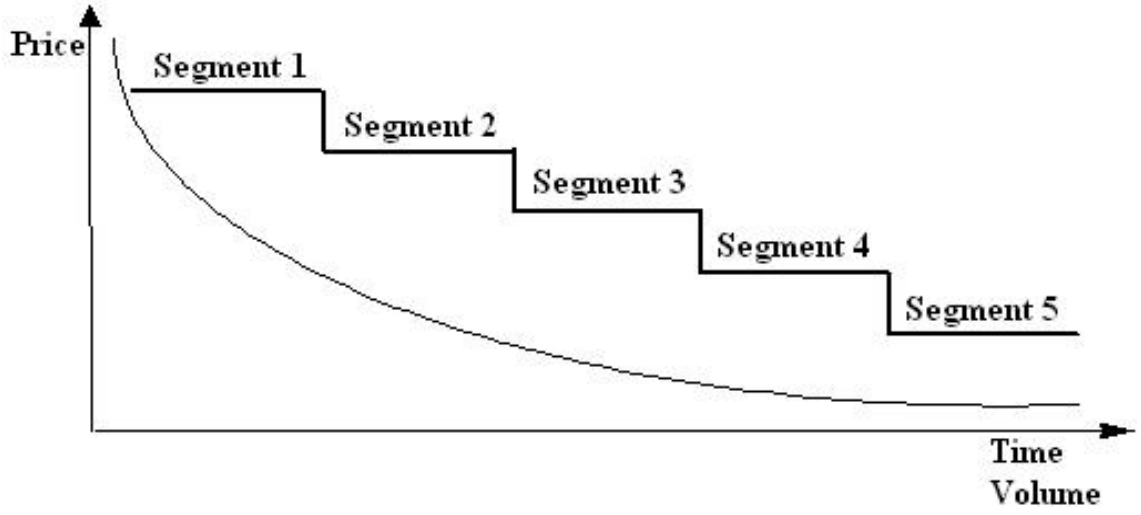


Figure 4.4: Price strategy ('slowly but surely')

Grip and increase (GI)

Start-up: Low barriers on both sides.
Options: We can face susceptible customers who are open to accepting the product. Early market entry allows gaining a high market share. We can count on these resources for internal development. Gaining experience fast can lead to intensive reduction of costs in the markets.

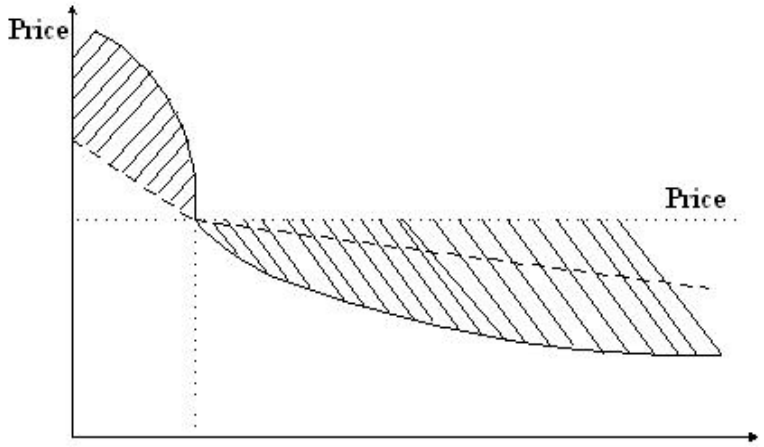


Figure 4.5: Price strategy (grip and increase)

Initial losses are compensated for by the incomes of the wide consumer groups. Entry barriers.
Conditions: Reserving capabilities and resources to fund initial losses and to reduce initial cost rapidly; flexible production and proper logistics background; existing commercial channels; communication blockades to intensively support the expansion; the board should be aware of the high risks and initial losses.

Highlight and protect (HP)
Start-up: Customer barriers are dominant.
Options: The company should provide unique benefits to the customer. This strategy focuses on target market segments and aims to realize full-service to the targeted customers meeting all their needs. Customer needs must be defined precisely and consumption constraints must be resolved. After market entry strong branding activity is needed and new generations should be introduced into the market.
Conditions: Precisely identifying market gaps; must focus on key market gaps and attract customers.

Modify but retain (MR):
Start-up: Business barriers are high and consumption barriers are low.
***Options*:** A sense of stability of competences must be maintained at the company. Instead of radical changes continuous improvements must be performed in the market segments dominated. A new system-oriented sales strategy should be developed where every division can find its option of renewal. Constraints of change should be interpreted as a need of the customers.
Conditions: Centralized control systems and wide ranged R+D activity; the manufacturer should give upgrades to the products and create better quality, rich selection and differentiated prices to implement proper strategy; effective R+D background is crucial for implementing the strategy; a company must have a huge market share to be able to strongly influence customer behavior.

4.5 Strategic potentials

To implement the completed and approved strategy, firms must develop their innovation potentials. These potentials can be

- implementation potentials,
- differentiating potentials,
- or knowledge potentials.

4.6 Factors influencing strategy forming

Strategies are always born as a result of a multilateral approach. Some basic influencing factors are summarized in Table 4.2.

Table 4.2: Factors influencing strategy forming

Features	Changes
Basic strategy	1.1 Offensive 1.2 Defensive 1.3 Counter strategy
Goals	2.1 Overall cost leadership 2.2 Differentiation 2.3 Concentration
Product-market combination	3.1 Product: new, temporary, old 3.2 Market: new, temporary, old
Type of innovation	4.1 Demand creator 4.2 Demand follower
Costumer behavior	5.1 Conservative 5.2 Early/late adopters 5.3 Susceptible
Ways of market entry	6.1 Traditional producer, service provider 6.2 New entrants
Behavior of producer / service provider	7.1 Innovator 7.2 Imitator 7.3 Adaptor
Focus of development	8.1 Primer innovation 8.2 Diversification 8.3 Searching gaps

Questions:

1. What are the elements of Porter's Five Forces model?
2. What are the typical directions of diversification?
3. What are the main characteristics of innovation strategy in supply dominated industries?
4. Describe the types of introduction of innovations.
5. List the main factors influencing the innovation potential.

References:

MODULE 5. – TECHNOLOGY TRANSFER

The word technology comes from the Greek 'techne' and 'logos': the word 'techne' meaning 'art, skill, craft' and the word 'logos' meaning 'study of'. So the word technology refers to the expertise, qualification and in a broader sense to the knowledge of creating something (Shane, 1982).
Generally technology is the synergetic combination of the following four (knowledge) factors (Figure 5.1).

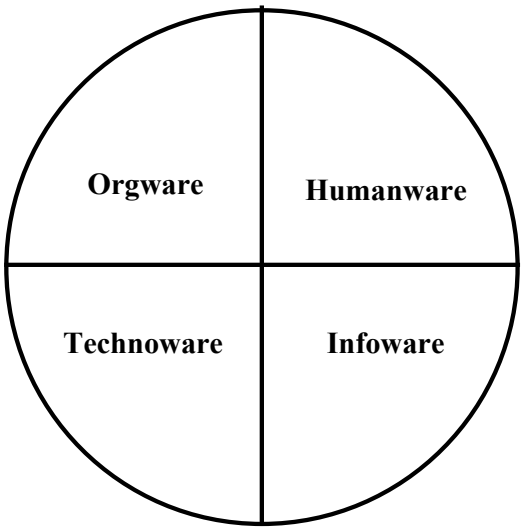
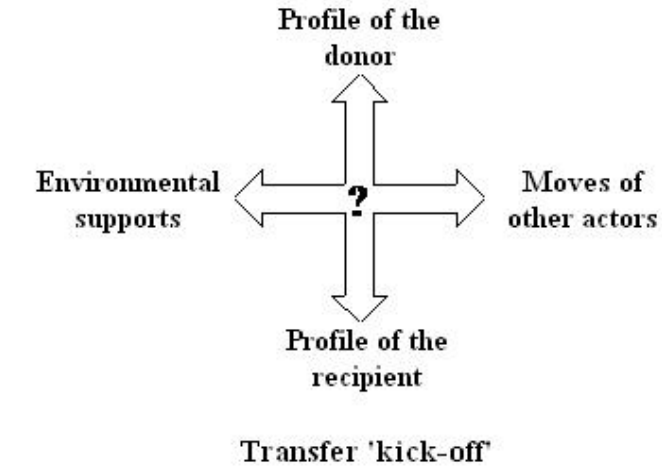


Figure 5.1: Components of technology

These four knowledge factors can be interpreted also as subjects of technology transfer The concept of technology consists of the product or service created, the processes of creation (manufacturing and distribution) and all the related knowledge elements (e.g. management, experiences, expertise). Technology transfer means the flow of all these technical and knowledge elements between individuals and organizations. Later in this module we will sum up the main questions of technology transfer. The actors and the questions of the process of technology transfer mentioned are represented in Figure 5.2.



DONOR	RECIPIENT
What When would the donor Why like to transfer? For who	What When would the donor Why like to recieve? For who

Figure 5.2: The key-actors of technology transfer

5.1 TRANSFER MODELS

The basic characteristics of technology transfer mentioned in the previous module can only provide a framework to achieve our goals (Mogavero-Shane, 1982). Hereinafter we introduce a model (which includes the relation of the actors) representing the special technology transfer strategies (Figure 5.1)
The 'Bridging Agency' model shows how the technology sources and the technology users are connected through an agency ensuring information flow. These institutions provide a link between the demand and supply sides of the potential partners and help them to find each other. In this process the agencies also help the actors to find the tailor-made solutions and mechanisms. The 'Research and Development Model' concentrates on linking the suitable technologies with the potential diffusion points. The model searches for the actors of research, development and adaptation. It is able to handle complex innovations and mechanisms and enhances the effective use of potential diffusion points. The 'Bridging Agency' model is suitable for start-up or occasional transfers because it provides a transparent cooperation of few actors. The 'Research and Development Model' should be used when we would like to make a quick and massive diffusion in a wide range. This model is suitable for creating a coordinated cooperation among numerous actors on the adoption side.

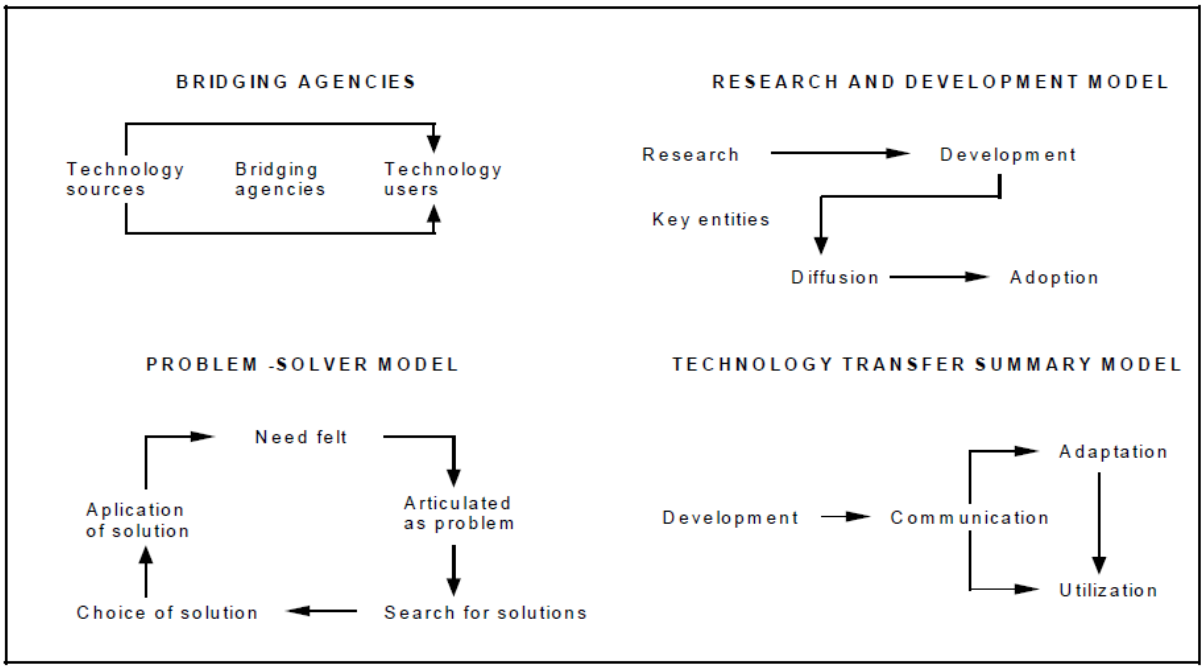


Figure 5.3: Technology transfer models

The 'Problem-solver Model' starts by clarifying customer needs. The customer needs are observed as gaps in the current technology so a search for a solution is initiated. The final solution is selected from the potential solutions considering the directions of application. This model not only summarizes and qualifies the needs but also considers the willingness of application. The concept aims to find the best suitable solution to meet the original needs. The model relies on the active collaboration of recipient organizations during the formulation and solution of the problem. The model handles the situation not as a simple transaction but adopts the additional developments also to meeting needs fully. This specialty of the model ensures fitting the development of new products or technologies to the special needs of local markets.

The 'Technology Transfer Summary Model' handles the processes of innovation from the aspect of economic utilization. Every innovation (during the active life-cycle phase of introduction) is launched in a competitive market. The innovator can hold advantages when it can cooperate with loyal adaptors in the early phase of introduction. The phase of adaptation is not only about increasing volume and mass-production, but developments to meet local needs are also performed. Multinational companies often use this model when the donor company should co-operate with an adaptor company from a totally different culture (e.g. European projects of Japanese companies, major U.S. companies in African countries). Every global firm has used similar solutions in the early stages of internationalization.

Nowadays what is called the 'Knowledge Exchange-Based Model' (including feedbacks from the adaptor) is applied in a wide range (Figure 5.4).

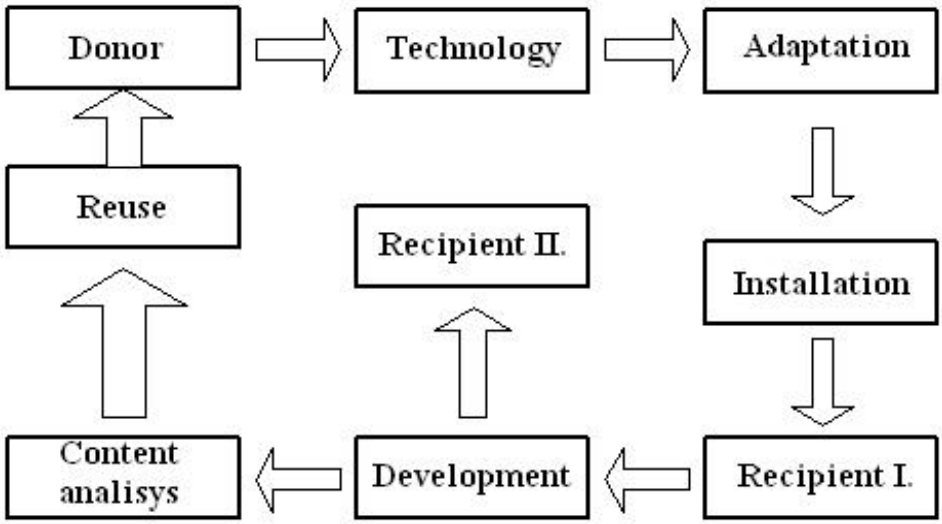


Figure 5.4: Knowledge exchange based model

The donor consciously follows up the acceptance of innovation and in many cases encourages the adaptor to share development ideas. The donor company supports technology transfer towards a third party as well in order to compensate for expenditures. It also adapts the developments of the adaptors and integrates them into their own development programs. These new results can be diffused globally in the next cycle of technology transfer. The model can be observed in the internal transfers of transnational companies and in projects of machine tool and method transfer. In transnational companies this process is generated by interpersonal relationships and by the research departments. In projects information is picked up through the monitoring system of customer service. The model is an effective tool for knowledge, technology and resource allocation to provide mutual benefits for the appropriate transfer operators.

5.2 TRANSFER MECHANISMS

The creation and differentiation of transfer mechanisms occurred simultaneously with the history of innovation. The changing needs and opportunities of the donor and the recipient are easy to recognize. There are several opportunities of technology transfer starting from the basic commercial sale to a complex and mutual knowledge transfer. In various points of this imaginary scale participants can have different strategies and lobbying forces. We review the transfer mechanisms from the points of view of both participants. The main characteristics (technological scope, environmental embeddedness, diffusion potential and financial situation) of the participants determine which transfer mechanism is suitable. The commonly used transfer mechanisms are summarized below.

Turnkey projects

The donor creates a functional system (performs the investment, test runs) and coaches the staff in operating the system. The experience of the donor is directly integrated into the new objective and into the actions of coaching. This can accelerate the realization of the project and can accumulate knowledge. Technology recipients are passive participants in the first stages. Turnkey systems are usually expensive because there is no financial or intellectual contribution from the recipient. This kind of transfer concentrates on uninterrupted reproduction so the integrated knowledge elements remain unknown to the user. This can restrain further development at the recipient side. In many cases the donor's (stated or unstated) goal is to maintain its knowledge monopoly. The disadvantage of the recipient can be reduced when the donor is willing to share complementary knowledge and to perform joint upgrades. The critical part of this transfer mechanism is the price. The recipient buys a complex system so the bargaining option is disadvantageous. The content of the know-how transferred is completely controlled by the donor. The option can be good for the recipient when it asks for offers from several donors. In this case the recipient can specify the parameter requirements. Acquiring knowledge by turnkey projects is a good opportunity for quick learning and fast catching up.

Inserting technology

This idea refers to the mechanism when the transferred technology is more developed than the general environment of the region or country where it is applied. The operation is isolated and there are no short-term goals of innovation diffusion. The key operators of the technology come from the donor company/country. This method is a result of a forced transfer when there is no opportunity for knowledge-based collaboration because of the innovation level of the recipient or recipient country. The level of integration of the new technology is low; therefore the level of diffusion will also be low. In many cases the products manufactured by the new technology are exported because local markets are unable or not willing to accept them. The insert method is a typical phenomenon when a transnational company (as a first step in its expansion strategy) installs its first facility consciously in isolation. Many firms from developed countries used this strategy after the Second World War (WW II) when they wanted to take advantage of the resources of a developing country (cheap labor or materials). This one-sided approach changed in the 1970s. Countries such as Malaysia, Singapore or Taiwan initiated the insert of electronic device technologies by providing economic advantages for off-shore companies to settle down in their countries. The recipient countries regulated the settlement of these companies so as to share their knowledge step-by-step with local entrepreneurs.

License trade

“Licenses are regulations about the use of patents, know-how, industrial design and trademarks” (Gazda, 1993). A license can be exclusive or non-exclusive. License trade means the selling of the donor’s technology in a designated commercial channel. The contracting parties set the share of the recipient according to the results of successful application. High acceptance potentials and autonomous decision-making are basic preconditions for successfully applying the technology purchased. Buying licenses is usually a key-element of national regional development strategies and convergence programs. This transfer mechanism is successful when the technology absorption potential of the recipient is high and there is a mature cooperation background. This transfer was preferred by the Japanese government after the Second World War in their development programs. The Japanese government provided full-scale subsidies to firms buying high-tech licenses under the reservation that they had to share it with all the actors of the market (including their rivals). The main advantages of the mechanism are that it makes possible swift changes in technology and the partners can flexibly limit the transferred licenses. Licenses consist of:

- technical description of the technology,
- provision of technical support,
- trademark protection obligations,
- regulations on further transfer.

License balance can be used to measure the innovation activity of firms and countries. Using license balance, the R+D potentials of different companies can be compared. This form of technology transfer was the most common in the 1980s when companies spent a great deal of money on defending their technology monopoly situations but were also open for export technology in a regulated form. The simultaneous protection and business utility of the licenses made it popular. The utility of licenses decreases when aggressive imitators enter the market. Subsequent enforcement of rights proves to be expensive and inefficient.

Joint ventures

A joint venture is business agreement in which two or more participating firms or individuals agree to establish a new enterprise in order to realize a technological program or to develop a new product or service. The contribution, division of labor and risk-share are defined in the articles of association. This entity is a good solution for long-term cooperation with huge investments and to ensure mutual control. Joint ventures are widely used when high-scale development programs are performed (such as the British-French Concord, German-French-Dutch UNIDATA or the European Union Airbus project).

A joint venture may be a solution to unite the different knowledge elements of the partners in order to create a new competitive position that the partners could not achieve without this cooperation. The cooperations can be extended to the widest range of knowledge such as technical, manufacturing, marketing and management experience. One of the most important conditions is the transparency and stability of the legal agreements. The main fields of agreements are:

corporate and tax laws
investment protection laws,

- intellectual property protection laws,
- laws of double taxation,
- tax laws (e.g. export dividend).

The establishment of subsidiary companies is a commonly used transfer technique to transfer the R+D results of the parent company to regions providing comparative and global strategic advantages in a controlled way.

Patents

Patents are collections of intellectual property rights regarding technical inventions. They consist of exclusive rights granted for the inventor for a period of time. Regulations can limit territorial use of the patent as well. Illegal infringement of a patent is punishable. Patents as a specific intellectual property are freely transferable and can be a subject of commercial trade. Patents are a popular form of protecting intellectual properties of individuals and independent laboratories. They can also be used to commercialize the invention. Patent rights are usually transferred by commercial or subsidy programs. This form of transfer has a long tradition in countries were legal protection is widespread and the technical infrastructure is well-developed. Patents can be used successfully if the recipient has a proper (technical and knowledge) background of using these special property rights.

Buying technological services

This is an indirect form of technology transfer. It has become popular with the expansion of transnational corporations. Due to the fact that transnational corporations are the prime movers of the world's technology transfer, this form of transfer is the most common form. The scale of the commerce of technology can only be estimated because the relevant information is confidential. To perform the estimation the following elements can be used: size and capacity of investments, export-import index of world trade, etc. An important index could be the regional and national balance of fees of technology transfers paid and received. The overrating of these indices can be dangerous because sometimes they are consciously distorted. Due to tax and business tactics, corporations try to hide the real value of their transactions.

Franchise systems

Franchising is the practice of transferring business models. Complex systems of manufacturing or service providing are transferred including the experience of establishment, operations, management and marketing tools and methods. Training materials are also included. Depending on the subject of the franchise, rights are usually shared in a combination of licenses. These complex packages include constraints to purchasing materials, using technologies and equipment and logistic processes. Franchising is a great opportunity to spread great business ideas and methods of management. A well-known brand is a good start-up for the recipient and makes a cost-saving low risk introduction possible. The franchisor ensures continuous developments, procurement benefits, and high quality services provided globally to the loyal customers.

Mobility programs and distribution of literature

The oldest and best-known form of learning and knowledge transfer is reading technical literature and gaining our own experience by internships. These forms were compulsory for the members of guilds. The goal of this form of transfer is to spread the necessary background information in order to provide long-lasting knowledge. A wide-scale of mobility programs is available (language programs, vocational education, counseling, etc.) This method is person-oriented and the focus is on the cooperating individuals. Generally these programs are used as a preparation or additional tool used simultaneously with business programs or grants.

Also this is the easiest way to gain knowledge and experience. The conditions and the scope of activities have changed, but the direct and personal experience and networking are still very important. These mechanisms have been formalized in the course of time. They are popular and efficient tools used for technology transfer by companies and governments as

well. They can usually be parts of mobility or exchange programs. Conference tourism is the fastest growing tourism segment.

5.3 International technology transfer

Technology transfer is used to describe international transactions generally despite the fact that it can represent the transfer mechanisms within a country as well. When market actors utilize each other's development results, we talk about local technology transfers, e.g. state funded national research programs are continued to create a marketable product or service.

5.3.1 Frameworks of international cooperation

Participants of the cooperations can be individuals, firms and also government institutions. Certain types of cooperations can be identified between these actors. These forms of cooperations have created a rich variety of methods and funding systems. The typical cases of international technology transfer situations can be derived from the location of the donor and recipient partners. Regarding the transfer potentials of the partner countries the following types can be distinguished:

- Countries on the same level of development:
  - North - North
  - South - South
- Countries on different levels of development:
  - North - South
  - 'Technology Oasis' - 'Technology Desert'.

5.3.2 Technology alliances

Firms have entered international markets and a new form of enterprise has been born. The literature calls it a multinational or transnational corporation. There is some uncertainty in the use of the terms in the literature. There are different opinions about the two terms. The idea of Simai is summarized below.
There is a process of internationalization which results in a structural and component change of dependency between national economies. These changes occur at micro and macro economic levels as well. Companies with operations in more than one country were simply called international corporations till 1974 when the Economic and Financial Committee of the UN conceived the two terms. A Transnational Corporation (TNC) differs from a traditional MNC in that it does not identify itself with one national home. While traditional MNCs are national companies with foreign subsidiaries, TNCs spread their operations in many countries sustaining high levels of local responsibilities. An example of a TNC is Nestlé, which employs senior executives from many countries and attempts to make decisions from a global perspective rather than from one centralized headquarters.
Figure 5.5 represents the relations of the different technology alliances and the process of innovation.

Characteristics of strategic alliances:

- pursuit for mutual benefits,
- division of labour to acquire mutual technological advantages,
- favorable access options for licenses, patents, materials and equipment,
- ensuring the conditions for a bilateral flow of technology.

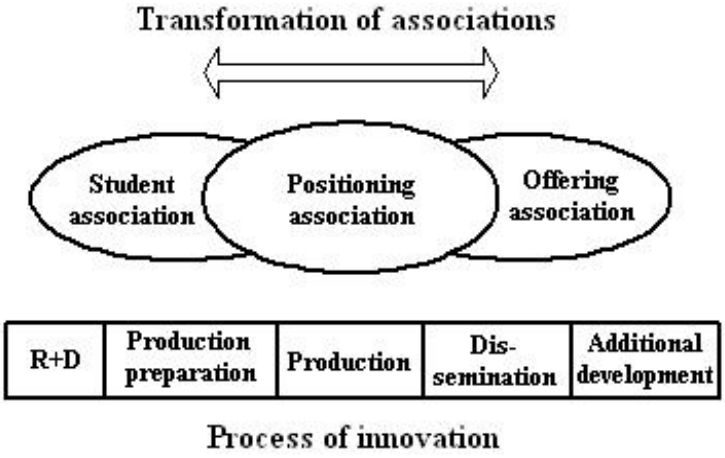


Figure 5.5: The change of the types of associations during product development (Wheelwright, 1995)

The first strategic alliances were based on technological cooperations. Later on defensive cooperations have become general due to the fierce competition in global markets.

New strategic alliances include intensive technological cooperation and focus on global objectives.

The most common forms of strategic alliances using technology transfer are:

- technological exchange programs,
- mutual license agreements,
- collective manufacturing and marketing programs,
- joint product development,
- independent joint ventures which operate as special competence centers.

There are two types of strategic alliances based on technology transfer: the resource-based and the competence-based form.

Typical forms of cooperation to increase resources are: technology barter, license cooperations, joint development programs, establishment of collective manufacturing and distribution. Companies focus on the equilibrium of the transfer rates. The only goal is to eliminate production bottlenecks so as to achieve high levels of synergy.

In competence-based cooperations – unlike the resource-based cooperation − the main element is not tangible material transfer, but the transfer of information or intellectual properties. These elements cannot be bought but must be established during the period of cooperation. The value of intellectual or information property is hard to assess. The result of information transfer is shown when the participants acquire new skills and knowledge along with the cooperation. However, this result comes in the long-term. In competence-based cooperations the contact person must pay attention to the relations of competencies.

Asymmetry is a basic characteristic of technology transfers. This phenomenon exists throughout the process. Asymmetry of material goods can be handled easily and compensations can be planned. Unfortunately, the same does not hold for immaterial goods. The cause of many spectacular failures was asymmetric learning from the cooperation. The partner who falls behind perceiving its deteriorating situation leaves the alliance and tries to block its previous partner. Many such examples are known in the cooperations of Japanese - American, Japanese - European leading companies. The majority of the companies use the

'technology transfer for market access' strategy while it is well-known that the position of a company in an alliance is based on the advantages gained, disadvantages and on organizational learning (Porter and Fuller, 1986.).

5.3.3 Clusters and regional economy

The idea of cluster was introduced when research projects of regional and industrial development were performed. Regarding the experience of the last decade, the companies which can integrate into the business, social and institutional network of their geographical environment can gain competitive advantages. Regions can be successful when a proper environment is created for clustering. Global competition is not enough to develop a competitive environment; cooperation between geographically close groups in the same industry is also needed. The cooperation can lead to the development of competitive products if the cooperation is based on knowledge-based services as well. In more and more markets competition is based on innovation potentials rather than prices. Global competition challenges not the individual firm, but the cooperating network and the hosting region. As a reaction to the challenge of global competition, companies applied different solutions so as to keep their competitive positions in the market. One option was the formation of clusters. Several clusters were established spontaneously (without governmental support) in the last few decades. The experience proved that clusters provide advantages to the member firms that can sustain their competitiveness and improve their performance in the global market. The experts of cluster development handle the networks of flexible cooperating companies in a region as an agglomeration. The competitiveness of these networks can be studied by means of four factors. Local governments should be able to influence all of these factors (Table 5.1).

Table 5.1: Competitiveness of clusters

Factor of competitiveness	Governmental intervention
Factor endowment (resources and infrastructure)	Provides infrastructure.
Demand conditions (mainly qualitative, e.g. growth, structure, refinement)	Creates regulations which influence the market. (The state is an actor as well.)
Supporting and related industries (factories, knowledge, etc., suppliers, complementary industries, competitors)	Influences the possible intercompany cooperation by competition, taxation and financial regulations.
Corporate strategy, structure (industry and business) and rivalries (which is responsible for maintaining competitiveness)	Localizes the scope of corporate strategies by determining the possible corporate forms and market structures.

„A cluster is a geographically proximate group of interconnected companies and associated institutions in a particular field, including product producers, service providers, suppliers, universities, and trade associations.” (Michael E. Porter) The role of the cluster is to enhance regional development. These companies are part of the same value-chain. They are rivals to each other but can cooperate as well. The members of the cluster have similarities and they also supplement each other. These companies can be suppliers to the same manufacturer, participants of collective research, users of the same technology or resource. Some European countries

interpret clusters not as a regional phenomenon. Clusters can be examined regarding the horizontal and vertical relationships of the members.

5.4 NATIONAL FRAMEWORK OF INNOVATION

The integrated governance of the innovation processes is a clear hierarchical structure based on the cooperation of the different actors with different motivations. This structure must contain several elements (at the levels of performance, methodology, institutional background, experience) of the

- systems,
- processes,
- networks
- and activities

of the national innovational framework.

The National System of Innovation (NIS) consists of the institutions, incentive systems and sphere of authority which regulate the directions and intensity of technological changes in a country.

Freemann (1974) defined the national system of innovation as follows:

"The network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies.

... the elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge ... and are either located within or rooted inside the borders of a nation state."

The division of labour and cooperative opportunities within the NIS are defined by the following elements:

- technology policy of the government,
- structure of industry and service sectors,
- R+D institutions and funds,
- education and training system.

Updating the idea of Freeman as an effect of the strengthening economical alliances (OPEC, OECD, EU), we can define three interdependent levels (supranational, national, regional) of innovation networks and the connected institutions (Figure 5.6).

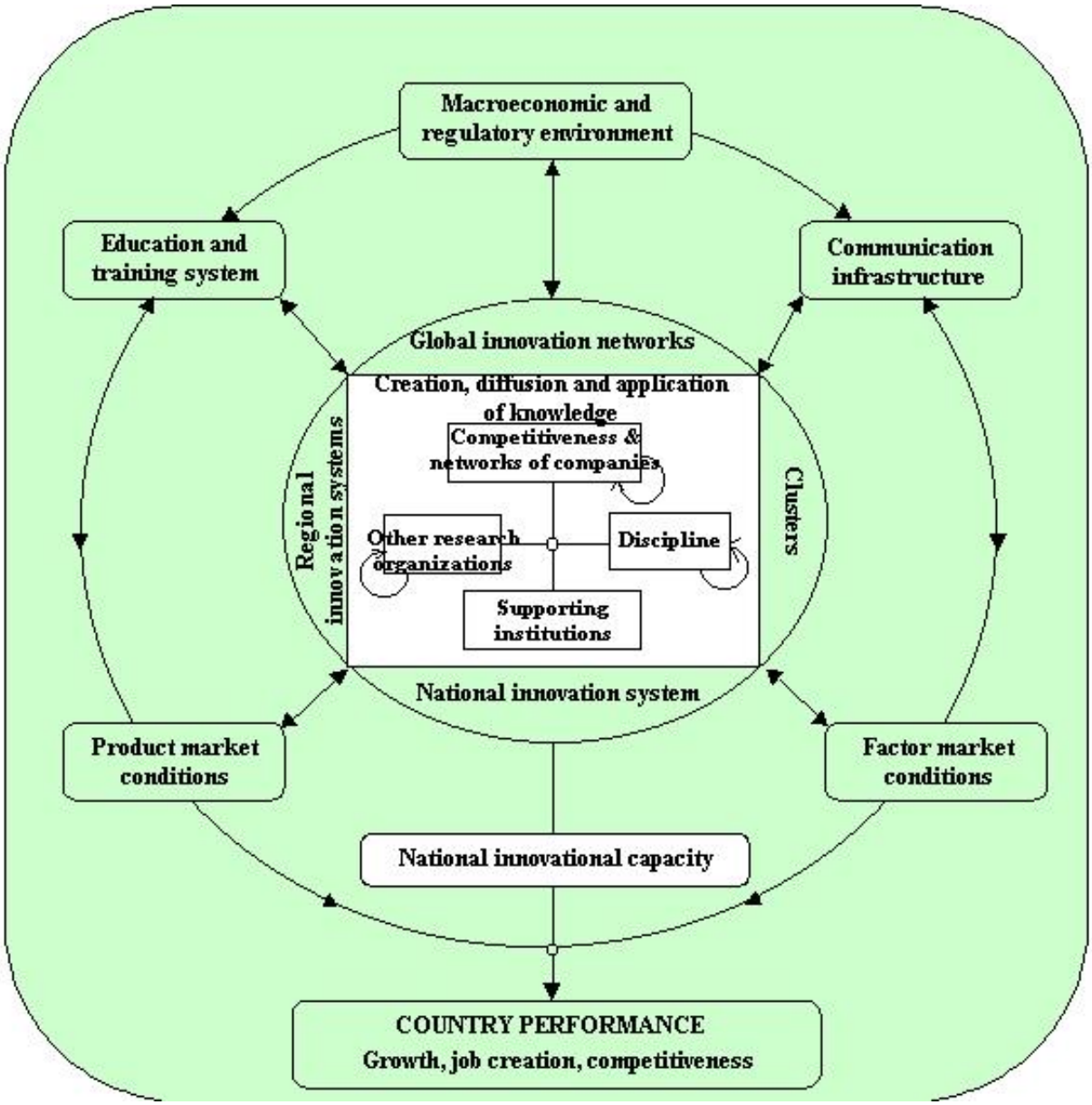


Figure 5.6: Elements of the national innovation system
Source: OECD Secretariat

5.4.1 Institutions of the classical innovation model

The classical innovation model is the simple linear process model of innovation. This process starts with the task of research and development following up the life of the product (service) till successful market acceptance. The institutions are based on this chain-like process (Table 5.2).

Table 5.2:
Institutions of the technology transfer / classic innovation model

TYPE OF INSTITUTION	FOUNDERS / MANAGERS	PRIORITY TASKS	EXAMPLES
1. BRIDGING INSTITUTIONS			
R&D institutions	industry science state	applied research services	Fraunhofer-Institute (Germany) (47 research and service centers) non-profit institution
	state science economy	public research (e.g. environmental production, energetics) supporting SMEs participation in EU programs	Organisation for Applied Scientific Research (Netherlands) (15 research institutions) non-profit organisations
Agencies	state	providing information managing programs mediation of EU programs loan consultancy	Anvar (France) 24 regional service offices network of experts
2. TECHNOLOGY INTERMEDIARIES			
Technopolises	individuals universities	intensive research rapid product launch	Silicon Valley (USA) Tsukuba (Japan) Technopole (France)
Scientific parks	universities economy individuals	business support providing infrastructure networking	Great-Britain: Scotland South England Austria: provincial system

TYPE OF INSTITUTION	FOUNDERS / MANAGERS	PRIORITY TASKS	EXAMPLES
Spin-off enterprises	individuals	implementing specific ideas	founders of the Silicon Valley
Industrial parks and satellite zones	strong enterprises	providing infrastructure strong production orientation	Székesfehérvár (Hungary) Sárvár (Hungary)
Business incubators	local governments state institutions	supporting SMEs providing initial infrastructure	Nyíregyháza (Hungary) Sátoraljaújhely (Hungary)
University Innovation Agencies (Liaison office)	universities	promotion of research results establishing enterprises	U.S. universities University institutes of technology (France)
R&D networks	government institutions regional organizations transnational companies	state research governmental decision making	Emerging countries
Purpose-oriented programs: ***-education*** ***-scientific dissemination*** ***-R&D*** ***-providing information***	state private enterprises	training, retraining strengthening diffusion	British corporate training programs industrial technical centers (France)
Regionally organized institutions	state local governments	conveying information additional funding monitoring and accounting functions	County Development Agencies (Hungary)

5.4.2 Institutions of the Knowledge-Based Innovation Model

The focus of the innovation model is knowledge production, knowledge transfer, knowledge utilization problems. Within this priority issues are:

- exploiting knowledge advantages,
- dynamics of knowledge equilibrium,
- methods of knowledge share,
- supporting learning processes.

New tasks of innovation institutes:

- creating and updating knowledge pools,
- ensuring the intensive and efficient use of knowledge pools,
- ensuring access to knowledge pools

Fields of knowledge transfer:

- sharing knowledge between knowledge creators ***(understanding − codification problems),***
- sharing knowledge between knowledge creators and users ***(transfer problem),***
- ensuring the multiple use of knowledge***(learning problem),***
- uniform distribution of knowledge ***(diffusion problem).***

Distributors of knowledge are institutions based on high level IT services or formal and informal networks based on these institutions. Funding can be private or public:

- IT service providers,
- network providers,
- content providers,
- search engine providers,
- communication supporters, operators.

5.5 VENTURE CAPITAL

In the broadest sense venture capital is a financial capital provided usually to early-stage companies to support the start-up, performance upgrade of the functions or development. The idea of venture capital is associated with funding start-up SMEs in high technology industries in the USA. In the 1980s a strong diversification began in the capital market. The attention of the investors was attracted to the development of numerous firms in their early development stages and to the management buy out (MBO) processes. Also inter-company financing appeared which nowadays has a great significance. Considering the importance of venture capital, the literature refers to this complex form and activity of investment as venture capital industry. Venture capital is a subset of private equity. Private equity refers to all kinds of property obtained outside the stock market. Therefore all venture capital is private equity but not all private equity is venture capital. The tools of venture capital industry are always adjusted to the existing investment goals and forms. There is no uniform definition of venture capital investment. The province of venture capital alters from region to region especially in the early phase of expansion.

5.5.1 Venture capitalists

There are three major types of investment groups in the private equity market: institutional investors, private investors and investment firms involved in inter-company financing.

Institutional investors

Institutional investors are organizations using retail deposits to invest in different funds, generating a concentrated demand. Types of typical investors include banks, insurance companies, operating as venture capital funds.

Private investors

The members of this non-institutionalized segment of venture capital investment are affluent individuals and angel investors. These actors finance companies invisibly and anonymously. They invest financial and intellectual capital (business experience, knowledge and social capital) into unquoted public companies with which they have not had contacts before. Angel investors are individuals performing venture capitalist activities. The international literature refers to business angels as a key factor in the evolution of market economy. Angel investors can contribute to the funding of SMEs (especially to innovative ones) and become intermediaries between institutional financing and friendly loans. Their activities in the market are not independent and they can establish several forms of cooperation using their unique synergetic effects.

Inter-company financing

Inter-company financing is a type of venture capital investment when SMEs are financed by greater firms. Participants of this popular type of financing can keep their independence and combine their strategic powers. Participants can be in a vertical or horizontal relation. Series of studies investigated the options of financing SMEs and found that the best option is non-institutional capital which can guarantee their successful operation. In the scope of a national economy the problem of financing SMEs will be smaller when a country has an efficient non-institutional capital market. The size of a non-institutional capital market is difficult to quantify due to the invisibility of the investors. Several independent estimates suggest that in countries where the venture capital market is efficient the value of angel investments is many times higher than the value of mutual funds.

Angel investors – business angels

An angel investor or business angel is an individual who provides capital for business start-ups. Business angels are individuals who have gained significant assets and experience in their previous firms. They risk their own assets to invest in promising start-up ventures. They expect that due to their investment and experience the value of these firms will rise so they can have substantial benefits when leaving the firm. In spite of the high risk, angel investors (trusting in their intuition and experience) look for start-up businesses. It is generally known that the biggest profit can be achieved when selecting the best start-up company. The value of the firm can multiply in a few years providing extra profits for the investor. Business angels are keen on finding these opportunities. The partners of business angels are inventors and small enterprises with patents without sufficient capital and a well-structured business plan or management board. They only have intellectual properties protected by copyright but only business monopoly rights can provide for the return of their investments. The support of business angels can be indeed useful since in addition to capital investment business angels help to create feasibility studies and business plans using their methodology knowledge. With the support of business angels, companies can become more attractive to other investors who want the companies' shares (and also the business angels' properties) at a higher price. Although this is the riskiest type of investment (because there is no performance data of the idea, technology, entrepreneur, market, etc.), usually no business analysis is done before the investment decision.

5.5.2 Role of venture capital in company financing

In recent the years it has almost become a slogan that SMEs are the engines of economic growth because of their innovation capabilities which can quickly and efficiently adapt to the changes in the economic environment. A specialized group of venture capitalists are looking for these innovative businesses for financial deployment.

Major features of venture capital:

- venture capitalists usually obtain significant control over company decisions,
- the time horizon of venture capital investment is usually 3-7 years,
- investment targets are not listed on the stock market,
- the venture capital investor is not interested in maximizing the return on the dividend, but in the rapid growth of firm's value,
- venture capital leaves the company as equity tranche,
- there are several ways of sale: selling the assets of non-viable firms or selling blue-chips on the stock market.

5.5.3 Venture capital or strategic investment

There are different types of venture capital investments considering the phase of innovation life-cycle when the capital is deployed.

Seed funding and growth funding
Seed funding supports ideas (usually the company does not exist), initial research and economic and engineering analysis activities. Because no legal firm exists at this time, the investors receive an option for future ownership. Growth funding is the financial support for the start-up, product development, marketing activities and for testing and manufacturing activities of an existing firm. Seed and growth funding are always high-risk activities.

Funding in the early stages
Early-stage companies which cannot get a loan because of their risky activities are in need of venture capital investment. In this case venture capitalists take significant control over the company to decrease the risk.

Expansion and development
Companies in the phase of expansion and development can get into a situation when the growth rate of income is high but in terms of the increased production still insufficient. Earlier investments are returned so the risk of a liquidity problem is low. If the firm needs additional funding, it can apply for loan to a bank, not only to venture capitalists. At this time the risk of investment is normal in general.

Initial Public Offering
In countries with developed capital markets one way of an exit strategy for venture capital is Initial Public Offering (IPO). Managing the issues of the transition period and IPO are the task of the venture capitalist. Venture capitalists play an important role in IPO, starting with the organization of the syndicate to the writing of the release report and subscription.

Management Buy Out and Management Buy In (MBO, MBI)
The first option is a form of acquisition where managers (supported by venture capitalists) acquire a part of their company. Management Buy In is an activity in which an outside manager or management team (supported by venture capitalists) purchases an ownership stake in the first company and replaces the existing management team.

Improving the firm's financial position

Firms in financial trouble can be a target of venture capitalists. If the company is viable and only the expertise of the managers is insufficient, venture capital can bring spectacular results. The choice of the proper investment tool can be implemented within the framework of business incubation.

The investment process of venture capital

The phases of venture capital investment (related to other forms of investment) can be distinguished easily.

The choice
For a successful deployment of venture capital the intention of the use of capital is needed. 90 % of applications submitted to venture capital companies get caught up in the pre-selection screening. The decision of capital deployment depends on many factors. Analyzing the decisions of the European venture capital companies, the most important aspects of deployment are: quality of corporate governance, sustainability of the leading position and the exit options.

Funding − Investment
A stock-purchase agreement is a document regulating the sale and transfer of a firm's shares. This document includes the amount, form and period of funding and information about convertible preference shares, rights of pre-emption and exit-related options, the right of access to information and the structure of the board.

Further funding – Value adding
The role of a venture capitalist does not end when the property is acquired. The contribution of a venture capitalist in the management of the company can hold priceless benefits. The venture capitalist can use his/her network and experience which can help to get additional external financers. A venture capitalist is a value-adding factor for the company.

Exit strategy
Venture capitalists are encouraged to invest by the rate of return. The increase of share value is not enough, profits must be realized. There are four different ways of exit strategy:

- public issue of shares,
- share buy-back,
- selling the company to another investor,
- company sell-off.

Questions:

1. Which type of technology transfer is described above?
2. List the basic models of technology transfer.
3. Describe the different kinds of transfer mechanisms.
4. Describe the effects of 'North-South' transfers on the donor and the recipient.
5. Describe the technological associations which create different types of cooperation.
6. Describe the characteristics of regional clusters.
7. Describe the different versions of national systems of innovation regarding their missions.
8. Describe the basic types of innovation transfer organizations.
9. What are the main characteristics of the knowledge-based innovation model?
10. What kind of groups are working on venture capital market?
11. What kinds of venture capital support do you know?

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Essay questions

1. Describe the concept and basic types of innovation.
2. Describe the different events of innovation which can be linked to the phases of long economic cycles (K-waves).
3. Which are the different levels of innovational change? (Definition by Simai)
4. Which are the elements of the multi-level model of innovation chains?
5. What is the difference between technological development and R+D activities?
6. What is the difference between the 'push' and 'pull' strategies?
7. Define the tasks of the actors in an innovation project.
8. List the situation-oriented factors influencing the spread of innovations.
9. Describe the basic diffusion models.
10. Give some examples to explain the trigger effect.
11. How can we interpret innovation during product development?
12. List the basic concepts of product development.
13. What is the basic idea of empathic design?
14. What kind of information must be gathered to perform user tests?
15. Describe the phases of the creation of a pre-dominant product.
16. What are the principles considered when developing a green product?
17. List the different methods of primary analysis.
18. List the phases of life-cycle and describe the typical events of innovation which can be connected to these phases.
19. What is the 'Sailing ship syndrome?'
20. What are the dimensions of product/technology portfolio?
21. What are the elements of Porter's Five Forces model?
22. What are the typical directions of diversification?
23. What are the main characteristics of innovation strategy in supply dominated industries?
24. Describe the types of introduction of innovations.
25. List the main factors influencing the innovation potential.
26. Which type of technology transfer is described above?
27. List the basic models of technology transfer.
28. Describe the different kinds of transfer mechanisms.
29. Describe the effects of 'North-South' transfers on the donor and the recipient.
30. Describe the technological associations which create different types of cooperation.
31. Describe the characteristics of regional clusters.
32. Describe the different versions of national systems of innovation regarding their missions.
33. Describe the basic types of innovation transfer organizations.
34. What are the main characteristics of the knowledge-based innovation model?
35. What kind of groups are working on venture capital market?
36. What kinds of venture capital support do you know

Tests

1. Which are the basic types of innovation?

a. Primary, secondary, tertiary
b. Product innovation, process innovation, social innovation, structural innovation
c. Radically new product, modified product

2. What are the main innovational events in the phase of improvement?

a.
- New capacities of production are created, based on new technologies
- Because of cost reduction, more and more scattered technological improvements are accomplished
- Beginning of the transfer of new technologies
- Innovation leaders compete against each other's international standardization
- The differentiation of customer needs forces secondary innovations

b.
- **Numerous technological innovations appear. They are concentrated in space and time.**
- **Using new materials and technologies throughout the whole branch**
- **New markets develop.**
- **Several secondary innovation appear (accumulation after the period of basic innovations)**

c.
- R+D expenditures fall
- Product range decrease
- Price competition

3. Choose the attributes of paradigm shift (Definition by Simai).

a.
- **all the actors of the economy are affected,**
- **based on the radical change of knowledge,**
- **has a complex mechanism of action and effectuation**
- **radical and continuous innovations are accumulating as an after-effect,**
- **forces not only the economic but the social environment to change as well,**
- **fluctuations in new fields of science ,**
- **provides facilities to change the infrastructure to a large extent.**

b.
- based on planned and conscious R+D activity,
- accumulates at the end of a K-wave (different materials or procedures),
- forces significant investments and creates a wave-effect,
- creates several secondary innovations,
- formation is affected by the:

– R+D potentials,
– size limit of investments
– scale of production,

and sales volume limits.

c.

- through radical technical change new organizational and managerial structures are created,
- affects several branches and also new sectors and production cultures are created.

4. Choose the elements of the multi-level model of innovation chains.

a.

- **Command and control processes, the problem-solving process chains, Information, decision-making chain.**

b**.**

- searching for information, developing ideas
- selection of ideas,
- acceptance of the ideas,
- ensuring conditions,
- guidance, gaining experience,
- provoking chain reaction(s).

c**.**

- assessment of the situation,
- research,
- development planning,
- implementation,
- diffusion,
- action reviews.

5. What is the difference between technological development and R+D activities?

a. There is no difference, they are synonyms
b. R+D activity refers to the theoretical programs and tasks while technical development refers to practical programs.
c. A technological development is an activity to develop new products or to upgrade the earlier ones, to develop and introduce new procedures, to modernize fixed assets, to improve the production processes and to use new scientific achievements in all the fields of the organization concerned. Product and production developments are part of the technological development. In a broader sense applied and technological research is also part of technological development. This last idea is called R+D activities including all the activities mentioned here.

6. Push strategy

a. Demand generating developments are the results of the technology push. This kind of 'push strategy' is determined by R+D institutions, the government and the companies' management. The customers have limited or no effect at all on the new technology.

b. 'Push strategy' is based on the demand following philosophy to meet existing needs. This strategy prefers to technological adaptations and knowledge transfer. Customer needs influence the features of the product or service. The customer is not a passive observer but an active contributor in the process of innovation.

c. Demand generating developments are the results of the technology push. Customer need is the major force forming the attributes of the product or service. The customer is not a passive observer but an active contributor in the process of innovation.

7. Choose the tasks and attributes of the project leader.

a.

- part-task scheduling
- appointment of experts for delegation,
- professional supervision and control,
- consultation with the coordinator.

b.

- **designing program plans, defining priorities,**
- **informing the organizations/persons involved,**
- **arranging personal conditions,**
- **appointment of the project coordinator, control and reporting activity,**
- **preparing submissions for decision-making boards,**
- **providing resources,**
- **creating temporary organizations,**
- **communication with senior management,**
- **dismissing the staff at the right time.**

c.

- scheduling subtasks and individual programs,
- up-to-date monitoring and trouble-shooting of the progress,
- leader and supervisor of the program,
- direct resource ordering,
- registering expenditures,
- assigning tasks,
- reporting,
- controlling work schedule.

8. Which are the situation-oriented factors influencing the spread of innovations?

a.

- low price
- known brand
- high-tech quality
- relative advantages
- compatibility

b.

- high-tech quality

- relative advantages
- low price
- compatibility
- complexity

c.

- **relative advantages**
- **compatibility**
- **complexity**
- **visibility**
- **introducibility**

9. Which diffusion model is described below?

Based on the assumption that a customer is able to purchase a product or make an investment when the products income-generating capacity exceeds a critical threshold. (This depends also on the customer's own perception.) The threshold is generated by the product's quality, performance, price and the customer's perception.

The threshold depends on:

- the adequacy of the customers need and the function of the product.
- scale of advantages,
- costs of adaption.

a. Gravity model

b. Forecasting consumer behaviour

c. Equilibrium model

10. Choose the characteristics of the trigger effect.

a.

- An impulse in a scientific field creates a change and a reaction in other scientific fields as well.
- This spread is not incessive and controlled but more similar to a vibration
- There is no effect on other disciplines and knowledge transfer will not be established through cross-links.

b.

- An impulse in a scientific field creates a change and a reaction in other scientific fields as well.
- The reaction is influenced by commercial interests.
- This spread is not incessive and controlled but more similar to a vibration affecting other disciplines while establishing knowledge transfer through cross-links.

c.

- **The trigger effect (pinball effect) is the impulsive process of innovation in the technological systems which can be identified through the chain-reaction-like spread in other fields as well.**
- **An impulse in one scientific field creates a change and a reaction in other scientific fields as well.**
- **This spread is not incessive and controlled but more similar to a vibration affecting other disciplines while establishing knowledge transfer through cross-links.**

11. In what dimensions can we interpret the rate of innovation?

a.

- market
- customer
- date of introduction

b.

- **level of maturity**
- **customer market**

c.

- new form
- new function
- new market

12. Which concept is defined below?

Development is driven by changes that are provided, forced or suggested by technology. Results of previously successfully applied and proven technologies are often transferred to new user areas (e.g. fish finder for anglers). Developments implemented in the raw materials and components industry often appear in manufacturing (e.g. aluminum in the automotive industry; results of aircraft industry used in safety devices; results of manufacturing of electric components used in household appliances). The ideas of these developments often come from defense military projects. Civil utilization of these kinds of products is often linked to a radical change of the user's range.

a. technology / market co-evolution

b. developer-driven development

c. technology–driven development

13. Empathic design is based on:

- **the simulative modeling of unexpressed customer needs while we develop a new product or service**
- the development based on the intuition of the designer
- cooperation of the technical and marketing experts

14. User tests are great tools to measure the success of a product. What kind of information must be gathered to perform user tests?

a.

- functional compliance test,
- assessing the acceptance of the functions,
- assessing the level of modernity,
- examining the reaction of competitors

b.

- **testing functional fit,**
- **testing effectiveness of adoption,**
- **testing price sensitivity,**
- **examining the spontaneous reactions of the customers.**

c.

- testing price sensitivity,
- examining the spontaneous reactions of the customers.
- assessing the level of modernity,

- examining the reaction of competitors

15. Which statement is false?

a. The developers of the predominant products are companies owning multiple resources and potentials at the same time to perform a successful innovation. Resources and potentials can be: technology, market channels, price leading role, knowing trends, beneficial investment position, and R + D advantages.

b. In many cases the predominant product eliminates latent customer needs with their key functions and no new complementary function is needed.

c. A predominant product is a new product or product group which incorporates a significant change compared to the older products (due to innovation processes) and is based on a new individual concept.

16. What are the principles considered when developing a green product?

a.

- **manufacturing using material- and energy-saving methods,**
- **the materials used and energy are recyclable or retrievable;**
- **minimal emission or lower than the emission of familiar solutions,**
- **use is based on renewable energy or regenerative materials,**
- **use does not cause long-lasting environmental damage;**
- **the destruction of the product does not cause additional environmental damage,**
- **the technology of recycling is well-known and environment-friendly.**

b.

- using recycled components,
- using disassembled parts or reused units,
- low cost inputs,
- finding material- and energy-efficient solutions,
- bio-materials and bio-energy utilization,
- recycling of by-products,
- finding recycling options.

c.

- using recycled components,
- using disassembled parts or reused units
- ensuring long product life,
- finding material and energy-efficient solutions,
- bio-materials and bio-energy utilization
- small-size and low-weight design,
- searching for repair options.

17. Which are the different methods of primary analysis?

a.

- **analysing influencing factors,**
- **analysing experience curves,**
- **designing technology forecasts,**
- **strengths vs. weaknesses,**
- **multi-scenario methods**

b.

- analysing influencing factors,
- analysing experience curves,
- brainstorming methods,
- strengths vs. weaknesses,
- multi-scenario methods

c.

- analysing influencing factors,
- analysing experience curves,
- designing technology forecasts,
- strengths vs. weaknesses,
- value analysis

18. Phases of a life-cycle:

- introduction,
- growth,
- maturity,
- decline.

Which statement group fits the phase of maturity?

a.

- manufacturers try to obtain new markets,
- encouraging waiting customers to buy, so demand is enhanced and sales will increase,
- intensive product advertisement,
- high initial prices, decreasing them later to overcome consumer inertia,
- rigid prices in the market

Ez a két sor hova tartozik?????seller with monopolistic advantages (patent)
the development focuses on eliminating the known weaknesses

b.

- **increasing competition in the markets to gain market share,**
- **trying to achieve maximum capacity utilization and low unit costs,**
- **price competition, price elasticity is high,**
- **increase in value of the additional services (service, consulting),**
- **diversification efforts will be strengthened,**
- **development (reconstruction) is gradually giving way to rationalizing interventions.**

c.

- new competitors and copiers enter the market,
- seeking to expand the range of manufacturers in order to increase market share,
- dissolving the rigid price elasticity,
- increasing volume due to production costs and the prices,
- development to achieve quality improvements and to reduce production cost.

19. What are the factors describing the so-called “Sailing ship syndrome”?

a.

- At the early stage of the S-curve the performance of the new technology is lower than the performance of the old one. Higher performance level can be assured only by individual solutions.

- Complex products can be certified by numerous technological parameters. Besides high performance features, the new technology can have disadvantages (regarding other parameters) which can raise difficulties in assessment.
- The reliability of the new product (which will be improved in leaps) is lower than that of the previous one. Initial low reliability can be a good basis for negative publicity.
- High manufacturing costs. No 'Boston-effect'.
- Changing competences threaten individuals and organizations.
- The new product clearly has better performance, so the decision is easy.

b.

- At the early stage of the S-curve the performance of the new technology is lower than the performance of the old one. Higher performance level can be assured only by individual solutions.
- Complex products can be certified by numerous technological parameters. Besides high performance features, the new technology can have disadvantages (regarding other parameters) which can raise difficulties in assessment.
- The reliability of the new product (which will be improved in leaps) is lower than that of the previous one. Initial low reliability can be a good basis for negative publicity.
- The new product is not a well-known brand yet, so the customers are confused.
- Changing competences threaten individuals and organizations.
- Investors try to save previous investments and gain time.

c.

- **At the early stage of the S-curve the performance of the new technology is lower than the performance of the old one. Higher performance level can be assured only by individual solutions.**
- **Complex products can be certified by numerous technological parameters. Besides high performance features, the new technology can have disadvantages (regarding other parameters) which can raise difficulties in assessment.**
- **The reliability of the new product (which will be improved in leaps) is lower than that of the previous one. Initial low reliability can be a good basis for negative publicity.**
- **High manufacturing costs. No 'Boston-effect'.**
- **Changing competences threaten individuals and organizations.**
- **Investors try to save previous investments and gain time.**

20. What are the dimensions of the product/technology portfolio?

a.

- **product factors,**
- **market factors,**
- **development and manufacturing factors**

b.

- market size, market share,
- quality, needs,
- growth, decline

c.

- development potentials,
- production and technology potentials,
- investment potentials

21. What are the elements of Porter's Five Forces model?

a.

- rivalry among existing firms,
- threat of new entrants,
- threat of substitute products,
- determinants of supplier power,
- determinants of rival power

b.

- **rivalry among existing firms,**
- **threat of new entrants,**
- **threat of substitute products,**
- **determinants of supplier power,**
- **determinants of buyer power**

c.

- rivalry among existing firms,
- threat of new entrants,
- threat of substitute products,
- determinants of rival power,
- determinants of buyer power

22. What are the typical directions of diversification?

a.

- **full-line diversification,**
- **horizontal diversification,**
- **concentric diversification,**
- **vertical diversification**

b.

- full-line diversification,
- horizontal diversification,
- hierarchical diversification,
- vertical diversification

c.

- full-line diversification,
- horizontal diversification,
- partial diversification,
- vertical diversification

23. What are the main characteristics of innovation strategy by industries based on the scale of economies?

a.

- **complex products,**
- **high manufacturing capacities,**
- **complex manufacturing systems,**
- **parallel development of products and technology,**
- **strong internal R & D,**
- **home based innovations**
- **innovations appear at suppliers**

b.

- being based on external innovation sources,
- customer oriented developments,

- supporting the development of the users,
- widespread dissemination is limited

c.

- ❖ powerful basic and applied research,
- ❖ long lead time of R+D processes,
- ❖ long introduction period,
- ❖ several patents,
- ❖ expensive lab work,
- ❖ huge concentration of capacity,
- ❖ high demand for resources by critical R+D activities

24. Which are the characteristics of the 'Highlight and protect' strategy?

a. Strong and precise market segmentation and positioning is needed. At the beginning of implementation the company must focus on customers with low price sensitivity who are willing to pay a higher price for the product. These customer groups (and the whole segment) should be expanded step-by-step. Price sensitivity is really important when focusing on different customer groups.

b. We can be faced susceptible customers who are open to accepting the product. Early market entry allows gaining a high market share. We can count on these resources for internal development. Gaining experience fast can lead to intensive reduction of costs in the markets.

c. The company should provide unique benefits to the customer. This strategy focuses on target market segments and aims to realize full service to the targeted customers meeting all their needs. Customer needs must be defined precisely and consumption constraints must be resolved. After market entry strong branding activity is needed and new generations should be introduced into the market.

25. The main factors influencing innovation potential are:

a.

- developers of technology,
- integrators of technology,
- technologically closed firms.

b.

- **differentiating adopter: able to create improvements in a focused area**
- **receptive adopter: usually suppliers; they are able to fit their technological improvement to the partner company**
- **differentiating copier: can only reproduce results of others in his/her own field**
- **competent copier: able to cooperate in innovative research networks and to adopt the results**
- **passive differentiator: their competences are only enough to reproduce a closed system.**

c.

- differentiating adopter: : able to create improvements in a focused area
- receptive differentiator: usually suppliers; they are able to fit their technological improvement to the partner company;
- technology integrator: can only reproduce results of others at his/her own field
- competent copier: able to cooperate in innovative research networks and to adopt the results
- passive differentiator: their competences are only enough to reproduce a closed system.

26. Which type of technology transfer is described below?

„…. only the technical system appears to the recipient. The transfer does not make the recipient capable of reproducing the knowledge; it only provides the possibility of using the knowledge."

a. passive transfer,
b. active transfer,
c. mutual transfer

27. Regarding the characteristics of technology transfer and the behavior of participants (donor, recipient, intermediators, etc.), we can talk about the following transfer models:

a.
- adaptation model,
- bridging agencies model,
- problem solver model,
- action oriented model,
- knowledge transfer model

b.
- diffusion model,
- bridging agencies model,
- problem solver model,
- information change model,
- knowledge transfer model

c.
- **diffusion models,**
- **bridging agencies model,**
- **problem solver model,**
- **action oriented model,**
- **technology transfer summary model**

28. What kinds of transfer mechanisms are known in the literature?

a.
- **turnkey project,**
- **inserting technology,**
- LICENSE TRADE,
- JOINT VENTURE,
- PATENTS,
- **buying technological service,**
- FRANCHISE SYSTEMS,
- MOBILITY PROGRAMS AND DISTRIBUTION OF LITERATURE

b.
- turnkey project,
- economic intelligence,
- **LICENSE TRADE,**
- **JOINT VENTURE,**
- **PATENTS,**
- Buying technological service,
- **FRANCHISE SYSTEMS,**

- **MOBILITY PROGRAMS AND DISTRIBUTION OF LITERATURE**

c.

- turnkey project,
- inserting technology,
- **LICENSE TRADE,**
- **FOREIGN DIRECT INVESTMENT,**
- **PATENTS,**
- buying technological service,
- **FRANCHISE SYSTEMS,**
- **MOBILITY PROGRAMS AND DISTRIBUTION OF LITERATURE**

29. What are the effects of North-South transfers on the donor and the recipient?

a.

Donor:

- high added value,
- benefits from the recipient,
- maintaining advantage,
- fractional transfer, additional knowledge;

Recipient:

- know–how transfer,
- reaching supplier status,
- displaying national character,
- parallel progress,
- knowledge combination;

b.

Donor:

- **high added value,**
- **benefits from the recipient,**
- **maintaining advantage,**
- **fractional transfer, additional knowledge;**

Recipient:

- **low reception potential,**
- **import substitution,**
- **rapid progress,**
- **receiving transfer,**
- **generational disadvantage,**
- **knowledge deficit;**

c.

Donor:

- resigning monopoly rights
- knowledge share,
- rebate at offset;

Recipient:

- low reception potential,
- import substitution,
- rapid progress,
- receiving transfer,
- generational disadvantage,
- knowledge deficit;

30. Which is the definition of 'learning association'?

a. "the association is based on agreements, which provide early knowledge transition; and it is often based on informal (interpersonal) elements of implementation."

b. „….associations often develop to minimize commercial transactions and product exchanges, thereby they can drastically reduce the costs of the above mentioned.

c. „….. is an alliance supporting their members and influencing marketing strategy as well. These associations can help to manipulate barriers to market entry. Usually established in the phase of product or technology development.

31. Characteristics of regional clusters

a. ".... A strong territorial concentration and division of labor is created at the same time, with all the elements of the value chain (education, research, implementation, support institutions). "

b. "..... Standards to meet local needs (Retail) "

c. "..... Based on local resources, low level of division of labor, leading to concentration (mining, raw material processing) "

32. The 'diffusion-oriented structure' of a national system of innovation can be described as follows:

a. This model focuses on the development of absorption and adaptation potentials to rapidly acquire and improve technology. It assures a great degree of freedom for the institutions.

b. In this model central development priorities and governmental programs play a great role. State funds are linked to the governmental programs.

c. It is developed for the rapid acquisition and diffusion of new innovation results. The involvement of the state is defined by practical standpoints (speed and previous knowledge).

33. The goal of bridging agencies is to:

a. „…..provide information to the industrial users and to commercialize the scientific results of researchers. Their main task is innovation program management to help the participants of the technology transfer to find each other.""

b. „…..establish relationships between the researchers (R+D institutes, universities, labs) and the actors of the industrial service sector. They usually work as a non-profit organization under special legal conditions. Bridging agencies have their own research activities, but their main task is to enhance know-how transfer at an early stage of basic research and in periods between two development projects."

c. „ to support start-up small enterprises by providing infrastructure. Their mission is to provide grants for the enterprises in the phase of growth.

34. The knowledge-based innovation model can give guidance in the following fields:

a.

- concentration of intellectual capital,
- concentration of relevant information,
- sharing equipment,
- concentration of services,
- opportunities for clustering,

- creating a favorable personal networking atmosphere,
- increasing economic efficiency,
- improving enterprising,
- improving employment,
- increasing the attractiveness of regions

b.

- concentration of intellectual capital,
- concentration of relevant information,
- low service rates,
- concentration of services,
- opportunities for clustering,
- creating a favorable personal networking atmosphere,
- increasing economic efficiency,
- improving the relationship management of entrepreneurs,
- improving employment,
- increasing the attractiveness of regions

c.

- **concentration of intellectual capital,**
- **concentration of relevant information,**
- **concentration of equipment,**
- **concentration of services,**
- **opportunities for clustering,**
- **creating a favorable personal networking atmosphere,**
- **increasing economic efficiency,**
- **improving enterprising,**
- **improving employment,**
- **increasing the attractiveness of regions**

35. What are the main characteristics of angel investors?

a. Institutional investors are organizations using retail deposits to invest in different funds, generating a concentrated demand. Types of typical investors include banks and insurance companies operating as venture capital funds.

b. The members of this non-institutionalized segment of venture capital investment are affluent individuals. These actors finance companies invisibly and anonymously. They invest financial and intellectual capital (business experience, knowledge and social capital) into unquoted public companies with which they have not had contacts before.

c. Inter-company financing is a type of venture capital investment when SMEs are financed by greater firms. Participants of this popular financing can keep their independence and combine their strategic powers. Participants can be in vertical or horizontal relations. Series of studies investigated the options of financing SMEs and found that the best option is non-institutional capital which can guarantee their successful operation.

36. What kinds of venture capital support do you know?

a.

- **seed funding – growth funding,**
- **funding in the early stages,**

- **development and expansion,**
- **initial public offering,**
- **financing MBO and MBI,**
- **improving firms' financial situation**

b.

- seed funding – growth funding,
- funding in the early stages,
- subsidies of development and expansion,
- initial public offering,
- financing MBO and MBI,
- liquidation of firms

c.

- seed funding – growth funding,
- funding in the early stages,
- loans to develop and expand,
- initial public offering,
- financing MBO and MBI,
- buyouts

Glossary

Innovation – Definition by Schumpeter
"The introduction of a new good – that is one with which consumers are not yet familiar – or of a new quality of a good.

1. The introduction of a new method of production, that is one not yet tested by experience in the branch of manufacture concerned.
2. The opening of a new market, that is a market into which the particular branch of manufacture of the country of question has not previously entered, whether or not this market existed before.
3. The conquest of a new source of supply of raw materials of half manufactured goods, again irrespective of whether this source already exists or it has first to be created.
4. The carrying out of the new organization of any industry, like the creation of a monopoly position (for example through trustification) or the breaking up of a monopoly position."

Types of innovation

- Product innovation
- Process innovation
- Social innovation
- Structural innovation

Kondratiev cycles
The long-waves (K-wave) modelling the nature of economic cycles.

Continuous innovations:

- are innovations which can be found in almost every branch of the economy distributed normally in time and space,
- are innovations forced by the production and supply chains,
- are innovations forced by the diversification/segmentation strategy.

Radical innovation

- are based on planned and conscious R+D activity,
- accumulate at the end of a K-wave (different materials or procedures),
- force significant investments and create a wave-effect,
- create several secondary innovations,
- formation is affected by the :
  - R+D potentials,
  - size limit of investments,
  - scale of production,
  - and sales volume limits .

The acceptance of innovation, the adaptation and transfer potentials are high. The companies use their own capital to reinvest in R+D activities to achieve their goals.

New Technological System
With radical technical change new organizational and managerial structures are created which affect several branches and also new sectors and production cultures are created.

Paradigm shift

- all the actors of the economy are affected,
- is based on the radical change of knowledge,
- has a complex mechanism of action and effectuation,
- radical and continuous innovations are accumulating as an after-effect,
- forces not only the economic but the social environment to change as well,
- fluctuations in new fields of science,
- provides facilities to change the infrastructure to a large extent.

The multi-level model of innovation chains
The integrated model of the innovation processes which describes the sequences of parallel activities and their structural coherence.

Technological development and R+D
Technological development is an activity to develop new products or to upgrade the earlier ones, to develop and introduce new procedures, to modernize fixed assets, to improve the production processes and to use new scientific achievements in all the fields of the organization concerned. Product and production developments are part of technological development. In a broader sense applied and technological research are also part of technological development. The last idea is called R+D activities including all the activities mentioned here.

Demand generating innovations:

- focus on latent or unknown needs,
- demand generating is part of the successful introduction,
- facilitate the conscious utilization of research achievements,
- accumulate in "innovation boom" periods,
- primary innovations usually come as a result of demand generating developments,
- the innovator influences the characteristics of the new technology.

Demand following innovations:

- aim to meet existing needs,
- facilitate the conscious utilization of development achievements,
- meet customer needs rapidly, technology transfer has priority over own research,
- are usually performed between two innovation booms,
- are often embodied as pseudo-innovation,
- customers have great influence on development processes.

'Push' strategy
Demand generating developments are the results of the technology push. This kind of 'push strategy' is determined by R+D institutions, the government and the companies' management. The customers have limited or no effect at all on the new technology. These developments facilitate the intensive creation of new technologies. The innovator can influence the demand of the technology and its characteristics (quality, quantity, formation, etc.)

'Pull' strategy
'Demand pull strategy' is based on the demand following philosophy to meet existing needs. This strategy prefers to technological adaptations and knowledge transfer. Customer needs

influence the features of the product or service. The customer is not a passive observer but an active contributor in the process of innovation.

In project organizations the division of labor should be based on the following principles:

- scheduling,
- monitoring progression,
- writing financial plans according to the regulations
- preliminary assessment of the program's performance,
- writing reports, preparing proposals
- program delegation in the organization,
- distribution of resources,
- designing working schedule and working methods,
- ensuring information share,
- team-work tasks, handling records.

The Schumpeterian trilogy that divides the technological change process into three stages is:

- invention (generating new ideas),
- innovation (developing ideas into marketable products and processes) and
- diffusion (new products and processes spread across the market)

Diffusion models

The diffusion models are structures describing the spread of innovations based on technical, behavioral and market analysis studies.

Trigger effect

Trigger effect (pinball effect) is the impulsive process of innovation in technological systems which can be identified through the chain-reaction-like spread in other fields as well.

Characteristics of new products

- embodying a new function
- better performance than that of the product
- new utilization of old product or technology
- new complementary function of the product
- product is transferred to a new market
- new product is created by the integration of old products
- old products are simplified for mass production
- dividing an old product to create new ones
- old product with a new design

User-Driven Enhancement

The primary purpose of development is to provide a better solution for a need known by changing the product's known parameters of performance. In this sense the most important is that new levels of

- cost / price,

- ❖ quality and
- ❖ reliability

have to be provided for the customers in the new product. In the marketing plan of a new product comparison (with the competitors' similar products) has an emphatic role which includes clear and definite requirements in development that have to be complied with.

Developer-driven development

Based on the reserves and the total or partial novelties of the technology owned, the changes made on the product are

- ➢ non-transparent or
- ➢ inconceivable (in lack of knowledge of technological opportunities)

for the customers.

Product developers create apparently illogical leaps of performance and combinations of functions. These developments are based on the competition of developers but not on customer needs, although these improvements can mobilize the imagination of customers. Original ideas can lead to the establishment of new markets, can rearrange the regulations of segmentation of existing markets (SUV for women) or can also change or resolve the boundaries of diversification. (The customer can choose the level of performance without limitations. Instead of bulk goods individually specified products are produced by mass production tools.) This concept of development often causes a radical change or a drastic expansion in the user group of customers.

User–context development

Two types of knowledge can create a new product: the latent demand and the unutilized technological opportunity, which two exist separately. The developers are consciously looking for those user environments where the afore-mentioned latent demand can be found. The continuous and systematic confrontation of the two sides leads to the solution. In this process direct contact with customers, early product testing and continuous collection of spontaneous needs play an important role. Usually the problem is that, in lack of an analogous technical system, a similar product / service or a model, the developers are not able to display concretely or measure with the solution offered the needs of the users/customers. (The customers must experience a certain product before they start to think about better functions, shapes, colors, etc. e.g. 3M–Notepad). It is often revealed that instead of a latent demand there is only a hidden desire without any solvent demand.

Technology–driven development

Development is driven by changes that are provided, forced or suggested by technology. Results of previously successfully applied and proven technologies are often transferred to new user areas (e.g. fish finder for anglers). Implemented developments in the raw materials and components industry often appear in the manufacturing (e.g. aluminum in the automotive industry; results of aircraft industry used in safety devices; results of manufacturing of electric components used in household appliances). The ideas of these developments often come from defense military projects. Civil utilization of these kinds of products is often linked to radical changes of the user's range.

Technology / market co-evolution

The technological potential and the market need meet in time and space, which allows a close cooperation and a relatively rapid development. This relieves the tension of cooperation and reduces the high level of risk deriving from the new product – new market combination.

Empathic design
The foundation of empathic design is the simulative modeling of unexpressed customer needs while we develop a new product or service.

User tests
User tests are great tools to measure the successfulness of the product after manufacturing the prototype and completing the development.

Predominant product
A predominant product is new product or product group which has a significant change compared to the older products (due to innovation processes) and is based on a new individual concept.

The green product
We talk about a green product when the negative environmental impact during the manufacturing, use or recycling of this product is lower than the negative impact of other substitute goods.

Life-cycle curves
Life-cycle curves show the stages a product or a service from its introduction to its decline in the market.

The S-curve
S-curves are mathematical models and graphics to represent the relationship of product or technology efficiency and the level of innovational efforts, investments and expenses.

Porter's Five Forces

- rivalry among existing firms,
- threat of new entrants,
- threat of substitute products,
- determinants of supplier power,
- determinants of buyer power.

Ansoff matrix
A strategic marketing planning tool presenting four general strategies according to the products and the markets

Strategic potentials
In order to implement the formed and approved strategy, the firms must develop their innovation potentials. These potentials can be

- implementation potentials,
- differentiating potentials,
- or knowledge potentials.

Technology
The word technology comes from the Greek 'techne' and 'logos': the word 'techne' meaning 'art, skill, craft' and the word 'logos' meaning 'study of'. So the word technology refers to the expertise, qualification and in a broader sense to the knowledge of creating something.

Transfer models
Transfer models are to describe the nature of technology transfer, the behavior of the participants and to determine the direction of knowledge flow.

Transfer mechanism
Different types of transfer mechanisms

TURNKEY PROJECTS
INSERTING TECHNOLOGY
LICENSE TRADE
JOINT VENTURE
PATENTS
BUYING TECHNOLOGY SERVICES
franchise systems
MOBILITY PROGRAMS AND DISTRIBUTION OF LITERATURE

North – North and South – South or North – South types of technology transfer
The concept to describe technology transfer situations between countries on the same or different levels of development

Technological alliances
Characteristics of strategic alliances:

- pursuit of mutual benefits,
- division of labour to acquire mutual technological advantages,
- favorable access options to license-, patents, materials and equipment;
- ensuring the conditions for the bilateral flow of technology

Cluster
A cluster is a geographically proximate group of interconnected companies and associated institutions in a particular field, including product producers, service providers, suppliers, universities, and trade associations.

National System of Innovation (NIS)
„The network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies. The elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge ... and are either located within or rooted inside the borders of a nation state."

Knowledge-based innovation model

A knowledge-based innovation model is based on creating knowledge, sharing knowledge and utilizing knowledge. Institutions of the model focus on these three different types of work.

Venture capital
In the broadest sense venture capital is a financial capital provided usually to early-stage companies to support the start-up, performance upgrade of the functions or development. The idea of venture capital is associated with funding the start-up of SMEs in high technology industries in the USA. Referring to the importance of venture capital, the literature refers to

this complex form and activity of investment as venture capital industry. Venture capital is a subset of private equity. Private equity refers to all kinds of equipment made outside the stock market. Therefore all venture capital is private equity but not all private equity is venture capital.

Venture capital – Private equity

There are three major types of the investment groups in the private equity market: institutional investors, private investors and investment firms involved in inter-company financing.