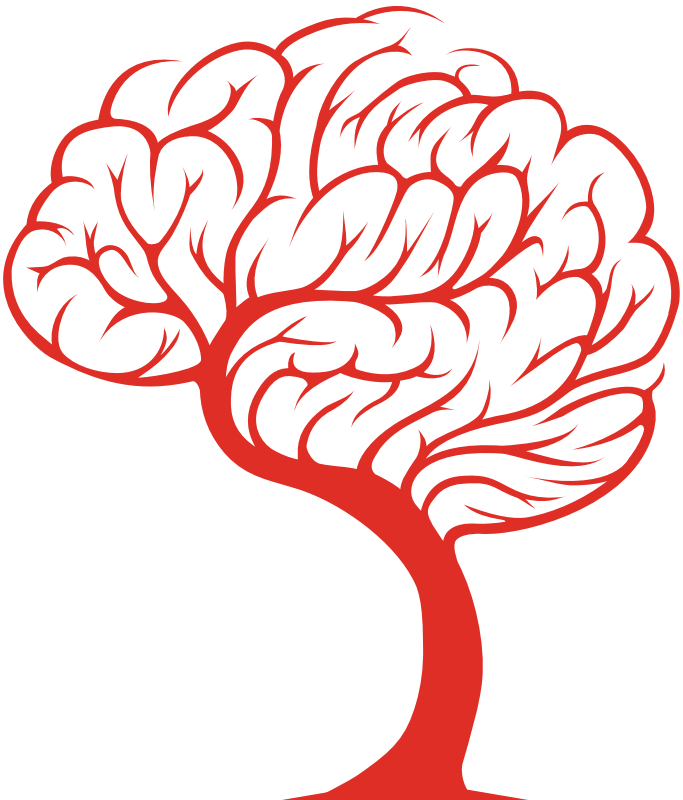
Managing the Fuzzy Front-End of Innovation

Publishing authors: Utz Dornberger and J. Alfredo Suvelza G.



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Managing the Fuzzy Front-End of Innovation

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Institutional Presentation

iN4iN

Intelligence 4 innovation, in4in, is a program of the International SEPT Program of Leipzig University and Conoscope GmbH, a consulting company, both of them based in Germany.
This program brings together a team of high-level professionals with experience in innovation management, enterprise management and development. The applied knowledge is a result of rigorous processes of experiences and knowledge systematization, advanced research on the topic and a direct linkage with the private sector.
Together, SEPT, Conoscope GmbH and their strategic international and multidisciplinary partners, deliver immediate implementation solutions in the field of innovation management and related areas.
In4in and their partners have been carrying out their activities in different regions of the world, with a decade of cumulated experience in Europe, Latin America and Africa.

International SEPT Program – Leipzig University

The International SEPT Program is a research and training program at Leipzig University dedicated to providing theoretical insights as well as practical experiences in the promotion of small and medium-sized enterprises in developing and transition countries.
SEPT was launched at Leipzig University with a strong support from the German Academic Exchange Service (DAAD) as well as other private and public partners.
Because of its location in Germany, SEPT staff have permanently the opportunity to learn from successful German Small and Medium-Sized Enterprises (SMEs) and to analyze in detail their best practices and winning experiences, as well as those of the institutions that foster and promote them.
These exceptional 'Mittelstand' Firms, as they are called in Germany, are known worldwide for their dynamism and constant innovation. Additionally, many of them have managed to achieve leadership po-

sitions in many different countries and markets, basically with high-value-added products and services. For these reasons, all activities that are offered by SEPT are based on the patterns of the outstanding German 'Mittelstand' and the measures that have been successfully applied to promote them. SEPT's main goal is to transmit this knowledge to institutions and firms from all over the world that are looking forward to implementing successful strategies in the promotion of SMEs.

Conoscope GmbH

CONOSCOPE GmbH was founded in 2010 by the companies INNOWAYS GmbH, CONTOUR 21 GmbH and inomic GmbH. These companies have each more than 10 years of experience in their respective fields and have common roots as they were all spin-offs from the Leipzig University. CONOSCOPE works with the objective to lead innovation for sustainable business success and implement innovation in these companies to ensure their long-term success.
What drives us is innovation, in order to offer our customers a comprehensive, unique and compelling services portfolio.

Preface

One of the authors' main motivations to publish this book is the need to raise the success rate of innovation projects undertaken by enterprises and organizations.

The emphasis placed by the authors in the fuzzy front-end of the innovation process is due to the fact that, within their experiences in the different fields of economic activity, they have repeatedly witnessed the decisive impact that this fuzzy front-end has in the fate and results of the innovation projects. When investing the necessary resources, using suitable human resources and promoting essential intangible capacities to cover the demands of this crucial period, it is possible to reduce the risk of failure of the innovation projects. The high rate of failure is not only related to the very nature of the innovation, which essentially means the attempt of something that has not been previously carried out. Many projects fail because of mistakes or deficiencies in the management of their front (early) phases, and these failings are often explained on one hand by the lack of analysis and poor planning, and on the other hand, by the insufficient use of management tools that can bridge knowledge, strategy and practices.

The two sections of this book pursue two main objectives: first, to deliver the reader the conceptual basis to understand the why and how of innovation management with a strict orientation towards market. Since an isolated application of methods and tools, without previously establishing a clear action line and without defining priorities, generally leads to realizing pointless efforts and incurring costs, which could be avoided. Both those who assume a leadership role in decision making and those who from their most specialized areas intervene in innovation projects, must understand innovation as a process incorporating multiple factors, areas and dimensions, and which implies certain complexities for the management and the employees. In this way, it is possible to count with the necessary elements to practice analysis and develop strategies. Based on this approach it is possible to begin with the implementation of tools, which allow materializing strategies.

Both the conceptual approach in the first section of the book, and the set of tools presented in the second section, arise from the practices of German companies and their successful innovation approaches.

Editors

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is a professor in development economics with special emphasis on SME Promotion at Leipzig University since 2004.

After completing his PhD at the University of Jena and a Master in Small and Medium-sized Enterprises Development at the Leipzig University, Germany in the year 2000, Utz Dornberger became Director of the International SEPT Program (Small Enterprise Promotion + Training) at Leipzig University.

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Prof. Dr. Utz Dornberger has been managing R&D projects in the German academic sector. Furthermore, he has international experience in over 100 training and business consulting projects in the field of innovation and technology management in five continents since 2001.

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Mr. Suvelza is an international consultant in innovation management and SME development. His background includes experience in governmental and non-governmental institutions as well as work with international cooperation bodies. Mr. Suvelza has also vast experience as entrepreneur in different sectors of the private economy. His activities as consultant, researcher and trainer comprise projects in Africa, East Asia, Europe, Middle-East, and Central and South America.

Currently, Alfredo Suvelza lives in Leipzig. He runs consulting and training projects with CONOSCOPE GmbH, he is a lecturer and a member of the evaluation board of the International SEPT Program at the Leipzig University and is involved in a series of innovative projects and start-ups with different partners.

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He is a consultant in Technology and Innovation Management specialized in the early phases of the innovation process (including innovation strategy, idea generation, evaluation and implementation) as well as the definition and management of innovation projects.

His career began in Latin America in the areas of industrial design and packaging. Since 2004 he is working at Siemens AG as a consultant for innovation management in its corporate R & D division in Munich, Germany. His projects are oriented for all the four sectors of the company: Energy, Industry, Healthcare and Infrastructures & Cities. He also gives innovation management trainings in Europe and Latin America.

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Mr. Hern´ßandez Valencia currently living in Colombia, He studied a MBA postgraduate course in Small and Medium-Sized Enterprises Development in Germany at the Universität Leipzig. He works as Co-ordinator of Academic Planning of the Universidad Tecnológica de Pereira, as main responsibilities are to plan, coordinate, control and assess academic activities such as creation of new academic programs, market studies on educative context and institutional capabilities to support academic functions.
Additionally, his task include assuring quality standards in the academic processes and administrative activities. He has been part-time professor and a consultant for Innovation Management, project Management and SME Development.

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He has led corporate projects of ERP system's implementation and given consultancy in different industries such as consumer products, personal care, agrochemicals, mattresses, plastics, pharmaceuticals, and services. His latest research included the study of factors that stimulate innovation in 50 micro and small Peruvian companies with a published paper at the IEEE conference APBITM (China).

Luis Bernal, MBA

He is currently in charge of economic analysis and development of innovation projects in biotechnology at the University of Applied Sciences Leipzig (HTWK, Leipzig), Germany. Among the activities in this institution include the development business plans, market and competitor's analysis, as well as consulting issues of technology transfer and management services. As an independent consultant, he plays a role in supporting programs to promote technology transfer, innovation and commercialization between Latin America and Europe. He has worked on projects in countries like Colombia, Panama, MERCOSUR countries, Kosovo, Germany and Peru.

Dipl. Kfm. Uwe Becher

Mr. Becher is General Manager of the consulting company CONOSCOPE GmbH, CEO and Senior Partner of the consulting company INNOWAYS and was Project Manager of the Entrepreneurship Programme for founders in Biotech and Meditech SMILE.medibiz of Leipzig University (Alemania) for more than 5 years. He also worked as Profesor at the International SEPT Programme "Small enterprise promotion and training" of Leipzig University.

His working fields are: Strategical advisory for companies and governmental institutions, especially in the field of internationalizing SMEs and Innovation Management, Training and Coaching for the middle and upper Management, for governmental decision takers and Entrepreneurs, and the Co-Management for companies regarding their foreign market entry.

Uwe Becher has numerous experiences in realizing and supporting exports, in financing and financial planning including company evaluation and in the Business Planning of new companies and the support for Entrepreneurship.

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She studied Business Administration at the Leipzig University. Mrs. Butzmann served at the beginning of her career as an investment manager for the Thüringer Industriebeteiligungs GmbH & Co. She has since 2001 worked as a manager in the company CDA Datenträger Albrechts GmbH, where she was the spokeswoman of the board of trustees in 2008.

Dr. Dirk Bessau

He studied Business Administration at the Leipzig University. Currently he is managing General Bundesverbands WindEnergie e.V. (BWE), after being engaged in the development companies in the energy sector. He has made important contributions to the systematization of knowledge of innovation management.

Maik Seyring

He studied Systems Engineering at the Leipzig University. He worked as a consultant from 2008 to 2010 for the Innovation Lab Services at the Leipzig University, besides operating as a consultant in the area of systems support since 2005. He has vast experience in the analysis and simulation of processes of innovation for service companies.

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Fernando received a Master of Sciences on Technology & Innovation Management (TIM) in 2002 from University of Applied Sciences of Brandenburg, Germany. He is Director of the Executive Program on "Technology Foresight and Innovation Strategy" since 2007 at Austral University, Argentine, and is guest Professor at SEPT-Leipzig University, Germany. His research focus is on strategic innovation management issues in business such us Technology & Innovation Strategy, Technology Foresight, S&T Roadmapping, and Innovation Leadership, Culture and Best Practices. He is engaged in the development of strategic TIM frameworks, methods and techniques like Technology Roadmapping or Scenarios.

Fernando has years of experience in research, training and consultancy projects in industry and academy. He has developed some management frameworks and tools working with organizations like 3M, Bayer, IAE Business School. He has worked and published scientific papers in international journals in Argentina, Chile, Colombia, Ecuador, El Salvador, Germany, Honduras, Mexico, Paraguay, Peru, Spain, United Kingdom, United States and Tanzania.

Omar A. Torres Z., MBA

He has broad experience in export project management and institutional promotion activities for SMEs. After his MBA at the University of Leipzig, he has been working on technology based innovation projects at the University of Leipzig and the Chemnitz University of Technology. He was part of the consultant team for the Biotech-MERCOSUR Program, and currently deals with the analysis and design of institutional models for the technology transfer consortium CERIM - "Central Europe Research to Innovation Models". Mr. Torres promotes the internationalization of SMEs' projects in Latin America and Germany, as freelance consultant.

PART ONE
Concepts

The innovation process and its challenges

The concept of innovation

Schumpeter points out the difference between the concept of novelty, which he names „invention", and that of idea development, which he defines as „innovation". Unlike this definition, currently the term „innovation" is used to point out a new or modified product. Taking this into consideration, different conceptions and points of view led to obtain different definitions of „innovation" in literature (Hauschildt 2004). Although there is a consensus to accept the novelty as a central criteria for the definition of the innovation, among the main authors exist fundamental differences in the use of the term innovation referring to the process or the result of obtaining something considered as „new". If we consider innovation as a process - based on Schumpeter's point of view -, it refers to the „process" followed to obtain something new. From the point of view related to the process objective, innovation is the „result" of a process.
In literature, innovations are often defined as a sequence of activities and decisions related to a temporary and economic way. In the conception of innovation as a process, it would be necessary as a first step to recognize that „invention" and the economical use of it are different. Roberts (1987) leads this conception to a simple formula: „innovation = invention + exploitation". According to this definition, innovation can be understood as a market-oriented economical use of an invention.

The dimensions of innovation

In this book, innovation is considered as the commercial value (utility, usefulness) of a novelty, thus distinguishing it from invention. Innovations can occur in the following dimensions:

- in products and services as product's innovations or
- in internal management processes and market interaction as process innovations.

Figure 1 illustrates in more detail this general description of the dimensions of innovation.

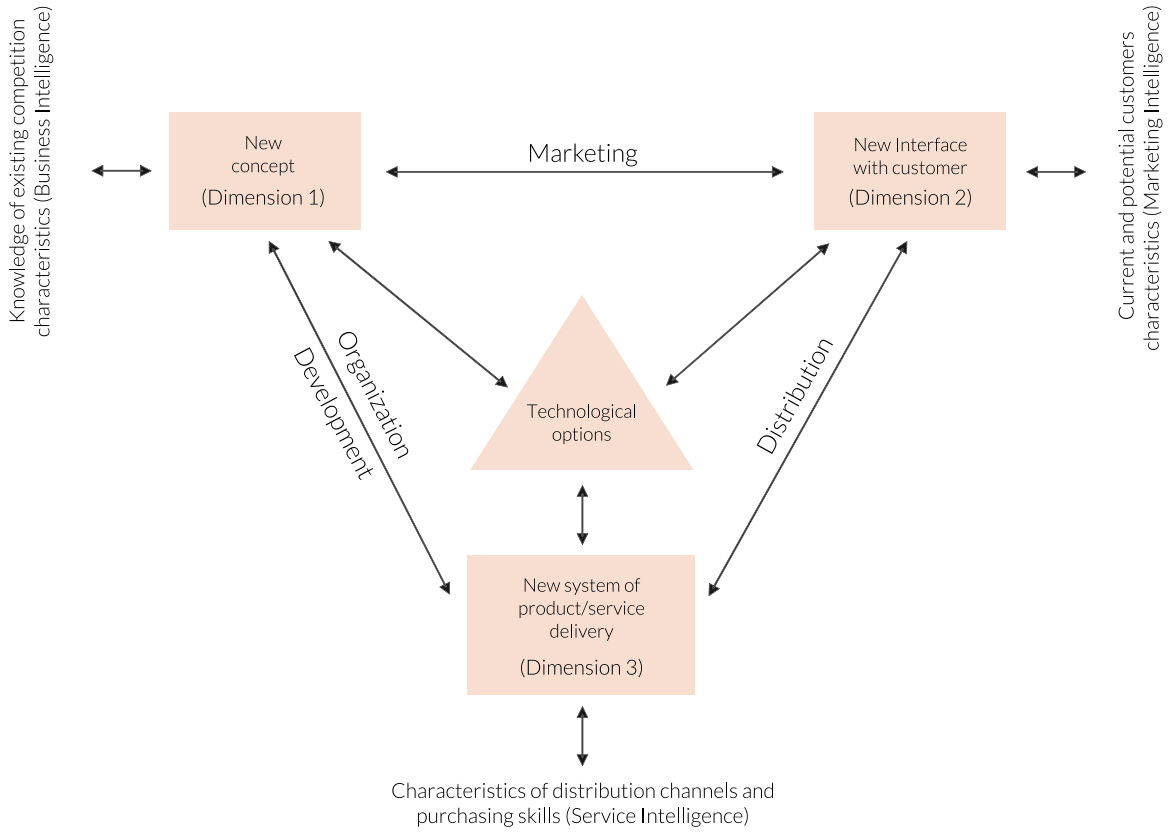


Figure 1 : Dimensions of innovation. Source: Modified from Bullinger (1994).

New technological developments have a decisive influence over new product and service concept development (Dimension 1) and simultaneously define the starting point for the development of new interfaces with clients (Dimension 2), as well as define a new system of products and services delivery to the client (Dimension 3). Particularly new information technologies and communications have driven countless innovations, which have changed the scene of activities in areas such as marketing, distribution and processes organization. The success behind service provider companies, such as Amazon or Dell, has been based especially on the use of Internet to establish new forms of interaction with clients on a framework of relatively traditional products trading such as books and computers. Thus, the innovative capacity of a company does not only rely on the employee's technological abilities, but it is increasingly based on non-technological abilities, such as market and service intelligence.

Stages of innovation process

The innovation process is made up of different stages. Figure 2 shows an ideal innovation process within a company. The starting point is the identification of opportunities for the enterprise. This will allow to search for novelties in the idea generation phase. In this stage new proposals and approaches will be evaluated and chosen. The concept „Fuzzy Front End of Innovation" summarizes these three phases. This concept is particularly important for the success of the innovation process, because the selection of the innovative idea mainly defines parameters such as characteristics, costs, and time requirements for the development of a new product or service, etc.

In the product development phase, is critical to focus the limited resources of the company such as financial capital, human capital, time, among others, in projects that promise to be successful. Finally, in the commercialization phase, innovation should be directed to the needs of customers and promptly implemented in the market (time-to-market).

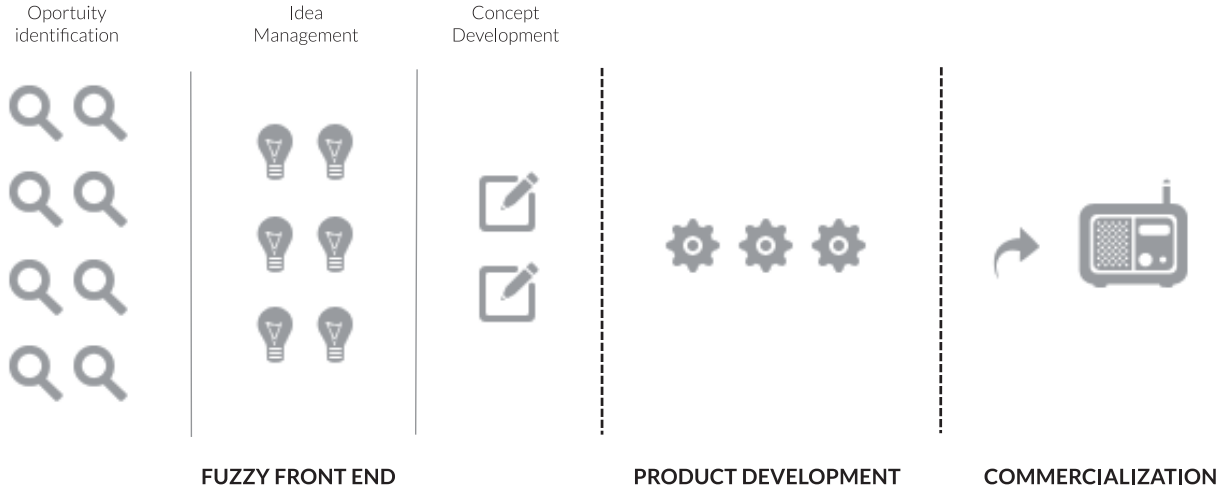


Figure 2: The innovation process inside companies. Source: Adapted from Chesbrough (2006).

According to the previous explanation, it is essential to consider the „process" nature of innovation projects. The innovation process requires the collaboration of different people and departments in the company which are related to research and development (R&D), marketing and sales, production and purchasing. The management of innovation should exert a special role and leadership throughout all phases of an innovation process.

Management of Innovation Processes

Hauschildt (2004) denotes innovation management as „the operative configuration of the processes of innovation“. The tasks of innovation management border closely with those of general management. Decisions on the implementation of innovations show specific characteristics which differ from routine tasks in the administration:

- Complexity/ multi-step
- Orientation towards future
- Uncertainty and risk
- Creativity/imposition

These characteristics clarify the substantial differences in innovation management and the general management of routine processes within a company. The task of the innovation management is “a process-oriented work” and not an isolated work, being responsible for a unifying task (and integral), because in the field of innovation processes different departments are involved. This “interdisciplinary” work is one of the key success factors for innovation.

These features of innovation management also help us to understand why the success rate of innovation processes is relatively low. Industry spokesmen often say that between 80% and 90% of new products are never successful, and a recent study by Nielsen Bases and Ernst & Young puts the failure rate of U.S. consumer goods at 95% and for European consumer goods at 90%.1

For this reason, the key task of the innovation management is the application of management tools which allow reducing this failure rate and, thus, increasing the efficiency of the innovation process, guaranteeing that innovative products or processes will ensure the survival and growth of the company in the market in the medium and long term.

Challenges of innovation management

The minimization of risks in the context of innovation processes plays an important role, especially for small and medium enterprises. Consequently, three key points must be considered for reducing risks in innovation processes (see Figure 3).

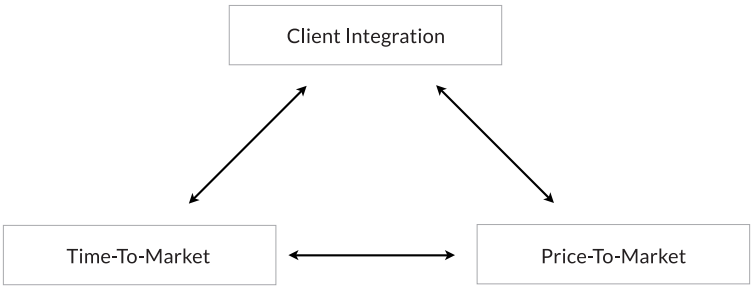


Figure 3: Key issues for minimizing risk in innovation processes. Source: Own elaboration.

Time-to-Market Management

The fast development in scientific research and technological development and the changes in consumers' behaviour, especially in the field of consumer goods, encourage the progressive shortening of the products' life cycle (see Table 1).

	Construction	Automotive	Machinery	Electronics	IT	Chemical
90s	9,3	7,3	7,1	6,3	5,3	5,5
70s	13,0	10,9	12,0	11,6	11,1	9,8

Table 1: Average length (in years) of the product life cycle in different industrial sectors, comparing the 70's to the 90's of the 20th century. Source: Develop based on different sources.

Simultaneously, one can observe the lengthening of the time required for the development of new products. The new products must be equipped with more and more features every time, which implies an increase in its complexity. In the same manner, reducing the size of the products plays an important role. As a result, the gap between the life cycle of the products in the market and the time required for its development is shrinking, and frequently the development period is even longer than the life cycle of the product itself in the market (Perillieux, 1995). The management of innovation must therefore take into consideration an accelerated reduction of life cycles. This situation must be, consequently considered in the integrated analysis of product life cycles (see Figure 4).

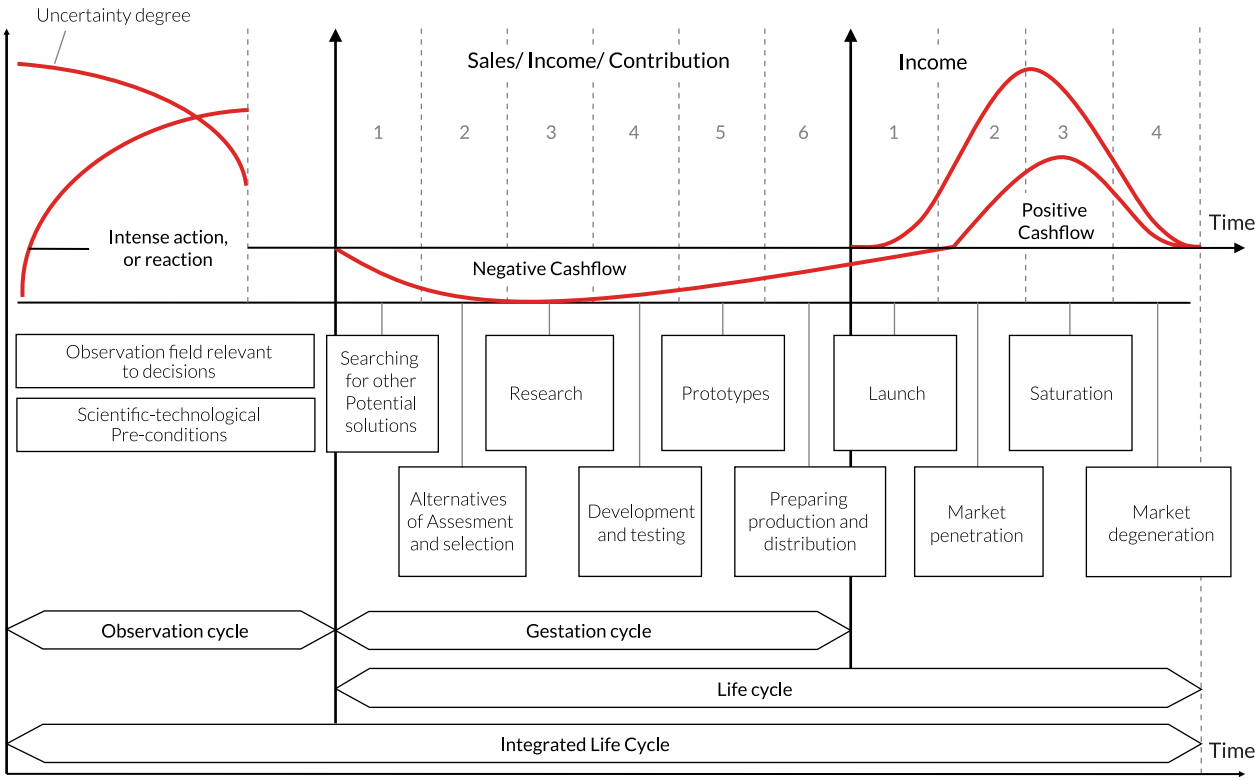


Figure 4: Integrated product life cycle. Source: Modified from Bullinger (1994).

The integrated life cycle of the product includes both the observation of the scientific-technological pre-conditions prior to a technology as well as the period between the search for alternative solutions in this domain and the market exit of the innovative product.

As a result, the management of Time-To-Market has gained increasing importance. Innovative companies require management tools that enable them to assess which impulses produce technological progress and market innovation. It is therefore necessary to generate innovation plans through the synchronization of the technological potential and the market demand. This allows defining the timing of innovation in the context of innovation projects.

Price-to-Market management

One of the major problems in the management of innovation projects is the management of Price-To-Market (price when launching a new product to the market). Many projects fail because of underestimating costs. For this reason, it is essential to pay close attention to the management of the Price-To-Market

since the beginning of the innovation process. Doing so, the innovation project is in line with the target market since its inception and hence, the profitability of the product or service holds a competitive advantage or helps easily to obtain it. In this process, one has to consider both development costs and production or service delivery costs. This is particularly important in innovation projects in highly competitive markets with short life cycles and a dynamic price development.

The goal is, thereby, to align the product or service development with the market and competitors actions. This implies the need for a paradigm shift in the management of innovation projects, which traditionally have posed the question: How much will the new product cost and how can the profitability of the company be ensured when selling this product? But the central question is certainly much broader: How much can the new product cost and how to target it toward the client's needs and the market to ensure the profitability of the company? Therefore, the cost factor (target costing) is crucial when defining the new product or service model (see figure 5).

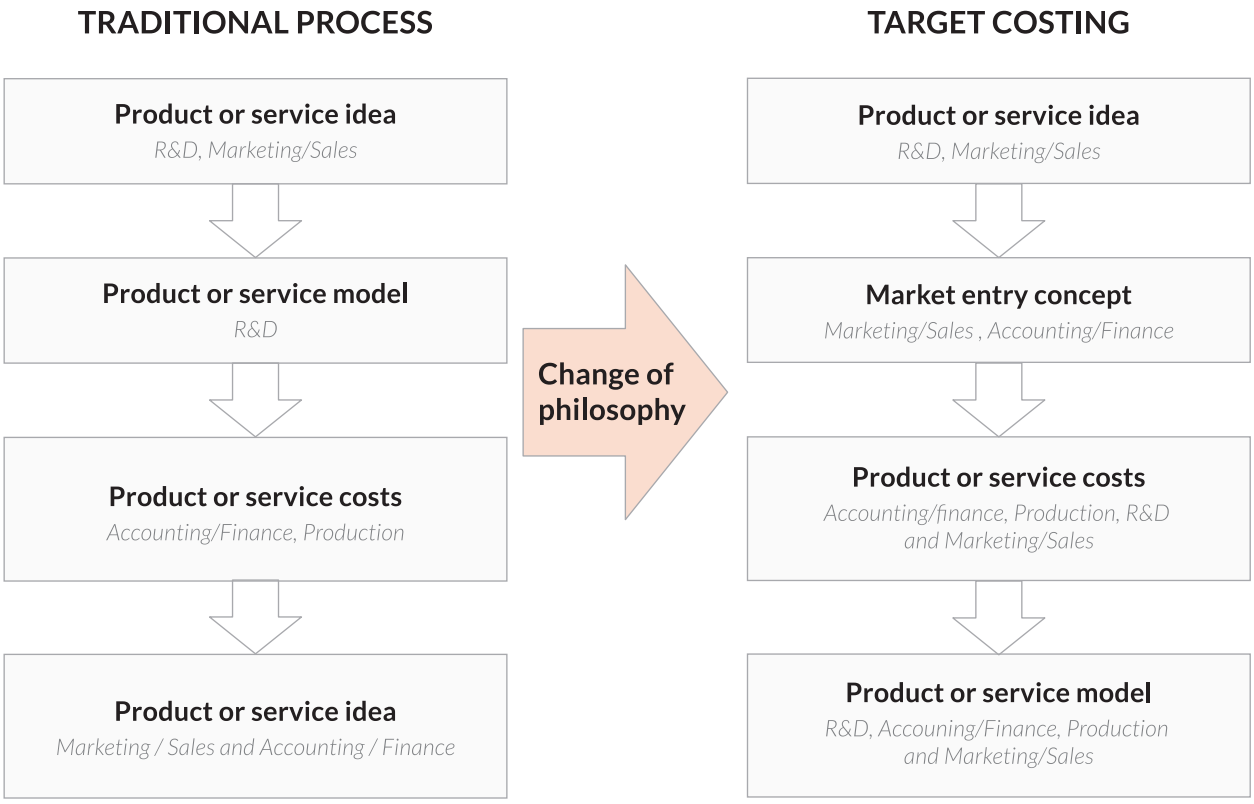


Figure 5 : The Meaning of the cost factor in the definition of a product model in the context of Time-To-Market Management. Source: Own elaboration.

Client (customer) integration in the innovation process

The narrow scope for planning and the great uncertainty of innovation, especially in its early stages, require a high level of cooperation between the different parties of the company involved in the project. Additionally, a good measure to reduce the risks of development is usually client integration in innovation processes. The client can give clues to the company about unsolved problems in the market and ideas for developing solutions and opportunities to implement certain existing technologies. The information concerning both the market and the technology can lead to the generation of ideas and concepts for new products. In the later stages of the innovation process, the integration of customers in product testing or application development may generate useful inputs for the improvement of products or services or for the prevention of failures.

Companies that involve customers more in obtaining ideas and their development processes, increase the successful launch of the product to market despite the high degree of uncertainty of these innovations. Particularly, client integration leads to a reduction in development time by up to 20%. Additionally reductions in the costs of development and product complexity can also be generated, though on a smaller scale. Companies which actively involve clients in the innovation process frequently appear more among the pioneers of the market than those that make it less often. The pioneers, given its time advantage, can temporarily enjoy a "monopolistic position" and catch the profits of the early stages in the product life cycle. The adaptation of a new product or service to the customer's demands is undoubtedly a major aim of innovation management. However, it must be recalled, that the customer's capacity to predict his/her tastes and needs has a limit. In most of the cases, customers refer only to their current needs and problems; that is to say, to situations which are within the scope of their direct experiences and imagination.

Suggestions to radical innovations, which can be distinguished for being functions or configurations so far unknown, cannot be expected from the part of the customer. Hamel and Prahalad (1995) make reference to innovations such as mobile telephone, fax and CD player, among others, to which clients were not manifesting any explicit need before they were launched to the market. Even Henry Ford had an opinion about it: "My customer's needs were faster horses, not modern transportation such as an automobile".

When an enterprise bases its innovation activities only on client's recognizable needs, it leaves apart many market opportunities. For this reason, it is important that during the idea generation phase both types: unexpressed demands and needs from people who do not necessarily belong to the current target group have to be considered. In this way, the potential existing within the market can be recognized and used.

Strategic management of innovation

Introduction

Currently, most of the markets are distinguished for having very aggressive and dynamic competitors headed by innovative companies. In this environment, called „hyper-competition" by some authors, new competitors are oriented to create constant unbalances and changes through new technology, shortening of the products life cycle, unexpected entries to new markets and radical definitions of the limits of their business core (D'Aveni, 1995). Quality and price are basic conditions required to be competitive (Forcadell and Guadamillas, 2002). As a consequence, enterprises should seek new markets in which they can maintain, at least for a short period of time, a competitive advantage which allows them to obtain some advantages (D'Aveni, ídem). In this context of intense competition, innovation is seen as one of the most valuated strategic resources and becomes indispensable.

The innovation strategy, assuming the enterprise as the unit of analysis, must be incorporated in the global business strategy of the company. Thus, this chapter will approach, in first place and on a succinct way, the definition of strategy; in the second place, the business strategy; later on, how the innovation strategy can be integrated into the business strategy; finally, the elements conforming an innovation strategy will be discussed.

Michael Porter (1996) states that a strategy is the creation of a unique positioning which the company achieves in the market through the implementation of a set of differentiated steps or actions which will result in a competitive advantage that will be tenable over time.

According to Porter (1996), a strategy focused essentially in the operational efficiency was successful in the early 70´s and 80´s. Japanese companies were able to penetrate and lead markets with pioneer practices related to total quality management and continuous improvement because their competitors were far from the productivity frontier. However, the rapid spread of these good practices would result in the fact that competitors could also acquire such capabilities generating standardization (homogenization) instead of differentiation and, thus, these were no longer strategic (good policy) practices. Moreover, this convergence of strategies normally occurs in a scenario where equality drives to price competition, ultimately leading profits to decline (Galavan, Murraz y Markides, 2008). Robert Burgelman (2002) from Stanford University, defines strategy as a way to gain and maintain control over one's own destiny. Galavan et al (2008), with a practical orientation, sustained that an isolated strategy lacks life and energy. It would only come to life through its linkage with innovation, leadership and change management.

From the definitions presented, it can be concluded that a business strategy based on systematic and continuous innovations, radical or disruptive, may provide the distinguishing element that has been sought to achieve the goals set by the company. However, due to the high degree of uncertainty and the risk inherent to innovations, the innovation effort deployed by companies must be focused and planned in a consistent manner. Innovation efforts without clear goals or well-conceived strategies are often detrimental to the company's performance and represent a negative impact factor in the company's innovation culture.

Business strategy and the innovation effort

In order to understand the relationship between the global strategy of a company and the role of the innovation efforts, it is necessary to review some basic concepts related to strategy and to consider the difference between a current status, a future status and the means and ways to accomplish the change from one situation to another.

Every company has a goal, whose realization will depend on the actions that its members carry out. The company's aim is reflected in its vision, goals and objectives, whereas its actions are fulfilled in its mission, strategies and tactics (see Figure 6). The first group is related to a state that the company wants to achieve in the future. The second group represents courses of action to be taken in order to achieve the proposed end.

The vision is what the company wants to „become or reach" in a given time. The goals define and shape what the company understands as the established vision. These have to be demanding enough yet realistic. If the goals are too high, they will demand unnecessary efforts and inadequate decisions that will affect the company. If they are mediocre, they will lead to waste of the company's capabilities and potential, will limit the employee's impetus and motivation, and will leave the door open for new competitors' entry. The objectives are the milestones that will transform goals into reality, and therefore, they should have measurable attributes such as the deadlines to be achieved and the quantity or magnitudes to be obtained. This hierarchical set of aims, goals and objectives will provide the criteria to determine whether the performance of the company was in line with the desired results or not.

The mission is, by contrast, what the company must „do", the purpose of its existence and the justification of its vision. Business strategies are the plans and courses of actions aimed to achieve goals: the strategies answer the question how to achieve the goals. The mission will be the point of reference when establishing business strategies. From the multiple strategies which can be raised to achieve the established goals, only those in line with the company's mission will be selected. For example, a company whose mission includes protecting the environment would do wrong if planning a strategy which contradict or ignore this principle. On the other hand, tactics (which allow implementing strategies) are achievable in a shorter period and have a more limited scope. The mission, strategies and tactics will also shape the image and personality that the company will project in its environment.

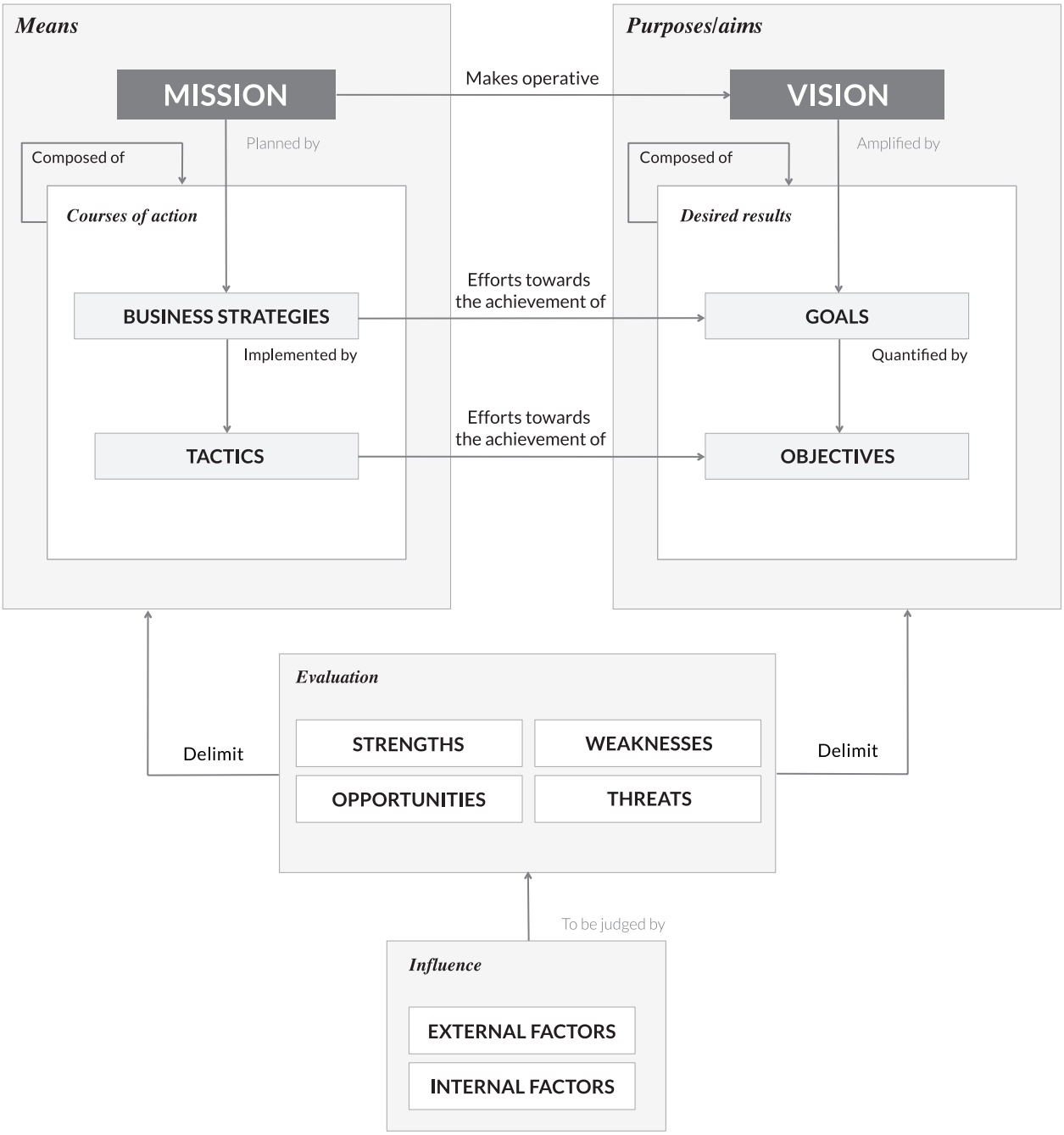


Figure 6: Business planning model. Source: Adapted from „Business Rule Motivation Model", The Business Rules Group (2007).

According to the model presented on figure 6, the strengths, weaknesses, opportunities and threats evaluation allows to delimit risks and rewards which arise from the influence of external and internal factors both in the purposes (vision, goals and objectives) and in the actions (mission, strategies and tactics). If they are not identified, analysed, and evaluated in a consistent way, these factors will not have an impact

on the business planning, but they will have an impact on the implementation and results.
Figure 7 shows, as an example, a summary of the mission, vision, great goals and main strategic axis of Procter & Gamble (P&G) in order to contrast the differences. According to Robert McDonald, President and CEO of P&G, innovation makes these strategies to become winners.

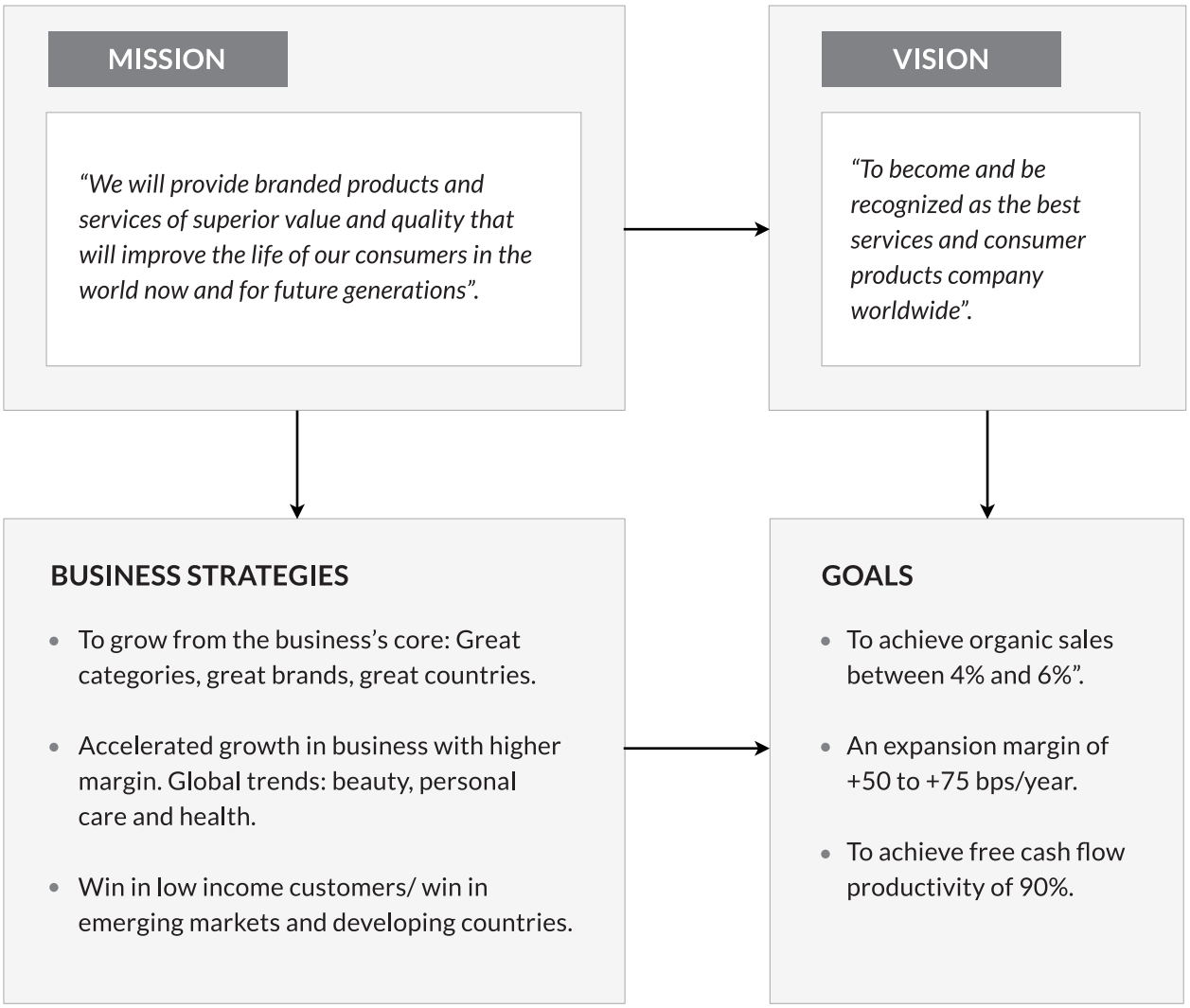


Figure 7: Example of vision, mission and strategic axes of the business. Source: Author´s Own elaboration based on P&G website and McDonald (2008).

Once the model of Business Strategic Management has been presented, it is possible to identify the starting point of the innovation efforts of the enterprise. The possibilities of innovation lie in the gap between what the projections suggest on where the enterprise is and where the company wants to be (Scott, 2008). Figure 8 clarifies this concept.

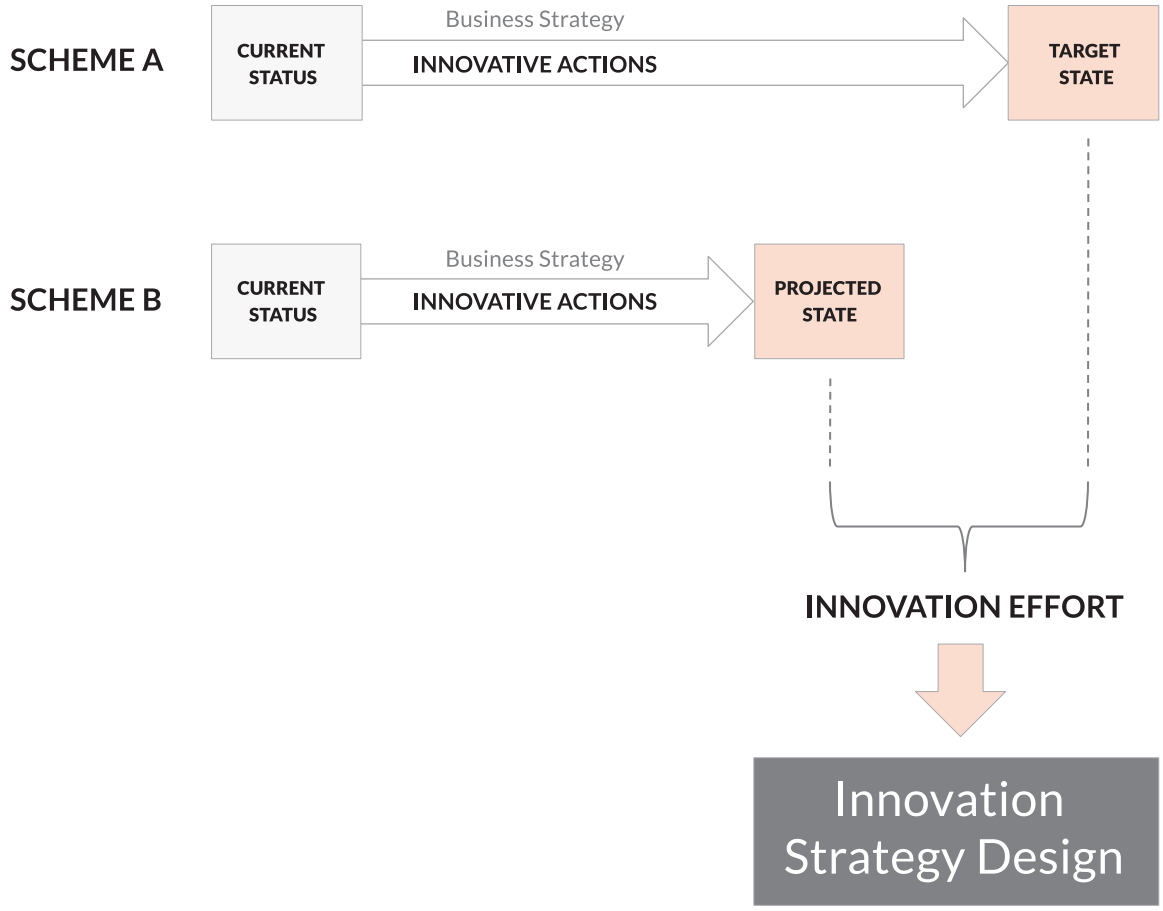


Figure 8: Innovation effort in Business Strategy. Source: Own elaboration.

If a state would be defined as a picture1 of the company results in a given moment of its existence, it could be deducted that the target state, realistic but demanding, represents precisely the group of results to be achieved (scheme A), while projections based on historical data of the company's performance would conform the projected state (scheme B). Assuming that the company only wishes to achieve its projected state (scheme B), it means that it will work on the same way that it has been done, without making changes that will produce a significant difference.

Indeed, the difference between the targeted state and the projected state establishes the gap to be filled by the additional contribution or the „innovation effort" that the company must be willing to perform, if it intends to reach the most challenging goals (scheme A). As shown in Figure 8, innovation is not an end, but the means which is a critical component of the business strategy. Depending on the magnitude of the required innovation effort, an innovation strategy will be designed in order to achieve the aspirations for growth of the company and to achieve the changes which will allow reaching the outlined targets.

Using the same chart (Figure 8), the phenomenon of hyper-competition can be better explained. For a

leader in innovation, the scheme B would point that its „traditional actions" are already including efforts and innovation activities, since historically, the enterprise has been innovative. When such companies pose even more challenging target to states with progressively higher innovation efforts, then the hyper-competition environment is generated in the market. These companies not only have a good innovation management, but they optimize it on a constant basis. Consequently, competitors who do not adopt strategic actions for innovation will become less competitive in the market and, therefore, they will have fewer chances to survive.

The innovation effort of the company will be deployed in two big stages. The first one is the strategic diagnosis and the second one, the design of the strategy itself.

Strategic diagnosis

The proper strategic management of innovation requires a good interpretation of reality and state of art. It is necessary to know the current status of the company and its products with regard to that reality and identify the different possibilities for courses of action.

To support the strategic decision-making, it is necessary to begin with the analysis of the product and services life cycle, of the technologies related to a product, service or process and of the industry or sector in which they compete.

Product and technology life cycle

A starting point for the analysis of internal strengths and weaknesses in the strategic management of innovation is the product life cycle model. The central idea of this model rests on the thought that goods and services have a limited lifetime in the market. Among the typical phases of this restricted life course of the products, the typical trajectories of sales and profits are also reflected (see Figure 9).

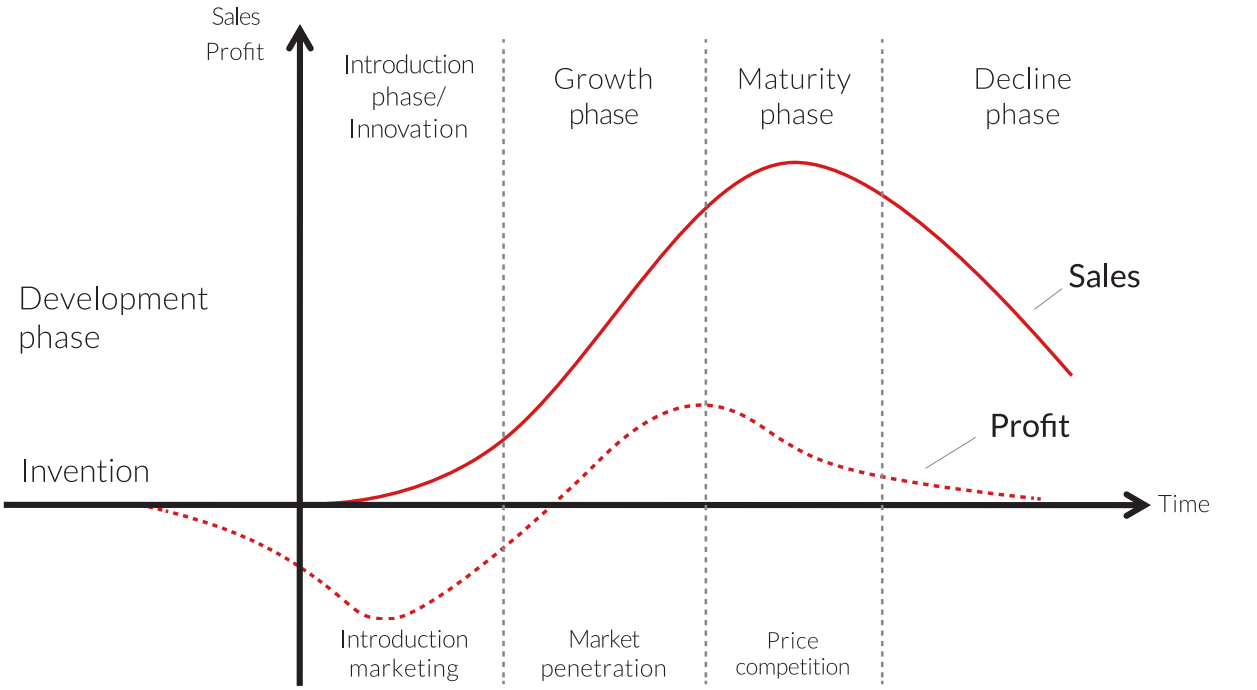


Figure 9: Product Life Cycle Model. Source: Lenk y Zelewski (2000).

Starting from the finding of a new solution to a problem (an invention), the product will be developed until it reaches its maturity in the market. It is then that the development costs arise in the company, which vary noticeably according to the sector in which it is competing and the technology it is using. With the market introduction, the commercial utilization of this novelty is produced (this is the innovation itself). Despite the continuous sales growth, the measures to penetrate the market and to increase sales commit financial resources. A positive transformation will occur on the return of investment only in the so-called growth and maturity phases. In the last phase, the declining phase, sales and profits will decrease.

Products are generally not sold in their original shape indefinitely. Planning products or services without considering their finite nature in the market is likely to become quickly an obsolete planning. The absence of a previously developed business strategy would avoid the recognition of this problem. If the company limits to "expect" incremental revenues and profit growth in the future, it will soon find a divergence between the expected numbers and the actual achieved figures (Figure 10).

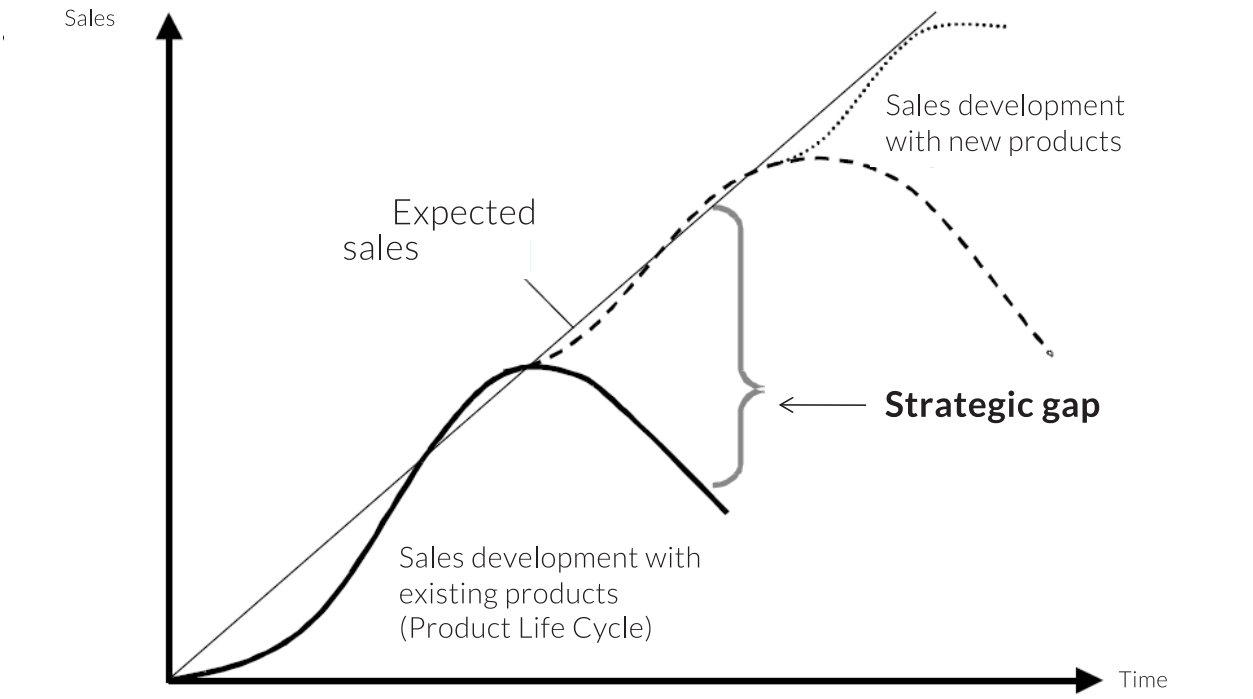


Figure 10: The problem of Strategic Gap. Source: Lenk y Zelewski (2000).

Measures to bridge the strategic gap are a timely and systematic analysis of the company (internal strengths and weaknesses), the analysis of the environment (opportunities and threats) and the development of the strategic guidelines of the company. Not only the products and services that the company offers have a limited lifetime. The technologies on which products and services are based can also age. This ageing process or obsolescence is subjected to a growing dynamism due to the rapid technological advancement, for example in information and communication technologies, engineering, biotechnology and environmental engineering. Many technologies and products make their way in a few years; one only needs to think of the generations of computer processors. The idea of a limited lifetime is also valid on the context of technology life cycle. For instance, the McKinsey model clearly shows the need and difficulty that companies have to change an already established technology to a more efficient one (see Figure 11). Showing a typical S shape, technologies have first a growing success, which then decreases from the point of view of their performance. Although at one point an old technology may have a higher performance, the development potential for the future are much higher with a new technology.

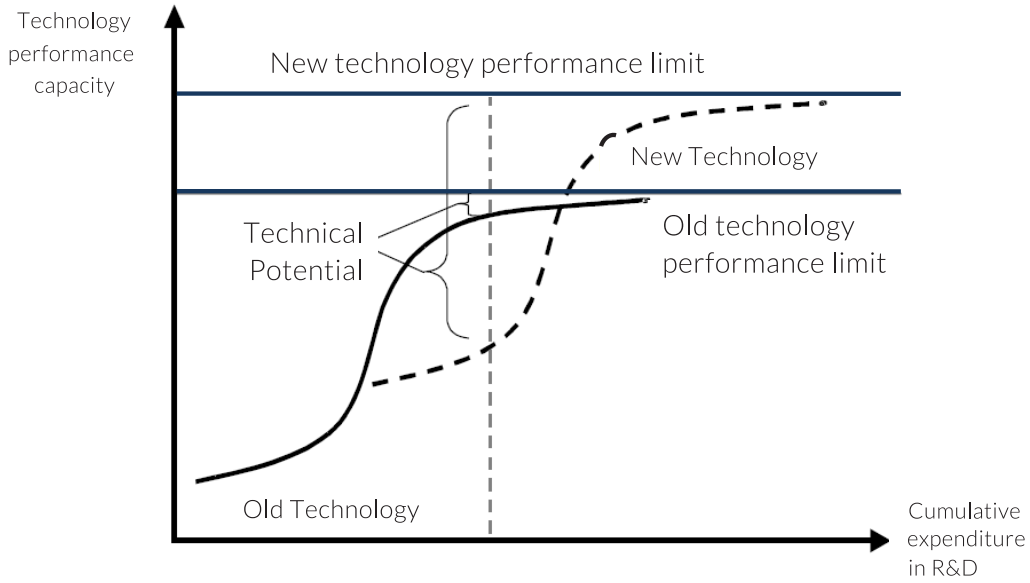


Figure 11: McKinsey´s Technology life cycle. Source: Taken from Perillieux (1987) p. 36..

The classification of a technology according to its position in the life cycle, proposed by Arthur D. Little, can help not only to recognize internal technological problems, but also to identify external technologies as well as the high and low attractiveness of a technology. In this classification, it's possible to differentiate the following stages:

- **New Technologies**
  The implementation in a cost-effective way is not yet clear or is unsafe.
- **Setting pace technologies**
  he first effects of its usage in the potential market and the competitive dynamic can be already recognized.
- **Key Technologies**
  They influence significantly the current competitiveness.
- **Basic Technologies**
  Competitors dominate (control) these technologies more or less at the same extent.
- **Displaced technologies**
  These technologies have been already replaced by new ones..

External and internal analysis

At a time when the product's life cycles shorten, every competing company which wants to build its position in the market needs successful innovation strategies. The basis for the decision on which strategy must be followed is an analysis of the company (internal) and an analysis of the environment (external). The internal analysis deeply explores the strengths and weaknesses, the resources potential, structure and infrastructure, and core competencies of a company. Internal factors also include the explicit or implicit values of the company such as the practices commonly used in the company, the assumptions and dilemmas, and the prerogatives of those in power in the company (The Business Rules Group, idem/). The portfolio analysis of the company and its products also belong to the internal analysis.

In contrast, the analysis of external factors examines, on one hand, the macro environment, whose factors are determined by the environment or surrounding conditions, which affect the existence, performance and development of the company. Current and future economic environment belong to this group, as well as the legal and regulatory environment, the changes and trends of society, the political environment and the overall evolution of technologies. Moreover, the external analysis explores also the competitive environment, which is constituted by five forces (Figure 12) immediately influencing the performance of the company and, thus, the strategy's design. Michael Porter proposed a very practical model for analyzing the competitive environment.

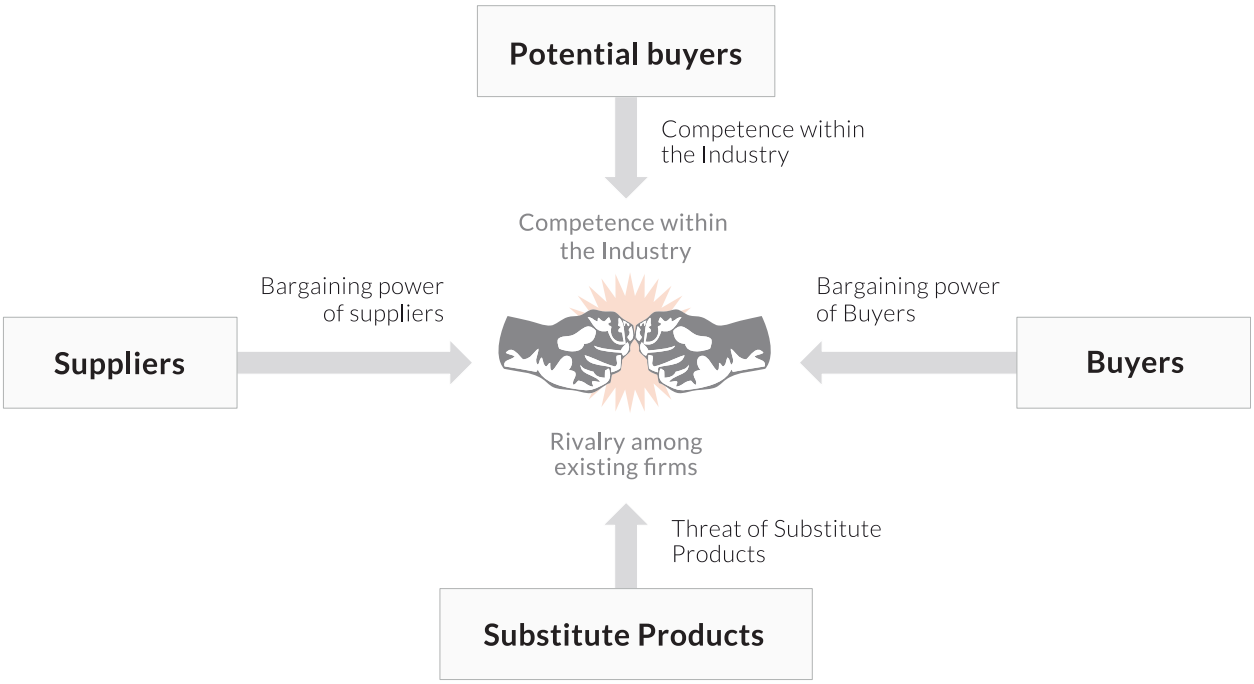


Figure 12: Michael Porter's five competitive forces. Source: Porter (1997), p.26.

Generic strategies and its impact in innovation management

Porter distinguishes the business (corporate) strategy in two dimensions: cost-leadership based strategies and differentiation strategies. These are complemented by its scope in the market – serving the whole market or focusing on a niche (niche strategy). These strategies are called competitive strategies (see Table 2).

		Competitive Advantage	
		Low cost	Differentiation
Competitive scope	Wide target Market	Costs leadership	Differentiation
	Narrow target Market	Focus on costs	Focused differentiation

Table 2: Business strategies. Source: Porter (1997).

According to Porter (1997), the long-term business success can be gathered from the implementation of only one of these strategies. Positioning „in the middle", in other words, to assay one and the other , does not lead to long-term business success, since according to him, focusing only on one of the strategies ensures the survival capacity of the company. The cost-leader can be identified in the market because of its low prices, whereas a company with a differentiation strategy highlights the superior performance of its products.

Similarly, the decision of the company's strategic management is strongly influenced by the definition of what is relevant in the market. In this way, the entire market can be reached or a niche strategy can be intentionally chosen. In the latter, the company must focus on the specific requirements according to its market segment. This course leads thus either to a cost leadership or to a differentiation strategy.

The basic definition of such strategy has a highly significant effect in the innovation management. In the context of a cost-leadership strategy, the innovation on the company's processes acquires a great importance. If in the long term exists a competition for the lowest prices with all the other players within a

given market, the company must be able to produce goods at lower prices. A quality leader, by contrast, must convince its customers with a relatively high quality. Current improvement and renovation projects are essential for the long-term business success, in which innovations become a fundamental need in order to maintain the quality-leadership strategy.

According to the strategic direction, the innovation efforts will be focused on different fronts. By specifying the links between process and product innovation, it can be understood that, in both cases, over time, technological innovation in its different forms becomes relevant. Just as product innovation usually lead to process innovation, process innovation also generate at least incremental product innovation. In any case, the direction of the innovation efforts can be differentiated according to the company's strategy. In the case of the niche strategy, it is argued that a company must offer its products according to its customer's wishes in a relevant market segment. These wishes may mean adapting to quality factors, cost, etc. Certainly, thanks to the homogeneity of niche customers, compared to an entire market, it is possible to implement more focused actions; it even becomes irrelevant to select among the forms of strategy. A well conducted market analysis can provide the basis to decide whether to apply a quality strategy or a price strategy.

Analysing the industry and its life cycle for forecasting sector's growth

The concept of sector life cycle is an extension of the simple concept of product life cycle. This is a tool that provides diagnostics of the sector situation in order to forecast its development. The base would be the following hypothesis: when immediate reaction or responses in the very short term is needed because of changes in the company's environment, the costs of measures for strategic adaptation increase. The concept of sector life cycle will be helpful for the early detection of relevant strategic problems, avoiding thereby higher costs caused by precipitated immediate reactions.

The position of the strategic business units in the framework of the current industry situation must be determined and a forecast of the future development should be carried out. This should ensure that necessary measures are taken in a timely manner. The need of these measures will become evident by:

- Identifying gaps in revenues caused by the simultaneous decline of the main products.
- Not noticing in the right moment structural changes in the industry development.

In order to know the industry life cycle, the products and „products generations" life cycles must be added (Figure 13). A product generation consists in all sorts of products which can solve certain customer's problem with a given technology. An example is the set of all the electronic watches which solve the customer's problem „time measurement and expression" with the aid of quartz oscillators and electronic integrated circuits. However, the industry is defined by a generic problem of the client, for which there is a solution regardless of the technology to solve it. So arise and vanish sectors or industries: according to the emergence and disappearance of typical problems and needs of customers (in the example, the need or problem to „measure and see" time).

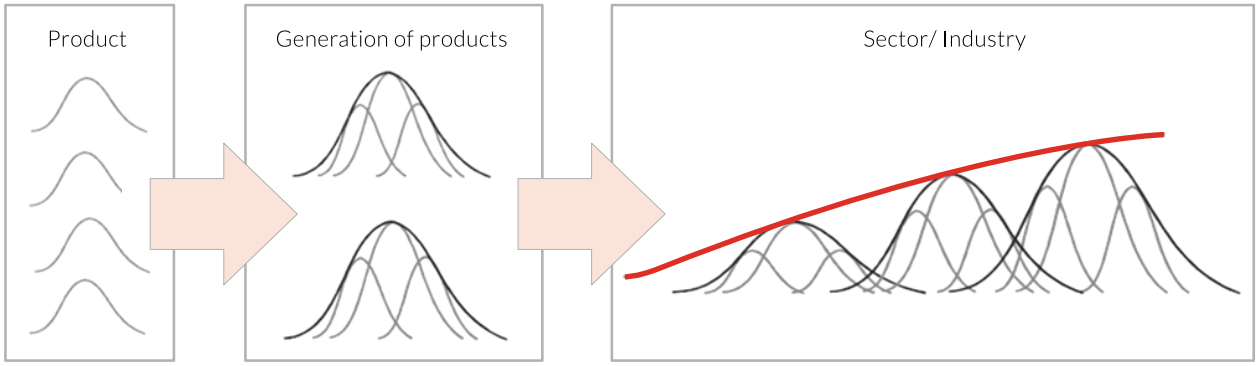


Figure 13 : Addition of product and life cycle of the product generation. Source: Lenk and Zelewski (2000).

An industry life cycle over time (in the sense of the evolution of customer problems regardless of the solution) can be understood as the sequence of several new technologies (in the graph, technologies life cycles are represented by the blue intermediate curves grouping different product life cycles curves). While an industry life cycle comes to an end only when the customer's problem disappears, different product generations can grow and decline within the same period (the long red line at the top corresponds to the life cycle of the industry).

The graph below (Figure 14) shows an ideal industry life cycle for computer based information processing systems used in the office:

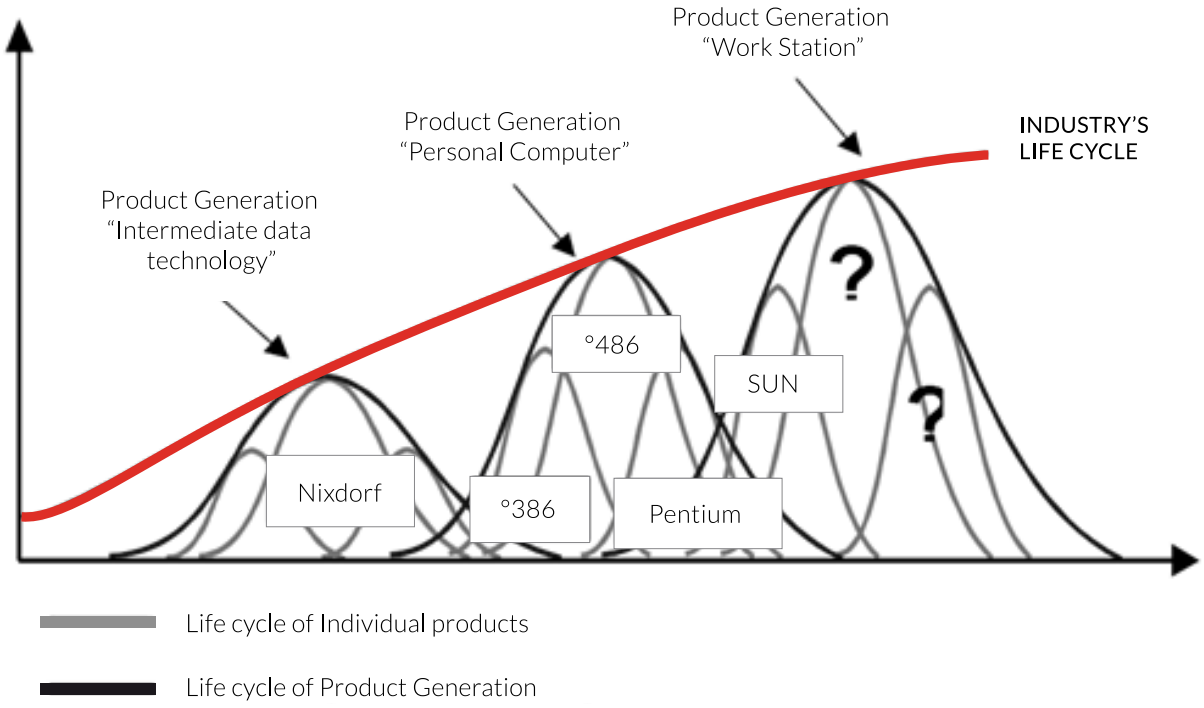


Figure 14: Typical industry life cycle for computer based information processing systems used in the office. Source: Lenk y Zelewski (2000).

Recognizing maturity and decline

There are recognizable indicators that help predict turning points in the sales of an industry. A particularly important point is the transition from the maturity phase to the decline phase of the industry. This transition is accompanied by a series of easily identifiable indicators (Figure 15):

- **Decreased interest from customers**
  Customers lose interest in the possible applications of the products in the announcement of product enhancements and innovations.
- **Substitute products and technologies**
  An example of substitute products and technologies is the introduction of colour television which was accompanied by a decrease in sales of black and white TVs.
- **Pressure on prices due to an overcapacity or lack of product differentiation**
  If capacity cannot be used fully and the prices are reduced because of overcapacity,

one can deduct the decline in the industry growth, since in most cases; these capabilities were achieved over a period of positive industrial development. Lack of product differentiation that occurs at the end of the growing process of development and continuous improvement is also an indicator of the decline in industry growth.

- **Market saturation**
  The reduction in the number of new buyers also indicates the industry's transition towards a stage of maturity or even decline.

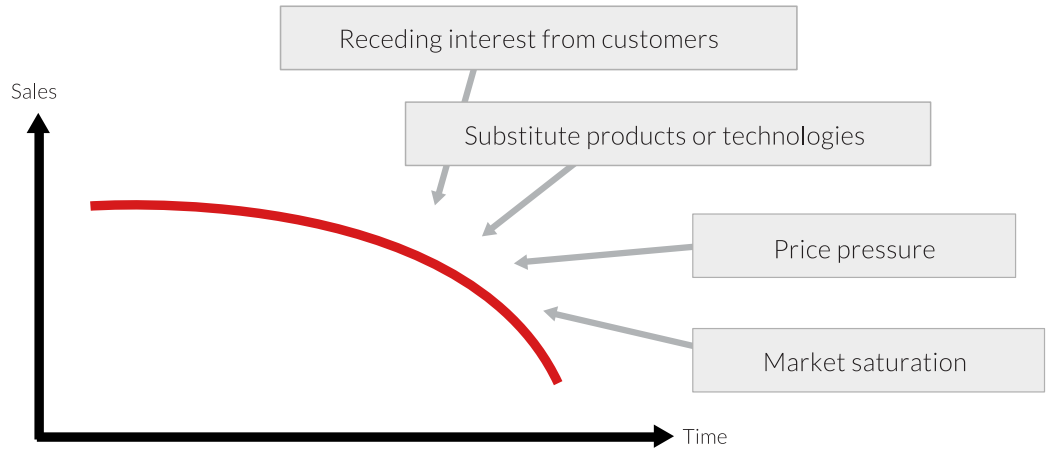


Figure 15: Decrease in sector's growth. Source: Lenk y Zelewski (2000).

Innovation strategy design

The design of the innovation strategy of the company will be given, on one hand, by the innovation approach, and on the other, by the innovation strategy, which must align all its components or axes with the approach.

The innovation approach will help to set out the vision, mission and goals in the different dimensions related to innovation. The strategies will make possible to close the existing gaps between current innovation capabilities of the company and the capabilities required to achieve the desired outcomes. The alignment of the components or strategic innovation axes will be the differentiating factor enabling the company to maximize the success probabilities of their innovation efforts in the overall business strategy.

Innovation approach

Metaphorically, the company must first decide where to play and then define how to win (McDonald, 2008). The decision of where to play will define the focus of innovation that will consist of the following non-exclusive dimensions: the scope of innovation, the kind of innovations that will by prioritized, the degree of novelty of the innovation outcomes and the market entry order (see Figure 16).

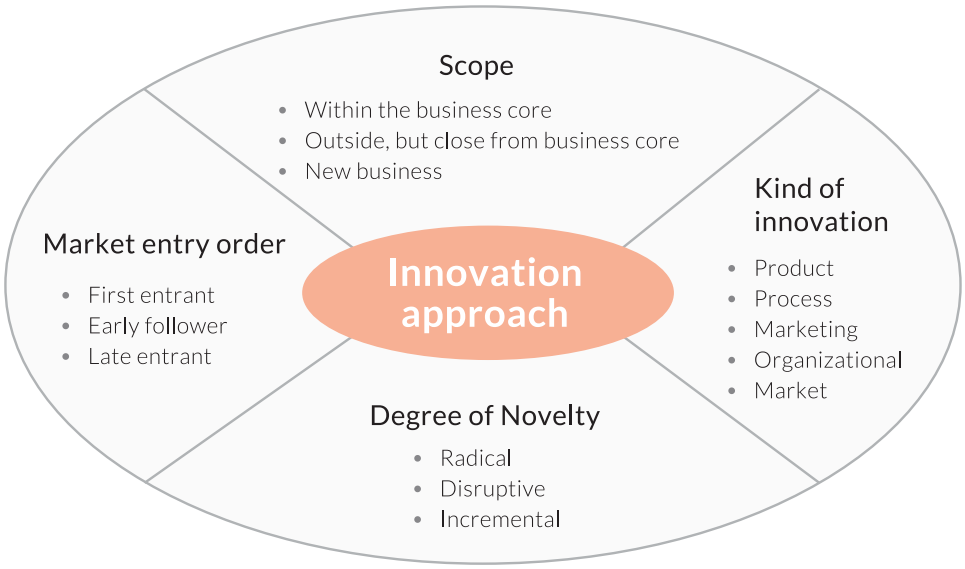


Figure 16: Innovation approach. Source: Own elaboration.

Scope of Innovation

The company must define whether the opportunity for innovation and growth is:

- Within the core business
- Outside, but not too far from its core business
- A completely new business for the company

The choice of the scope will correspond to the resources and capacities that the company has to expand the areas of expertise, the external pressures forcing it to change the course and the growth targets that it has set. There are even companies that opt for diversification, meaning that their scope is set in and out from their core competency areas, which obviously requires a strategy which shows greater challenges.

Global leading companies reformulate their areas of action and innovation fields based on global trends in technology and consumption needs of the population (Ebert, Chandra and Liedtke, 2008). This is because both factors provide the means of more rapid economic growth and higher margin which enables companies to achieve their goals. In recent years, for example, the beverage industry has been showing a new direction away from the core of its business by innovating with functionally hybrid products (Blischok, 2008). These drinks not only fulfil their traditional function of quenching thirst, but also include healthier solutions with vitamins or fewer calories. With these moves, the barriers between industries are increasingly permeable creating a much more intense competition.

Kind of innovation

Innovation has been traditionally regarded as new products development, but companies can compete in a variety of areas: providing new and better services, improving operational execution, acquiring new technologies, finding new ways to understand customers better, etc. (Mc Donough, Zanck and Berdrow, 2008). Therefore, an innovative company will not only be one which can create new products, but also the one having the ability to place them on the market at the right time and under the best conditions. Three generic types of innovation spanning a wider range are mainly considered (product, process and organization). However, there are several typologies of innovations, identifying among them product, process, marketing, organizational and market innovations.

Product innovations are new or improved products or services introduced to the market to meet consumer's needs (Abou-Zeid and Cheng, 2004; Trott, 2008). Marketing innovation is the implementation of a new trading method related to product, promotion, positioning and price (OECD, 2005). The focus of process innovations is to improve efficiency or reduce costs in production, administrative and logistical processes (OECD, idem). Organizational innovations refer to the implementation of good practices in the workplace or in relationships with external organizations (OECD, idem). Finally, market innovations can arise if the market size is reduced or competition is such that the company cannot achieve the necessary market share to grow at the desired pace. On the one hand, the company may choose to enter new market segments or completely new markets, adapting its products to the particularities of these. On the other hand, market innovation can occur when the company has developed a product innovation that has no place in its market and has to look for other markets where to place it. A different case is a new product which is so innovative that it can modify consumption patterns, and therefore, the characteristics of existing markets.

The company must decide whether to focus on one type of innovation or choose various types. Clearly, if a company handles both demand-driven innovation (product innovation, marketing and / or market) and innovations geared towards efficiency and cost reduction (organizational and process innovations),

it will have a better position to face the competition. In fact, innovation projects often require changes in processes and company structures.

Market entry order or launching

A fundamental decision for innovations in product and for an eventual innovation project has to do with the time-to-market and, consequently, with the period before this launch. This dimension responds to the degree of proactivity and reactivity of the company. The order of market entry is classified as "first mover" "early follower" and "late entrant".

The term time-to-market is directly related to the profitability of innovation. Given the nature of the market (global economy, intense competition, increased deregulation and increasing rates of technological advances), the product life cycle is reduced. This means that the period for the commercial use of any innovation and the corresponding depreciation of the investment is becoming smaller every time. New generations of products or completely new solutions occur more often. If a company in this environment cannot quickly get to market with their own innovations, valuable time is lost and the profitability of the entire project is jeopardized. A late release could in any case be compensated with aggressive and intense marketing as well as through existing distribution channels which have already demonstrated their performance and efficiency - a measure that is often taken by large companies.

As it can be appreciated, the life cycle of products is closely related to the order in which the company enters the market. The company must know the key moments when its innovation should be introduced to the market and the phases of maximum growth, maturity and decline as seen in Figure 9. The launch time must be planned and set in one of the early stages. Although market forces may influence the duration of the different phases of the project, a company can exert more control by redefining the length of those with the help of techniques to reduce the development time of the innovation. There are companies that handle carefully the precise moment of their launchings, for example by introducing successive versions of the product as incremental innovations to enhance product and brand presence in the market in order to extend the stages of growth and maturity and thus getting more benefits from the innovation. Because of this, the launch strategy gains importance for the commercial success of the innovation.

According to Mc Donough et al. (2008), the first movers coming into the market with new products, vie for having next generation products and are the ones who usually make drastic movements in their product-market position. Therefore, a "first entrant" strategy focuses mainly on product innovations. The "early followers" monitor the actions of the "first movers" in order to adopt and / or adapt the new introduced product. With the aim of gaining market share, "early followers" should focus on having a better understanding of the customer and offer services that allow them to compete with the pioneers, thus its success is often given by marketing innovations. As for the "late starters", they should focus on reducing

costs and producing on a large scale, therefore, process innovations are often their main objective. Briefly, it is possible to differentiate between two basic strategies for launching (Timing Strategies): the "first movers" and the "followers".

The first movers are those companies which are the first to offer an innovation to the market. In this respect, the pioneer- strategy is used as a synonym for first mover strategy. They have great capacity and resources to recognize and observe the new technological developments, consumption trends, introduce radical innovations and create new markets. A key factor is to take advantage of the stages after the product launch to achieve as much sales as possible at the highest prices that the market is willing to pay. In this way, it is possible to exploit a temporary monopoly position (optimization of Time-To-Profit).
The followers in general are the companies offering a product after it has been released by another. Thus, the follower can be a copycat company or one that has not developed the technology by itself but after the first mover. If this is the first case, the copycat strategy can be considered to meet or possibly exceed the pioneering technology even at the time of launch. Because of this, for the "early follower", shortening the development time to accelerate the market entry is a crucial factor for success. Especially in highly dynamic sectors such as information technology and communications, for example in the Internet, only a few months or even weeks may be critical to be listed as the first in the market. In this constellation, the imitators often have the opportunity to overtake pioneers before reaching maturity in the market. For example, this type of follower can present or attempt to set a new standard with its own development. For the "late entrants", development time becomes less important because they enter imitating competitors in a matured market with existing standards, however, they must achieve high productivity and efficiency in their processes in order to reduce prices to levels that will allow achieving the necessary sales volumes and thus, reach their goals.
Table 3 shows the advantages and disadvantages of the "first movers" and followers in general. Finally, success in the order of market entry will depend largely on the barriers that the company set to prevent the entry of new competitors, and one of the best barriers will be a strategy of continuous innovation.

	First movers	Followers
Advantages	• Pioneer profits • At launch there is no influence of competition • Reputation and Image • Experience • Greater margins for pricing • The advantage that gives the experience curve can be transformed into a cost advantage • Definition of standards • Potential for radical or disruptive innovations • Changing consumption patterns • Early construction of market know-how • Determination of distribution channels. • Placement of barriers (registration fees, patents)	• Lower R&D costs. • Learning from the experience of the first entrant ("first mover") • Lower uncertainty about the demand and buyer's needs • Reduced risk of technical errors in the product
Disadvantages	• Longer development time and higher costs • Costs of market access (e.g. regulations) • Uncertainty (risk of loss of investment) • Errors in the new product • Getting to the equilibrium price / value of the product for the customer • Changes in the buyer's needs • Uncertainty about the next steps of the market • High costs of market access • Risk of technological leaps • Efforts to convince potential customers can be very high • Danger of imitators are able to come out to market soon • Patent can be a cause for the competitor to have access to technology	• Existence of entry barriers and risk of not overcoming them • The first entrant ("first mover") has established itself as market and technology leader • Lower image benefit in the long-term • Need to adapt to the standards set • Novelty is no longer a competitive advantage or marketing • Eventually it is necessary to align the strategy with that of the pioneer • The need for rapid reaction capability and excellent coordination • It is likely that other competitors are about to enter the market

Table 3: Advantages and disadvantages of the market entry order. Source: Adapted from Schewe (1996).

Degree of Novelty

Innovations are classified according to their novelty degree in incremental, disruptive and radical innovations. Incremental innovations represent minor changes to existing products that are constituted in discrete advances in time and cause less impact on both the market and in the production and knowledge systems of the company. Radical innovations, conversely, are major changes which usually involve introduction of new technology products that cause a great impact on the markets. These include the discovery of new knowledge, are highly risky and involve the reconfiguration of the company in terms of knowledge and resources investment and in terms of the usual practices of the organization.

On the other hand, disruptive innovations are not great technological breakthroughs such as radical innovations, but they create a break in the market by supplying marginal segments not considered by radical innovations. Clayton Christensen, creator of the theory of disruptive innovation, says that the technologies at an early stage do not meet customer needs. As they evolve these become more complex because companies focus on developing more sophisticated products for more demanding customer segments, displacing customers willing to pay reasonable prices for more basic and simple products which suit their needs. There are many companies that come in a dizzying race without observing that certain products are surpassing customer expectations. Xavier Mosquet, General Manager in Detroit at The Boston Consulting Group, refers to the French supersonic aircraft „Concorde“ as an example of an entirely new product, which however, failed to capture neither the price level nor the market share necessary to achieve the equilibrium point. This kind of situations opens the door to companies that strategically achieve positioning their „disruptive“ innovations to attract customers who are outside the scope of the market because they lack skills, access or wealth (e.g. eBay or Intuit's Quick Book with a very simple accounting software for small businesses), attracting frustrated customers who have to adapt their way of working to products that do not meet their needs, or customers who don't find what they desire due to market fragmentation (e.g. P & G unifying the market through big brands), or clients who did not need and did not value all the functionality of existing products on the market (e.g. Tata with a basic car but more affordable) (Scott et al., 2006).

Companies leading in innovation try to find a balance between the different degrees of novelty of their innovations. As seen in Figure 7, P & G in its third strategy focuses on reaching low-income consumers. This strategy opens the way for disruptive solutions that provide more basic products that meet the needs of marginal market segments. An example is PUR, a low-cost water purification product, for domestic use that reaches very low-income markets. His second strategy is the drive to achieve more radical innovations, since the approach is to develop new products and hybrids that follow global trends. In the first strategy, P & G aims to strengthen the positioning of their big brands through a better understanding of the needs and aspirations of its consumers. This understanding of consumption patterns will allow incorporating them into their existing products through incremental innovations.

The innovation strategy

The innovation strategy includes the following axes: innovation process, innovation culture, organizational structure for innovation, knowledge platform, financial and time resources, foreign aid and infrastructure. Each of them is a strategic axis that must be aligned with the rest (see Figure 17).

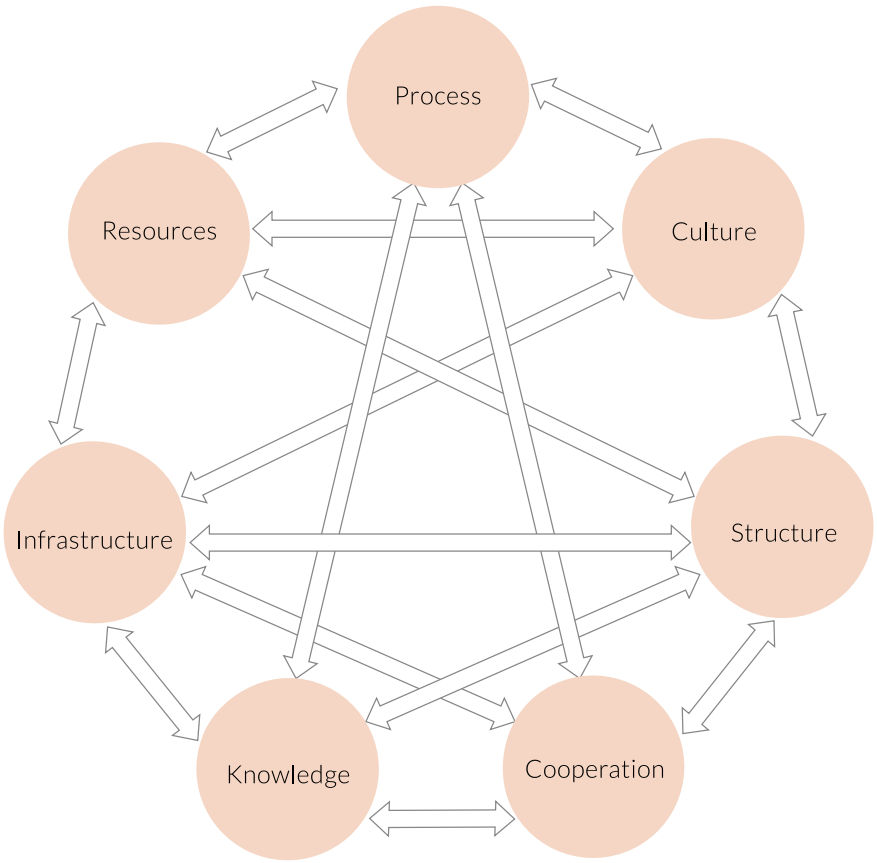


Figure 17: Alignment and complementarily between strategic innovation axes. Source: Own elaboration.

The innovation strategy will aim to close the gaps between the current status and the goal state of each strategic axis, so that these are aligned with each other and according to the needs and possibilities of each company (see Figure 18). Both the vision and mission of the innovation system of the company and the goals in each of its strategic axes must support the innovative approach that was defined and derived from the business strategy (see Figure 18 and see also Figure 8). The strategic innovation plan should clearly describe the activities, milestones, human, financial and time resources required to achieve the objectives which were set.

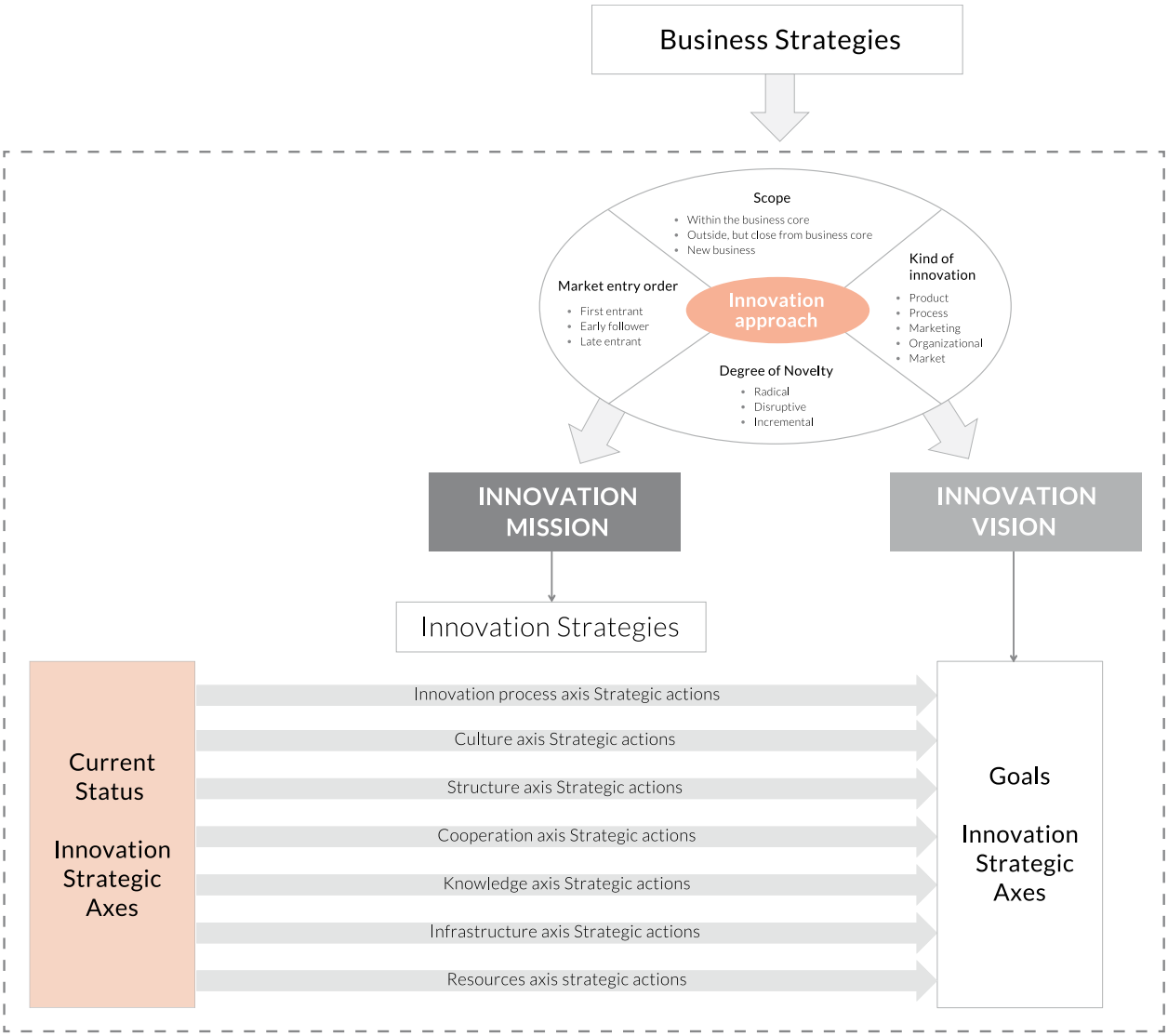


Figure 18: Business Strategy, innovation approach and innovation strategy. Source: Own elaboration.

Christiansen (2000) argues that the design of the innovation system, and therefore the innovation strategies, depends largely on the industry to which the company belongs. Table 4 shows the relationship between the abundance of ideas for new products versus the risk degree of the investment linked to their development. This analysis suggests that there are differences between industries that lead to different innovation strategies. This approach will help in the analysis of the strategic innovation axes shown below.

Many Ideas Abundance of Ideas Few Ideas	**Numerous/low risk** • Focus: diversification • Example: Mass consumption industry	**Numerous/high risk** • Focus on areas with a competitive advantage • Example: pharmaceutical industry
	Limited/low risk • Addressed search of ideas • Example: cement industry, chemicals, commodities	**Limited/high risk** • Race to be the first with the best product • Example: electronics
	Low	High

Table 4: Relationship between ideas abundance and investment risk. Source: Adapted from Christiansen (2000).

Strategic axis: Innovation process

In the case of the innovation process axis, the strategy will consist, firstly on selecting the kind of process that will be used and later on optimizing it.

According to Robert G. Cooper, creator of the stage-gate process[3] for new product development, the choice of the innovation process will depend on the risk of the innovations being carried out. A radical innovation requires a process with more gates, since a higher risk requires more checkpoints to assess whether the project should continue or not. This is the common scenario for industries in the quadrants of "high risk" (see Table 4), where companies like Merck, the giant chemistry-pharmaceutical chemistry, could only get a single drug approved out of 5,000 to 10,000 compounds that it produces, taking between 10 and 15 years to develop a successful medicine at an average cost of 1 billion dollars. Meanwhile, incremental innovations having lower risk may require a process with fewer gates and therefore with more

[3] *New product development process, which goes from the idea management until the product launching. It comprises stages, set of activities, and is followed by gates where the continuity of the project is evaluated.*

focused stages. Due to the lower cost and risk of these projects, the involvement of senior management will be more specific allowing junior staff even to make investment decisions.

The second strategic checkpoint is to optimize the innovation process. Cooper (2009) points that, like all processes, the innovation process is likely to be optimized. The strategy is to analyze the value flow of the innovation process in order to improve the activities that are adding value and remove those which are not. This strategy will reduce the cost of the innovation process (improving the Time-To-Profit) and shorten the Time-To-Market.

Strategic axis: Innovative culture

Innovation is a complex phenomenon that largely comprises the management of social processes. Ensuring that staff cooperates with each other is crucial to unleash the creativity and leadership required to innovate.

A strategy aimed at building an innovative culture should first of all get staff members to identify the purpose or mission of the company. This will be the inspiration to unify the company toward achieving the innovation goals. In the same way, it should act to disseminate business goals very clearly among employees in order to avoid mistakes and accelerate the innovation process. To encourage recognition, appreciation and acceptance of ideas (Riederer et al., 2005), to assign innovation goals to employees to promote the contribution of ideas (Forcadell and Guadamillas, 2002), and to encourage experimentation through tolerance for mistakes so that staff take risks without fear of being punished (Alegre and Chiva 2008) are all also success factors within an innovative culture.

Specific examples of strategic actions in this axis are given by Irizar, a Spanish company leader in innovation. At Irizar, 10% of time is allocated to shared learning, every employee is encouraged to contribute with at least two ideas for improvement per year and 90% of employees participate voluntarily in team works (Guadamillas and Forcadell, 2002). In this sense, the elimination of behaviour related barriers to innovation is another key factor for project success, and, therefore, the innovation strategy.

Strategic axis: Organizational structure for innovation

The strategy in the axis organizational structure for innovation should seek the necessary connections to ensure favourable communication channels for the continuous production of ideas and the successful conduct of the innovation process. A company may have a staff with a very innovative culture but if there are no structures that allow the use of their creative potential, the expected outcomes will not be achieved Policy-making oriented strategies that encourage decentralization of power and decision making, flexibi-

lity and complexity in terms of expertise, functional diversity, the degree of professionalism (Liao, 2007; Sciulli, 1998, Damanpour and Gopalakrishnan, 1998) and implementation of incentive systems (de Jong and Brouwer, 1999) often lead to better innovation outcomes. Additionally, recent studies (Menguc and Auh, 2010) suggest that firms combining both incremental and radical innovations should not have completely formal (more standardized and mechanical) nor completely informal structures (less bureaucratic and organic).

In industries such as those in the quadrant "numerous / low risk" (see Table 4) which have a holistic approach to innovation and seek to implement a significant amount of ideas, is particularly vital that structures encourage individuals to take initiative and provide collaborative spaces for them. In industries where new product ideas are very rare (quadrant "limited / low risk"), firms compete commonly in efficiency through process innovations for which they need inclusive organizational structures that endeavour the participation of employees to improve these processes.

A suitable structure is also important in high-tech companies as that in the quadrant of "high risk" (see Table 4). A classic example is Xerox, which built the first PC (personal computer) in the U.S. in 1973. However, his laboratory, located in Palo Alto Research Center, was so separated from the functional areas that they did not understand the concept of the PC, rejecting it and categorizing it as useless. Researchers as Ledwith (2000), Guadamillas and Forcadell (2002), and Koc (2007), propose that appropriate structures for innovation are those forming multidisciplinary teams or multifunctional teams self-led by its members and not by functional managers that can take sides in favour of their functional area. However, various factors determine the suitability of the implementation of one structure or the other.

In turn, this strategic axis should include programs of incentives to motivate people. The incentive structure is another way to unleash the innovative potential of employees. These systems range from the reward for improvement ideas or contributions until the financing of full projects in the form of an internal venture capital.

Strategic axis: external cooperation

The strategy in the axis of cooperation with external organizations will be given by the kind of industry and the company's strengths and weaknesses.

A partnership under a scheme of "functional complementarity" may take place when the strength of one of the companies relies on the launching to the market (sales and distribution channels strongly established) and the other in R&D. Another type of collaboration is the case of firms with different technological know-how which integrate efforts to create a product derived from the "technology mix".

This strategic axis is very important for industries of the quadrant "numerous / high risk" (see Table 4). Proposing a scheme of "open innovation" through alliances with strategic partners will allow them to

share the high risk and diversify their research areas. In this way, the latest technological developments can be used without carrying out the development itself in the process. Alliances (strategic) are another form of R&D cooperation, which are also called Venture-Management. In the latter, technological knowledge is acquired through participation in young and dynamic technology companies. The importance of the R&D cooperation with scientific institutions (universities, institutes) and the contributions of regional innovation networks of science, politics, finance and business should be also emphasized. According to Handok Pharmaceuticals Co., a pharmaceutical leader in Korea, it is important to know what they can do and what they cannot. This company is seeking strategic partnerships to develop innovations together with other organizations or to consolidate technology-licensing agreements (using technology developed by other companies that they cannot develop at home) (Langvardt, 2010). The innovation strategy must be sufficiently precise to balance the developments made at home and partnerships so that business goals are not affected.

Another example of this partnership is that of Buckman Laboratories Inc., a specialist in chemical products. They managed to establish a close relationship with their clients focusing on the strategy of the latter to produce their innovations (Mc Donough et al., 2008). When this integration strategy is successful, it will become a powerful incentive so that the customer does not switch its supplier.

Strategic Axis: Knowledge platform

The difference between what the company knows and it needs to know in order to compete creates a knowledge gap that must be eliminated. Polaroid Corporation was a case of example due to lack of strategy in this axis. Its bankruptcy in 2001 was due to the fact that Polaroid Corporation wanted to change the core of its business from analogue cameras and instant films manufacturing to digital systems without closing the gap on their knowledge platform, which focused on the chemical area and not in computer imaging technology (Mc Donough et al., 2008).

A company may decide whether to close their knowledge gaps by developing it internally, by acquiring it from external organizations or by striking a balance between these two alternatives. Biotechnology companies with high intensity of R&D generally have strategies to reinforce their research capabilities by entering in partnership with external entities (Hall and Bagchi-Sen, 2007). On the other hand, companies that do not achieve a substantial updating of its knowledge platform should align their goals to their capabilities.

It is necessary to keep in mind that this axis does not refer only to gaps in technical and scientific knowledge, but also those existing within project management, portfolio management, innovation management, etc. These gaps are usually closed through training or external consultancy.

Strategic axis: Infrastructure

Strategic actions in this axis must be directed to build the infrastructure that supports the innovation system. All documents, information and experiences related to the management of innovation projects and the lessons that emerge from them will form part of the assets of the organization. The development of metrics is a very important factor that will assess the success and development of the innovation system. For this purpose, information technology will play a key role not only for storage, dissemination of information and reporting innovation outcomes, but also to support each stage of the innovation process, such as the implementation of an extranet and intranet software specialized in the capture, storage and dissemination of new ideas.

Strategic axis: Resources allocation

As the innovation project progresses, it must be nourished with financing, human resources and the time necessary at the right moment to achieve the success of the project.

According to Cooper (2009), after approval at a certain gate (the concept of Stage-Gate process), the project must come out of this with the resources to carry out the next stage, otherwise the approval decision will have no sense and the project will be queued along with other projects without reaching the required time-to-market.

The most important strategic actions of this axis will be oriented toward fundraising or financing for innovation projects of the company. Internally, the optimization of the innovation process can be a mean to reduce costs related to innovation, so that these savings will serve to "self-finance" more innovation projects. According to Robert Burgelman, reducing costs through increased overall productivity can serve for channelling the saved resources towards investment in innovation. Externally, proposals will be sought and presented in order to achieve innovation funds from government, banks, venture capital or by making alliances with other organizations. Equally important is to have an adequate and formally stipulated budget for innovation activities (Ebert et al., 2008).

In short, the implementation of an innovation strategy is a great challenge. However, any new developments regarding good business practice begins with a process of trial and error, and over time, the learning process allows to find rules that structure the knowledge. Good innovation practices are in an intermediate state of structuring. As knowledge becomes more structured, it will be "more easily consumed" by more companies. Those companies gaining an advantage today will be those being able to see patterns and choose to use them where others see only chaos (Scott et al., 2006).

Evolution of the innovation model in the firm

Based on the previous sections, it is easy to see that there are many possible combinations to define the innovation approach of the enterprise and the innovation strategies to achieve the proposed approach. Establishing the superiority between different approaches and strategies of innovation is difficult because they depend on the context of the industry. However, a company may assume an evolution path in order to achieve innovation systems that have increasing impact on the business strategy.
According to Christiansen (2000), evolution (progress) towards improving the innovation system in the business must happen in stages. Firstly, he recommends evaluating the progress of the system by identifying what is not working properly. Secondly, deciding in which problem or improvement to work. In addition, thirdly, do the work and produce changes. He advises not to cover more than three components simultaneously. There are different options for choosing the axes or components to be considered:

- The axes that are priorities from the management perspective
- Those that seem to have greater impact on innovation outcomes (performance)
- Those that are the easiest to change until the management team acquires more skills and can focus on other axes
- Those presenting more manageable exchange risk and thus, will not wreak havoc in the company

This progress will be carried on as the company gains expertise in the development and alignment of the strategic axes of its innovation system and decides to undertake more challenging innovation approaches towards the achievement of excellence in this field.

Creativity as basis for innovation

Creativity is one of the most valuable resources to explore new areas of knowledge. Creativity, in its simplest definition, can be understood as ability to create, that is, to produce something out of nothing. Creativity comes from the Latin word "creare", which means to generate something new, invent something, produce something, but is also associated with the concept of choice.

Originally, the concept of creativity was used to designate the cause of a personal intellectual creation, referring especially to artists. However, nowadays, this concept is not limited to the arts (Amabile, 2005). In fact, creativity becomes important now in business as a tool for generating new ideas.

Psychology has dealt with creativity as a study object. However, creativity is much more difficult to analyze because, unlike intelligence, creativity is elusive at the time of being measured. The identification of the moment when creativity is activated into an individual is not something that is fixed by pressing a button. American psychologist Joy Paul Gilford came to the conclusion that creativity involves several psychic characteristics of human beings (Guilford, 1950):

- Sensitivity to problems: recognize when and where there is a problem.
- Fluency: produce many ideas in a short time.
- Flexibility: abandon the traditional ways of thinking and develop new perspectives.
- Redefinition: giving new uses to familiar objects, improvise.
- Preparation: adaptation of ideas to reality.
- Originality: ideas should not be replications of pre-existing ideas.

According to Guilford, there are two different types of thinking: convergent thinking and divergent thinking. Convergent thinking starts from a general knowledge and moves on closing its scope but increasing in detail. This process can be used to define problems in a concrete and clear way. Divergent thinking does the reverse process: starts from a particular subject and moves on to increase its scope. The aim is to develop ideas in different directions which provide solutions to problems which were previously identified. Although divergent thinking is used in the generation of ideas, the creative process includes not only one but both types of thinking. Creativity needs a starting point and this must be clearly defined. This is achieved through convergent thinking, defining problems, thinking corridors or areas of innovation. Subsequently, after generating a number of ideas using divergent thinking, convergent thinking is used again to select the idea or combination thereof that best solve the problem or the optimal solution with regard to different factors. The following chart shows the path of the creative process.

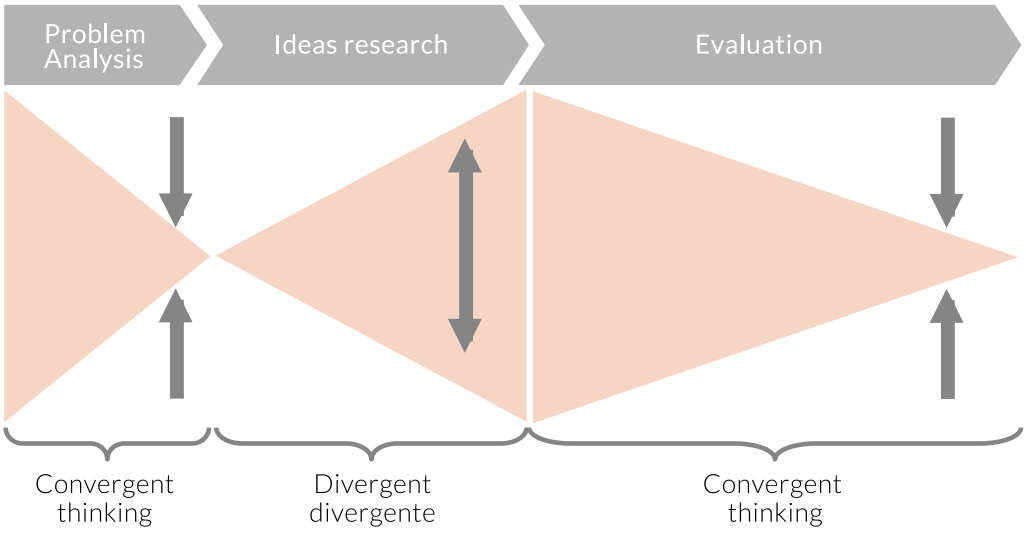


Figure 19: Thought during the creative process. Source: Own elaboration.

In order to develop ways of thinking that stimulate the ideas generation (this is creativity itself), Edward De Bono developed the concept of lateral thinking (De Bono, 1970). This way of thinking seeks to generate alternative thinking directions, in opposition to vertical thinking, which seeks to develop ideas in a thinking direction that is already defined. Normally, the mind accumulates experiences and patterns that are used when decisions must be taken. However, these existing patterns in the mind do not always offer the best response to a situation. While vertical thinking is analytical, lateral thinking is provocative to suggest these new thinking directions. Nevertheless, according to De Bono (1970), these two forms of thought are not antagonistic. In this sense, lateral thinking may be useful to find ideas or directions for problem solving and vertical thinking may be useful to develop them.

From birth, human being starts to gather experiences, from moving his own body with an objective until acting so that other people make what this human being wants. That's why experiences which have not been lived before become uncomfortable, because they are outside the framework already established through experience. Activities such as cycling or swimming mean a new experience different from the normal movement in the air. Maybe if we did not learn to walk, or simply did not have the experience of moving in the air, learning to swim would not be so difficult, or would be as difficult as learning to walk. Of course, not all accumulated experiences are unnecessary. In fact, many of the experiences gained are necessary to tackle new problems. The major drawback appears when the reactions are based only on accumulated experiences and problems are not questioned. Normally, these problems can be solved based on the standards established by experience, but new ways to solve the problems do not arise from this practice.

Establishing patterns can be more easily understood through a chart, as shown in Figure 20. following, the first given sequence, the sum of the two triangles results in a square. The mind accumulates this result, which can help to deduce that if instead of having two triangles there would be four, the result may be two squares.

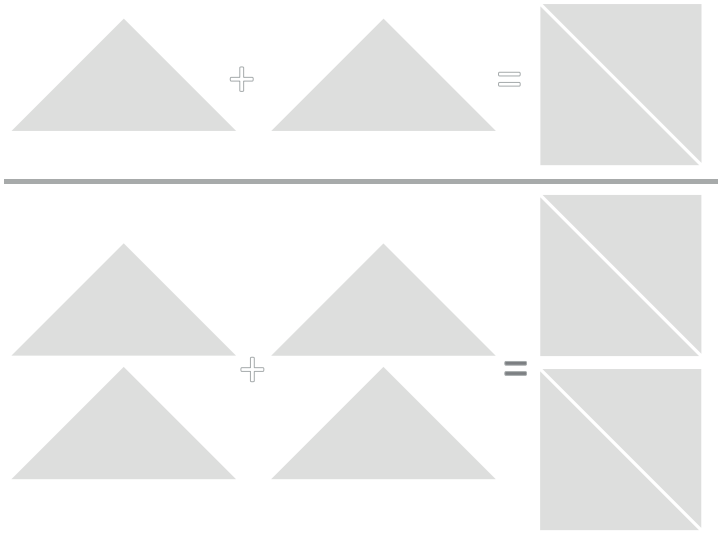


Figure 20: Pattern of thought. Source: Own elaboration.

The use of knowledge of the first pattern in which two triangles results in a square, persuades the mind that in the case of having 4 triangles, the result would be 2 squares, but leaves out the possibility that the result could be a bigger square, as shown in Figure 21.

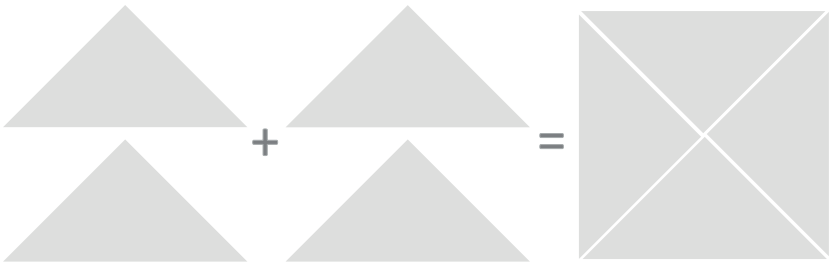


Figure 21: Alternative solution to established pattern. Source: Own elaboration.

The same happens with knowledge, technical problems tend to be solved based on the knowledge we have. For example, if a mechanical engineer is faced with a problem, he will tend to seek the solution to that problem in the field of knowledge of mechanics, even when the most effective solution is in the field of chemistry. Much of the creativity techniques suggest new ways to seek solutions to existing problems. Another aspect to consider is the creation of partnerships. By having a problem or an area to apply creativity, people tend to make associations with situations or circumstances surrounding the problem or issue to be solved. That's why some creativity techniques, as will be discussed in following sections, aim to present different elements with which independent associations can be made or different from the typical associations which are made in a particular field of action in order to reach new associations or new ideas. The objective of creativity is, then, to break with these pre-established patterns in order to get new ways to find ideas or solutions to problems. The development of creativity is, therefore, the ability to find new ways to solve problems, and, in this sense, is a skill that can be developed in a person.

Creativity and innovation

Although normally the link between creativity and innovation is almost immediate, the reasons why this link exists are not always clear. Creativity, as previously mentioned, can be understood as the ability to produce new knowledge. However, the human being occupies much of his life accumulating existing knowledge to be used in facing daily problems. This is why, among other things, creativity diminishes in humans as years pass by, since the accumulation of knowledge during the education and through experience restricts the ability to think in new directions (Herb, 2000). The accumulated information and knowledge are not always enough to solve problems or challenges. It is then that creativity is necessary. The increase in product's complexity in order to improve the competitive position thereof on one hand, and the development of new technologies on the other, make the development of new products or improving existing ones objectives which are increasingly elusive. The use of creativity in analyzing problems and finding solutions to them, allows that the complexity of products and technology do not become a barrier to innovation.

Viewed from the perspective of innovation, creativity is more than just the creation of something new. Generate something new would be a relatively easy task. That's why, in the context of innovation, creativity should be defined only as the creation of something new, but at the same time valuable. The value or quality of what is new determines its influence on an innovation; in other words, the more valuable the result of creativity (e.g. an idea), the more likely that this will become an innovation. By becoming innovation, the idea that results from creativity will provide a benefit at the end of the innovation process, when the idea hit the market after becoming a product.

Stages of the creative process

Although creativity cannot fit into the framework of a process (as this cannot be activated and deactivated as is done with a computer), there are certain stages to go through to generate an idea. Understanding these stages helps in the time to facilitate a favourable environment for creativity, so that the right tools at the right time can be implemented. As mentioned above, there are different kinds of thinking to be used according to the existing need. When analyzing a problem convergent thinking is used and when generating ideas divergent thinking is used. But which are the phases where these different types of thinking are used? The problem identification, idea generation and its evaluation are part of the activities to be done during the „creative process", but more activities can be identified while generating ideas:

- Problem identification phase
- Research phase
- Incubation phase
- Enlightenment phase
- Development phase

At first, there must be a motivation to use creativity. This is the problem identification phase. This phase is more complicated than it seems, because it must determine the problem to solve, which is not always easy. It may be a technical problem in the simplest case, but can also be a need in the market, or even less simple, it may be to create a market need. The importance of the problem identification phase is clarified just by asking what the point of a brilliant idea is, if this fixes a problem in the wrong place. Linking this issue directly with the innovation process can be thought that this phase corresponds to the phase in which areas of innovation are identified, for whom later on ideas should be generated.
The following is the research phase. Once identified, the problem or area in which creativity is wanted to be applied, it's necessary to start gathering information. This information helps to better define the problem and identify the tools and resources that could provide a complete solution to the problem. Another activity in this phase is to set the problem in different scenarios or analyze it from different points of view. This helps to identify different directions to solve the problem or start the ideas generation process. Once the problem has been defined and the analysis of their environment performed, then an incubation phase is initiated. During this stage, the problem or area of innovation matures. Often it is simply loaded with the problem, and in some cases it is confronted with different situations. In this phase the problem is also abstracted, and thus compared to other similar problems or situations that already have been experienced. In some cases, we try to find the pattern of standard problem in order to give a solution to it.
The phase of "enlightenment" is where ideas are generated. After having compared the problem to other

situations already experienced and be familiar with the problem and the resources to solve it, there comes a moment of enlightenment in which one or more ideas around the problem are generated. As previously mentioned, this phase cannot be arbitrarily activated at any given time, but the tour through the previous phases facilitates that this moment of "enlightenment" occurs. It should also be mentioned that these phases do not always occur in similar time spans. The journey to the generation of an idea can be relatively fast.

Finally, when an idea is conceived, it is not always ready to be presented, much less to be implemented. Thus, in the next phase, that of development, it is necessary to mature the idea and take it to the point where it can be presented. Many times the idea must be faced with the problem of verifying that it definitely offers a solution to the problem or truly addresses the need that had been identified.

Other classifications only include four phases: preparation, incubation, enlightenment and verification. The content of the phases is similar; the difference is only in the differentiation between problem identification and finding information on the classification described above, while this other classification only refers to a preparation phase.

Creativity stimulation

Creativity, as memory and other human capabilities, can be developed. In order to do so, different means have been developed which contribute to solving problems that required creativity. There are different terms to refer to these means, for example, techniques, methods and tools. The techniques are sometimes referred to brief indications that help organizing information, such as the use of cards for boards or sticky notes to collect ideas. Under the "creative methods" concept, it can be understood as a systematic procedure with several steps, which is also based in some techniques.

The different methods of creativity can be divided into intuitive methods and systematic-analytical methods (Winkelhofer, 2006) (Figure 22). Intuitive methods aim to generate insights that lead immediately to ideas. These can be classified as intuitive methods of association, of guidance and of confrontation.

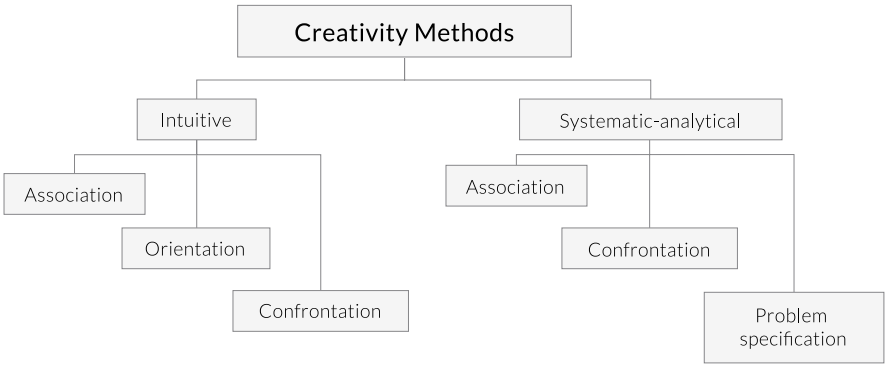


Figure 22: Creativity methods classification. Source: Winkelhofer, 2006.

Within intuitive association methods, we can find the „Brainstorming", which through a non-judgmental discussion, ideas and partnerships are developed. The "Brainwriting" method is also classified in this category. This method consists in writing ideas and associations spontaneously on a paper that must be passed to other group members.

Among the intuitive methods of orientation is bionics. These methods involve fields unrelated to those of the problem, for example of nature, with the objective of coming up with solutions that contribute to develop solutions.

Intuitive methods of confrontation take an object of stimulus that is not directly related to the problem (e.g. a word) and it is confronted with the problem to derive ideas from this stimulus. An example is the method "Synectics" whereby several analogies are made in different areas to derive ideas at the end.

Furthermore, systematic-analytical methods study more in depth a situation to find in a systematic way, the causes of problems or circumstances that result in ideas to solve problems or proposed challenges.

The first category is the systematic-analytical methods of association. These methods divide the problem into sub-problems to be solved independently. The resulting solutions are structured, combined, are varied and then consolidated in a comprehensive solution. An example of these methods is the morphological box. The next category is the systematic-analytical methods of confrontation. Just as in the systematic-analytical methods of association, the problem is divided into parts, but in this case based on analogies. An example of these methods is the morphological matrix.

The category of systematic-analytic methods of problem specification consists of methods that divide and prioritize the problem and its parts in order to make visible the main problem on this basis and develop the solution for it. An example of these methods is the relevance tree analysis.

In the literature about creativity, there are many creativity methods. Some of them are designed to be used individually, others in small groups and others in larger groups. In the second part of this book, different creativity methods will be described.

Creativity in organizations

In many organizations, the use of creativity tools is considered synonymous with creativity. However, fostering creativity depends not only on tools, since there are other elements that contribute to the fact that an organization can effectively use creativity. One way to understand these additional elements is the analysis of the three components of creativity by Ambile (2005): expertise, creative thinking skills and motivation (Figure 23).

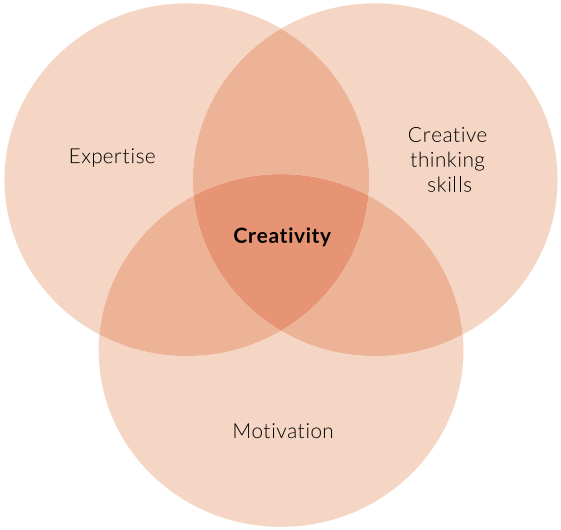


Figure 23: Components of creativity. Source: Own elaboration.

The expertise is all the knowledge the person possesses. This offers different approaches or ways to find a solution. The development of expertise includes conducting seminars and courses on a specific topic, studies made by the individual and conferences, among others.

Creative thinking skills refer to the way a person approaches a problem and its solution. It includes how to seek ideas, the way in which we analyze the problems, methodologies, techniques, etc. Creativity techniques are part of these creative thinking skills. It can be concluded, therefore, that the use of creativity techniques as those described above, to increase the creativity in an organization, influences only a third part of the creativity.

The creativity of an organization can be influenced by working on the three components of creativity, but, depending on the organization, the influence that one component or the other has can be bigger or smaller. Some studies conclude that motivation has the biggest influence in order to improve creativity (Amabile, 2005); nevertheless, it is important to keep in mind the other components to get good results.

Besides identifying the three components of creativity, Amabile has identified six practices of the management contributing to creativity, namely, challenge, freedom, resources, teamwork characteristics, supervisor encouragement and strong support from the organization.

- **Challenge:** Refers to assigning the right person to fulfil each activity. This involves collecting information necessary to combine the tasks with the right person to perform them so that the person has a challenge which can be accomplished.
- **Freedom:** The possibility that employees have to choose how to achieve the established goals. For this, it is important that goals are clearly defined and not changing constantly, otherwise freedom does not contribute.
- **Resources:** It consists of obtaining a balance between economic, time and physical resources to foster an enabling environment for creativity.
- **Characteristics of teamwork:** This practice refers to having an influence in the formation of teams to achieve diversity and to encourage different points of view, fellowship or "team spirit", the same enthusiasm for the goal and mutual respect. Thus, the creative team will be more efficient.
- **Encouragement of supervisor:** Refers to the influence that the superior has on the employees, the way he recognizes their ideas, not extrinsically, but intrinsically, so that the creativity contributions of the employee are evaluated and taken into account according to their potential.
- **Organizational support:** Refers to the support of the leaders of the organization through collaboration and information exchange to stimulate a creative environment.

The stimulation of these factors contributes to increase creativity in organizations, but in each of these factors is also possible to adversely affect creativity, for example, changing constantly the goals of the organization, or simply ignoring the initiative of employees, or eliminating any resource that can be used by an employee to develops ideas which favour the achievement of goals. There are also other difficulties, as many valid business imperatives such as the pursuit of productivity, coordination and control affect a creative environment. That is why a balance between stimulating creativity and controlling business performance should be found.

Creativity in the organization is something that can be cultivated as a principle and can be integrated into the philosophy of the organization. It is also something that can be developed. However, this requires work on it. Creativity should not be left in the hands of the skills of each person; there must also be a stimulus, if necessary, incorporated into the strategy and corporate culture of the organization. In order to effectively influence the creativity of the organization, management must be actively involved to facilitate the actions and elements that stimulate creativity.

Innovation culture

Introduction

Organizational culture is among the intangible elements that have the greatest influence on innovation and its results. It determines the manner in which its members assume their roles, face different tasks, set goals, design strategies and cooperate or compete to materialize them. In a nutshell: the way of doing things, beyond the quality and pertinence of the formal provisions that the entity holds, derives from the culture, since this culture will determine the way these are interpreted and assumed into the cultural framework of the organization.

The direct relationship between organizational culture and climate affects factors such as trust, not so much in terms of security regarding the capabilities of those involved, but rather in terms of the expectations that they have concerning the opportunistic behaviour of other members, or about the internal competition influenced by perceptions and interests of each actor involved. In this way, trust determines the levels of cooperation and commitment within the organization and its sub-structures, whether they are permanent as departments or temporary as teams formed for a specific project.

On the other hand, culture has a temporal dimension as it emanates from recognizable patterns in the history of the organization, for example, how to exercise authority and communication, willingness to take changes, challenges and commitments, and importance attached to certain areas, among others. No wonder that this impulse from the past tends to outline the future path, and this often results in barriers to innovation, as discussed later on.

Culture determines, therefore, behaviour and intangible factors inherent to innovation as the predisposition to creativity, limits to lateral thinking or tolerance to risk and failure. Of course, this influence is also visible through more tangible means as the funds or personnel that are allocated to innovation and the attribution of greater or lesser importance to innovation activities.

Innovation culture is subject to a development or evolution. A.T. Kearney proposes a model of four stages of development towards excellence in culture for innovation (see Table 5).

	I Traditional	II Emergent	III Leading	IV World class
Corporate mission	"Be the best" without specifying how to achieve this mission	Focus on client	Focus on new products and services	Innovation as a mission
Support to innovation leadership	Focus on traditional performance metrics	Reactive, not proactive	Encouraging and promoting innovative thinking and promising initiatives	Leadership is measured based in undertaken or sponsored innovations
Organizational values	Efficient functions and processes	Reacts to changes when they are unavoidable	Fosters innovation, but it is not yet part of the organizational culture.	Innovation is the most important driver for the company´s success
Team spirit	Innovation requires creativity that can´t be planned	Thinks occasionally "out of the box"	New ideas are always welcome	For innovation, we always walk the "extra mile"
Motivation and individual mentality	Innovations are made in the R & D Department	If it is rewarded, then it is interesting for me	Innovation is fun and motivating	Innovation gives me the greatest satisfaction
Innovation as key topic of communication	Innovation is not a key part of our internal and external communication	Innovation is part our internal communication, when driven by an individual	Innovation is regularly part of the internal communication	Innovation is a key component of all our internal and external communication
Reward mechanisms	Support to Status Quo	Related to an established scheme of things	Linked to the direct impact on business	Linked to the potential for creative innovation of competitive advantage

Table 5: Excellence stages within the culture for innovation. Source: A.T. Kearney (2007).

The elements of promotion or support to the innovation culture are evident: values and norms for innovation promotion and the basic assumptions of this promotion. These three types of factors are reflected in the dimensions of the innovation promotion, namely orientation of the organization, creativity, trust, change and risk, as shown in Table 6.

	Cu ture for innovation					
E ements of innovation promotion	• Innovation vision • Innovation goa s and strategy • Myths and history of innovation • Rewarding Innovation	• Encourage ideas deve- opment • Free disposition of working hours • Creativity techniques • Interdiscip i- nary teams Const- • ructive conscience (awareness) of conflicts	• Workers training • Know edge networks and ma- nagement of know edge • Intensive communi- cation with customers and sup- p iers • Wi ingness to earn	• Open vertica and horizonta communica- • tion Manage- ment sty e fostering confidence	• High f exibi- ity of struc- tures and processes • Changes acceptance and adopti- on of these changes by the mem- bers	• Adequate risk dispo- sition by members of the organi- zation Acceptance • of prob- ems in the innovation process High • to erance to fai ure • Risk awa- renes
Va ues and norms for innovation promotion	Importance of innovation within the company	Ideas deve- lopment and discussion	Holistic ex- pansion of the knowledge base	Competence, benevolence, integrity	Desire for continuous improvement	Risk ac- ceptance, tolerance to mistakes
Basic assump- tions of innovation promotion	Constant development to assure existence	Chaos as a way of creati- ve thinking	Knowledge process as base for evo- lution	Human image	Companies as part of the dynamic envi- ronment	Need to take entrepreneu- rial risks, risk awareness
	Orientation towards inno- vation	Creativity	Knowledge	Trust	Change	Risk
	Dimensiones de fomento de la innovación					

Table 6: Culture and dimensions of the innovation promotion. Adapted from AT Kearney (2007).

The links between culture and the dimensions and elements that promote or, at least, enable innovation in an organization are complex. To give some structure to this multiplicity of factors and behaviours that shape the culture for innovation, a three-point model brings them together and classifies them in success factors (see Figure 24).

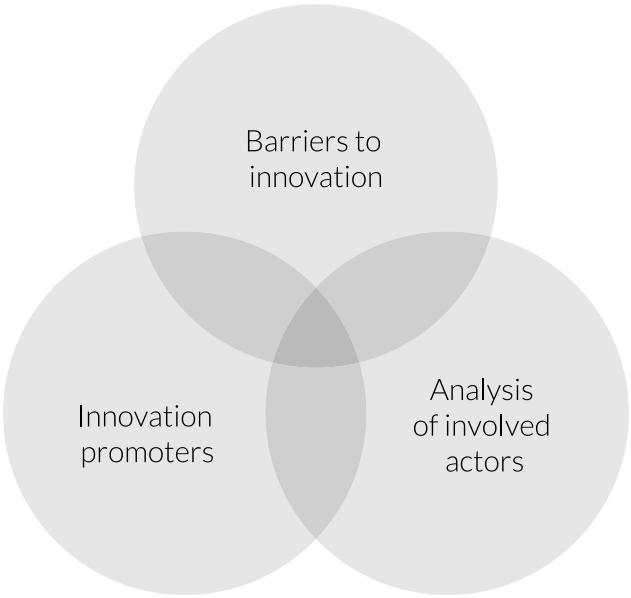


Figure 24: Success factors for the organization's culture development. Source: Own elaboration.

Barriers to innovation

A barrier to innovation is an obstacle which inhibits, conditions or prevents the establishment of a suitable environment and hinders the proper management of the elements of the innovation promotion dimensions and, thus, constitute impediments to innovation itself.

These obstacles may originate within the entity or outside it. Examples of external barriers are the difficulty of access to external funding, high risk in the national economy or in the markets of the organization, limited availability of qualified personnel in the region, or the bureaucracy in terms of slow and unnecessarily complex administrative procedures, restrictive and poorly developed regulations and, above all, the lack of protection to intellectual property rights. These exogenous barriers and its potential solutions are discussed in other sections of this book. Since the focus of this chapter is on the culture within the organization, the analysis will focus on those barriers originated within the organization.

Barriers within the organization tend to interrelate and interact with each other, forming a complex interweaving of obstacles that can lead to vicious circles of repetitive behaviour, trapping the organization in a status quo that prevents, slows down or drops the effectiveness of innovation processes.

There are three main types of internal barriers: those related to an unfavourable organization to innovation, the ones related to an insufficient resources allocation and, most importantly, behavioural barriers.

Unfavourable organization to innovation

An organization unfavourable to innovation is reflected in structures that do not respond to the needs that innovation activities require. The improperly established roles and responsibilities hinder the consistent exercise of authority and delegation with clearly defined faculties and responsibilities, as the duality and lack of clarity of roles leads to a decreasing commitment to the established objectives and the impossibility of making effective decisions at the levels remaining in the grey area of authority and responsibility. On the other hand, the processes and procedures relevant to innovation which are not clearly defined usually end in disoriented actions and an inefficient use of all kind of resources.

Poor measurement, insufficient monitoring and control make the visualization of the status of innovation projects and processes difficult.

At the management level, barriers are often seen in limitations to cope with uncertainty, risks, results and timing of innovation. This is usually caused by incongruities between the competencies and professional skills of managers on one hand, and the requirements of strategic and holistic vision on the other. From there erroneous decisions about incompatible innovation projects that do not waste incompatible or potential synergies could arise, causing scattered efforts rather than progress towards the achievement of objectives.

Insufficient resources allocation

The allocation of insufficient human resources is reflected in the provision of few posts or the allocation of people with inadequate profile to projects and areas related to innovation. In many cases, human resources are allocated to an innovation unit that was created more to show that the organization is trying to work in this area and that it has such unit than to bear fruit in this area.

Similarly, meagre and unrealistic budgets make the acquisition of the means and knowledge necessary for innovation remain simply unattainable. This is directly related to the provision of infrastructure and insufficient equipment, with limited specific technological resources, which are often expensive, and with limitations regarding access to key information and knowledge as scientific literature and recent and reliable market information.

Behavioral Barriers

Behavioural barriers are the most critical, since they frequently influence directly in the development, overcoming and impact of other barriers such as an inadequate resource allocation or the inappropriate

structure design. These barriers can be found in all organization levels and, mainly, between levels, departments and teams.

One of the most common forms is the traditional administrative behaviour, which can be seen in the excessive rigidity in the control of activities and processes through excessive regulation and bureaucracy. This involves the establishment of inflexible routines that take up all efforts of the staff and prevent the exercise of their creative abilities. Also typical is the excessive rigidity of the hierarchy, which prevents the direct flow of ideas from low to middle and senior managers. Probably one of the most detrimental barriers is the inadequate distribution of working time of employees: if this time is used solely or primarily on the performance of routine and urgent tasks, no time is left for the generation and exchange of ideas. Among the classical and extremely disadvantageous behaviours for innovation is the excessive centralization of decisions, especially the less strategic ones. Finally, the resistance to change the status quo and winning formulas is a fear of managers that often eliminates the mere idea of seeking change.

As for the barriers related to the behaviour of groups, the most common are to be seen in unnecessary rivalry between departments and projects of the organization and the rivalry between managers, assistant managers and their teams. This is usually due to excessive professional jealousy. This triggers and feeds back issues of trust, which in turn causes and reaffirms a lack of familiarity to work in teams and to formulate and commit to shared goals. Also common is the existence of pre-established patterns for the opinion-forming and the adoption of postures and attitudes.

The individual behaviour of members is directly linked to the ego of people and often generates and fuels great barriers based on the fear to attempt and failure, the fear of change and especially the fear of critical opinion of colleagues to unconventional or "out of the box" ideas, since individuals want to avoid any possibility of being perceived as ignorant or irrational. This is related to excessive self-comparison with colleagues and extreme professional jealousy. The results of these behaviours usually trigger some others which undermine innovation activities, such as resistance to take on challenges under the motto "it has never been done, I do not know how to do it", the indifference and apathy at work and the demotivation.

At the organizational level, disposition barriers and cultural characteristics refer to the general resistance to change, to the habit of senior management to give little support to suggestions of the staff of lower ranks, a fact which is usually based on prejudices as "only senior managers have good ideas". Excessive sensitivity, susceptibility and widespread professional jealousy of the members of staff in change projects produces stagnation in the way of thinking and the development of tolerance to new initiatives and ideas. This will perpetuate a vision focused on local and immediate reality.

Barriers to behaviour can and should be overcome to pave the way for innovation. This can be done only when these have been clearly identified. It is necessary to work on two other critical factors to overcome these obstacles.

Analysis of involved actors

As previously explained, companies often face resistance to change, which in turn is based on the described behaviour barriers. To analyze the reason and source of these barriers, all the actors involved in an organization which are relevant to innovation should be analyzed

This analysis should focus on the attitude of the person involved toward change and his power and influence base in the organization. This requires to know in-depth the attitude of each one involved towards the other members.

One of the critical factors for a good evaluation and analysis is a good knowledge of the informal structures of an organization, since power and influence of people is often based on them, beyond formal positions and roles. This means that some relationships which have more to do with sympathy and antipathy among members, common characteristics or personal goals and simple preferences, play a role sometimes difficult to detect, but often very important.

Other factors influencing the power and relationships are the seniority, the professional profile and the shared experiences. Some of these factors have direct influence on the confidence levels of individuals towards others.

The identification, evaluation and analysis should be developed through activities planned especially for this purpose, for example, workshops or sessions. In the section on tools for innovation management of this book a tool for this procedure is provided.

Innovation promoters

The innovation promoters are individuals or groups of individuals who facilitate the elimination of barriers to innovation and in doing so, they raise the levels of motivation and increase the chances of a successful execution of changes and, hence, of the innovation projects.

These promoters are committed to the innovation process to a very personal level and with their example inspire other members of the organization to take on changes in behaviour, thereby improving the culture of innovation.

Promoters usually have strong leadership skills and personality traits that turn them into people who are respected and heard more per their ability of persuasion, argument and knowledge than by a simple

exercise of mere authority. Thus, they achieve results and assume key roles such as:

- An increase in overall confidence and trust among the actors involved
- Mediation between fears and prejudices about the processes of innovation
- Establishment of bridges for communication in those structures blocked by conflicts or mistrust, opening up the way for building positive relationships
- Interaction for discussion of new ideas and approaches
- Balance, mediation and conciliation between existing and new structures and relationships

The main challenge of the promoter is to facilitate the open discussion about the barriers and the distrust of employees with regard to innovation processes.
Among the critical factors for a promoter or team of promoters are their willingness and ability to support the innovation process and reduce concerns. This requires the sponsors to have well developed communication skills, abstract reasoning ability and temperament to generate sympathy and, at the same time, they must be firm. Of course, a prerequisite is that the structure determined for the innovation process allows the integration of promoters. This depends mainly on the decisions, the convictions and commitment of senior management. From there, the promoter or team of promoters will achieve step by step the elimination of behaviour barriers first and then the unfavourable organization barriers and the inappropriate allocation of resources.

Organization for innovation

The tasks in a company are usually executed by two organizational forms: the stable or permanent and the temporary by projects. The following example will illustrate the difference: the R&D department of a firm performs tasks in the area of innovation, is a form of permanent organization and corresponds to a form of line organization. In contrast, a project for the development or improvement of a product, service or process is specific and temporary in nature; it lasts until the objectives are met, although the project structure may be later restored and giving a new beginning for a new phase.

Normally, the nature of innovation causes most of their activities to be structured in organizations according to the type of projects. These usually include the division with specific responsibility for innovation and R&D and members of different areas such as marketing, production, finance, administration, etc. As expected, the materialization of these organizations involves the formation of teams.

This chapter will focus on analyzing the organization of innovation projects.

Reasons to seek a good project organization

The success of a project is conditioned by the prior establishment of an appropriate organizational framework. Under this organization, the structure of the responsibilities of the project is clarified within the broader framework of the organization of a company. In other words, it should clarify who is responsible for what, who authorized what to whom and who is disciplinary and technically subordinate to whom.

The organization of the project not only involves giving sufficient powers of coordination and decision to the project manager, but to realize organizational forms that encourage cooperative, interdisciplinary teamwork and between different areas.

The typical organization of a company is linear. The line organization, which is characterized by separations according to functions (production, marketing, purchasing, administration, finance, etc.) normally imposes some obstacles to teamwork because it pays more attention to isolated linear functions of the company than to projects. For this reason there are often conflicts of interest between the “line organization” and the “project organization”. If the project priorities are unclear, especially when resources are scarce, there are obstacles and disruptions that threaten the success of each project.

Poor organization of projects leads to:

- Poor coordination of the tasks of the different divisions
- Pressure caused by deadlines (e.g. for the delivery of an offer)
- Little knowledge and attention of purchasing (procurement) and marketing staff for technical issues
- Little knowledge and attention of technical staff for business affairs
- Issues to define responsibility and interlocutors (for example, in case of customer questions)
- Little attention to business objectives

The transition from a linear-based organization to a projects-oriented enables a quick decision making and continuous observation of the progress of the project. As the manager of a project, the project-oriented organization ensures the coherence of its tasks with its responsibility and with its command or authority.

Forms of project organization

Pure projects organization

This form of organization implies that each project manager has full technical and disciplinary responsibility. Everyone involved in the project form a separate structural unit and all work is fully framed in the project, so that they are detached from the lines of organization by divisions or departments. The project manager has all the responsibility and authority.

This form of organization ensures a firm project management, a clear limitation of liabilities and the unity of tasks and competences. The pure projects organization is highly recommended for large projects and especially for important R&D projects.

The advantages are reflected in the proper flow of information, which is associated with a lower number of levels that decisions and information must go through. The project team can work focused on their business and the staff feels more identified, so that motivation is also enhanced.

A very rigid and closed project structure shows some disadvantages. In this case, teams can develop a kind of clique, creating problems of acceptance and isolation from those who are not involved in the team or are working on another project. This can even lead to double efforts as contact is lost between teams.

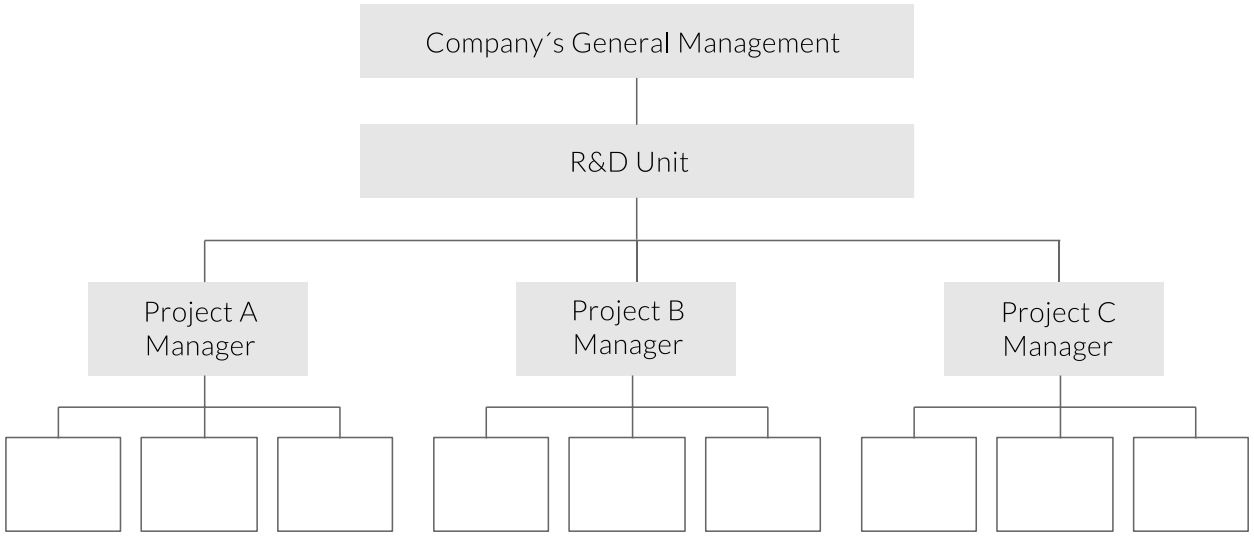


Figure 25: Pure projects organization. Source: Pleschak/Sabisch, 1996, P. 157.

A variant of this form is that of venture teams, where employees from different areas are involved in a project. By the end of the project, the employees return to their former areas or become managers of new business units or divisions resulting from the project. This form is suitable for high-level innovations, such as the development of new technologies or entry into new business areas.

Matrix Organization

The matrix organization is basically two-dimensional. In this, the project employees maintain their normal tasks line of the linear organization while dealing with the project. The manager of the area or department is the one who has disciplinary control over the project workers, regulates the allocation of staff and is responsible for the execution of each task. The project manager, meanwhile, has the power to lead the technical aspects of the project and coordinate with the functional areas (of line) that should be involved. While the allocation of employees to the project is flexible with this form of organization, the division of competences (powers) between the project manager and area manager can be very problematic. The double subordination requires an exceptionally clear definition and agreement on priorities, areas of authority and responsibilities, thus potential conflicts are avoided from the outset.
To make this work well, it is important that project employees are released from their normal linear tasks (of line). If employees must perform the project work in addition to their other tasks, they will be quickly overwhelmed and unmotivated.

The matrix organization leads to greater acceptance of project work because there is a constant exchange with the linear (in line) work. Furthermore, after work on a project, the reintegration of the project employees to their jobs is easier. This form of organization is suitable especially for small and medium projects with clear priorities.

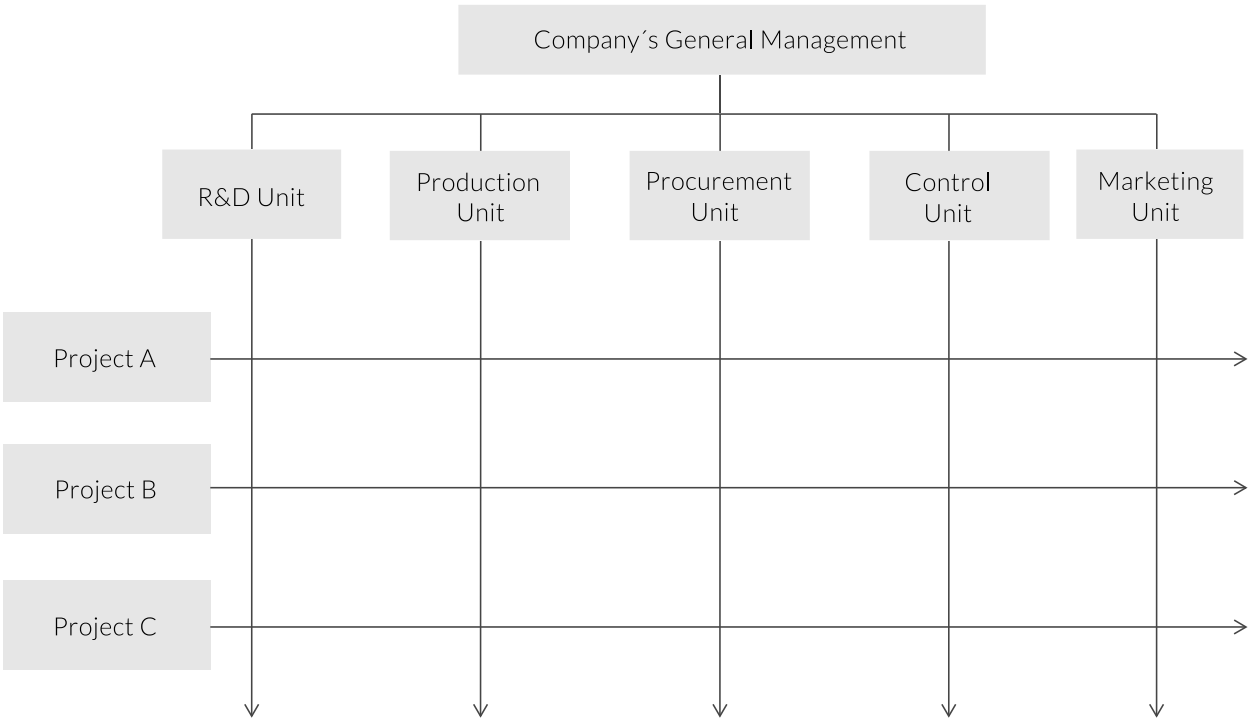


Figure 26: Matrix organization. Source: Pleschak/Sabisch, 1996, P. 158.

Staff organization

In this kind of organization the project manager has neither power of decision nor leading role or full responsibility for the project. He plays a role rather of an adviser and is subordinated to a manager of an area or to the general manager, who fully supervises the project.

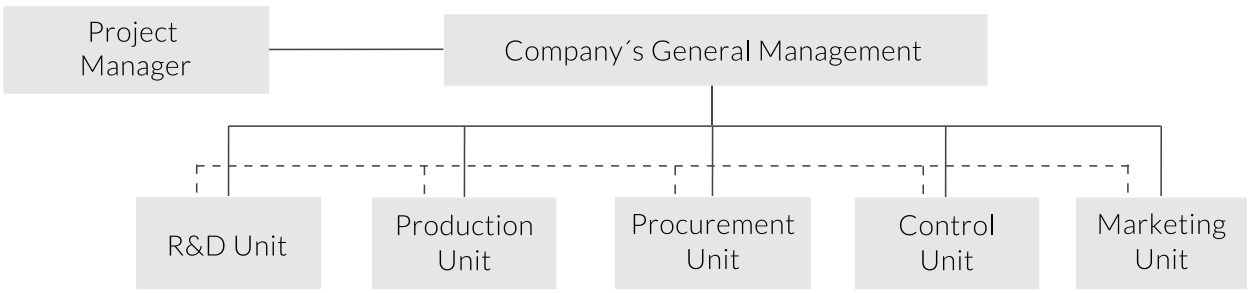


Figure 27: Organizational Staff. Source: Pleschak/Sabisch, 1996, P. 158.

The advantage of this organization is that it is not necessary to make major changes in the structure and that is possible to achieve that different organizational unit´s or department´s work on the project. This form of organization is suitable for medium-sized projects with clear priorities which are not very intertwined.

Timeshare organization

This form of organization is applicable to all kinds of projects, as it allows very flexible configuration possibilities. Employees are assigned to a project for a certain time per day or week. The rest of the time, they perform their activities in their respective units or departments (line Organization). During the time assigned to the project, the project manager has to be in charge of the disciplinary and technical decision; when the employee works in his division, the area manager has the lead.
When decisions regarding time periods that overlap must be taken, for example, an employee's long vacation, it is necessary that both managers agree (from the area, and the project). It is also very important to have an agreement or contract signed by the employee, the manager of the area, the project manager and the General Management. In this way both times and responsibilities will be clear for all sides.

Company organization favorable to innovation

To reduce resistance and problems of acceptance, it is important that the company has an organization favourable to innovation. The following are set of issues that must be taken into account.
A flattened organization or with few levels in its hierarchy enables greater transparency within the firm, clear responsibilities and short cuts for making decisions. This, in turn, increases the responsibilities of employees and with it, their motivation levels.

An efficient division of work is essential for workers to develop skills and specific knowledge to apply them in their work. Specialization, to the appropriate extent, is relevant for complex and innovative projects. An essential condition for the division of work and the specialization is a well-functioning co-operation that crosses the boundaries of the different units or departments.

Open communication is crucial. One of the most common causes of failure of innovation projects are the problems of communication and information. To have an open and transparent structure, workers should be encouraged to ask questions and make their own suggestions. The networks of information favours that employees know the status of the current situation effectively.

Teamwork, especially in autonomously responsible teams whose success is measured, leads to higher employee motivation and can accelerate and qualitatively improve the processes of R&D.

The delegation of responsibility and decision making power should go hand in hand. Frequently, tasks are simply delegated without the competence to decide or the corresponding responsibility. Even worse, in some cases the delegation of responsibility is seen without delegation of any power of decision.

Fixing ambitious goals allows employees to find the challenge in their work and, thus the exploitation of their potential can be higher.

It is important to make a good project management. Division of work and specialization require much coordination, which is possible through a proper project management to ensure the success thereof. Employees should be responsible for themselves for the formulation and adjustment of a good planning, ensuring to timely accomplish the execution of their part of work. This should be done in coordination with cooperating areas. It is also important to give employees the opportunity to correct or improve their work.

The strongly hierarchical and rigid forms of organization harm the process of innovation. Therefore, the flexibility of the forms of organization which are adopted is crucial. For example, it should be possible to quickly organize a team of specialists to solve an urgent problem.

Senior management must be committed and interested in different projects, because it often only supports ideas and projects in which senior management is involved or excited.

Establishment of a creative work climate is extremely important. Thus it is necessary to have open spaces to develop and implement innovative ideas. Attention should be paid to the working environment. For example, in a creativity session, by simply changing the wallpaper or decoration, a difference can be made.

The establishment of a system of incentives for creative work is highly advisable. The quality of creative ideas is often very difficult to measure, making it impossible to establish a reward system for creative work which is based on the performance of creativity. However, a reward should be given for this creative work. In fact, accepting new ideas instead of taking them as “crazy” is already a form of reward. Non-material means such as the recognition and extension of the competences (powers) facilitate the achievement of a good climate for innovation.

The Innovation Manager

The task of innovation management is a process-oriented work and it is not a job of a single department. Innovation management must be an integrated task; in innovation processes different areas or departments of the company must work together. This interdisciplinary work is one of the crucial factors for success of any innovation. Besides this task of interdisciplinary management, in innovation projects is also necessary to achieve an organizational differentiation between innovation processes and the routine or linear direction processes. The tasks of creating, evaluating and selecting ideas are not routine activities of the company management and should be carried out by creating circles of innovation or creativity teams.
In the course of innovation processes, the task of the innovation management is to prepare the decision and present the basics of this decision to the general management. This includes the representation of a severe or threatening situation (perhaps the end of the life cycle of a given product or market maturity of new technologies), the presentation of criteria for choosing innovation projects, including its logic application, and the presentation of product variants based on technical and / or aesthetic innovation option.

Consequently, the tasks of the innovation manager define the skills which he must have:

- Direction of the „know-how“ both from the strategic and operational points of view
- Interdisciplinary work, ability to work in team
- Use of communication and presentation skills
- Influential promotion for new ideas, organization of joint work with internal and external experts
- Promoting creativity among employees
- Planning of efficient and goal-oriented innovations so that these will be accepted in the market.

In many small and medium enterprises, innovation management is a task of the general manager. Due to the high workload in various areas of the company management, he often cannot meet the specific requirements of the innovation management (direction). In companies with a R&D department, many times the responsible for this department takes the task of managing innovation processes. In this case, this person usually has a technical background and is often not prepared for managing processes which span several departments of the company. For these reasons, it is absolutely necessary to introduce an innovation manager in small and medium enterprises, just as it happens in large enterprises.
From the tasks of the innovation manager arise different fields of activities (see Table 7), which are more specifically outlined and then concrete in their sub-tasks. An overview of the whole spectrum gives an idea of the complexity of the scope of an innovation manager.

Action field	Innovation manager tasks
Innovation Decisions Preparation	• Identification of innovation potential within the company • Definition and presentation of company's innovation alternatives. • Selection of innovation alternatives based in factors such as „Time-to-Market" and „Price-To-Market"
Innovations Implementation	• Overcoming resistance against innovation. • Internal communication of innovations within the company • Factors selection to control innovations
Knowledge Management	• Access to external knowledge. • Management and interconnection of internal knowledge within the company. • Identification of knowledge gaps within the company. • Call for internal knowledge bearers in the company.

Table 7: Innovation manager tasks. Source: Adapted from Bessau (2000).

The first area of action of the innovation manager is the preparation of innovation decisions within the company. Innovation decisions have a high complexity. On one hand, at the beginning of the innovation process, structures are not recognizable to the innovation manager. For this reason, many problems related to innovation or its consequences are often overlooked.

As part of the preparation of innovation projects, the manager is responsible, at first, of finding all the possible potential of innovation both inside and outside the company.

Finally, all innovation alternatives derived from the potential opportunities must be defined. It is now reasonable to order the alternatives according to their attractiveness and priority. That alternative found as the most suitable should be conceptualized and expressed in a document for its potential implementation. At this point, the innovation manager should be in the position to provide general information about the plan and its expected duration, as well as resource requirements for the implementation of the various alternatives for innovation. Important criteria for a market-oriented selection are factors such as "Price-to-Market" and "Time-To-Market". If they are taken into account, the risks of innovation are kept as low as possible.

The presentation of innovation alternatives to the company's management is also in the scope of the preparation of decisions for innovation. The innovation manager has to clarify to the general manager

the advantages and disadvantages of the alternatives of innovation, as well as the potential bottlenecks that are generated (e.g. due to insufficient human and financial resources). He must also show the changes needed in the structure of the company (e.g. in order to establish a multidisciplinary team for the project).

The second field of action is the implementation of innovation in the enterprise. To begin, the manager of innovation must overcome all the resistance of employees in relation to innovation. It is possible that the innovation project will produce fear and disinterest to employees, or makes them feel ignorant or afraid to take responsibility for the project, as usually employees are comfortable with the status quo of the company.

Additionally, the innovation manager must face other barriers to acceptance which could arise as a defensive posture, environmental concerns and arguments against the investment policy. For this reason, one of his important functions is to communicate with internal customers. Similarly, it is up to him to do the presentation of innovations outside the organization. The control of innovation's success is part of their responsibilities.

Knowledge management is the third scope of the innovation manager, who is responsible for initiating and directing the flow of information across the enterprise. Today, knowledge is one of the most crucial strategic factors of company competitiveness. Therefore, it is the innovation manager's role to cover knowledge gaps existing in the company, especially those that affect the strategy and innovation projects. First, the manager has to find out what kind and quality of knowledge is already available in the company. Simultaneously, he must create incentives so that workers of the company are open to the ideas of innovation.

A further aspect that is also crucial in knowledge management is the access to external knowledge. In this sense, the integration of customers in the innovation process of the company turns out to be decisive. Information from customers must be systematically collected and processed to serve as a basis for the generation of new products or services and to verify its compatibility with the market.

Pricing of innovative products and funding strategies

Pricing and costing

It is noteworthy that the goal of achieving certain performance with the capital employed in innovation projects can be reached through various combinations of product and price features. This goal can also be achieved with variants of low-cost products for a large number of buyers, or with products for exclusive niches composed of few customers with high purchasing power. Even if one considers only one version of the product, there could be a reasonable space to negotiate as a result of pricing. This is due to the following reasons:

a) The higher the price, the lower is the unit sales (in most cases). The fact that this is actually detrimental to the company's profit and return on investment depends on the behaviour of customers: their willingness to pay and the price elasticity of demand, in other words, the actual relationship between the price and the quantity purchased. This relationship depends on psychological behavioural patterns of buyers and is different for the various groups of buyers. For example, the demand for a product in a specific group of buyers could be reduced slightly from a significant price increase. For some products, there is a customer behaviour which is almost independent of the price, the so-called inelastic demand for products like food, tobacco, energy for food manufacturing, fuel for personal mobility, etc.

b) In the case of some products, the consumption is very difficult to reduce or limit even when the price increases. While it is usually accepted as a rule, the inverse relationship between price and quantity demanded is not always true. In some cases, the more expensive the product, the more attractive it is to some customers. In this case, it is not about a price difference but based on differences in product characteristics, although this difference was only the brand. In pricing, it can be seen more and more how some manufacturers set their prices intentionally exceeding the thresholds of 10 or 100 or 1000, rather than using the psychological pricing so far preferred (eg, 9.99 or 99 or 950). The product projects an image of greater value. In this way, a higher income can be obtained from a set of products than setting a lower price, if for this higher price a compatible design and an adequate distribution channel have been chosen.

The price that customers are willing to pay and variations in the quantity demanded at different price levels can be determined through different market research methods such as Conjoint Measurement (it is recommended that an innovative company invest sufficient resources for such services). The results from this type of analysis are the basis for the implementation of other methods, for example, the Target Costing, which will be explained later. There are methods to estimate the willingness of customers to pay, that innovative companies can implement themselves; for example, investment calculation methods can be used to estimate the benefits produced by a particular purchase from the customer's perspective.
A method so far not widely used by SMEs is to put themselves in the client's position and evaluate a new own product in terms of the benefit it offers to the customers. In the area of capital goods, this is much easier (and possible to do with known mathematical procedures of calculation) than in the case of consumer goods, for which usually one has to investigate various psychological preferences and the willingness to pay for several feature combinations of a product using the so called customer panels interviews. However, also in the case of capital goods, it is rare to present to the customer an estimate of economic benefits (e.g. long-term savings) along with the price offered. Of course, this is different for products which typically require this type of analysis, for example, large industrial plants.
Then, for products whose usage leads to clear monetary effects for the client, as in the case of capital goods, the provider may employ processes of investment valuation to show potential customers the value of individual innovations. When investigating the purchase decision the client makes from a number of alternatives from the point of view of its economic benefit, the company can better match own innovations to existing needs. The company can also improve the competitiveness of its own products, because competitiveness is by nature a relative characteristic and, therefore, must be taken into account in direct comparison with the alternatives that the customer has. Finally, the company can prevent from the beginning the rejection to new products caused by factors such as cost.

The process of investment evaluation

The investment evaluation processes are applied to all known alternatives of products that solve the same customer problem or satisfy the same desires. Among these methods can be mentioned:

1. Comparison of costs account
2. Comparison of earnings account
3. Comparison of profitability account
4. Amortization Account
5. The net present value method
6. Method of internal rate of return
7. Annual method

Of these methods, 1, 2, 3 and 4 are called static methods, while methods of 5, 6 and 7 are used for dynamic evaluation of the investment.

The price comparison is not even mentioned, since it could hardly be considered a method. However, the price comparison is perhaps the most common practice among customers of innovative products, generally of private clients (users or individual buyers), but also of many industrial customers (those who buy the product to incorporate them into their own products, services or processes). However, this comparison does not allow seeing the benefits in the long term, as normally expected from the purchase of innovative products. The simple comparison of prices is not a good idea, as demonstrated by countless experiences which for its significance have even become popular sayings: “cheap is expensive” or “who buys cheap, buys twice”.

Static methods are also unsatisfactory. For decades, they were part of the strategy and management practice in many companies. These processes make an oversimplification of reality and, for that reason, should be considered as models that because of their assumptions may produce results far from the true consequences of investment or purchase decisions. In fact, using static methods of assessment clearly erroneous decisions have been made, although the mathematical procedures have been resolved successfully. The main causes for the inaccuracy of these processes are:

- The consequences of a product's purchase, which usually last a long period of time, are reduced to a fictitious period of time which in average is usually 1 year. Static methods, therefore, do not distinguish whether the monetary return produced by the use of the product (e.g. a machine) takes place in the early years or just some years later. Of all the cash flows a single average is estimated, without taking into account that there are advantages in receiving cash flows as soon as possible and use them for other purposes, or, at least, to save for the payment of interest.
- No one considers the sums of money remaining as a result of purchasing a product at a lower price compared to other products, even when these sums mean an advantage.
- Artificial auxiliary figures are constructed (estimated interest and depreciation) alt hough the actual values are accurately known: the statutory depreciation and interest agreed with the bank in cases of investment financing.

Among the indicators of static methods are some well-known as return on investment (ROI) and the payback period. Dynamic processes have decisive advantages in comparison with the methods referred to here. At this stage, we will enter further into of the methods of net present value and internal rate of return.

Advantages of dynamic investment evaluation methods

As for the assumptions, dynamic methods have, compared to static ones, the decisive advantage of giving the investments the character of a series of cash flows, which usually have a negative initial payment followed by a series return flows of different magnitudes. This means that the cash flows at different points in time are mathematically processed and valued economically. The earlier occurrence of a positive return flow (or negative), the greater its effect on the outcome; that means, in the capital value or in the internal rate of return of the investment that the client makes to purchase a product. Of course there are as in any model, assumptions that simplify the process to make it more manageable, for example, the assumption of perfect capital markets with a single rate of interest to equity (own) and loan (borrowed) capital, as well as for credit and savings. But in short, the assumptions of the dynamic processes make much more sense than those of static ones.

In the second part of this book the two methods: net present value (NPV) and internal rate of return (IRR) are explained in detail with an example.

With the help of these two methods for evaluating investments, innovative companies can predict customer decisions in advance. This is a very interesting possibility for the planning of own competitiveness at the level of their products.

Funding strategies for Innovations

This subchapter describes both the financing options for innovation projects and innovative companies and the respective decision criteria of the funders.

To maximize opportunities and minimize the risks that the acquisition of a funding implies, it is necessary to make a reasonable selection of the components of the business financing and innovation projects, as well as an intensive preparation to negotiate the funding.

The meaning of financing is that it allows taking a leap in growth. In fact, many businesses are possible thanks to funding.

By providing liquidity, funding allows further investment, to cover distribution costs and maintain inventory at levels that correspond to a market quota and sales volume which have not been achieved yet. This is what often allows real growth. Without funding, the growth would be very slow: it would only be financed with resources from small increases in the amount of sales of the daily turnover of the business. There is another interesting perspective: when bringing forward the growth over time, funding can justify and lead to more growth. The big efforts (e.g. distribution), which are possible only through the additional resources that funding allows to have in advance, lead to greater sales volumes, if everything goes as planned.

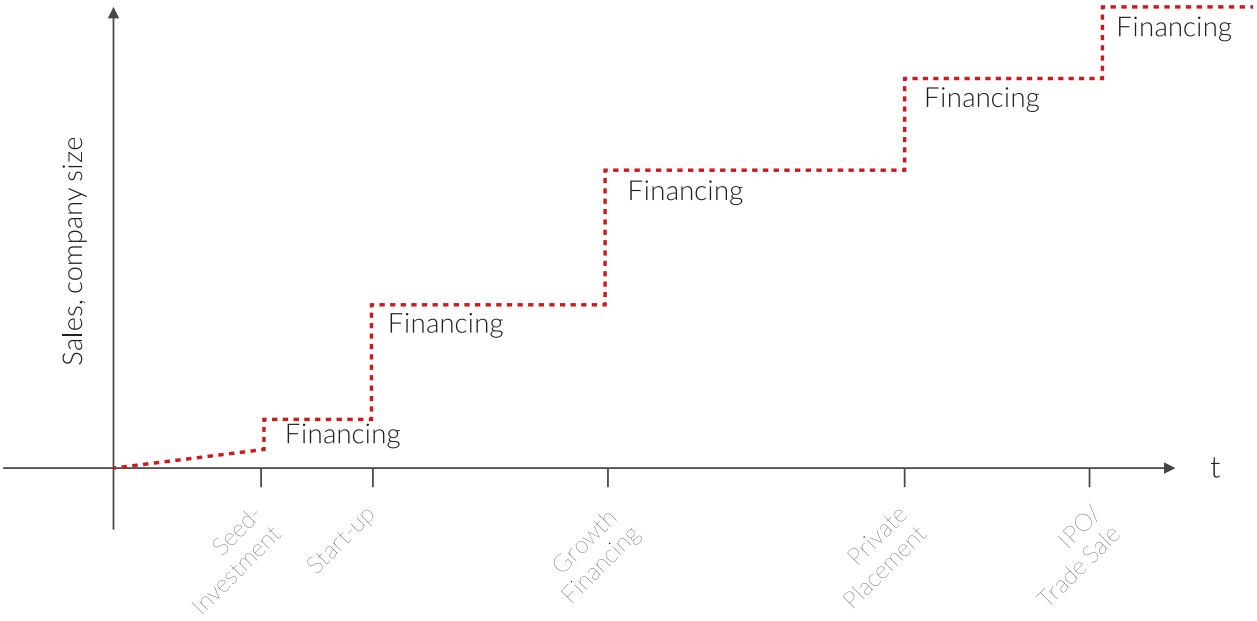


Figure 28: The sense of financing: to enable the upscaling of sales and the company size. Source: Own elaboration.

Structure of internal and external financing forms: equity and debt capital

The following table shows a matrix that contains the main funding possibilities for businesses and innovation projects.

Financing	Debt Capital	Equity
Internal Financing	• Debts • Reserves	• Self-financing • Retained benefits • Equity reserves • Equity increase
External Financing	**Long-term:** • Loans, leasing • Liabilities **Short-term:** • Supplier credits • Customer credits • Current account loans	• New shareholders • Shared equity increase (shares issuing)

Table 8: Financing Matrix. Source: Own elaboration.

Financing sources are classified into four categories: internal and external financing on the one hand, and equity and debt capital on the other.
Both equity and borrowed capital may come from outside or from inside, from the perspective of a particular period; for example, if new partners are included to raise equity, this own capital is considered as external financing. On the contrary, an equity increase through contributions from the existent shareholders would represent an internal financing. After the inclusion of new shareholders these „belong" to the company and therefore, these new contributions would not be designated as external funding. Then, the differentiation between internal and external financing depends also on the situation at a specific moment. However, the difference between equity and borrowed capital is independent of the situation.
The authorized shareholder capital represents equity and in most cases, increases with income (profit) and decreases with the losses of the company. Additionally, there is no fixed interest rate on this capital. Equity investors tend to have a voice in the company decisions that can either hinder or help the original shareholders. In any case, those who provide equity capital must maintain a closer relationship with the development of the business than the external investors. Furthermore, the former must accept their commitment to the success of the enterprise and beyond the contribution of an amount of capital; they must contribute as well with know-how, contacts and their own time to achieve this success.
There are typically two types of investors:

Those commonly known as financial investors are venture capital financiers or business angels and have a clear interest in increasing the value of the company they have invested in. From this business, they can generate revenue by selling their equity share (exit); for example, the sale of a company's block shares that has raised its value is usually the main source of financial success of venture capital investments. For businesses, these investors tend to be good partners who support by financial investments but also business know how and linkages in the market. Since the owners of the company are the key players to these investors, they must continue to play the leading role. Financial investors usually participate in less than 50% of the company to avoid discouraging the main players or moving them to subordinate roles.
On the other hand, those known as strategic investors are companies (often large) that have long-term interests based on their business strategy. In regards to their character and motivations, these investors are generally not financial investors. Strategic investors usually plan the full acquisition or at least the control of the company, in which they normally try to acquire more than 50% of the shares.
Another form of debt capital is provided by banks or by private investors who are not shareholders of the company. This capital must be insured through support or guarantee mechanisms such as mortgages, personal guarantees, etc. Typically, this capital generates fixed or variable interests, which are always set out in a contract. This interest must be paid regardless of profit or loss generation by the company.
One advantage of this form of external capital is that lenders have little or no influence over company decisions. The outside investors have no decision power on the board or assembly of shareholders. Ano-

ther advantage is when the loan interest rate is lower than the return on total capital of the company's economic activity. This is precisely what is sought to generate an acceptable profit for the owners of the company. In fact, an increase of external capital leads to an increase in return on equity, reducing its share in total funding. This relationship is known as leverage effect of external capital (leverage effect that increases the return on equity).

Another form of financing that is constantly growing is called mezzanine capital, which is a mixed form. It is considered a type of equity, as responsibilities lie on the capital in case of problems. However, this approach involves not only participation in profits or losses, thus avoiding the total risk of equity loss. Most of the mezzanine capital receives a constant interest. This form of capital usually takes one of two options: it can be a small amount of its equity which is part of the initial capital of the company, ensures the investor a say at the shareholders meeting, however, by participating, this creates for the investor certain liabilities. The second option is when the mezzanine capital represents a great part of the capital. In this case, the interests set are fixed at a high rate. The mezzanine capital optimizes to a certain extent the investors' benefits: they obtain participation in the ownership of the company, but are also exposed to eventual losses by bankruptcy risk. Still, on average, they continuously receive higher interests, if the company does not fall into serious difficulties.

Additionally, there are grants and development funds. In the case they are non-reimbursable, they will directly increase the income of the company as they will be registered as extraordinary income in the bookkeeping. These funds can compensate costs for innovation projects, thereby reducing the losses that could occur. The subsidies are instruments of the governments to support specific economic sectors. At the same time, they have the risk of making companies direct themselves towards the objectives of public actors. Therefore companies are well advised when they receive development funds that fit their business strategy. The following figure provides a general overview of the financing methods accessible to businesses at different stages.

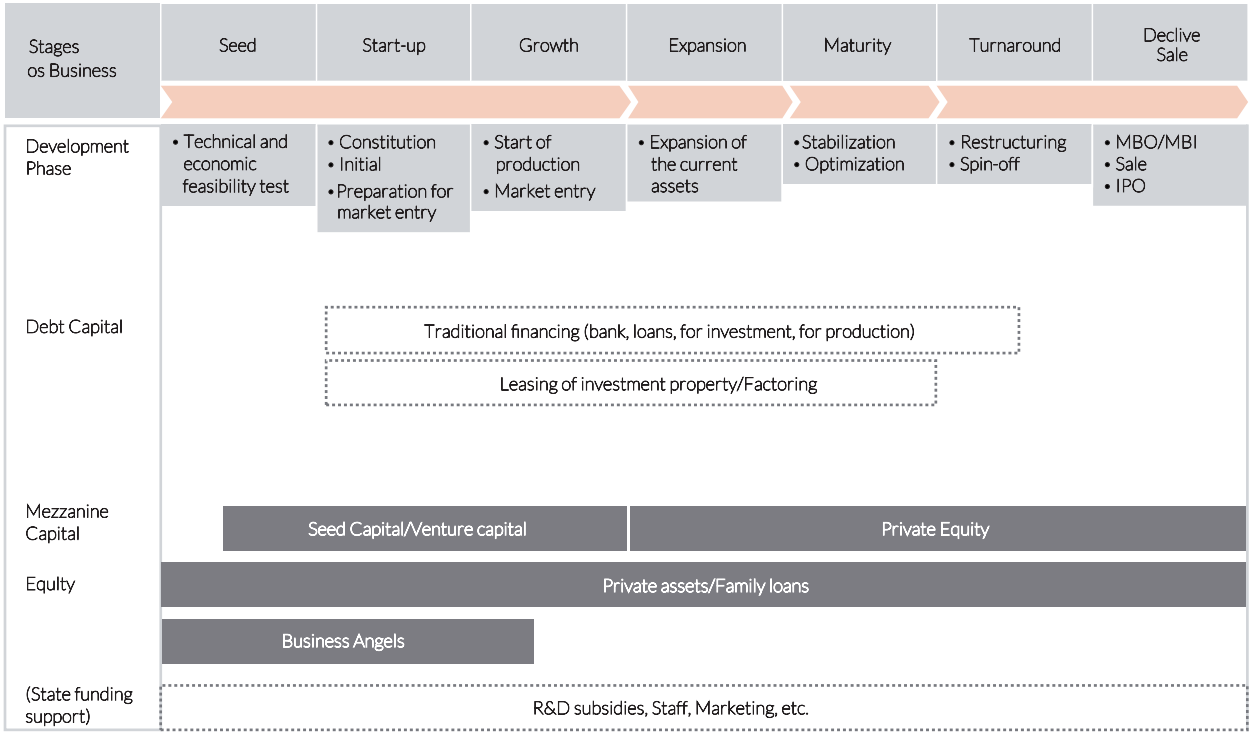


Figure 29: Forms of financing according to the development stage of the company.

Decision criteria of investors

Most investors expect and seek to see that the return on their investment is clearly higher than the return on other risk-free investments such as bank savings. The other motivation to invest is psychological: to build something of their own and be able to act largely independently.
In the following section, we will review external investors to understand their decision criteria, from the point of view of their return expectations.

Criteria of public seed capital funds and business angels

A very risky investment is that which is intended to finance the early stage of the company, the so-called seed stage, in which perhaps the fundamental innovation projects are still in process and the prototype has not yet been developed. It should be taken into consideration that for the investment of seed capital funds, there are so-called total failures, where the company goes bankrupt and all the invested capital is lost. For this reason, in a lot of countries the financing of the seed stage is usually managed with public

funds. These have a promotion character; because the objective of the public sector is the creation of new jobs, the establishment of new technologies, or the industrial development of certain regions or the entire country. In turn, these factors become the decision criteria on funding.
Besides the criterion of the purpose of promotion and the other essential criteria, in these early phases there are other requirements: the existence of a clear benefit for the client and the existence of unique selling points (USP or unique selling proposition, which are the critical differentiation factors that convinces the customer to buy the product of the company instead of the competitor's).
The following questions are normally raised by seed investors:

1. Have any patents been acquired? Patents represent a guarantee for the fund, because eventually, they could be profitable when sold.
2. Is it the appropriate team of entrepreneurs?
3. Is the sale of the fund shares (EXIT) realistic in a period of 5 to maximum 7 years?

Question No. 2 is particularly interesting. If the team of entrepreneurs convinces the funders, will depend on:

- If the team is complete. All key areas should be covered by the appropriate shareholders.
- If the team is convincing regarding the so-called 3M's: Management, Management, Management. This criterion is based on the experiences and the perspective which assumes that many companies with great products do not achieve success when their management is weak or mediocre and that many companies with exceptional management can be leaders in the market even with mediocre products.

Compared to a development loan (which implies all the same risks of total failure for the government), participating with equity in the seed stage has the advantage that the fund would participate more in the results of a successful company. In contrast, a development bank granting credits instead of participating with capital contributions as shareholder, has less advantages because it assumes the same risk but its income in matter of interests does not increase in the case of success of the supported company. In the seed funds, there may be also a mixed form of participation: here, the mezzanine concept has also become a trend, resulting in mezzanine seed capital.
Business angels are usually investors in the seed phase as well. These individuals provide capital at a very early stage with a large risk. As individuals, their goal is the high profitability of their invested capital rather than developing a geographic area or job creation. For business angels, the same criteria as

for seed capital funds are important at the time of making decisions. Business angels typically work at a regional level, meaning within a radius of up to 2 hours away by train or car. This is because business angels normally contribute with much more than just capital; they support the company with all their experience, know-how and contacts. It is not uncommon that in addition to their commitment, which they bring along with their money, they contribute with an interim management. For this reason, business angels are very interesting for young enterprises.

Nonetheless, the first goal when entrepreneurs do not have enough start-up capital is generally the 3F's: Friends, Fools and Family. Obtaining funds from these sources is interesting for several reasons, although it is often insufficient. Family and friends often provide money without interests and usually uncollateralized. At the same time, entrepreneurs feel a deep obligation to return the money to their financiers and therefore, a great responsibility for their own success, although they do not have to provide guarantees.

Decision criteria of private equity investors

Unlike the seed funds, private equity funds or individual private investors (persons or companies) start looking for participation in businesses much later. They have similar criteria compared to the seed stage funders. However, they impose as a requirement that the company is already in the growth phase, with no more losses, and that the products and the business model of the company have been already tested. The private investors can also act when the company faces difficulties but still has a good prospect for the future after the addition of new capital. In these cases, funders exert more influence on the selection of the managers. This type of investors invests to obtain participation in companies that are not publicly traded on stock exchanges.

The time horizon of private investors can be much longer than that of the seed capital investors. In this case, the expectation of development of profits and sales of the company is also long-term oriented.

Criteria of commercial banks

Commercial banks are risk-averse, in comparison to private investment funds and seed capital investors. For banks, the full payment of the loan and the interest in a timely manner are crucial. The interest rate is established in a contract. Even though it can vary, this variation is established in advance and is not modified with respect to the profits of the borrower. Consequently, banks are not affected by the success of a good customer or by the high risks they face. The decision to grant a loan depends mostly on the aforementioned expectation of full and timely payment. This expectation of the bank may be positively influenced by a convincing business concept or the appropriate market conditions.

- An indispensable condition is a sufficient equity ratio. This requirement of the banks varies by country, but it is usually between 10% and 70% of equity within the total capital.
- Guarantees in the form of mortgages of land and real estate or other assets.
  There may be also collaterals in the form of personal or bank guarantees provided by government guaranteed banks.

Commercial banks carry out the evaluation to determine if a company is solvent through quantitative and qualitative business factors.
Among the quantitative factors are:

- The equity ratio
- Sales
- Profit or losses in recent years
- The margin and its evolution
- The company assets, including patents
- Deviations of these data concerning past planning

These data have the advantage of being easily accessible, but the main disadvantage is that it always comes from the past.
Among the qualitative factors are:

- Management and organization
- Team
- Strategy
- Product and market position
- Sector environment and competitive environment

These factors say more about the opportunities and future risks to the lender and, therefore, of the repayment. However, they are difficult to quantify and put into an assessment scheme. Banks develop and refine their models of assessment, although for a number of qualitative factors, a subjective assessment by the staff of the bank turns out to be the only solution. The rating is a process through which banks compare the situation of their borrowers with the results of an investigation of insolvency and determine a sort of note or rating of the borrower. The rating is also used to determine the importance of qualitative

and quantitative factors allowing the observation of large amounts of data about the past of their customers. This empirical rating is very important and is used for evaluating credit potential.

Criteria of development and promotion banks

These banks, mostly publicly funded, have an explicit mission to help and support and their conditions are more favourable than those of commercial banks, especially with less collateral requirements and more favourable interest rates. They often do not require guarantees up to a certain limit or if they do, these are partial. Interests are usually subsidized and therefore, lower.

Important criteria for development banks are generally more related to the purpose of fostering and less to the bank's profitability through interest on loans. Regarding this matter, its behaviour is significantly different from commercial banks. It is also possible that commercial banks refuse funds to a company when it is very young and the risk is too high from their point of view. For this reason, development banks are, along with private equity investors, the most important funders.

Development banks can also back up the responsibility of commercial banks which means that they assume the risk of unpayable credits on behalf of the commercial banks by taking the responsibility instead of the owner or the company that receives the loan from the commercial bank.

The guarantee banks are a special form of development banks that offer entrepreneurs access to a guarantee for the payment of the credit so this can be presented to another commercial or development bank in order to receive a loan.

PART TWO
Tools

Management of the fuzzy front end of innovation

In the management of an innovation process there are three different phases (see Chapter 1):

- The early phase of the innovation process consists of analyzing market opportunities, developing ideas to meet the demand detected in the market and developing the concept of the new product and processes. At the end of the early phase, an innovation plan must be developed.
- The second phase of the innovation process is mainly focused on the implementation of the innovation project, that is, the development of the new product or process.
- At the end of the innovation process comes the introduction phase of the new product to the market in order to achieve a successful commercialization.

This chapter is primarily focused on the presentation of the tools that can be applied in the management of the first phase of the innovation process.

Before innovation projects are born or set up, ideas must be developed in the early stages. But this process also needs to be structured and oriented. Ideas do not come out of nowhere and they should be regulated by the so-called thinking corridors which must be previously identified. This means determining the directions in which ideas will be developed. This does not depend, in turn, on random decisions, but on a profound analysis of the internal and external demands to define the areas with the most promising innovation opportunities, which at the same time should contribute to the objectives and strategies of the company in the future. Otherwise, one could invest and innovate in attributes or components of services and products that do not add a significant value to the customers or the company.

When the innovation fields are defined, the generation of ideas can take place. The idea generation phase is not necessarily a linear process; it probably includes several rounds to finally reach the right ideas. Moving along this sequence, ideas must be evaluated according to the defined criteria. Sometimes, to quickly detect the best ideas within a group or „pool" of ideas, not only one but several processes of evaluation are required. These ideas need to be developed to have, in the end, a defined concept taking into consideration all the possible success factors. Based on the concept of the new product, the innovation project planning has to be developed considering the internal and external resources of the company. Finally, the plan is evaluated and in the best case, adopted by the next stage of the process: the NPD phase (New Product Development) in which its development begins (see figure 30).

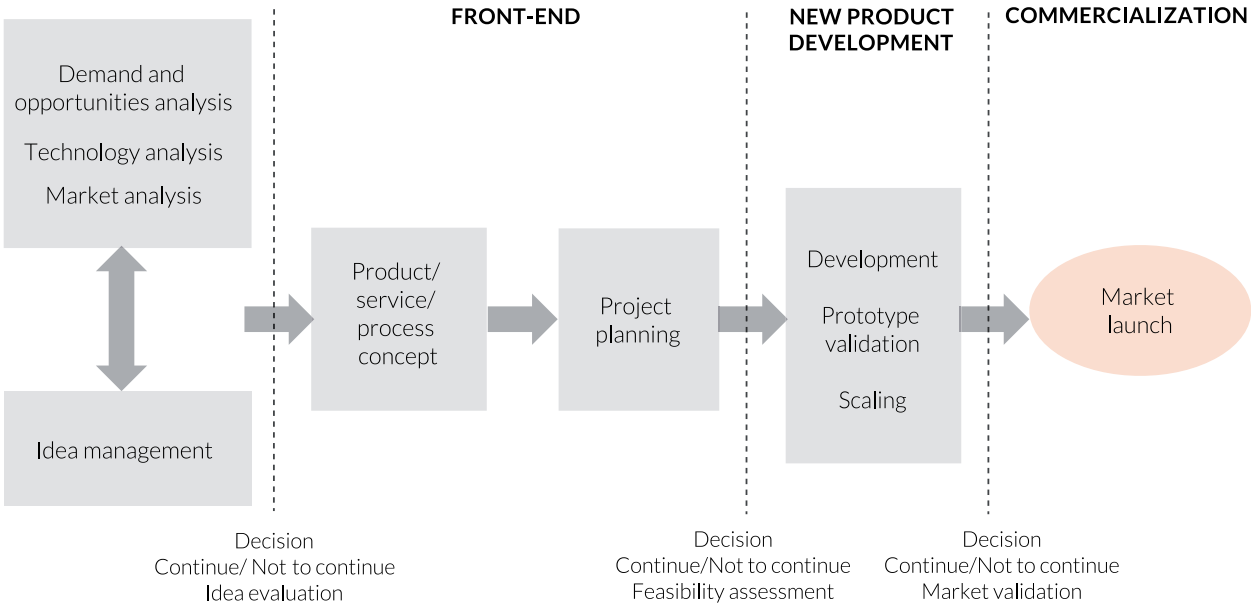


Figure 30: The front-end phase of the innovation process. Source: Own elaboration.

However, this process shown above is not so simple. For example, in the phase of the demand and opportunity analysis, it is essential to establish a clear link between the innovation focus on the one hand, and the general business strategy on the other. This involves the development of many activities to make a comprehensive analysis of the internal and external factors of the organization. As far as the idea generation phase is concerned, it does not only require the correct method for the generation of ideas but it also depends on building the right team and having the appropriate environment (e.g. organizational culture) to encourage the generation of ideas; the progress of an idea in the process does not occur automatically. As it was previously mentioned in the first chapter of the book regarding the „creative destruction", the introduction of new ideas faces resistance within the organization. Ideas do not progress by themselves through the innovation process: key people, methods and other elements are necessary for moving ideas forward.

In the past decades, the attention was mainly set on the NPD phase and the other phases were managed by other disciplines such as sales and marketing. But the early stage of innovation, also known as „Fuzzy front-end" (the confusing front-end) was not the focus of the analysis. However, this front-end represents, as shown in Figure 31, the part of the process in which innovation can be more influenced, since the front-end of innovation management shows a high potential for improvement.

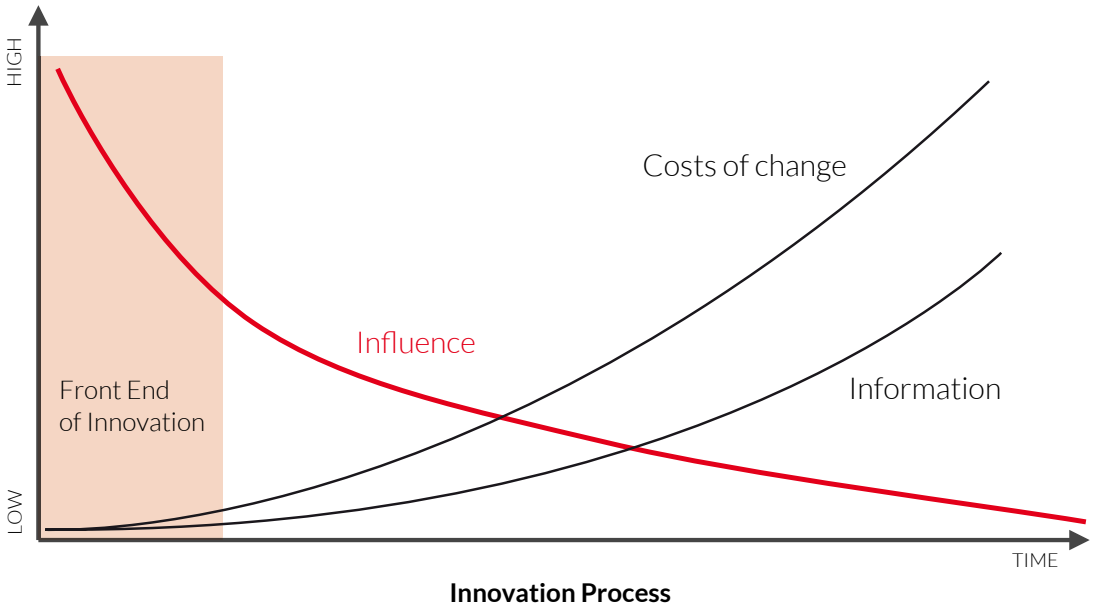


Figure 31: Influence, cost of changes, and information in the innovation process. Source: Hippel E. von (1993). Wheelright and (&) Clark (1993).

Demand and Opportunity Analysis

The demand and opportunity analysis should be divided into the analysis of market demands and opportunities (external) on the one hand, and the analysis of demands (internal) on the other.
The market demands and opportunities are the first sieve of ideas for further processing. There is a variety of information sources and tools to collect and systematize them. Among these, we can find:

- Market research reports
- Interviews with customers
- Market trend analysis
- Technological analysis
- Interviews with experts
- Competitor analysis

There are several methods for structuring the collection of customers and market information (see figure 32).

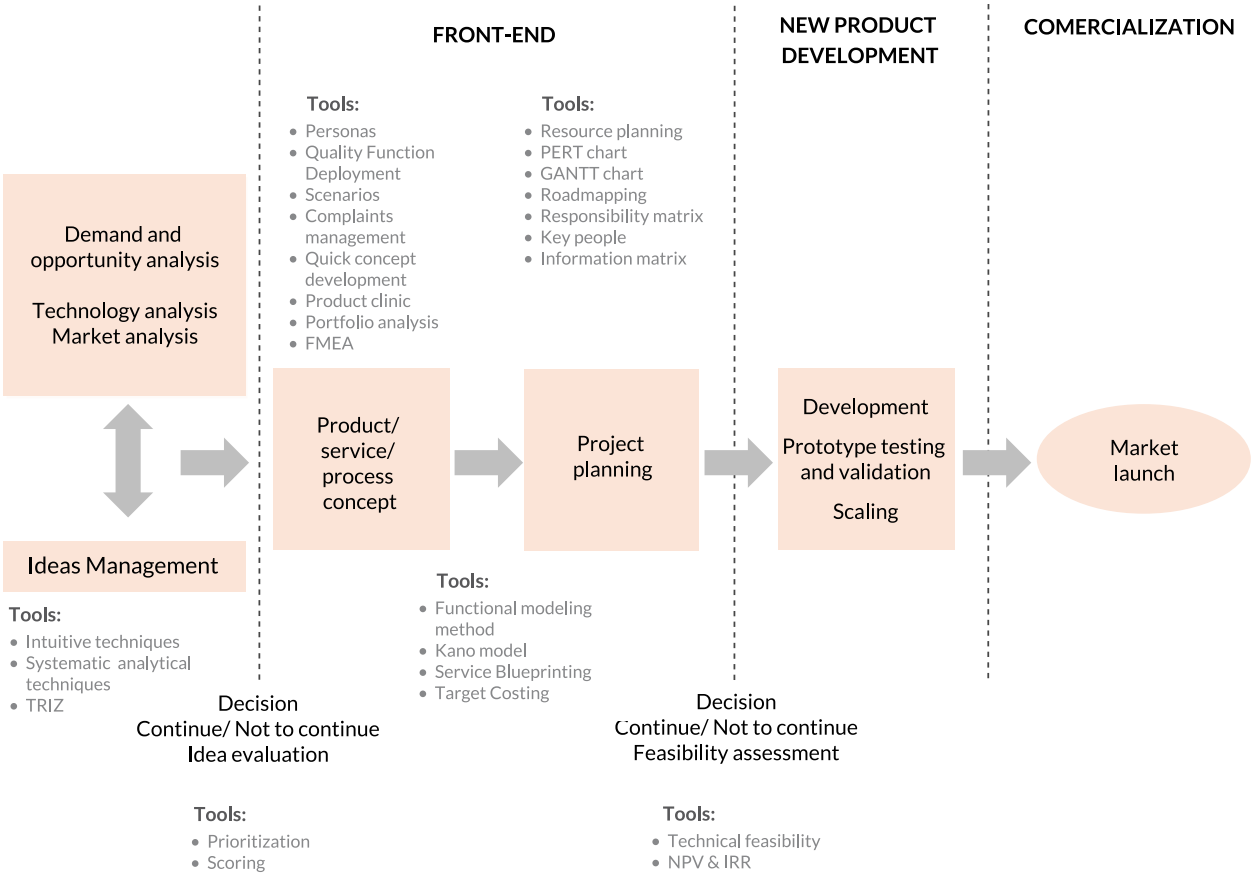


Figure 32: Management tools in the front-end of the innovation process. Source: Own elaboration

Personas is a tool capable of transforming data about the market into a subject, into a model. The tool takes the information of the market and turns it into an archetype that facilitates the design of services for defined markets with specific characteristics. In this way, the information of the market can be managed very effectively, by displaying the typical customer (or different typical customers) while decisions concerning the design of products or services are being taken.

One of the most powerful tools for innovation management is the QFD (Quality Function Deployment), because it can assist the innovation process from its inception until the design phase. The results are achieved through a clear definition of the customer requirements (What does the customer want?) and its fulfilment (How is this accomplished?). Both the demands and the factors that satisfy them are introduced in the so-called House of Quality and in this way, it becomes possible to link them, visualize them, and also to identify the positive and negative interrelations with each feature of the product involved in satisfying the customer demands. The tool allows one to determine where or in what should be innovated. Finally, the implementation of the benchmarking within the QFD enables the company to redefine the

strategic areas for innovation taking into account the products offered by the competitors and their ability to meet the needs of the customers compared to the company's own offer.

The scenario technique allows analyzing different possible variants of the reality in the future. Since the different scenarios are constructed based on coherent combinations of variables, this method is very useful for determining the options of action and strategy courses that should be adopted in certain future scenarios. It is advisable to create scenarios with the variables that could affect the project the most and not to develop too many scenarios; it is more useful to develop some scenarios with clear contingency strategies.

Particularly in the area of service companies, an effective complaints management can provide valuable suggestions from the client for the improvement of products and service concepts.

The rapid concept development method is a market research approach that combines the qualitative and quantitative approaches. This method seeks to obtain substantial information about the needs of customers in a short period of time complementing qualitative elements, such as Focus Groups, with quantitative elements such as telephone surveys for market research.

The product clinic concept is based on the analysis of the company's own products and the competitors' and on the use of the results gained for innovations. In the product clinic, finished products or well-developed prototypes will be compared among themselves and with other competitive solutions. In a small working group comparative evaluation and a practical test of the different products will be conducted.

To determine the company demands, we must analyze the long-term business strategies of the company, its goals and objectives in the long term. The company will have commercial objectives and financial goals as well as other types of objectives in each specific case. Therefore, it will be necessary to be clear on what the product represents for the company in strategic terms in the present and the future. Thus, we determine how necessary and profitable it is to carry out an innovation project of the product or service in question.

The tools that contribute to this analysis are:

- Review and analysis of policies, vision and mission of the company
- Product line and product mix analysis
- Product portfolio analysis

For the portfolio analysis, the matrix of the Boston Consulting Group is a very useful tool. Developed some years ago in order to analyze products from the point of view of their market growth and the participation that the company has in the product market, the matrix provides an overview of the profitability of the company's product groups (portfolio) and the ability of each product or service to generate cash. Portfolio analysis models are directly related to the future performance of the products or services in the market.

The FMEA (Failure Mode Effect Analysis) technique is very useful for the classification and categorization of identified risks in production and service provision processes. The detection and further management of potential failures is a very important approach to improve these processes.
The experience of the authors and the good results obtained with the application of certain tools has been the basis for selecting some of these and developing manuals for their application. For this first phase of the process, four tools have been selected: Personas, QFD (Quality Function Deployment), FMEA, and the Scenarios Technique.

Idea generation

When the frames and the direction of innovation are defined, the generation of ideas can take place. The idea generation phase is not necessarily a linear process; it probably includes more rounds to finally reach the right ideas. Ideas do not come by themselves in the process of innovation. Key people, methods and other elements are necessary for moving ideas forward.

Intuitive methods are those that allow to reach a broader range of ideas, because they are usually not limited by reason and logic. Therefore, special precautions should be taken. Among these techniques we can find:

- Brainstorming
- Brainwriting – 635 method
- Bionics
- Analogies (Synectics)

On the other hand, systematic-analytical methods require staff with a deep knowledge of the product or the service that will be the object of the development process, as they closely involve the rational characteristics of the product/service. Among these are:

- Checklist
- Morphological analysis (morphological box)
- Relevance tree
- Six thinking hats method

The use of a method or another depends on the conditions; therefore it is suggested to define which application to use considering the situation of the company and the availability of relevant information. The requirements for the development of a new product or service are also different from those related to the modification, adaptation or improvement of existing products or services.

The theory of inventive problem solving, TRIZ, is a methodology that contains a set of tools to generate ideas for solving a given problem. This methodology provides methods that facilitate the problem formulation, the analysis of systems, failure analysis and even the identification of system evolution patterns. This systematic process has been generated in the area of engineering, but can be applied in different areas. The different tools of the TRIZ are structured in a knowledge base, a sequence of actions and a modelling representation of a current technological system, generating in this way ideas to solve problems and make innovations.
For this part of the process, the authors chose to explain the following tools in detail:

- Brainstorming
- Analogies (Synectics)
- Checklist
- Morphological matrix
- Six thinking hats methods

Idea evaluation

A simple method for the assessment of ideas is the clustering and prioritization of ideas. This consists on the prioritization of the groups of ideas in quadrants, taking into account the customer benefit, the company's benefit, size and market growth, and the maturity of the market. The groups of ideas must be evaluated according to the existing activities in the company that can generate synergies, the radical nature of the idea, the business opportunity of the idea and the perceived potential threat if the idea is implemented.
In the process, the alignment of the external and internal assessment criteria with the business strategy of the company is very important. The external and internal demands must be prioritized.
The assessment of ideas considering the internal and external aspects can also be performed through two basic methods: Scoring and evaluation.

The scoring method is based on the weighting and rating assigned to selected criteria according to fun-

ding requirements, the ease of implementation, degree of customer acceptance, usability and originality, and so on of the new ideas.

This method assigns a weight to each criterion of the product or service depending on their importance in providing the service as a whole. Then it is rated according to a predefined range, how much the product meets the criteria, the highest value of the rating corresponding to the greater degree of compliance. Finally, the sum of all the weighted values must be calculated and compared to those of the other ideas, choosing the one that obtained the highest value.

The evaluation method involves assigning a value to the different properties of the service, of the market, competencies and ability to manage expected risks, and then comparing these values with the other options. The following group of criteria is taken into consideration:

Product/Service

- Benefit for the customer
- Degree of differentiation
- Opportunity for additional products
- Barriers possibility against competitors
- Economic benefit
- Position in the market

Market attractiveness

- Market size
- Market growth
- Market dynamics
- Adjustments of the focus areas
- Weakness of the competitors
- Low entry barriers
- Market accessibility

Competence and technology

- Competencies
- Technologies
- Window to the market
- Technological complexity
- Complexity increase

Ability to manage risks

- Technical risks
- Risk of rupture of the market
- Lack of skills
- Strength of the competitors
- Cannibalism among the own products

The optimal scenario would be that representatives of strategic planning, marketing, development, sales, distribution and service were present in the assessment rounds. Once the evaluation of ideas has been carried out, they can be grouped in accordance with their affinity into various groups.

If at this point ideas have been evaluated and selected according to the key criteria outlined above, it significantly decreases the risk of wasting valuable resources of the company during the development stage of the product or services, since the ideas with low commercialization potential are dismissed in the beginning.

Definition of the concept

Once the ideas with potential for innovation have been evaluated and selected, the planning process must be completed preparing the conditions for the management of the project implementation and determining its location along the line of the technological and scientific development. The concept of the product, service or process must be defined with precision and coherence.

The definition of the concept of products, services, or new or modified processes is one of the most important stages of the innovation planning. The importance lies on the coherence that the innovation result must have regarding the set objectives.

It is advisable to determine the hierarchy of objectives at the time of its definition. When presenting them graphically, it is possible to understand which goals are developed from others and which are more closely related. For a comprehensive overview of the objectives, it is necessary to define the involvement of people, the motivations and the rationale for decisions, including the timeframe. Of course, the objectives must be determined with a strict market orientation.

The concept should define the needs and desires that the new product or service must satisfy. The combination of different attributes that meet these needs and desires can be easily analyzed using the Kano model, which allows the categorization of the attributes of products and services into three groups (basic, operational and emotional). The definition of the concept must specifically answer the following questions:

- What is the product or service?
- What need or desire must the product meet?
- Who is the target of the product or service?
- How is the product or service different from the competitors'?
- How is the product or service generated?
- What is the product made of?
- What are the parts or components of the product or service?

Should innovation be directed to a process or solve a specific problem, the concept must be directly linked to the specific approach of the problem or the current definition of the process.
The functional analysis allows analyzing the interaction of the components of a system. This tool analyzes the functions performed by these components and is useful for checking the coherence of the attributes that are meant to be generated in the product or service in relation to specific goals. Similarly, the functional analysis allows checking the interrelationship of the components of a system that complies with certain process.
A very useful tool for generating innovative concepts of services is the Service Blueprinting, which is a method of analysis, visualization and optimization of service processes. With the use of Service Blueprinting, the layout of the service is described in a flowchart. As a result, we obtain the presentation of the chronological sequence of activities in the service process (in the horizontal plane). Each individual activity is classified in different vertical planes according to their closeness to the customer. With this method, both the customer's point of view as the provider's with respect to the process is evident. The strength of using Blueprinting is on the detailed structuring of service provision processes with the aim of raising customer satisfaction, increasing the effectiveness (achievement of objectives) and the efficiency (benefit-cost ratio) of these service processes considering each one of its stages.

One of the most important criteria in the development phase of the innovative product or service concept is the commercial feasibility. To avoid going through the whole process and reaching in the end a product or service for which costs and prices are beyond what the market is able and willing to pay, it is essential to make adjustments and modifications already at this stage.

To fulfil this purpose, the Target Costing method is an efficient, effective and relatively simple option.

Considering their great usefulness and versatility, the Service Blueprinting and the Target Costing have been selected to be explained in more detail later on.

Project planning

Core elements of project planning are:

- Plan of activities
- Scheduling
- Resource planning
- Cost and financial planning
- Structure planning (roles and people in charge)
- Risk management

The planning of activities allows describing people in charge, important aspects and dates for each required activity. The structure plans and the task lists are usually ready at the beginning of an orderly project planning process. On the other hand, a PERT chart or network diagram does not only denote the sequence of activities; this can also show the critical route of the project by clarifying which activities are prerequisites of others and which resources are involved. To visually show the duration and temporal interdependence relationship among the different activities, the GANTT chart, or bar chart, is an appropriate tool for easy reading.

It is important to strike a reference in the time space and the development of science and technology for the innovation project. To achieve this, a very suitable tool is the Roadmapping, which articulates the foresight, the management and the strategic planning in a comprehensive manner in terms of aggregation levels (corporate, industrial) as well as in terms of time (extrapolation, retrospective). Additionally, this tool promotes the coordination of requirements and demands with the scientific-technological offer through the collaboration and integration of relevant actors. Roadmapping is a wonderful tool for planning and allocating resources in the short, medium and long-term, facilitating the flexibility and adaptability through the identification and delineation of alternative pathways.

There are different methods to establish the requirements and to allocate resources to different activities of an innovation project. In case of having the project blueprint, this can be complemented with the allocation of resources for each specific activity. It will also be necessary to perform an adequate resource analysis, comparing different options to choose the most economic and safe ones in terms of availability and quality.

With the purpose of allowing an appropriate management of the project, the structure of the project must be clearly defined as well as the nature of the organization in terms of formality and administration. Human resources can be easily arranged in an organizational chart that includes the organization's structure of the innovation project in different hierarchical and approximation levels.

A responsibility matrix can combine the correct assignment of sufficient human resources to the project

tasks, indicating their roles, their authority and the necessary and conferred competences. The analysis of key people examines the role, particular interests and the influence of key individuals on the project. This tool also allows establishing possible conflicts and designs measures to take in the future.
Since the information management is crucial for the success of the innovation projects, it is recommended to plan the information flows that will be needed. The information matrix can identify who the key people are and what information they should receive. This instrument can still be used later in the project management phase.
Moreover, the financial planning and the control of project costs can be made through a budget which can determine any time the balance between what has been planned, what has been executed and the variations. This will allow taking timely preventive and corrective actions and redirecting the capture and allocation of the project resources.
Traditional accounting and financial control instruments such as the income statement and the cash flow should always be kept up to date to quickly obtain a reliable view of the project's financial situation.
We will present below detailed explanations or implementation guides for certain rules that can be also applied in this phase of the innovation process in its early stage:

- Structure plans and tasks lists
- PERT chart or network diagram
- GANTT chart or bar chart
- Roadmapping

Feasibility assessment

It is necessary to include a feasibility assessment in the plan for several reasons, for example to present the plan to potential financiers or to the top management of the company.
In addition to the technical feasibility, the financial feasibility of the plan must be proved as well. To do so, we can use the common techniques for innovation profitability analysis showing indicators based on discounted cash flows such as the net present value (NPV), also known as net present worth (NPW) and the internal rate of return (IRR). These investment evaluation methodologies are also used to show customers the additional value created by introducing a new product, an innovative service or process innovation in into their activities. The time required for the return of the investment is another very important indicator of innovation projects. Later on in this book, we present the dynamic methods of investment appraisal.

Intangible aspects of the Management of the front end of innovation

In each phase of the innovation process, different intangible factors that significantly influence the success of the innovation projects must be taken into account. Typically, these aspects are closely related to the organizational culture and the way in which this promotes or inhibits the establishment of a favourable environment for innovation. Behavioural barriers hinder the understanding and cooperation necessary to pursue successful innovation projects.

The methodologies for measuring the cultural disposition towards innovation and for identifying barriers and their solutions will be further addressed in this book. In order to enable the change in the culture towards innovation, besides the elimination of barriers, it is necessary to perform an analysis of the stakeholders involved and include innovation drivers within the organization itself. For this purpose, methodologies and explanations are given below.

The innovation plan

The central document in which all essential information from the early stage of innovation management converges is the innovation plan. The importance of writing a good document lies mainly on the need for systematic information that enables to maintain the focus and pace during the project implementation. The absence of a document that provides a framework and guides the actions often leads to inefficiencies related to the dispersion of efforts, to distant perceptions among members of the organization regarding the project, to inadequate or poorly defined organization, to disorganization of the contributions and activities of the involved stakeholders, as well as to inaccurate estimations of the resources and time needed, among other problems. In a nutshell, a good documented innovation project contributes to reduce the risk of project failure by providing good information for the implementation. On the other hand, it allows the company to have an integrated vision of the innovation project with clearly defined elements, which can be used to monitor and control the advances and partial results during the implementation with regard to what was originally planned. In this way, the document greatly facilitates timely corrective decisions. The innovation plan is structured as follows:

Part 1

- Analysis of external and internal demand
- Analysis of technological options

- New product/service/process idea and its value proposition
- Concept of new product/service/process
- Impact on firm performance

Part 2

- Key activities for project implementation and timetable
- Key resources
- Key partners in project implementation
- Cost and feasibility of the project

The first part is intended to document the opportunities, needs, analyses, reasons, ideas, solutions; that is, all the concepts and existing and proposed elements to be taken into account to achieve the desired impact. In contrast, the second part contains all the planning to implement the new concept, including everything needed to make things happen in such a way as to obtain the change and impact foreseen in the first part.
The document structure is designed in a way that responds certain key questions when it comes to elaborate the project innovation:

- In what product, service or process we want to innovate?
- How do we want to innovate in this new product, service or process?
- How is the concept of the new product/service/process?

To answer these questions it is necessary to perform an analysis of the internal and external demands that drive innovation. It is also necessary to identify the technological options and finally manage the ideas that result from the above, to determine how the innovation will be achieved.

Analysis of external and internal demand

The internal demands are mainly related to needs or motives within the company or the organization that could trigger an initiative to innovate in something. Internal cost pressure or the need to achieve the targets of the company's strategy can generate some of these internal demands. On the other hand, continuous improvement practices and the observation of our customers' portfolio, their needs and satisfaction are often among the most important demands. Of course, problems and risks generated in production

processes, provision of services or logistics coupled with the constant need to increase efficiency and safety of these processes often represent an internal demand as well.
Conversely, external demands come from those actors and forces surrounding the company in its context. External demand is most commonly generated by competitors, which constantly produce challenges when they innovate and grow in number. Similarly, potential clients and new markets also trigger external demands that motivate innovation. Many demands are generated by external regulations and other environmental forces that set new challenges to products, services or business of the firm, making it necessary to generate an innovation project in order to adapt the company and its production to the new requirements of existing and new markets. The increasing resource constraints and, consequently, the rising prices of inputs and raw materials are other external factors that often generate demands.
Additionally, the strategic foresight of the company enables the visualization of demands that will appear in the future, from both external and internal sources.

Analysis of technological options

The existing technological options should be identified and described thoroughly. Only then, the best combination of available and accessible technologies for the company can be identified, which allows to meet the innovation project objectives. Monitoring technology is a very important source of information and often can help to trigger a new innovation project, just because of the impulse caused by a new technology that opens new possibilities to enhance or create products, services or processes.
Here, important features of technologies must be analyzed by comparing them with each other, whether it is production technologies, machinery, component options, alternative forms of communication and distribution, etc.

New product, service or process idea and its value proposition

In this chapter of the innovation plan, the management of the ideas generated after identifying internal and external demands must be clearly documented. Sometimes, ideas come from the analysis of the technological available options. These ideas are possible solutions to those problems or possible ways to exploit identified opportunities. Once the ideas were generated and collected, these should be further developed and evaluated in order to select the idea or set of combined ideas which will generate additional value by exploiting a new market, increasing the usefulness and efficiency, solving a problem, reducing risks, etc.
Moreover, this chapter should document in a very precise way the value proposition related to the chosen

ideas. For this purpose, it is advised to compare the current reality of the products, services or processes with different scenarios that could happen if the ideas proposed were implemented.
The value proposition must be described in accurate terms and has to reflect, for example, a change in the benefits delivered to customers, an increase in the efficiency and safety of the processes and services, or any other fact that allows the appreciation of the generated value.

Concept of new product, service or process

This chapter is intended to describe as clearly as possible the concept of the new product, service or process. Certainly, this also applies to incremental innovations that simply introduce improvements in the products, services or processes.
All tools that help describe in detail the design, form, composition, physical-chemical characteristics, times, quantities and all other measurable variables relevant to the new concept should be included in this section of the document.
In addition to the detailed description of the new concept of product, service or process, it is necessary to incorporate those aspects that will affect the new concept. Changes or new strategies in communication, marketing and distribution should be clearly defined. The same applies to changes in production plants and production lines, input supply strategy, infrastructure and permanent changes in the organization and staff. In this way, the unit costs of products or services as well as the cycle costs of processes can be calculated. All necessary measures related to the field of intellectual property, licensing and other related legal issues must be also stated in this part of the document, as same as the risks and corrective measures related to the new concept.

Impact on firm performance

Since innovation only counts as such when it generates value and has an economic impact. This section of the document is the one that contains the indicators that show the convenience of carrying out the project. Here should be expressed all expected changes in terms of sales, market share, growth, cost reduction, time reduction, risk reduction, positioning in relation to competitors or corresponding variables according to the nature of the project.
It is of utmost importance to quantify the expected impact. For this purpose, different tools can be used such as sales projections, projected cash flows or projected competitive assessment reports, among others.
At this point, another very important question arises, and will be answered in the following paragraphs:
How will the innovation project be managed?

Key activities for project implementation and timetable

Once the new concept and its impact are clearly documented, it is necessary to also document the activities that will make possible the achievement of the goals. All tasks to be done must be listed and described here, as well as the responsible actor and the temporal project structure needed to carry out these tasks. This will provide clear milestones to assess the implementation progress.

Key resources

Normally there are certain key resources for project implementation. These can be human resources, experts, new facilities, machinery and specialized information. In that regard, these resources should be described in detail on this chapter, including their costs and the ways to access to those resources.

Key partners in project implementation

Certain resources, knowledge and key relationships for the project are often in the hands of third parties and this generates the need of cooperation for implementation. This section of the document describes the partners, the mechanisms used for keeping the relationship and the transactions with them. The responsibilities and benefits that each of the parties involved will get when participating in the project must be also clearly defined.

Cost and feasibility of the project

All calculations of costs emerging from the implementation of the project must be shown and described in detail. Here it is important to clarify that this is about the costs related to the implementation of the project, including the initial investment required. Conversely, fixed costs related to production, provision or functioning of new products, services or processes should be included in the first part of the document, on the chapter dedicated to the new concept.

Finally, the feasibility can be determined by analyzing the data of this chapter in comparison with the data documented in the first part, on the chapter related to the impact on firm performance. By doing so, the convenience of implementing the project instead of another will be clear.

The innovation project canvas

One very useful tool for presenting the most important aspects of the proposed innovation project in a summarized and integrated way is the innovation project canvas. In this canvas, all the information from the early stage of innovation management converges and is synthesized. This tool serves as an executive summary and greatly facilitates the visualization of the innovation project.
Inspired by a similar canvas used for business plans development (Osterwalder and Pigneur, 2010), the authors propose the following structure for the canvas (see figure below).

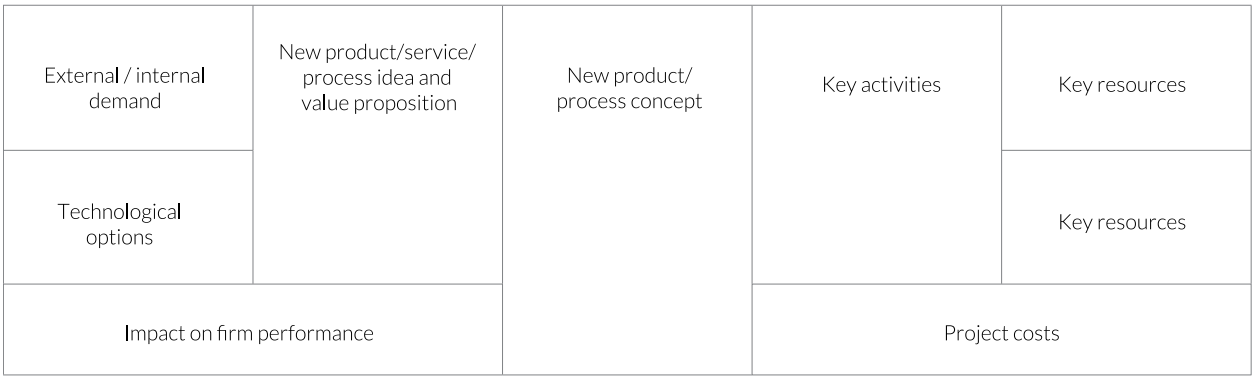


Figure 33: Innovation Project Canvas.

Given the qualities of the innovation project canvas, this tool is ideal for communication within the company and among the members of the project team. Moreover, it allows comparison of different versions from an innovation project, facilitating the analysis and discussion of alternatives.

Personas

To develop products and services in a customer oriented way, the analysis of the needs and requirements of the customers is mandatory. The customer requirements should be the basis for all tasks related with the development of new products. Hence they have to be extracted, documented, stored and presented in a proper way, which makes them useable in an efficient way by the innovation team. Personas are one possible approach to represent all the information collected about the customer.
The method introduced and described in this handbook aims at transforming information about the customer into a form, which is easy and accessible for the innovation team. The suggested solution is the development of fictive customer profiles (Personas) which could be the potential user of the service or product, which has to be developed.

Description

Personas are detailed, accessible archetypes, which are representative for actual groups of users and their needs. They are based on research with real people and constructed out of specific data about these real people, but not directly based on individual people.
The Persona-and-Scenario method was developed by Alan Cooper, a Visual BASIC developer. Cooper believed that it was essential to have empathy with users in product design, and used a persona in the product development of Visual BASIC. The Persona-and-Scenario method is a design technique to help to provide the product that users really want to use.
Personas "humanize" usually big quantity of customer information, which exists within a company, in a way, that the "fuzzy customer" is transferred into concrete users, which represent the focused target groups. The advantage of this tool is that it is much easier to keep information in mind and refer to them during the innovation process, which is related to people (in our Personas case), then remembering hard facts from market research reports. It is also easier to develop for a specific person instead of developing for „the user".
Personas are not reflective of every customer or market segment and they are ideally based on qualitative user research like observational studies, contextual inquiry, interviews, etc.

Why Personas?

The development of new services or products is usually structured in projects, which are performed by a more or less open and interdisciplinary team. Normally each team member has at the beginning of the project his/her own view and expectations on how the final product or service should look like. One of the most fundamental bases for a successful development is a common and data-based understanding of the user within the team. This is important for a focused and aligned cooperative team work. Personas can transport this conform view into all by the innovation process connected departments in a company. So other departments like the marketing department target the same customer groups and can comply with the work of the innovation team.

For innovation teams, which most of the time consist of experts from fields which have nothing to do with marketing, it is often difficult to identify and communicate the information which is valuable to understand the customer requirements. Even if the information is identified and communicated, a consistent interpretation by all team members is not guaranteed. Personas offer an elegant way to escape from this dilemma.

A lot of companies perform intensive market research like customer interviews, field studies, telephone and internet surveys, hotline tracking, etc. The data gained through these tasks are processed, analyzed and generally afterward provided in form of reports, consisting of big piles of papers. These extensive reports gain most of the time not the attention in innovation processes they deserve. Mainly this is because they are not usable for the work within these kinds of projects. During the development process of services or products there are hundreds of decisions to be made where the customer reports mentioned above play often no role at all. The majority of the decisions are based on some facts and a lot of unspecific assumptions about the customers and their needs. Besides the imparting of knowledge about customer groups, personas are also valuable for the evaluation of design decisions, where market research reports in general fail.

In general, innovation projects are set up to target as many as possible customers. This makes it difficult to focus on the relevant aspects and leads often to products or services with a vast of complexity, because features are implemented for almost every imaginable customer in the world. The development of products or services for markets is problematic because they are consumed by individual customers and not by „markets". Personas allow the development for a restricted number of concrete defined customers. They define who is a target customer and who is not. This limits the options and enables better decisions which features should be implemented and which don't. The quality of a service or product can benefit from the limitation of features or options.

Product attributes and features which satisfy one customer can annoy other customers (e.g.: a disco with loud music in a holiday complex). A customer satisfaction level of 50% will not be reached if we satisfy all customers up to 50%. The customers should be separated into groups and solutions should be developed which satisfy single groups 100%. Personas are in these circumstances an optimal way to do so.

The following Persona is an example for a product development project. You should keep hereby in mind that the Persona was developed for this specific project and includes attributes according to this purpose. Let's assume there is a company from the electronics industry, which offers shavers and the management has decided to innovate in their premium product. To do so, they decided to use Personas as a tool to keep the innovation process customer focused. The following Persona is an example how one of the target customers might be described.

Example of Personas: Tom Jones

Tom is 40 years old and finished college with a MBA degree. Now he is working in an international marketing company, where he is the Branch manager for Great Britain. His responsibilities reach from human resources up to key account managing for customers all over Great Britain. He is the face of the branch and has to meet regularly with the main customers.

Most of the time he manages to return home from his business meetings late in the evening, but from time to time it happens that he has to stay overnight in a hotel.

As the representative of his company for Great Britain he also has to regularly go to the Headquarter in New York. Because of his job and position he has to wear suits and ties every day.

His annual income was 70.000 pounds last year.

His job also takes most of his time at weekdays, but he spends most of his free time at weekends with his family. He lives 30 miles outside of the city with his wife and two children in a suburban detached house. Hence, the days he works in London, he has to go to the office in the morning by car (a BMW). One of his hobbies is fishing. From time to time he and his best friends rent a boat and go for a fishing trip for 2 or 3 days. When he comes back from his trips, you would not recognize him as a manager of a marketing company.

Tom shaves his beard every morning, but it is a must for him and no pleasure at all. At the weekends or at holiday seasons he prefers to wear a three day beard. Some years before he used to shave his beard wet. This took him up to ten minutes every morning. Nowadays he uses an electronic shaver, because it is quicker and it stresses his skin not so much, but he is not highly pleased with the shaving results of his actual model..

Types of Personas

Personas can be separated into different classes, which are introduced in the next paragraphs.

Primary and Secondary Personas

The first separation of Personas is the one between Primary and Secondary Personas. Primary Personas attract the most of the attention during the development process. They are the main focus the service or product is developed for. The outcome of the use of Primary Personas will be sufficient for most of the future users. If the developers just consider the Primary Personas the result will also match the most of the requirements of the Secondary Personas. The other way around it can be this way but doesn't have to be. Primary Personas have attributes which are shared by a big part of the target groups. Secondary Personas instead incorporate characteristics of smaller parts of the potential customers which are maybe also rated as relevant for the project.
Secondary Personas are relevant for specific requirements which would not fit into the profile of Primary Personas. They represent requirements of customers which could not be incorporated into Primary Personas. Secondary Personas should enrich the development process and not restrict or hinder it.

As an example, a public transportation system would be examined. The goal is to provide the customers with information about the time schedule of the busses. As Primary Persona in this case a retired woman is selected and as Secondary Persona a teenager. Why is it this way and not vice versa? From the primary Persona we can get, that the schedule attached to the bus stop has to have big letters and should be easy readable, because of elderly people often cannot see a well as younger ones. The developed solution fits to all target groups and excludes none by its attributes. If we had chosen the teenager and his requirements as primary focus, the result could be not sufficient for other target groups like the elderly people. Nevertheless, the teenager as a Secondary Persona can add value to the solution. Perhaps it implies additional information at the bottom of the schedule with a link to the online timetable with additional features, which is accessible via mobile phones.

Descriptive vs. Individualized Personas

Personas can be differentiated by the perspective they are described. Descriptive Personas profiles include mainly data how the Persona is seen by others like the marketing department. On the other hand,

Individualized Personas profiles set the customer into the context of the buying decision, using scenario. They reflect how he sees himself.

> An example for a descriptive Persona profile is: Jon is a 40 year old manager in a company....; he likes to play golf at the weekends ...; ...he is married and has two children...
> An example for an individualized Persona profile is: I m Alison and I m 23 years old...; ...to speak in front of many people makes me feel very insecure....

Special form: Assumption Personas

Assumption Personas are Personas which are developed without any prior market studies or other information basis. They are just based on assumptions the stakeholders have about the target group. These assumptions are different for each person, because they were developed from individual experiences and information which was processed, internalized and consolidated.
Although we strongly recommend to develop Personas on a basis of data and information, Assumption Personas can also contribute to the development process. The collective development of Assumption Personas shows gaps in the common understandings about the target group within the development team. It also reveals missing information about the target group, which have to be raised. Assumption Personas are mainly used for communication within the team. If there is no available data to create original Personas and the information cannot be raised, Assumption Personas can also be used in the regular way.

Personas development process

Personas underlie a life cycle which consists of four phases.

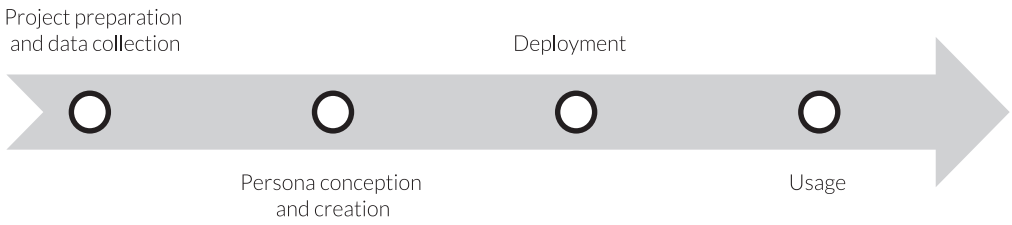


Figure 34: Personas development process.

Project preparation and data collection

Team building

The core team should consist of people from different departments, which can contribute to the Personas development. Of course you should include staff who are already involved in user research, market research, business analysis, task analysis, or any other user or customer focused research. In addition it might be helpful to integrate some advisory members like data mining experts, graphic designers, or software developer.
The number of the core team members depends strongly on the structure and size of your organization. In general the core development team should include at least two and maximum ten members.

Activity planning

You should plan your activities before you start the development process and keep a regularly updated activity plan.
The activity plan should contain at least the following points:

- A definition of the scope of the project and the associated goals for the Personas core team
- A description of a communication strategy (You have to educate others about the Personas method and how to use them)
- A listing of milestones and deliverables (The Personas development process has to follow a strict time schedule to align with the global business and product planning)

Data collection

Personas are all about customer orientation.
A deep and profound understanding of the customer's requirements is necessary for the development of Personas. Personas should be developed in a scientific way and base on concrete facts. Hence the starting point of the true development should be the creation of a user information database. The data in the database has to be collected and transformed into an adequate uniform format. To keep the costs of the Personas development in strict boundaries, it is advisable to use already existing data as far as possible. These existing data can come from in-house or external sources like market research companies. A list of

potential data sources follows. The list makes no claim of completeness.

- Existing market or user studies
- Field studies
- Customer surveys
- Target group reports
- Market segment analysis.

Additionally the following data sources can be helpful to:

- Results of usability tests
- User profiles (extensive descriptions of real users)
- Customer/account briefings (background information about key customers)
- Actors of use cases
- Documentations of customer observations
- User requests, sales data, strategy documents, information and training material for sales staff, business plan.

To develop valuable Personas a selection of the previously named data sources should be sufficient for the most of the cases. During the composition of the data base you should consider to use quantitative as well as qualitative data. In general, data from several resources deliver better results than from one single resource.
The next step after the collection of the instantly available data is the development of a data-theme-matrix. This is a view of the relevant themes of the project scope and the according data which support them. As a result gaps within the data base will be discovered, which lead to a data collection plan. To fill the gaps most of the times a customer survey is performed.

Additional data

A direct survey with the future users of the service or product is the best method to obtain all the necessary information to fill the discovered gaps. For a qualitative questionnaire the following topics can be valuable:

- Goals of the customers (in relation with your objective)
- Actual proceeding of the customers to reach the goals

- How the customers interact with existing products or services
- What do they like or dislike about existing products or services
- What are the surroundings or the context the customer uses the product or consumes the service
- Common personality or character attributes
- Cultural environment of the customer

This information enriches your personas and helps your team to understand how people think, act and behave without the product or service, which has to be developed.
If there is no possible access to the customer, a stakeholder approach can be helpful. It also contributes to the quality of the Personas as an additional procedure beside a direct questionnaire. Interviews with business stakeholder, which interact with customers regularly, can get you a good insight into the behaviour and thoughts of the customer. These stakeholders in general have developed a keen sense for the requirements of the customer.
If it is impossible to fill the discovered gaps with real data, it is better to fall back to assumptions instead of ignoring them.

Restaurant Example

In the following example, a new restaurant/bar concept has to be developed. To fill the knowledge gaps about the customers a survey was performed. The following questions are a sample from the questionnaire.

- How often do you visit a restaurant?
- Who is with you or do you go alone?
- How much do you spend?
- How important are the following points for your selection of a restaurant?

  - o Reasonably-priced food
  - o Quality of food
  - o Selection of food
  - o Selection of drinks (wine, beer, liquor)
  - o Special food (vegan/vegetarian/low-fat)
  - o Buffet style
  - o Romantic setup
  - o Trendy place
  - o Quite environment
  - o Outdoor seats
  - o Accessible via public transport
  - o Child friendly
  - o Free parking
  - o Cleanliness
  - o Politeness of staff.

Persona conception and creation

The goal in the second phase is to create a set of Personas, which is

- relevant for the product or service and the business goals
- based on data or clearly formulated assumptions
- engagingly, informative, and inspiring for the organization

On this occasion, the development of Personas is based on data, which was identified in the first phase. The development of the Personas can be performed in five steps.

Identification of important user categories

The first step is to identify groups of users, which are important for the business area. The early development of categories, although they are based on assumptions, helps to structure the data analysis and creates a link between the present view on the customers and the data driven Personas, which have to be created. User categories can be defined through descriptions of user rolls, user targets or user groups, which are important for the business.
The definition of categories before the data analysis is performed allows introducing a top down approach into the more bottom up based method. It also makes it simpler to process the information to Personas.

Restaurant Example

For our restaurant example, the predefined groups were couples who want to have a romantic evening; groups of people, who want to have fun and families. This raw division represents groups of users and no single user at all.

Data analysis

The data analysis step processes the raw data collected previously and extracts the relevant information for the user and service or product domain. There are different ways to perform the data analysis. The

appropriate methods and tools depend on the structure of the available data. There are two major goals in this analysis step. The first one is to separate the customer base into a number of groups and the second one is to identify the specific similarities between the customers in the groups.

Grouping of customers „by hand"

You can try to classify the customers by hand, using the previously in step one defined categories. With this handmade classification you get an insight whether you find customers for each group in your sample or not. Furthermore you see whether they are distributed homogeneously between the predefined groups. If you don't find any customer for some groups or their distribution is very unequal, your groups represent perhaps not the reality of your customer basis. You should consider to redesign your groups. In a further step you can examine how alike the people within a group are or how much they vary. Similarities within the attributes you can search for are areas like age, sex or job description. If the groups are not homogeneous, you should separate them again by additional attributes. It is not easy to name a number of groups which is optimal, because it depend very strong on the specific domain and project goals. The „manual" approach is well suited if the data source allows no statistical examination.

Restaurant Example

To do a basic classification in our example we use the predefined user groups. In our customer survey, we asked about their companion when they visit a restaurant and use this information to separate the whole sample into three groups. If we had specified the predefined user groups in more detail, also other attributes like age, money they spend for a restaurant visit and so on could be relevant for the classification.

Statistical data analysis

To use statistical methods to find hidden insights, you need a homogeneous data basis. You can perform statistical tools like correlation analysis, cluster analysis, or principal component analysis on your data. The first one will show you dependencies between specific attributes of the customers in your sample. For example, with correlation analysis you can receive the information, that there is a dependency between the number of children a person has and the frequency of visiting restaurants or bars. If a strong correlation between two attributes is verified, these should influence the definition of the Personas. In our example it would be appropriate that a Persona without children goes twice a week for dinner in a

restaurant, but for a mother of three it would be inappropriate to include this fact into the profile.
Cluster analysis is the assignment of a set of observations into subsets (called clusters) so that observations in the same cluster are similar in some sense. In our case these observations are the customers with their attributes, which have to be analyzed. As a result of the Cluster analysis you get groups of users (clusters), which are possible starting points for your Personas. For each identified cluster you can define one Persona skeleton, or take one of the persons as a development base for the next steps.
Additionally to the Cluster analysis, you can perform a principal component analysis. With this analysis you limit the number of possibly correlated variables (attributes of the customers) to a smaller uncorrelated number of variables. Using this smaller number of variables a complexity reduction of the Cluster analysis takes place. This method may or may not lead to better results. After the clustering of the customer you use the original attributes for further analysis instead of the principal components (smaller number attributes).

Restaurant Example

The analysis of the collected data from the restaurant survey showed, that the cleanliness of the restaurant and the quality of the food was important for all the customers. Hence these aspects can be seen as preconditions and can t support the clustering of customers. So they were excluded from further analysis. In some of the points there were common feelings within the whole sample but there were also mixed feelings about several features as the buffet style, the selection of food and drinks or the location. These varied feelings indicate the presence of different customer groups. For the next step a correlation analysis was performed. The findings of this analysis can be found in the table with absolute correlation numbers below.

In the following table (see table 9) the cells with a grey background, for example, can give some implications for the Persona development. The first one shows a correlation between the expectation to have a romantic surrounding and the expectation to have a wide selection of drinks (wine, etc.). The small number in the cell child-friendly vs. romantic setup shows that there is no dependency between these two aspects. On the other hand, the expectation to have a child-friendly environment correlates strong with the requirement to have reasonably priced food and drinks. This findings should be incorporates in the description of the Personas.

	Selection of food	Selection of drinks	Special food	Buffet style	Romantic setup	Trendy place	Quiet environment	Outdoor seats	Child friendly	Reasonably-priced	Free parking	Public transport	Polite staff
Selection of food													
Selection of drinks	0.42												
Special	0.41	0.32											
Buffet style	0.25	0.16	0.05										
Romantic setup	0.27	0.48	0.32	0.04									
Trendy place	0.07	0.26	0.14	0.16	0.14								
Quiet environment	0.25	0.31	0.22	0.12	0.44	0.17							
Outdoor seats	0.15	0.05	0.12	0.20	0.13	0.23	0.30						
Child friendly	0.19	0.07	0.22	0.40	0.03	0.04	0.07	0.40					
Reasonably-priced	0.18	0.20	.0190	.44	0.22	0.07	0.12	0.22	0.52				
Free parking	0.21	0.16	0.03	0.26	0.20	0.12	0.08	0.17	0.33	0.30			
Public transport	0.22	0.40	0.12	0.15	0.09	0.32	0.30	0.14	0.27	0.34	0.20		
Polite staff	0.35	0.39	0.27	0.12	0.33	0.13	0.25	0.11	0.14	0.12	0.06	0.10	

Table 9: Correlation matrix.

It's important to remember that the data analysis aggregates information about the customers. From a customer survey you can get, that 50 percent of the railway travellers would like to have a coffee during their journey. If your sample is big enough, you can get representative predictions about the amount of coffee you can sell if you offer this kind of service. Personas on the other hand are not representative. From the Persona which likes to drink coffee you can deduce that a coffee offer would make a train trip more comfortable and based on this you can make a design decision. But you cannot predict any future sales figures.

Development of Persona skeletons

The third step is to define Persona skeletons for each group of users, which were defined in the previous step. Persona skeletons are lists of basic characteristics which you derive from the users in each category. You can pick one single customer of the group and orientate your proceeding on him. But do not use him in general, because he might not represent the group with each of his characteristics.
Examples for basic Persona characteristics are:

- a name and picture
- demographics (age, education, ethnicity, family status)
- job title and major responsibilities
- goals and tasks in relation to your service or product
- environment (physical, social, technological)
- a quote that sums up what matters most to the persona with relevance for your service or product

Restaurant Example

For our example we can set up three Persona skeletons (because of the three user groups). A very limited skeleton would be the following.
Name: Paul Alan, 29 years
Family: single, has a girlfriend
Job: banker; annual income: 85.000 Pounds
Wants to relax and have a good time with his girlfriend.
He goes out for Dinner two times a week and spends $80 each time.
"I want to have an excellent service and I m poised to pay for it"

Select the most valuable skeletons

The goal of this step is, to select a subset of skeletons which is most valuable for the development project. To set up a decision basis you can gather feedback from the stakeholder. The priority of these Personas can be determined by frequency of use, the market scale, purchasing power and strategic importance. The most important decision factor is the significance of the Personas for the business strategy and the project goal. With this prioritization you can make a selection of skeletons, which will be developed towards final Personas in the next step.

With the decision which Personas are most valuable for the company and the project also the number of Personas is finalized. The optimal number of Personas depends strongly on the type of development project you plan to do. If you plan to develop very specific software for accounting you need just a few Personas, because there is probably no big variation in the usage of the software or the requirements of the users. On the other hand, if you plan to innovate in a mass customer service like public transportation, you probably need quite a lot of Personas to cover all of your target groups. In general, you should choose between three and seven skeletons to develop Personas in detail. You should try to limit the number as much as possible, to focus your further work.

Example of Personas: Restaurant

Here we have to decide which of the customer groups are more important for our business. As you can imagine, it is almost impossible to develop a restaurant concept which satisfies the “family” customers and the “romantic” customers both 100 percent. In this stage, the value of the customers was calculated (frequency of visit, spending during one visit and size of the target group.

In our case, the company decides to focus on the “romantic” and the “fun in a group” customers. Hence, in the next step two Personas were developedin detail.

Define Personas in detail

Add more detailed information to the skeletons to form complete Personas. Individualized details and storytelling elements give Personas real personality and context. Personas become specific with details that make them real: names, families, pet peeves, homes, jobs, type of computer used, goals, tasks, needs, etc.

Additional information

- attitudes, need for trust and assurance
- great quotes from the Personas
- information needs
- background: the Persona's story
- scenarios: stories of why and how they would use the service or product

Scenarios are a deepening of the Persona. You should keep them task focused. Four to five paragraphs are mostly sufficient. Scenarios should also incorporate the Persona's environment. They can be messy and idiosyncratic – like life is.

Example: Tom Jones

The following example shows a scenario of a Persona, created for a development project for a new electric shaver. The Persona is Tom a 40 year old manager, who lives with his family in the suburbs and works in the inner city. One possible scenario could be: Tom is late for work because his youngest child cried all night long and he could not sleep until 4 am. When he wakes up this morning, it is just 7:45 am. He has an important meeting at 9 am and he will need one hour to the office because he is stuck in traffic jam for 30 minutes almost every day.
Everyone can picture the morning of the manager in his mind and deduce that time plays an important role for Tom, especially on this morning when he is late. On the one hand, 30 minutes time is lost in the car (an implication for mobility use of the shaver?) and on the other hand less time is left to shave at home (fast shaving).

Select a picture for the Persona that „feels right". Add additional pictures which show the persona in context (at work or at leisure time). Show members of their family, their house, office or other locations. You can also show other relevant details like: pets, car, friends, favourite magazine, favourite places or technology the Persona uses.
Every detail which is added to a Persona limits the degree of freedom in the development process. With strict orientation on the Personas during the development process, also the overload of the product or service with innumerable features and decision options will be prevented. For example, if we design for a Persona which has overweight, some sport offers of a holiday resort are inappropriate or some design options and materials for a product are obsolete.

Sharing Personas

There are three mayor areas to share the developed Personas within your Organization:

- formal
- informal
- and subliminal

The most common way to introduce Personas in your organization is through formal presentations or education sessions. You can print posters of the Persona descriptions and hang them up in the office or working space. So they are always close to the team. The Persona descriptions should be on the team website or easily available to all organizational members via intranet.
A more informal way is, to use them in stories and scenarios or referring to them during meetings. You can also introduce your Personas using them for design reviews. To include Personas as the starting point for any discussion of „what users want" is a subliminal ways to use them. Most important is to find ways to keep the Personas in mind of the organization.

Using Personas

There is a huge number of ways to use Personas. To keep the customer and its needs in the focus of the development process, Personas can be used in almost every stage within the development process of a product or service. The fact, that Personas can be used for communication purpose within the development team was already mentioned above. With Personas, the vision of the service or product and how it matches the requirement of the customer can be visualized. In this context one of the most important cases used is the identification of features and functions for the new product or service. The requirements implied in the Personas services and products can be developed with attributes that contribute perfectly to customer satisfaction. A set of Personas can also be used to test whether the developed service or product is adequate for all of the target groups or whether eventually some variants should be developed.Personas can be used as templates for „usability reviews". The team overtakes the position and mindset of a Persona and uses the service or product in that way the Persona would do. This is also a good basis to setup scenarios to test the conformity of the service or the product and its attributes with the customers' expectations.
Based on Personas a „day in the life" experience can be established for the stakeholders of the development process. The „day in the life" experience is a method where the participants reconstruct a day in the life of a Persona. Especially the situations in which the service or the product is used by the Persona are in the focus of the tool and are examined. With the application of this tool a much deeper understanding for the problems, which should be solved by the product or service, and requirements of the customer can be raised. The method takes a look at the socioeconomic environment the customer lives in and uses the product or service.

Quality Function Deployment (QFD) of products and services

Definition

There is no single definition of quality function deployment (QFD), but the following statement describes the basic idea:
„QFD is a methodology that goes along the whole product or service development process and translates the clients' requirements into product or service characteristics" (Schmidt & Steffenhagen, 2007).
QFD is not only a quality tool, it is also an important planning tool that allows taking the „voice of the costumer" through the product development until market entry.

The QFD Approach

Among the main advantages of the QFD is that it allow us to understand the clients' requirements. This tool transforms the qualitative terminology in which products and services characteristics are described into measurable terms, which the firm will use for designing and redesigning its products and services.

QFD for products

In order to undertake the product development, it is necessary to „translate" these fuzzy requirements into measurable product design requirements. This process involves five main stages:

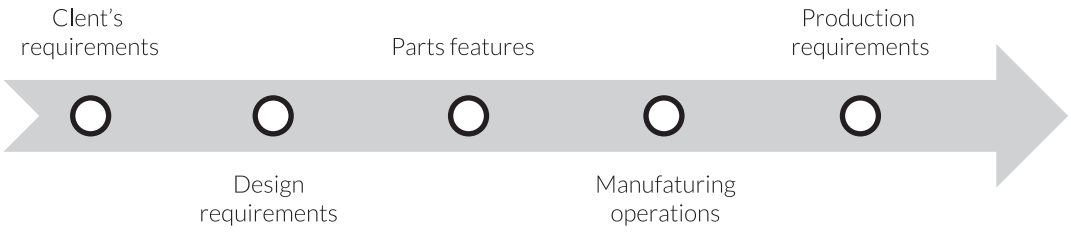


Figure 35: The QFD approach for products.

The requirements analysis allows to understand what the client wants. While the design requirements show the functions of the product. These, in turn, will be the base for the characteristics of the product components.

QFD for services

Just like with products, the QFD for services starts with understanding the clients' requirements. This will be then converted into quantitative design requirements.

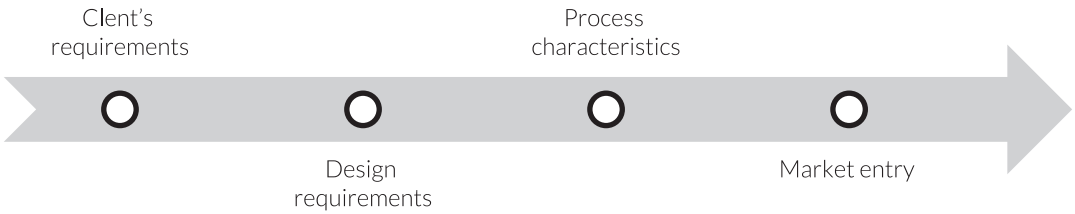


Figure 36: The QFD approach for services.

Services are not developed as a whole; instead, they are developed through the integration of different components. The component features are what provide the functionality that in turn satisfy client requirements.

Firm organization is another factor that effects service development. Unfortunately, the importance of the service development process is not known by all the employees. For this reason, the establishment of an appropriate communication system is particularly important. This system must keep the meaning of the clients´ requirements during the development process.

Methodology of QFD

The QFD development methodology is based on a series of matrices called house of quality. The structure of these matrices is described in the following sections.

„House of Quality" (HOQ)

The matrix is called the house of quality, due to a roof-like structure in its top. This house can be divided into „rooms". A tour through the different „rooms" is described below.

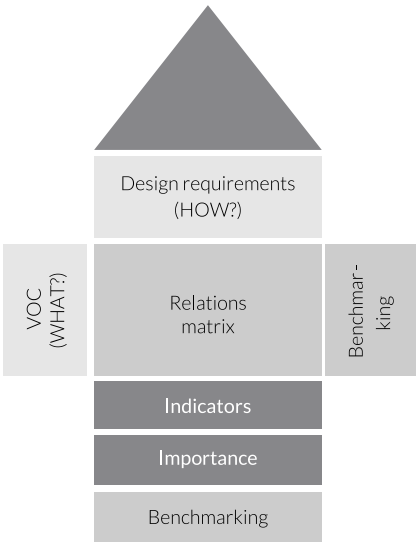


Figure 37: House of quality.

Voice of the customer - VOC (What?)

QFD starts by establishing objectives (called „What?"). The objectives normally derive from client requests and are called the „voice of the costumer".

Client's requirements (What?)

Table 10: „What" list.

For a better definition, these customer requirements can be classified according to their contribution to the functionality of the product or service.

The kano model is a helpful tool for this classification. In this model, three kinds of service characteristics must be differentiated: performance, basic and emotive. The requirements mentioned directly by the clients will be called „performance requirements"; other wants are difficult for clients to verbalize. However, some other wants cannot be or are not verbalized by the clients, but are important parts of the product because they perform basic functions, which the customer expects. These basic functions are known as „basic requirements". Emotive requirements are a third kind of product feature that reflect a need the client has not appreciated before. Figure 38 depicts the sorts of quality in a client satisfaction level vs. the fulfilment level of the need.

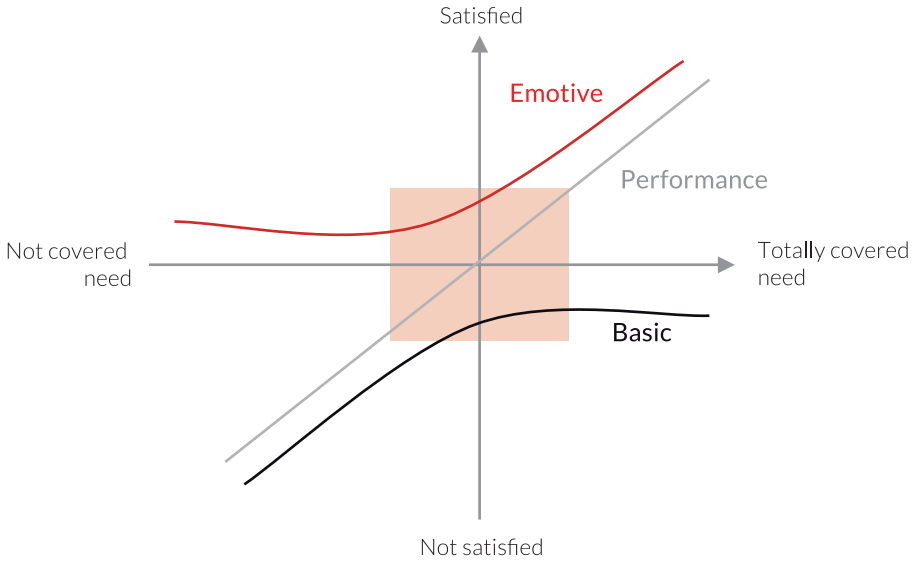


Figure 38: Kano model.

Design requirements (How?)

The next step, after carrying out the „What" list, is the definition of „How" for each „What". In fact, the „How" are the requirements of the product's design. These are the measurable features that will be evaluated in the finished product.

Design requirements (HOW?)								

Table 11: „How" list.

Relations

However, relations between the client and customer are not always 1:1, there are more complex relations and with varying strength levels. In table 3, a matrix shows the relations between „What" and „How". In this matrix, the determinations of the relations will be carried out taking into account 3 strength levels: weak relation, medium relation and strong relation.

	Design requirements (HOW?)			
Client requirements (WHAT?)				
	3	9	1	
	9	3		
	1	3	1	9
		3		
			9	
				1

1	Weak relation
3	Medium relation
9	Strong relation

Table 12: Relation matrix.

This representation makes possible to revise the analysis. An empty column indicates no relationship between the client and design requirements..

Indicators (How much?)

„How much" is the measure for the „How"-s. These values make clear how efficient the firm must be in order to achieve the client's satisfaction. „How much" must consist of measurable elements that provide a wider analysis and optimization chance.
A new opportunity to assess the analysis appears here: if most „How much"-s are not measurable, then the „How" definition was not exhaustive enough.

	Design requirements (HOW?)			
Client requirements (WHAT?)				
	3	9	1	
	9	3		
	1	3	1	9
		3		
			9	
				1
	Indicators (HOW MUCH?)			

Table 13: QFD basic table.

Correlation matrix

The correlation matrix is a triangular table. „How" is integrated by establishing the correlation between all these elements. This matrix describes the strength of the relations between the design requirements. The aim is to identify which requirements support each other and which ones get into conflict.
The positive correlations allow for increasing the product development efficiency, without risk of duplicate effort for the same result. Negative correlations are important because they help identify design features where it is necessary to decide which features are most important for the product.
If there are no negative relations, there could be a mistake.

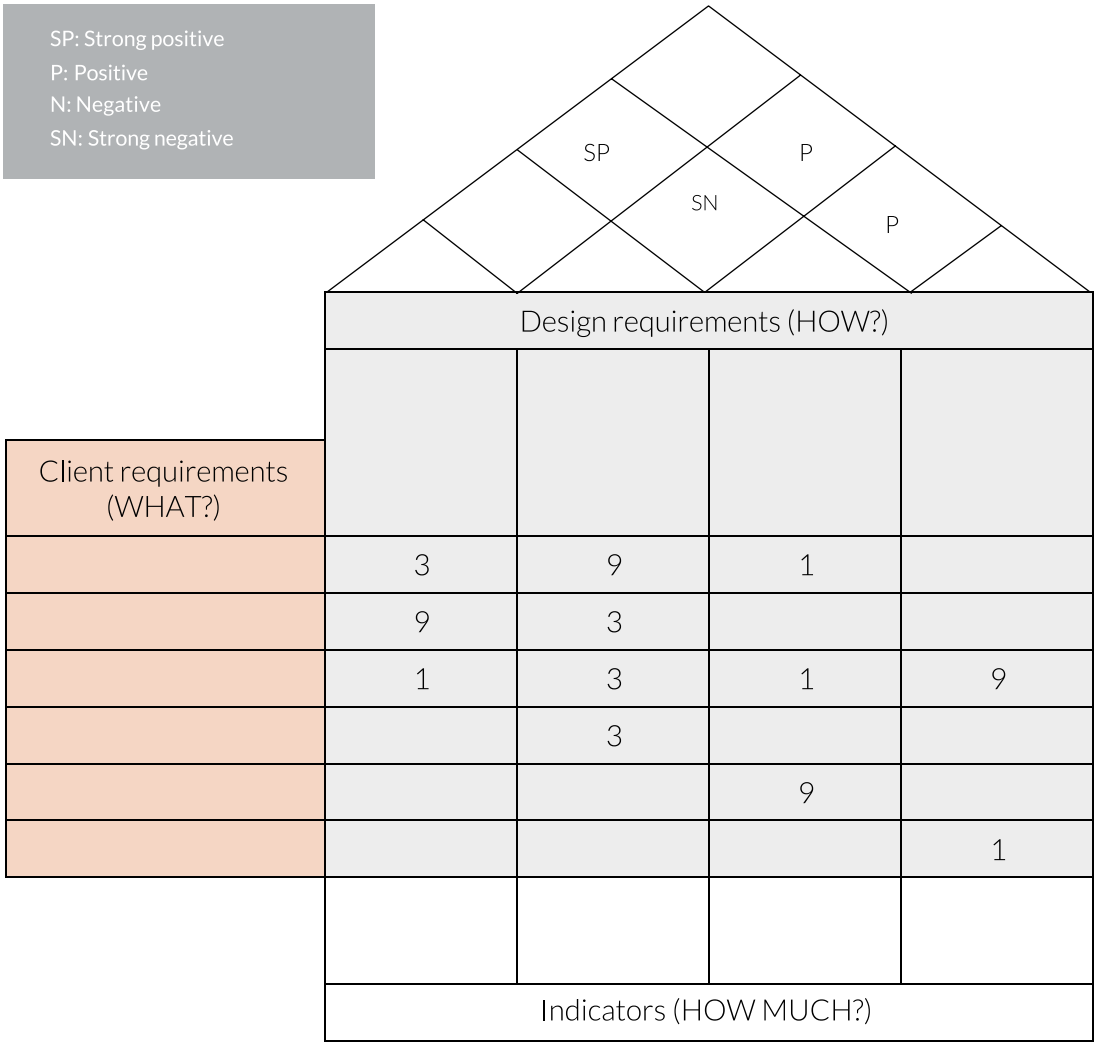


Table 14: Correlation matrix.

Benchmarking

The QFD technique allows for a competitor assessment based on benchmarking. The competitor's products are compared to the company's offer. Benchmarking is carried out for „What" and „How".
The competitors' „What"-s assessment is called consumer´s competitive evaluation. For that reason, client oriented criteria must be taken into account. This means: Consumer's perception of our products will be assessed with regard to the competitors.
Competence assessment of „How"-s is called technical competitive evaluation. It is recommended that personnel in charge of the product or service design (engineers, consultants, etc.) make this evaluation. The benchmarking is, basically, a technical comparison with competing products.
If „How"-s are developed from „What"-s properly, the competitive assessments should be reasonably consistent. This means that client´s requirements strongly inter-related should have a similar competitive assessments. If not, perhaps something significant was not taken into account.
For the evaluation, scores between 1 (very poor) and 5 (very good) could be used.

	Design requirements (HOW?)						
Client requirements (WHAT?)							
	3	9	1		2	3	5
	9	3			4	3	5
	1	3	1	9	2	4	5
	Indicators (HOW MUCH?)						
Our company now	2	3	3	4			
Competitor 1	4	2	3	2			
Our company in the future	5	5	5	5			

Table 15: Benchmarking.

Importance level

The importance level allows stating the relative significance of each „What" and „How" to achieve the wanted final goal. „What"-s relative significance is established through consumer evaluation. The relative scale used, normally 1-5 or 1-10, must express more significance for the consumer by larger numbers (5 or 10 being the best rating).

„How"-s are assessed giving weight to the relations. The next table shows the weight given to each relation:

Weak relation	1
Medium relation	3
Strong relation	9

Table 16: Weights for the relations.

For each („How") column, the „What"-s significance level is multiplied by the symbol's weight. This makes a value for each relation. The importance of „How" is computed adding these values.

		Design requirements (HOW?)			
Client requirements (WHAT?)	Importance				
		3	9		
		9	3		
		1	3	1	9
			3		
		Indicators (HOW MUCH?)			
Importance		63	81	42	24

Table 17: Importance levels.

The importance level of the „How"-s is an approximation for the most important design requirements for client's satisfaction. However, it is important to mention that the obtained numbers should help and not limit the design process. The relative values of the results must be questioned using other existing criteria .

Case Study

For a better understanding of this management tool, a case study is used. This enables step-by-step explanation as well as illustrates its use in the real world.

Case: Office chair manufacturer *

This example comes from a real firm based in Michigan, USA, that will be referred to as "the company" for reasons of anonymity. The firm has been in the furniture industry for 5 years.
Our company has world-class competitors and new competitors in the same region. Nevertheless, our company prides itself on the innovative capabilities of our service staff. Our CEO has set forth an ambitious innovation plan for the entire line of furniture products. Initial SWOT analysis results (Strengths, weaknesses, opportunities and threats) have shown that the marginal utility per invested dollar in the furniture industry is the highest. Besides this fact, the company has gone against the economic vein and hired (or rather stole) two of the top strategists from some of its world-class competitors. Our aim is to exploit the huge "hole" or gap in the competitive field of customization.
The Service Manager determined, based on a feasibility study, that this methodology, helped with Brainstorming and Pareto analysis, could show the earliest results. QFD is envisioned to aid in the identification of the customers unsatisfied and unspoken needs.

**Adapted from Kumar et al. (2006); integrating quality function deployment and benchmarking to achieve greater profitability, Benchmarking: An International Journal, Vol. 13, No. 3*

Project team

Before the QFD starts, a multidisciplinary team should be established with members form different departments like marketing, product development, etc. Another important point is that the team members should have a similar level of position in their departments. Furthermore it is necessary to choose a team leader. Finally, rules to encourage teamwork should be established: a meeting timetable, responsibilities, approach to the topic, etc.

Case: Office chair manufacturer *

The company s organization is as follows: service and staff functions are together in the service area. In addition, the service area encompasses all of the client satisfaction functions; all activities that involve product innovation, product improvement, value analysis, process innovation and improvement, and process mapping are under the service function umbrella.
A committee led by a high-level manager was created to pursue the QFD effort. The effort and work of this committee are subject to review by the CEO once every month.

Project definition
QFD team defined the following approach for the products that were performing well in the market:
Extended QFD scope statement: To modify or redesign popular existing office furniture products to maximize customer satisfaction through a maximum customization and faster time performance.
A similar determination was established for home furniture products. When applied to its fullest potential, QFD processes grow rapidly. Even with reasonable elimination of choices at each stage, final QFDs have a large number of process attributes to control. For this reason, only partial results of the QFD project undertaken by company will be presented

The product: the chair
One of the best-selling products was a high-end office chair with powerful ergonomic design features. Its 17° back inclination was a result of a one-year long study. This chair had also other features that provided more physical comfort and physical wellness. With 17° inclination, it was not only comfortable, but it was also good for keeping blood pressure low under prolonged use. An appropriate QFD statement would be therefore:
To develop a new height-adjustment mechanism or to modify the existing one to optimize user physical wellness and keep costs within a range conducive to the marketability of the office chair.

Client's requirements determination

Key to the QFD process is listening to the „voice of the customer". Unfortunately, there is no unique method to determine the „voice of the customer". Each client has an individual way to appreciate product features. There are two key factors influencing the formation of opinion about a product: the technical and the emotional. Both are important. The easiest features to identify and to measure are the technical ones. In spite of this, the emotional can become the deciding factor for the buyer's selection. Hence, it is imperative to pay attention to the customer in order to understand their emotional response.
Some of the best methods to hear the „voice of the customer" are:

- Interviews with users
- Lead users
- Surveys
- Focus Groups
- Existing information stored within the company

The information collected by „hearing" the voice of the customer should first be organized in logical groups. This step can be performed by using vicinity diagrams.
Additionally, there are some requirements that the consumer never mentions. Normally, these can be regulation issues or special requirements from the company side. It is important to consider these needs at this point, so that the process goes on with all of the possible identifiable customer needs.

Case: Office chair manufacturer *

"Voice of the Customer"
In this case, customer´s needs or requests regarding to the chair´s heightadjustment mechanism were drawn from the first QFD, which was developed for the total office chair. Requirements were established by involving a focused group of customers (high level or senior executives of 23 firms), sales staff, and the former managers from the competition, and an external consultant that played the role of facilitator. Fishbone, Pareto and vicinity diagrams were used to generate and extract the customer requirements shown on the column of the figure below.

Costumer requirement
Adjustment range
Speed of adjustment
Easy adjustment
Customizable
Safe
Comfortable
Interchangeable

Importance level

Once the voice of the customer is determined, it is important to quantify the importance of these features for the consumer. The most used technique for doing this is to ask clients to score these features in 1 to 5/10 scales (1 being the worst possible score for a feature). If there is a client complaints gathering system, this is a valuable information source for the QFD team. Client complaints can be brought together and quantified to determine which features are important to them.

Case: Office chair manufacturer *

The same client and expert group used to determine client´s requirements determined the importance level. First, this group rated (1-5 scale) the relevance of each requirement, as shown on the right column of the table below.

Costumer requirement		Import
Adjustment range	LTB	5
Speed of adjustment	LTB	4
Easy adjustment	LTB	4
Customizable	LTB	4
Safe	LTB	5
Comfortable	LTB	4
Interchangeable	LTB	3

Definition of product requirements

Consumer needs must be translated into measurable characteristics. The comprehension and interpretation of the needs through the definition of significant objectives is an important step in QFD. If this step is appropriately performed, one can be sure the voice of the consumer has been „heard". To carry out this activity, it is recommended to conduct a brainstorming session and then to organize the ideas. This can

be made with an Ishikawa diagram (see Figure 40). This kind of diagram allows dividing elements in groups: design requirements, parts and parts characteristics.

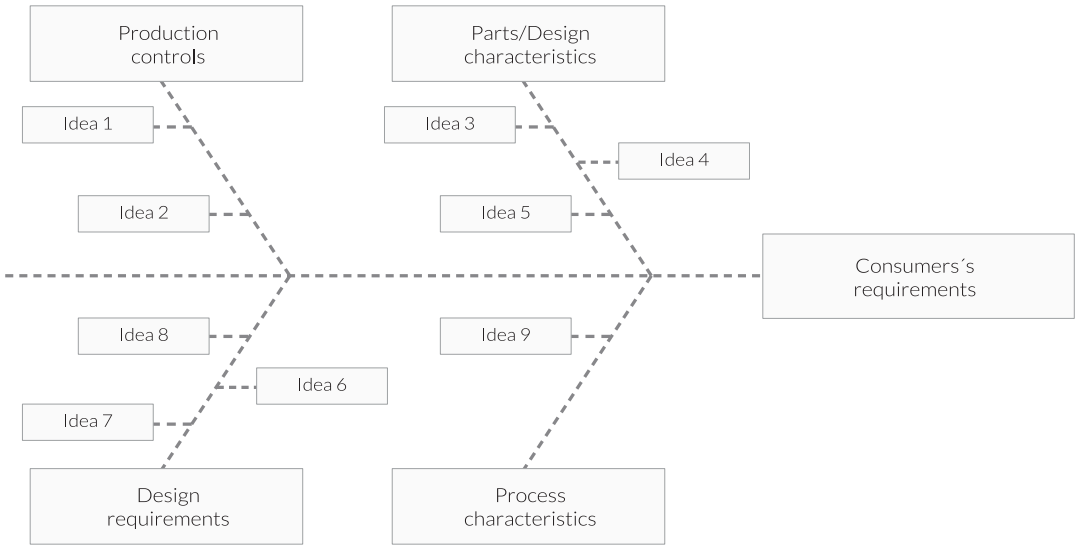


Figure 39: Ishikawa or Fish Diagram.

Case: Office chair manufacturer *

Engineering, sales and marketing staff and the external consultant were used to identify and draw product characteristics/requirements that could influence or would meet client´s requests, as we can see on the figure below.

LTB	STB	STB	LTB	STB	STB	LTB	LTB	LTB
Product characteristics / Design requirements								
Adjustment range	Time adjust	Effort to adjust	Knee Space	Number of adjustments	Complexity	Meeting federal regulations	Adjustment increments	Location of adjustment

Completing the matrix of relationships between client requirements and design requirements/product characteristics, and setting target values

In this step, direct relations between „How" and the satisfaction of customer needs are in a strong (9), moderated (6) or weak (3) degree. It is recommended to fill in the matrix by columns. In addition, in this step, those values for design requirements that achieve consumer´s satisfaction are determined.

Case: Office chair manufacturer

The same group was used to assess the strength of the relation between each customer requirement part and product characteristic (9 x 7). A three-point scale was used to assign the numbers to each matrix cell: 1 shows low relation; 3 represents medium relation and 9 indicates a strong relation.

			LTB	STB	STB	LTB	STB	STB	LTB	LTB	LTB
			Product Characteristics/Design requirements								
Costumer requirements		Import.	Adjustment range	Time to adjust	Effort to adjust	Knee Space	Number of adjustments	Complexity	Meeting federal regulations	Adjustment increments	Location of adjustment
Adjustnebt range	LTB	5	9	9	3	9	1	1	9	9	3
Speed of adjustment	LTB	4	3	9	1		9	9	3	3	1
Easy adjustment	LTB	4	1	1	9		3	9	3	3	9
Customizable	LTB	4	9			9		3			3
Safe	LTB	5		3	1			1			1
Comfortable	LTB	4	9			9	3		9	9	3
Interchangeable	LTB	3			1						

Customer benchmarking

The costumer benchmarking evaluates the behaviour of our product or service in comparison with the competing products or services concerning the ability to satisfy the costumer's requirements.

Case: Office chair manufacturer

To benchmark, the extent to which our product satisfied customers requirements was assessed, adjusted to a scale between 1 and 5 and was situated in the column named “our company” .
The three world-class competitor firms (Haworth, Herman Miller and Steelcase) were also evaluated for the level of satisfaction for their respective products. These assessments are located in the next three columns.
Then, on the basis of the competence weaknesses in their products reflected in ratings lower than 5, and taking into account each requirement importance rating, future objectives for our outputs for each request were determined and were written in the “our company in the future” column. For example, on the second request, for adjustment speed, our competitors get 2 or 3 points, which means that there is a lot to gain by doing this better than competitors, since clients perceived this request as very important (4 in a 5 scale).
Additionally, little improvements could guarantee big profits as competitors are not doing addressing the customer need appropriately. Thus, an objective of 5 was chosen to maximize customer satisfaction with this requirement.
Continuing to the right, the next column indicates the improvement ratio. This is computed as the ratio of where the company wants to be versus where it is right now in terms of each customer requirement satisfaction. Then, for the second request, the ratio is calculated as 5/2 = 2.5.

Costumer requirements	Import.	Our company now	Competitor 1	Competitor 2	Competitor 3	Our company in the future	Improvement ratio
Adjustment range	5	3	4	2	3	5	1,67
Speed of adjustment	4	2	2	2	3	5	2,50
Easy adjustment	4	3	2	2	4	5	1,67
Customizable	4	3	2	2	3	5	1,67
Safe	5	4	4	4	3	4	1,00
Comfortable	4	4	4	4	4	4	1,00
Interchangeable	3	3	3	3	4	4	1,33

Technical Benchmarking

In this step, the company´s technical assessment should be performed with its strong competitors. This can be performed, when possible, by buying or renting competitors' products. The QFD team must try to develop comparative information for each product characteristic/design requirement.

Case: Office chair manufacturer

The same group used to determine product requirements (engineering, sales, marketing staff and the external consultant) was used to carry out competitors technical comparison. Our competitors were evaluated regarding to how they managed in each feature in a 1 to 5 scale (see rows below)..

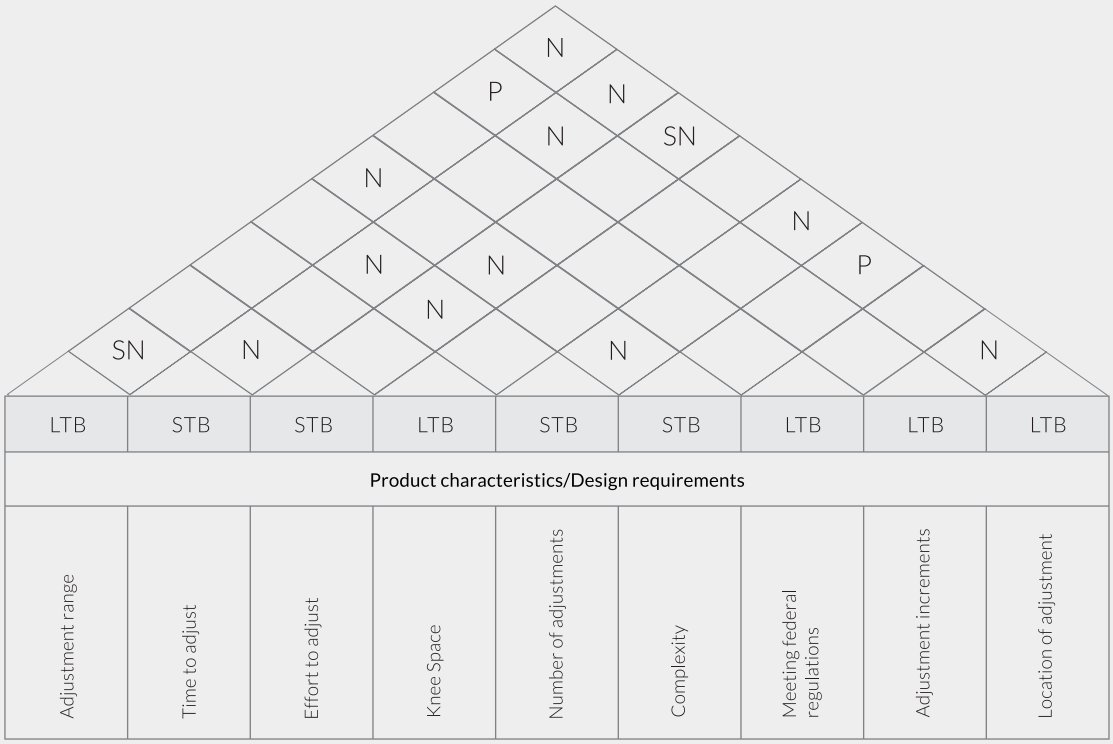
Costumer requirements	Import.	Adjustment range	Time to adjust	Effort to adjust	Knee Space	Number of adjustments	Complexity	Meeting federal regulations	Adjustment increments	Location of adjustment
Units		seconds	Inches	force	inches	count	# of steps	yes/no	count	„within arm reach"
Our company now		4	3	2	2	4	2	5	3	4
Competitor 1		2	2	2	3	3	4	5	3	4
Competitor 2		2	2	2	2	2	3	5	3	4
Competitor 3		4	4	3	3	4	3	5	3	4
Our company in the future		5	5	4	5	5	4	5	3	5
Target		26-42"	5	2	20"	3	2	yes	Infinite	15"

Correlation matrix

This is the roof-like looking part of the „House of Quality". The objective of this matrix is to determine which of the design requirements/product characteristics are linked and how strong that link is.

Case: Office chair manufacturer

The QFD team evaluated which chair features were related and how strong these were. To determine the relation strength, 3 intensity levels were defined: Strong negative (SN), Negative (N), Positive (P) and Strong Positive (SP). The following figure shows the obtained results:

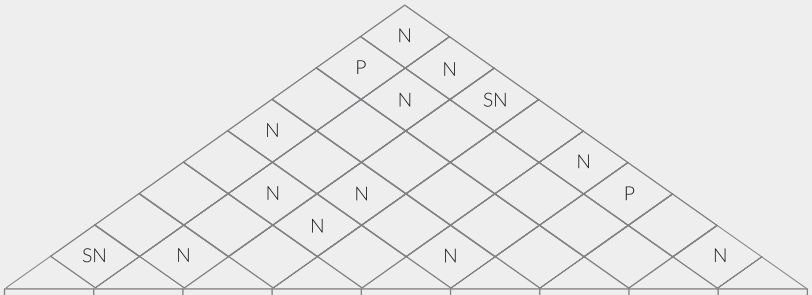


Importance level calculation

The last QFD step is the calculation of the absolute importance level of our product characteristics/design requirements. These values are calculated by multiplying the importance factor for the consumer by the assigned value of the relation between customer requirement and product characteristics/design requirements.

Case: Office chair manufacturer

In our example of the office chair we can clearly see, that adjustment range and knee space are the most important characteristics in fulfilling customer requirements.



			Product characteristics/Design requirements								
Costumer requirements		Import.	Adjustment range	Time adjust	Effort to adjust	Knee Space	Number of adjustments	Complexity	Meeting federal regulations	Adjustment increments	Location of adjustment
Adjustnebt range	LTB	5	9	9	3	9	1	1	9	9	3
Speed of adjustment	LTB	4	3	9	1		9	9	3	3	1
Easy adjustment	LTB	4	1	1	9		3	9	3	3	9
Customizable	LTB	4	9			9		3			3
Safe	LTB	5		3	1			1			1
Comfortable	LTB	4	9			9	3		9	9	3
Interchangeable	LTB	3			1						
Units			Inches	seconds	force	inches	count	# of steps	yes/no	count	„within arm reach“
Importance			133	100	63	117	65	94	105	105	84
Our company now			4	3	2	2	4	2	5	3	4
Competitor 1			2	2	2	3	3	4	5	3	4
Competitor 2			2	2	2	2	2	3	5	3	4
Competitor 3			4	4	3	3	4	3	5	3	4
Our company in the future			5	5	4	5	5	4	5	3	5
Target			26-42"	5	2	20"	3	2	yes	infinite	15"

Scenarios

Introduction

The scenario method is a tool for decision making inherent to the strategic management of organizations, business units, of technology, innovation, products, etc., mainly used to support processes or prospective projects and strategy development (search, formulation or design, implementation and control).

The scenario method seeks to provide flexibility, robustness and consistency to the processes of strategic decision making concerning complex systems (complex adaptive systems or CAS), especially in environments of high uncertainty. Theory and practice in the successful management of complex systems such as innovation have shown that it is imperative to: a) use systemic analysis, b) recognize that while the future is unpredictable (it is plural and indeterminate), it can be constructed, and c) have strategic thinking skills. These are the key premises of the scenario-based strategic management.

The scenario method consists basically of simulation games based on the deliberate combination of possible future hypothetical facts, derived from the objective, subjective and/or creative interpretation of anticipatory quantitative and qualitative elements difficult to formalize, for example facts or events, trends, changes and disruptions in fields such as demographics, politics, science and technology, economy, society, environment, laws and regulations. In other words, the scenario method enables decision makers to design and explore the universe of possible futures for a given set of constraints in order to think and act strategically and in advance accordingly. When exploring the future of complex areas such as innovation, one faces a vastly broad universe of possible solutions. As a working and analysis method, the important thing is not to recreate a situation, but several situations, in order to be able to compare, discern and decide. It is certain that a future will happen, but as no one knows which one, an honest way to deal with the uncertainty is to propose several possible situations. The scenarios are not a means of foretelling the future, but are used to systematize the hypotheses about the future –optimistic, pessimistic, trending, extreme, to deepen in them and make better decisions. The prospective approximation allows decision makers to discern risks and opportunities, to avoid problems and obtain benefits.

From the perspective of strategic management of innovation and technology, the scenario method contributes, mainly, to the early identification of opportunities and creative ideas for innovation (customer needs and demands and future technological developments) as well as the strategies to capture such opportunities.

The following pages describe the main aspects that compose the implementation of the scenario method, including a process outline of an exercise for the design and implementation of scenarios.

History

The term scenario comes from the performing arts, where it refers to the physical environment in which a theatrical plot occurs and the summary or set of directions of an action sequence of a film; that is, where the scenes that take place during the play. In fact, Peter Schwartz (1991), former scenario planner at the Royal Dutch Shell and founder of the think tank GBN based in California, compares the initial process of creating a scenario with writing the screenplay for a movie. Every representation describes the environment in which it is located and how the story goes (its characters or actors, the costume design, furniture, etc.) as thoroughly as possible so the viewer can feel immersed in that imaginary world.

As in the performing arts, in planning or in studies of the future, it is about imagining and presenting situations as something real lived by „actors" (e.g. a customer in a specific sector) so that decision makers can understand the consequences and implications of the given situation in the scenario. While it is said that in planning the word scene first appeared in the French planning, it was Hermann Kahn who introduced the term scenarios in the defense strategic studies directed by the Rand Corporation for the government of the United States in the 50's. During the 60's, H. Kahn and A. Wiener (1967) consolidated the concept through strategic planning studies. In successive exercises of scenarios they foresaw the loss of control of the Soviet Union by the communist movement, described the „hardware" technology of the future that included banks with the centralized computer and personalized information of the individuals, and predicted that parents would be capable of selecting the sex and personal traits of their children through genetic engineering.

In industry, the Royal Dutch Shell was the pioneer in applying the scenario method. The management based on scenarios allowed Shell to anticipate the great oil crisis in 1973 and take actions that turned it into the second largest oil company in the world. In the mid-80's, the scenario method allowed Shell to identify the Soviet Union as the biggest competitor in the European gas market.

The success of Royal Dutch Shell quickly aroused the interest of others, such as General Electric and the Batelle Institute, to develop and implement the scenario method. Today, private, public and mixed organizations in virtually every sector of the academia, the industry and the government, sophisticated scenario techniques are developed and applied for a broad range of purposes. In Siemens AG in Germany, or Koninklijke Philips Electronics N.V., in the Netherlands, for example, the scenario method is a central part of strategy design processes and technology planning, as well as in the ideation of new products, services and business models.

Despite the many success stories, the spread of the scenario method is still limited, probably for two reasons, namely: the lack of knowledge or misinterpretations of the method on the one hand and on the other, the fact that applying the prospective method is not an easy task, even when the application of individual techniques is.

Key considerations for scenarios

Definition

In view of the fact that the future cannot be known precisely and/or entirely due to the multiplicity of forces that shape it, and also because of the complexity and diversity of the interactions among these forces, it is imperative to dismiss the idea that strategic planning should be directed to a single „most likely" image of the future. On the contrary, decision marking relative to complex systems must be based on a broad spectrum of future possibilities, including its eventualities and implications.

Scenarios, as a tool is a method developed to design, select and evaluate situations and options regarding a topic of a complex system. The scenarios, as a product (output) of an analysis process, are an instrument for communicating information about complex situations.

In a primary definition, a scenario is a description of a hypothetical future situation that could adopt a complex system and, eventually, the process of causal relationships that lead to this situation, for its proper understanding and analysis. In other words, a scenario is a conjecture about a particular condition that a system under study (e.g. an organization, a knowledge area, a market, customer preferences) will possibly acquire in the future. The scenario represents therefore, a set or sequence of scenes of a reality that is believed can or will happen in the future providing comprehensive details of that fictitious reality so it can be understood and the given situation can be analyzed in a concrete way.

The scenarios are stories of the future. By definition, a scenario is a narrative description (of the future) therefore, implicitly, a scenario is commonly a formal prose narration about a possible future. However, depending on the complexity and specificity of the content, if the information is quantitative or qualitative and on the expertise on the issues of the audience receiving the message, the scenarios can be a theatrical performance, short films or videos, animations and computer simulations, illustrations, graphs and charts or tables and journalistic articles, among other forms.

Constituent elements of scenarios

A complex system can be explained through the combination of the particular conditions of four essential elements, namely: variables of influence, social actors, time and space. These essential elements constitute the essence (the DNA) of scenarios:

- **Variables of influence:** every system receives the inflow of a set of factors or forces (in domains such as politics, economy, society, technology and environment) that configures the punctual status of the system. At the same time, the variables that have

influence on a system, present relationships among themselves and with the system, different in nature, meaning and magnitude. In this way, different types of variables inhibit or promote specific changes of status of the system depending on the structure and shape effects and degree of overlapping in the group.

- **Social stakeholders:** changes of a system's state are the result of state of the forces that affect it, induced at the same time by direct or indirect actions of social actors that operate in the middle of the variables. Social actors are monolithic agents (e.g. individuals, organizations, groups) holders of goals and interests or means and resources that motivate them and enable them to operate on the variables, respectively.

- **Space:** regardless of the case, each scenario exercise refers specifically to a delimited area. Space is the place where the system object of study operates and may be defined geographically, as a market or as a forum.

- **Time**: every planning exercise responds to a work time horizon, determined both by the will of the organization or time frame as by the time horizon

Key requirements that scenarios must satisfy

The term scenario is frequently used in the media (newspapers, radio, television, magazines) or in the workplace (meetings, memos, reports, conferences). However, while although scenarios are descriptions of situations, not every description of a situation is a scenario. Clearly, in most cases, it is not about scenarios as a formal method for analysis and decision-making process, but about the use of the term as a mere synonym of option, alternative or situation. Assiduously, there are three scenarios, typically, the trending scenario, the optimistic and the pessimistic in reference to the mathematical projection or extrapolation of the same situation slightly modified by a generally multiplicative coefficient. At the same time, there are also three scenarios, of high, medium and low probability, when we are strictly speaking about the same situation in which only the crude odds ratio has been changed with some objectivity. The mathematical accuracy (e.g. probability of occurrence) is not the unit of measurement of the quality of a scenario, on the contrary, the main requirement that scenarios must satisfy are:

- **Plausibility:** to be possible
- **Internal consistency:** to be free of contradictory or illogical conjectures
- **Description of casual processes:** to explain why they could happen
- **Utility:** relevance for the achievement of strategic objectives
- **Exhaustiveness:** to reliably explore the universe of possible solutions.
- **Plurality:** to be different and sufficient for the decision-making process.

Types of scenarios

In planning, the greater the time horizon and/or the greater the variability in the possible states of the system, the greater the universe of possibilities and, therefore, the uncertainty. Conceptually, the future adopts a conical shape; the cone represents the space of what is possible, in which each point represents –in theory- a possible scenario. In practice, many of the infinite points in this geometry are not possible due to internal inconsistencies.

The objective of the scenario method is to distinguish the aberrations of the significant solutions for the study of this space. There are four different types of scenarios and different ways to classify them. In practice, it is important to explore the space.

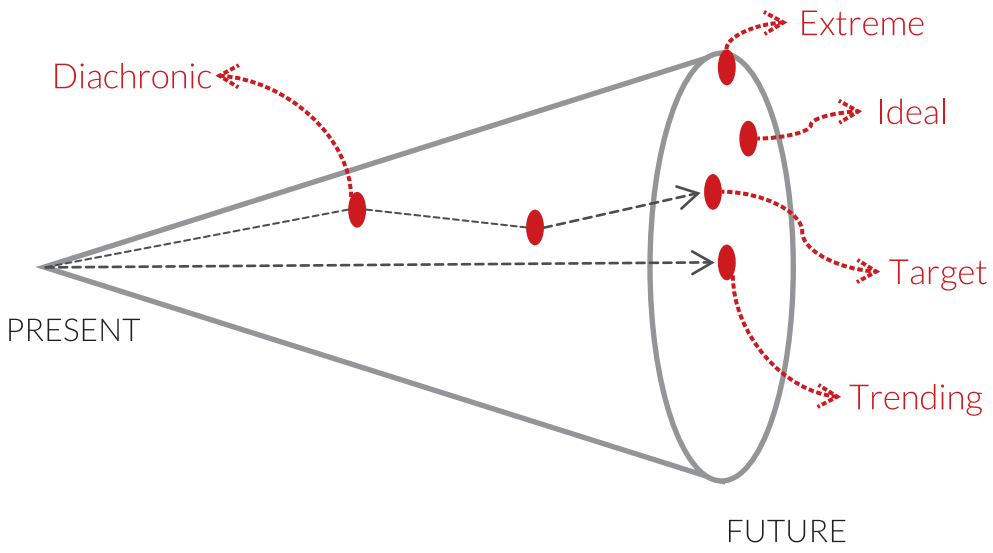


Figure 40: Conceptual model and types of scenarios.

The most commonly used types of scenarios are shown in Figure 40 are explained below:

- **Exploratory scenarios vs. normative scenarios:** the scenario method can be used as an exploratory or normative mechanism of the space of what is possible (or impossible) to determine how to reach a desired future from the present.
- **Diachronic scenarios vs. synchronic scenarios:** in order to know the path to a specific future it is necessary to design a sequence of (diachronic) scenarios over the time horizon. It is mostly required to know the possible futures in a given time (snapshot scenarios).
- **Trending:** it is a scenario that could occur if nothing changed which means that the same situation that keeps happening.
- **Ideal:** it is the best scenario that the planner would like to have, although it is rarely feasible.
- **Extreme (s):** totally different to the trending scenarios. They are in the periphery of the space of what is possible, and by convention, the superior is called optimistic and the inferior pessimistic.
- **Target:** it is that which the planner aims to reach (goal or target scenarios); generally, this is the scenario that represents less profit losses for all the social stakeholders with goals and means over the system object under study.

In the management of innovation and technology, especially when the possibility of radical innovations or technological disruptions want to be considered, it is particularly advisable to implement methods that allow taking the extreme exploratory scenarios into account.

The scenario method

Scenarios are primarily a method: a set of organized techniques shaping a process to systematically achieve the design of scenarios. Over the past three decades, theorists and practitioners of different schools of thought have resulted in different design processes (and techniques) of scenarios (Godet, 2001; Schwartz, 1991; Reibnitz, 1992; Geschka, 2001; Gausemeier, 1996). Differences – in the organization, types of techniques, necessary resources and operating conditions – among design processes of scenarios naturally produce different results. However, any of the known scenario methods can respond to the three-phase structure (preparation, development and transfer) and three steps (analysis, survey and construction) as shown in Figure 41.

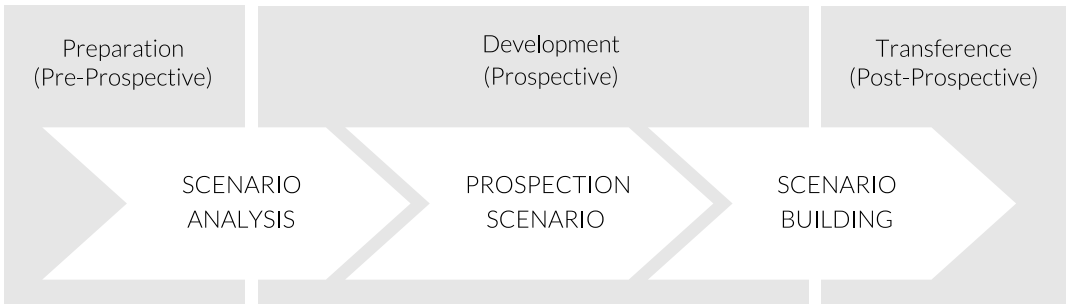


Figure 41: Scenarios design process.

The design process of scenarios in a strict sense, takes place mainly in the second phase, while the phases of preparation and transfer relate to the establishment of an analysis framework of the exercise (objectives, goals and purposes) and to the implementation of the results (communication, evaluation and decision-making), respectively.

Preparation or (pre-prospective): beyond the issues of project management such as planning, fund raising, organizational support, etc., every design exercise of scenarios is preceded by a phase of strategic definition of issues that can determine the quality of the obtained results. The preparation phase involves defining the following:

- Decision to be made: to define explicitly which decision will be made based on the scenarios and what the needs or the prospective questions are.
- Essential knowledge: to establish which knowledge is required to make the decision.
- Object of study: to define which system will be the object of study, including the boundaries or limits and interesting aspects of it.
- Space: to clearly specify the space that will include the study for the construction of the scenarios.
- Time: to set a prospective time horizon on the one hand, and the retrospective time space (recent past included in the analysis) on the other.

  This current phase will be conclusive regarding the type of scenarios that will be designed and the suitability of the particular scenario method that will be implemented. Finally, to define the elements of the analysis framework of a scenario design exercise, it is important to have a previous analysis and a strategic diagnosis of the situation of the topic under study. For this type of analysis, the tools available in the organization, i.e. SWOT, can be used.

Development or (prospective): strictly speaking, this is the phase in which the design of the scenario takes place specifically. The design process has three generic stages, namely:

- Analysis scenario: The purpose of this step is to understand the structure of the system (its components or subsystems or set of inflows) the structural analysis is essentially to identify and select the variables of influence and key social actors. An exhaustive listing of variables of influence (sixty, or even more) may be accomplished by using simple techniques such as brainstorming, 6-3-5, cognitive-maps, system-sketches. The key variables are those that exhibit a greater degree of influence; to visualize and select key variables it is useful to construct a map of activities (the extent to which a variable influences the others) and dependency (the extent to which a variable is influenced by others) as shown in Figure 42. The quantity of key variables to select oscillates between five and twenty-five, depending on the method.

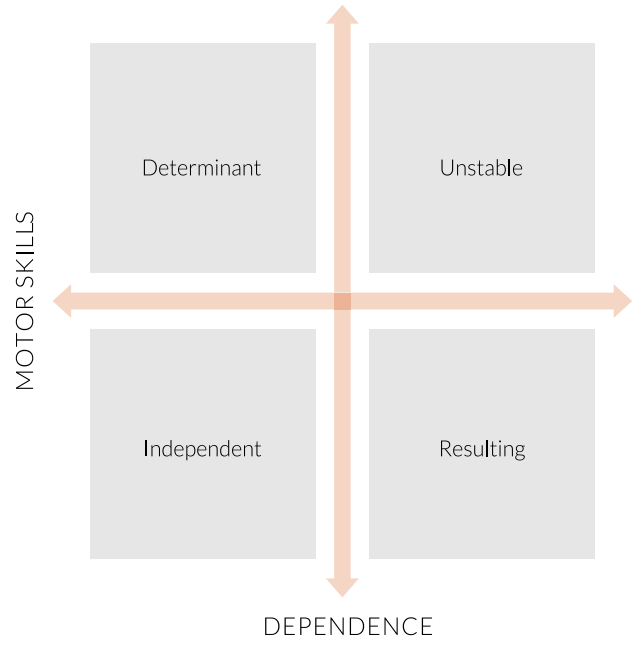


Figure 42: Design process of scenarios.

Once the key variables have been selected it is possible to deduce what social stakeholders have created interests and means or resources to act on each one of them. Therefore, it results feasible to design action plans according to conflict hypothesis or collaboration opportunities with the social stakeholders at the end of the process.

- **Prospection scenario:** the challenge at this stage of the process is to determine different possible states (or future configuration) of the key variables for the fixed planning time horizon. Every variable has measurable characteristics (qualitative or quantitative) that determine their state; the „attractiveness of a technology“ as a variable, for example, can be measured by metrics such as its performance (functional performance), market potential, operational and maintenance costs, price, availability, etc. Magnitude changes in the metrics of the variables lead to changes of state (of the system) and, consequently, changes of scenarios.
- The future configurations of the key variables therefore determine the space of possible futures. The more dynamic the planning environment (e.g. with rapid technological development or economic or political instability) or the higher the planning horizon (e.g. where scientific discoveries or disruptive innovations may occur), the greater the probability of finding high variation in the metrics of the key variables, therefore, the greater the space of possible future will be. The challenge lines in creatively imagining the universe of what is possible, only this way we can be sure that the space of possible futures has been explored. Creativity techniques and consultations experts such as brainstorming and delphi are useful to identify between two and five possible configurations, clearly distinct and relevant for each key variable.
- **Construction scenario:** it is a scenario that results from the combination of a future configuration of each one of the key variables, free of inconsistencies (the coexistence of two future configurations is totally or partially contradictory, conflicting or illogical). The purpose of this step of the process is to identify and select a set of three to seven scenarios (solutions) more consistent and relevant.
- In a scenarios exercise, billions of combinations of future configurations of the key variables can be established. However, not all combinations are solutions, only the combinations free of inconsistencies can be considered solutions (possible scenarios).
- For scenario exercises with more than three or four future configurations for five to seven key variables, it is necessary to apply techniques such as field anomaly relaxation, cross-impact-matrix, cross-consistency analysis and morphological analysis. Low complexity exercises can be performed by manually using morphological analysis.
- Once the most consistent, different and relevant solutions have been identified and selected, it is possible to draft the scenarios (scenario writing). The logic of the situation and the implications for the system should be interpreted based on each combination of possible configurations, expressing the results in a narrative form with details of design to make it understandable, feasible, communicable and vivid.

Transfer (or post-prospective): the post-prospective stage covers the implementation of the exercise results, that is, the use of scenarios. The ultimate goal of any scenario exercise is decision-making. This will require then to communicate and validate the results, analyze the implications of the designed scenarios and search for and implement initial strategic solutions.

Final remarks

The concrete reality is not isolated but relative and complex (frequently social), which should be viewed as a whole (system), because otherwise there would be a risk of leaving something important out of the explanation, description or in the consequences. The complexity of the concrete reality leads to the paradoxical notion that the future possibilities are endless, but the future will be only one. Hence, the scenario method should lead to select only a few but important possibilities (scenarios) - either because they are very significant or qualitatively different- that will not only be compared, weighted and eventually be considered for the decision-making, but also, and most importantly, because their consequences and implications will be evaluated. That means a scenario should deepen in the true meaning of each one of its implications. Only such scenario illuminates the decision-making.

The design of scenarios is a creative process about „what would happen if ...“ restricted to show the logic that suggests that it would happen. The design of scenarios is to selectively conjecture about the future of what is possible and then discern on its anomalies and solutions.

In summary, the nature of the process, together with the design and transfer possibilities offered by the scenarios themselves, make of scenarios a tool that:

- Promotes systemic, creative and problem solving thinking.
- Promotes the understanding of the implications of current decisions and the selection of long-term strategies.
- Works as a platform for discussion and analysis promoting communication, team work and the creation of a common language.
- Contributes to the organization and structuring of dispersed knowledge.
- Allows recognizing, analyzing and selecting meaningful options for the future (creating knowledge and „memory” of the future).
- Allows bringing awareness and achieving willingness to support ideas or issues expressed in the scenarios (it creates census and shared visions).
- Enables communication and „selling” ideas, helps to produce images that will be used by other means for the dissemination and promotion of complex contents.

The scenario method is one of the most sophisticated tools for strategic management, and that is perhaps, the reason why it is so difficult to implement as the best organization practice. Nonetheless, it differs from other methods by its exhaustiveness on the one hand, and its versatility on the other; emphasizing its capacity to integrate quantitative and qualitative information through a wide variety of techniques and a great diversity of internal and external actors to the organization.

Creativity methods

Stimulating creativity

Creativity as well as memory and other human capacities can be developed. For this, various means which contribute to the solution of problems that require creativity have been developed. There are different terms to refer to these means, for example, techniques, methods and tools. The techniques are sometimes referred to as brief indications that help to organize information such as cards or sticky notes to collect ideas. By the concept of „creative methods" we mean a systematic procedure with several steps that can also be supported on diverse techniques.

The different creativity methods can be divided into intuitive and systematic-analytical methods (Winkelhofer, 2006) (see Fig. 43). The intuitive methods seek to generate perceptions that lead immediately to ideas. We can distinguish three types of intuitive methods, the methods of intuitive association, of intuitive guidance and of intuitive confrontation.

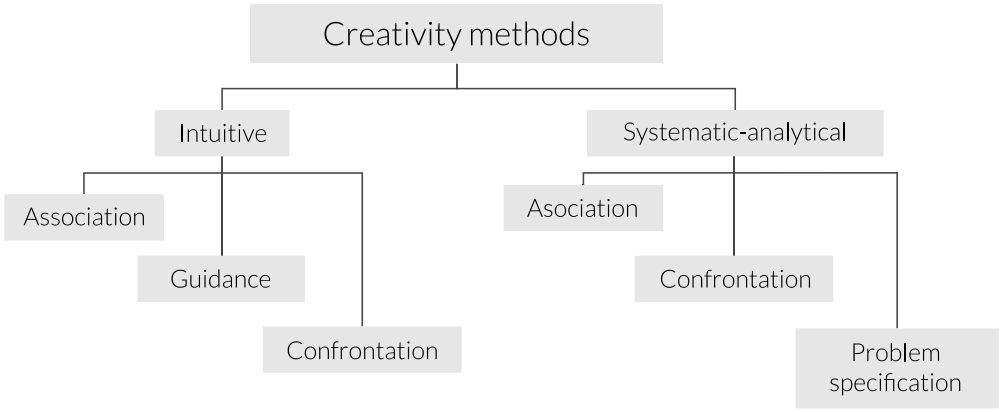


Figure 43: Classification of creativity methods (Winkelhofer (2006).

Within the methods of intuitive association, there can be methods such as brainstorming in which ideas and associations are developed in a discussion without criticism. Similarly, the brainwriting method is classified within this category. This method consists in writing spontaneous ideas and associations in a paper that are passed on to the other members of the group.

Within the methods of intuitive guidance we can find bionics. These methods involve fields external to the problem, for example, the field of nature, in order to raise ideas that contribute to develop the development of solutions.

The methods of intuitive confrontation take an object of stimulus without any direct relation to the problem (e.g. a word) and it is confronted with the problem to derive ideas from it. An example is the synectics method through which general analogies are made in different areas to, ultimately, come up with ideas.

Systematic-analytical methods further explore a situation in order to systematically find the causes of the problems or circumstances that lead to ideas that can solve problems or proposed challenges.

The first category is the systematic-analytical methods of association. These methods divide the problem into sub-problems that must be resolved independently of each other. The resulting solutions are structured, combined, varied and consolidated in a joint solution. An example of these methods is the morphological method.

The following category is the systematic-analytical methods of confrontation. As in the systematic-analytical methods of association, the problem is divided into parts, but in this case, based on analogies. An example of these methods is the morphological matrix.

The category of systematic-analytical methods of problem specification divides the problem into parts and arranges them into hierarchies in order to make the main problem visible and based on that, to develop a solution to it. An example of these methods is the relevance tree analysis. In the literature there is a large number of creativity methods. Some of them are designed to be used individually, others in small groups and others in bigger ones. A description of several creativity methods is given below.

Brainstorming

This is perhaps the best known and the most used creativity method (not always used in the most appropriate way). This method consists in generating ideas through the interaction of an interdisciplinary group (5 to 7 people) to discuss ideas, thoughts and solutions around a specific topic. Ideas arise by free association and the interaction of different points of view; the generation of new ideas proliferates.

Steps:

1. Definition and presentation of the problem, the conditions and the evaluation criteria.
2. Collection of ideas. The use of a board to present ideas allows the participants to see them and get inspired to generate new ones.
3. Presentation and grouping of ideas.
4. Evaluation of ideas

For the development of brainstorming, it is recommended to have a moderator. During the course of brainstorming, the moderator must ensure that each idea is taken into account without being criticized, regardless of how silly it may sound. Jokes or satires against members of the group must not be allowed either; this could lead members to feel self-conscious and, consequently, will refrain from expressing an idea that could result in a solution. The selection of participants is essential to obtain different points of view, and for this reason, the moderator must involve all participants.

Checklist (Osborn)

This method is based on the principle that the solution to a problem may arise from the structuring of ideas around the formulation of it. With this principle, Alexander Osborn, also known for developing the brainstorming technique, created a checklist to be used to solve problems. Each of the items on the checklist does not need to have an answer but each one must be considered as it may possibly lead to some idea.

Steps:

1. Definition of the problem
2. Review of each item on the checklist, taking the defined problem into consideration.
3. Development of solutions to the problem, starting with the items on the checklist.
   If at some point an idea cannot be generated, we should move on to the next one.
4. Evaluation of the generated ideas and, if necessary, case development for some of them.

The following table shows the checklist.

What is similar?	What function? Similar? Similar material? What parallels are there?
What other utilization options?	New usage options? Usage for other people? Other usage options through changes on the object?
Adapt?	What is it like? What other ideas does the object suggest? Are there similar examples in the past? What can we adapt from them? What can be taken as an example?
Change?	Can the object be given a new shape? Can the purpose be changed? Can the color, tone, smell or resemblance be changed? Are there any other possible changes?
Enlarge?	What can be added? Should more time be employed? Can frequency be increased? Can it be made more robust, bigger, longer, fatter, and thicker? Can it be given additional value? Can the number of parts be increased? Can it be duplicated or multiplied? Can it be exaggerated? Can it be more expensive?
Minimize?	What is unnecessary? Can it be small, more compact, shorter, lower, flatter? Can it be miniature? Can it be aerodynamic, slighter? Can it be divided into parts?
Replace?	Who or what can replace it? What other pieces or parts are possible? What other materials, production processes, energy sources or places are possible? What other solutions are possible? What other sound?
Deform?	Is it possible to regroup the parts? Is it possible to develop new models? Can the order be changed? Exchange the cause and the effect? Can the speed be changed?
Change to the opposite?	Is it possible to take what is positive instead of what is negative? Achieve the opposite? Bring the bottom up? Change roles? Change people's positions? Change the order of the process?
Combine?	Try a combination? Make a compound? A selection? Group a new selection? Join multiple objects into one? More action fields instead of just one? More goals? Less goals?

Table18 : Checklist (Osborn).

Morphological analysis

The morphological analysis consists in the collection and systematic analysis of parameters and their possible values or characteristics, from which possible solutions or ideas are developed. The selection of the parameters and the definition of the possible values or characteristics of each parameter can be made in groups.

Parameter	Possible values or characteristics of the parameter			
Light source	Candle	Bulb	Halogen lighting	Fluorescent tube
Diffusion of light	Opaque glass	Paper	Natural fibers	Indirect lighting
Energy source	Electricity	Batteries	Solar energy	
Material	Madera de Cedro	Aluminum	Polyethylene plastic	Glass
Style	Medieval	Retro	Pop	

Table 19: Morphological Matrix: Lamp example.

In the example of the table above (see Table 19) there is a description of parameters of a lamp and possible characteristics that each of these parameters could have. For example, as light source, it is possible the use of a candle, a bulb, halogen lighting or a fluorescent tube. The points connected with lines identify the selection within the possible characteristics of each parameter

Steps:

1. Definition of the problem.
2. Definition of the parameters of the object or problem to be solved.
3. Definition of the values or characteristics of each parameter.
4. Preparation of the parameter matrix and its values or characteristics.
5. Selection of the characteristics of each parameter and development of the concept or solution to the problem.
6. Evaluation of the idea or solution.

Below are some examples of different levels of the morphological analysis through the use of matrices.

Two-dimensional matrix

A company that produces umbrellas wants to expand their range to include more specialized and unusual products. The company is looking for new ideas.

The first step is to identify the categories of ideas that would be used as axes of the matrix, keeping in mind that the goal is to discover opportunities and not reach an immediate solution. In this case, the axes could be called, one as „accessories" (additional characteristics that consumers could appreciate and that could be incorporated to the umbrella), and the other as „scenarios" (places or situations in which the umbrella could be used). If these two axes were selected, the appearance of the matrix could be as follows:

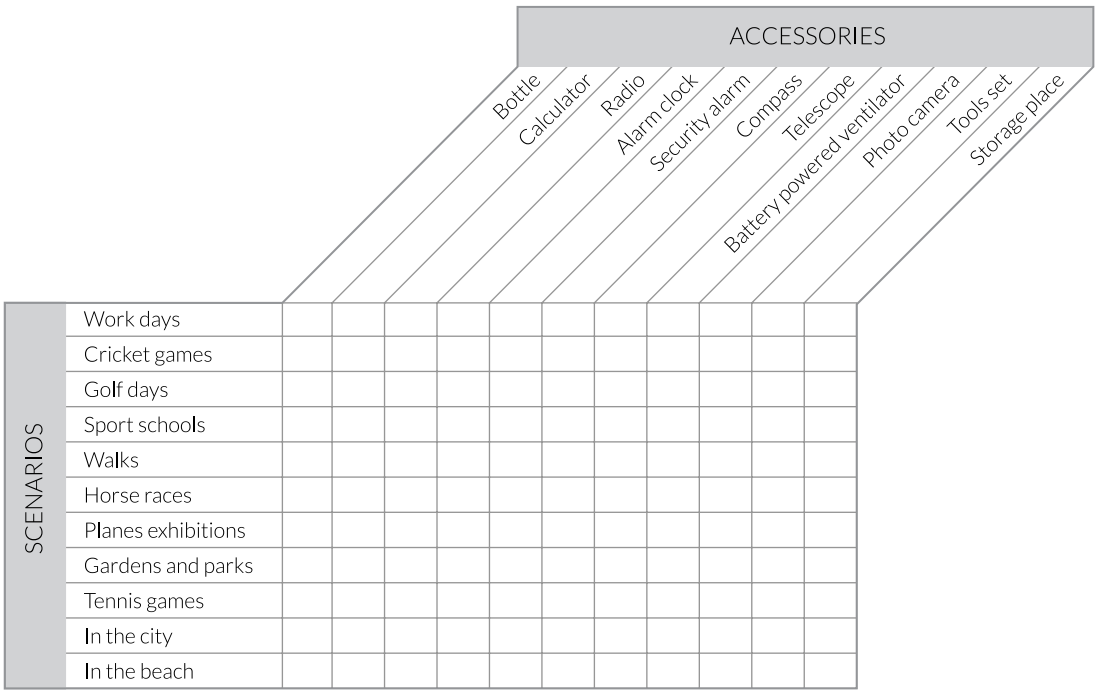


Figure 44: Two-dimensional matrix. Source: Muñoz (1994).

This example shows an 11x11 matrix (121 items) and it is clear that it is possible to add more items to each axe. With a combination of ideas like this, the possibilities of finding one or two that are correct increase greatly.

The three-dimensional matrix

A packaging manufacturer wants to find new ideas to build new markets. Again, the success depends on determining axes that are relevant to the problem and that are appropriate. For example, a three-dimensional matrix would look like the Figure 45. With those three axes (content, material and shape) 448 (8x8x7) combinations or ideas generated. Moreover, in this example, the simple addition of a new item in the axis of the shapes would generate other 64 ideas. But even if we limit ourselves to the 448 original ideas, it is possible to expect, statistically, that from them around seven or eight potentially „winner" ideas will arise.

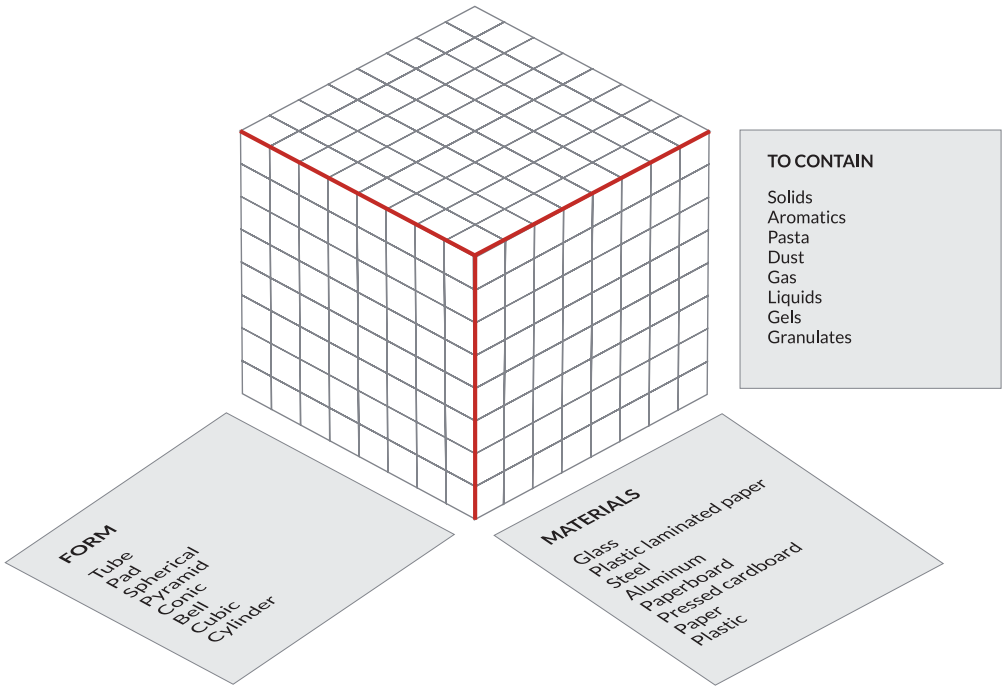


Figure 45: Example of a three-dimensional matrix. Source: Adapted from Simon Majaro (1994)

Ideas evaluation

Due to its enormous potential to generate ideas, the morphological analysis sometimes poses a serious problem for those who must evaluate its results. It is obvious that dealing with computer lists with 10.00 combinations or ideas is a discouraging task. Fortunately, there are two methods to simplify this task.

Grouping ideas

Instead of focusing on one idea at a time, they can be analyzed in „groups"; for example, we can evaluate the combination „paper-ball-coffee" against each of the scenarios. This approach reduces to a manageable size the extension of the lists. The fact of evaluating the groups of ideas against the items in a column tends to focus the attention on that column and often, in the evaluation session new approaches or items arise; for example, „would it be possible to use this combination in the military service?, in an airline?, etc.

Multi-stage sieving

This approach is based on the principle that often, creative people find it easier to work with ideas that are expressed visually. This can be achieved in the case of a four-dimensional matrix if the first three axes are presented in the form of a cube. In this visual representation, the best ideas are selected and evaluated in combination with the four axis, using a two-dimensional matrix. If it turns out that there is a fifth axis, we must build a new cube in which we will take the best ideas that were obtained in the first cube to evaluate them in combination with the two remaining axes.

Analogies (Synectics)

The use of analogies consists in taking the problem that needs to be solved to other knowledge areas or simply to other scenarios. This stimulates the flexibility of the already established thinking structures, facilitating linkages to generate new ideas. The essential part of this method is the selection of the analogy. It is possible that a group cannot find a suitable analogy or that the found analogy does not lead to the generation of good ideas. We should also take into account the knowledge of the selected area. Although the overall exercise simply attempts to make the mind more flexible, a greater knowledge can lead to new associations and understandings. A good analogy may be done with nature, therefore it is recommended to have at least one participant who is an expert on the selected area, in this case, a biologist.
An example could be network intelligence: one of the problems with the proliferation of communication networks is to find the best way to communicate. In order to develop ideas for a more efficient communication, we used the analogy with intelligent swarms within nature. Analyzing the topic, we found that ants leave a pheromone by the places where they walk through so that other ants can find a more efficient path to go somewhere, for example, where their food is. In this way, we can also think about leaving a mark or sign on information packages, for instance in emails, that could be read and interpreted by other

forms of messaging processes and thus, make its transmission and storage more efficient.

Steps:

1. Definition of the problem
2. Search for the analogy
3. Analysis of the selected analogy
4. Search for the analogy elements that are linked to the problem.
5. Generation of ideas from the analogies.
6. Evaluation and development of ideas.

Hat exchange method (6 thinking hats by Edward Bono)

This method involves the systematic analysis of a problem or situation from different points of views. Each view is represented by a „hat", which is characterized in a specific way:

- White hat: it is focused on data, facts and information about the problem:
  - What information is available?
  - What data, facts or information are missing?
  - What data must be obtained and by who?

- Red hat: with this one, we can express any feeling or intuition about the problem. The perception and the feelings should be expressed without being criticized by other mem bers of the team.
  - How do you feel?
  - How do you feel about the problem?
  - What sensation comes to your mind?

- Black hat: we must be careful with it. This role indicates the errors and gives a critical look at the solution of a problem or the implementation of an idea.
  - Is the possible solution profitable?
  - Is any law or regulation violated?
  - What are the risks?

- Yellow hat: it is optimistic. When wearing the yellow hat, it is necessary to focus on consciously identifying the benefits of a project or an idea.
    - What are the advantages?
    - What does everyone get?
    - What advantages can it bring to other people?

- Green hat: it concentrates on creative thinking. In this space, new ideas can be generated by complementing the already existing ones.
    - What are the alternatives?
    - Where do you think you can have fallen into paradigms?
    - How can the process be accelerated?

- Blue hat: This hat emphasizes the control of methods and processes. The issues that must be reflected on and the steps to be followed are determined here.
    - What aspects still need to be considered?
    - What is not clear yet?
    - What should be discussed?

Although the method offers some variations, we usually follow the sequence in which each of the roles or „hats" has been described, documenting each of the results under each point of view. This method can be used individually, but also in groups, for which it is advisable to have a moderator who can maintain the discipline in order to fulfill each role.

Service Blueprinting

Description

Service blueprinting is a service planning help tool. It can be used for developing new innovative services as well as for improving existing services. The method is also appropriate for ensuring the quality of service processes. It can also be used for new employee training or for showing clients a service cycle overview.
The service blueprinting output consists of a graphically-presented overview of the service process and its activities. Service blueprinting allows for visualization of the service development process in its early stages. In each process step, contact points between client and firm (and physical element, if a tangible service) become visible. It is possible to identify failure points and discover areas for innovation as well. This technique eases the identification of cost saving potentials and offers an excellent base for further service process management.

Objectives

Services are difficult to conceptualize in development, due to their intangibility. It not possible to „experience" services with prototypes alone. Service blueprinting is a tool that gives a better understanding of the services and their basic processes. The objective is to establish the activities of the service production in a graphical representation. Service blueprinting with its strong client-focus differs from other methods of process analysis; service blueprinting supports client satisfaction. Service blueprinting considers not only the client requirements during the process design, but also the firm's internal requirements.

Information requirements

Before starting the service blueprinting, preliminary information is required.
Service blueprinting is a complete service production process that summarizes points of client interaction as well as the invisible client process steps.

The following information should be provided:

- Client requirements for each client-targeted segment
- Documentation of processes and sub-processes of existing services
- Related resources for each process step (personnel, machines, accessories, etc.)
- Time frame of the processes, duration of the step

Especially for new developments, some information may not be available, take care to note it when it is discovered during the process.

Identification of the relevant target groups and their requirements

A successful service development requires the determination of relevant target groups and identify their requirements. Target groups must be precisely defined and can be formed through differentiating characteristics such as age, gender, profession, lifestyle, etc. The development of these client groups and their requirements is not part of the service blueprinting; rather it takes place in the „requirement analysis phase".

Process

The service blueprinting is based on the separation of the service into individual processes that can be assumed separately. The process progress chart is depicted horizontally. Each single component is on a different plane, ordered vertically. Each plane represents a level of closeness to the client, the higher the level the closer the interaction level is to the client.

Planes

Service-blueprinting differentiates between five degrees of client interaction and integration (See Figure 46).

- The **client interaction** line separates the process steps of the service activities that the client carries out independently.

- The **visibility line** separates the service activities that the client can see from the service activities which are hidden from view. Above the line, the process components that can be seen, heard, smelt or perceived are ordered.
- The **internal interaction line** separates activities that imply immediate relation to the client's order from support activities. Support activities serve as the preparation for the primary activities but do not belong to the client's order. Examples are the maintenance of a ski lift or the cleaning of an office.
- The **control line** separates the preparation activities from the general management activities.

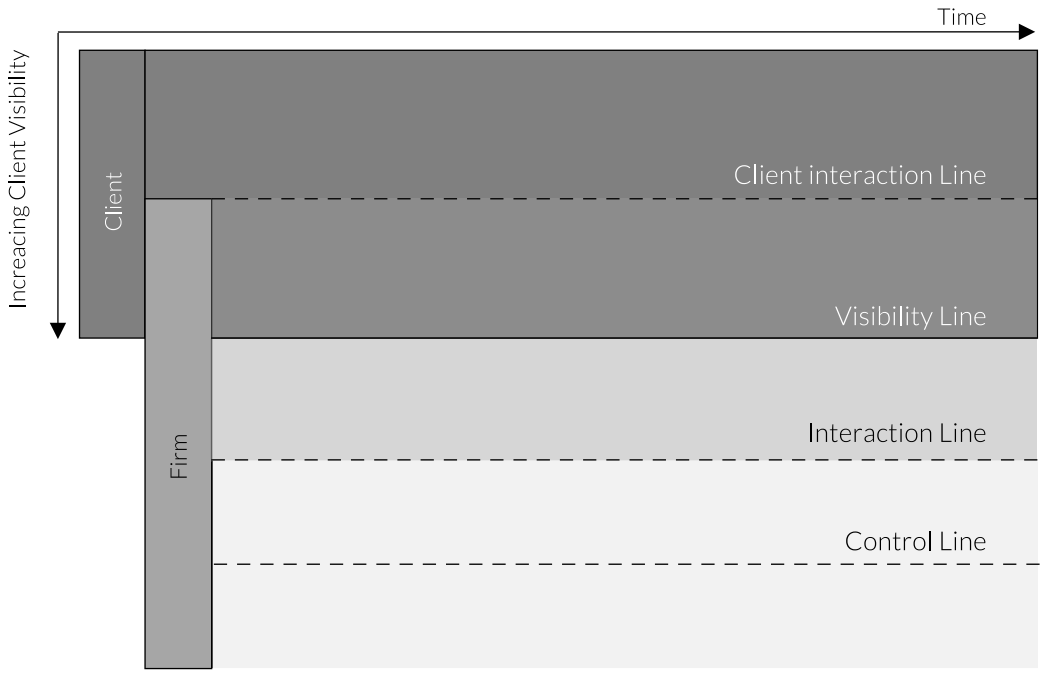


Figure 46: Interaction planes of service blueprinting.

Service-blueprinting differs from other approaches of process modelling and analysis, in that the vertical distribution is related to the responsible areas of each division. Assignment of responsibilities for each process step is also not shown visually. Here the client focus is to be considered; for many clients it is unimportant which divisions they need to be in contact with to get their service order properly accomplished.

Participants

The development team for a service blueprint should be represented by different service departments such as service development, service provision and service support. In some cases, the inclusion of the client is also useful. Before starting, the objectives of the service blueprinting process must be clear for each participant. Normally, it is not useful to follow every possible application from the beginning; focusing on one or two possibilities typically leads to better results.
Depicting the service process as it should flow in the future is vital to the process. The depiction of every „special case" is counter-productive and eventually does not contribute to the accomplishment of the objectives and hinders the service blueprinting process.

Service blueprinting for new services

The development of a service blueprint for new services is carried out in four steps:

Figure 47: Service blueprinting-process for new services.

1. Definition of the ideal customer interaction process, from initial contact to the end of service interaction
2. Identification of the contact points between the client and service provider. This includes all client-perceivable process steps performed by the service
3. Identification of the interactions between the front office and the back office
4. Definition of time standards, tolerance levels and of the resources required.

Depiction of the service process from the client's point of view

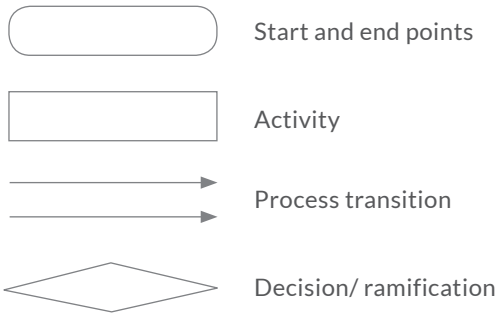
The first step in service blueprinting is the identification and delimitation of the service. Here, the service is modelled as it is perceived by the client. Keeping in mind optimal client satisfaction, the process is arranged so that it represents an optimal course for the client. It is important to consider that a service blueprint is va-

lid for only one target group. For multiple target groups, the optimal service processes are often dissimilar. Therefore, an additional service blueprint should be considered for any additional target groups.

Example: Household appliance maintenance

Different groups conduct household appliance warranty registration and repair in different ways. Older clients may be accustomed to visit the original retailer personally; younger clients may choose to establish contact via the Internet.

A flow diagram illustrates the service process. Actions are represented by rectangles; process transitions are represented by arrows; Start/End points are rounded rectangles; and decisions/ramifications are diamond shaped.



Ideally, software can assist in creating a service blueprint. In its simplest form, the presentation is a linear process composed of individual sequential steps. Every potential influence on the process, inputs and outputs, must be represented.

Identification of client contact points

The differentiation of the client and the service firm actions is an essential element of service blueprinting. In the second step, the contact points between the client and the firm are identified. The process steps that are performed exclusively by clients are placed above the client interaction line. Process steps with direct contact between the client and the firm are located between the client interaction line and the visibility line. Finally, the client-perceived activities performed by the firm, but do not imply direct contact, are included in the service blueprint.

Example: Restaurant

Meal selection is a client-concerning process. Meal ordering is a direct interaction between client and service provider. In the case of visible meal preparation (i.e. system gastronomy), there is no direct interaction between the client and the service provider, but is perceivable by the client.

Identification of front and back-end integration

After identifying the directly perceivable activities, the next step is to define the unperceivable steps. The process steps will be placed between the visibility line and the interaction line. Depending on the objectives of the service blueprint, the processes of the two lower planes (support and control) may be included.

Example: Household appliance maintenance

Washing machine repair and maintenance is not always possible at the client s address. For some models, it is necessary to pre-order the required spare parts. The acquisition stages are usually invisible to the client, but are part of a normal repair process for a business.

Resource definition, time standards and tolerance

Next, it is necessary to determine the process time frame. To do this, the estimated labour time, the related costs and the necessary employee count are required. Appropriate process durations are defined for each activity and enable the proper resource-use-calculation. The time standards must include possible deviations in order to obtain a realistic calculation. Thus, it is possible to test time-critical services and determine if they can be provided according to the client requirements.

Example: Household appliance maintenance

For each process step, time and resources used for the repair service were determined based on experience. This information is used afterwards for the simulation of the operation. It is possible to establish the ideal employee workload and optimal employee count for various service-order scenarios.

Service blueprinting for existing services

The service-blueprinting procedure is also appropriate for existing services. By illustrating and analyzing the current status of the service process, it is possible to see areas of improvement within the service sequence. Creating visual representations support process improvement by showing the flow and highlighting potential points for incremental adjustment.

Figure 48: Blueprinting process for existing services.

Service documentation and decomposition into component processes

First, the service processes must be documented; many methods such as observation/follow-up or service transactions monitoring are adequate. From the client's point of view, the process course can be carried out using the critical incident method. Appropriate methods for the internal service processes component documentation are structured interviews and workshops.
Service Blueprinting presents the process steps in a chronological order; therefore the process depiction must be synchronized with service process decomposition.

Depiction of the service process

Based on the process documentation a flow diagram including all process steps has to be developed and it must be converted to the service blueprint. This can be performed with an adequate software package.

Determination of resources and time standards

During the third step, the real process roles must be transferred to the service blueprint. In the simplest cases, each process step can be ordered into a previously defined executable role. Applying the RACI-Model (responsible, accountable, consulted and informed) is recommended for bigger service organizations. In addition to having responsibility for the process step or component process, the advisor and information provider role should be established. Finally, the service blueprint is completed by sequencing the process step resources and measuring the time for process completion.

Analysis and service improvement

Based on the analysis of used resources, time constraints or identified communication gaps an improvement of the existing service delivery process can be developed and documented in a new service blueprint.

Service-blueprinting example

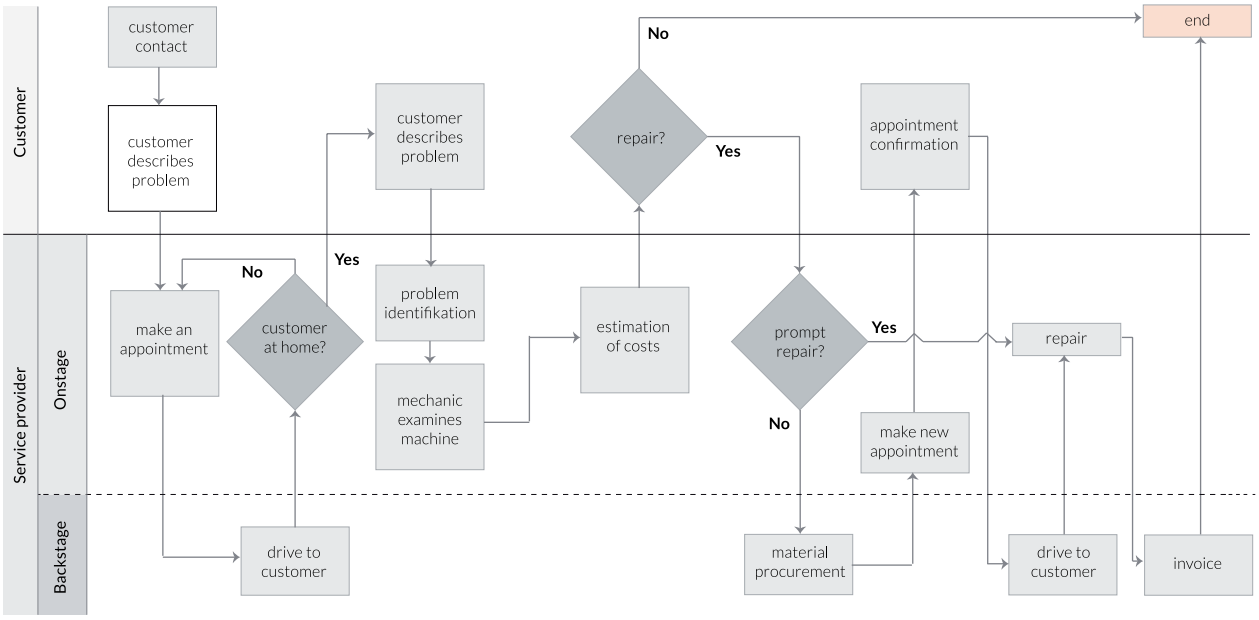


Figure 49: Example service -blueprint: Household appliance maintenance.

Example: Household appliance maintenance

Figure 49 illustrates a service blueprint for household appliance maintenance service. There are two main objectives of the blueprint. The first is to analyze and visualize the customer interactions, while the second is to have a map that enables better estimation of the typical costs and time needed for performing of the service delivery process. For the purpose of simplification, the two deepest levels of the blueprint were not included.

The starting point of the service process is the breakdown of the machine. The client at this stage contacts the service company. Typically, the clients will describe the problem from their perspective and an appointment to visit the customer is made. Next, the mechanic arrives on-site; in the event that the client is not there, a second appointment has to be made. After speaking with the client about the problem, the mechanic examines the appliance and makes a repair cost estimate. For repairs that require no additional parts, the estimate is given to the client and once the terms are agreed to, repair can begin immediately. If the mechanic has to order parts or secure special tools, a follow-up appointment with a time estimation is given. After successful repair, the firm provides an invoice for services rendered. Finally, the client makes payment and the process is finished. In this case, follow-up customer service is considered a separate service function.

As Figure 49 shows, not all of the process steps flow in the same level. The description of the problem, the arrangement of the appointment, and the payment of the invoice are not conducted by the service provider. For these steps of the process, the client is responsible. The steps that appear in the onstage level are all perceivable by the client; he/she is integrated in the process. The backstage processes (spare part ordering, mechanic travel, invoice preparation, etc.) are not perceivable by the clients.

Further applications of service-blueprinting

The service blueprint of an existing service displays the real moments of the service provision. It is possible to have a better understanding of the process and service success factors. Further analysis of the service can be done with different goals in mind. Possible objectives could be to increase client satisfaction, to diminish the process step times, to reduce costs, or to increase the service quality. The service blueprint can also be used as a starting point for process cost analysis. Service blueprint-based simulations can support service analysis. Some examples are service simulation and FMEA.

Service simulation

Further service process analysis is conducted by using simulations. Depicting a service with the service blueprinting does not automatically guarantee its validity. With help of simulations, trouble spots in the process design can often be exposed.
In order to determine the minimum and maximum service achievement times, the individual process steps must have their times established beforehand. The time at which an event takes place must be differentiated from the event's duration. Potential waiting times, which can often take up a large portion process time, are often not included in the plan, therefore they are difficult to plan as a „constant" in the process. Waiting times typically appear where processes are blocking or competing with one another. Only through process observation (observing the process flow and which of the processes compete or conflict with others) over an extended period is it possible to make conclusions about service operation process and cycle times. Computer simulations can assist in finding potential bottlenecks due to a lack of resources and help order the process steps appropriately. With the use of simulations, it is possible to test time and quality distributions of the service-related demand to determine the optimal solution.

Some results of service simulations:

Times

1. Times of individual process steps
2. Duration of complete transactions
3. Waiting times of processes
4. Waiting times of single process steps
5. Resource idle time

Costs

6. Process costs
7. Process step costs
8. Resources costs

Work load

9. Resource work load

This information can be used after the adjustment of the service-blueprint. By conducting repeated simulations, it is possible to validate process modifications. Service simulation is an effective method for iterative improvement of the service blueprint and the service processes.

FMEA – Failure mode and effect analysis

In addition to service process simulation, service blueprints are a good starting point for identifying possible failures in the service provision process. The critical points in the service provision are typically client contacts. These contact points are easy to identify with service blueprinting because of the interaction and visibility lines.

The FMEA method has three phases:

- Identify – What could go wrong?
- Analyse – What is the probability of failure and the potential consequences?
- Take action – What can be done to avoid the failures or to diminish the heavy consequences?

For this phase, valuable information can be obtained by means of service blueprinting; developed solutions should also be documented in the service blueprinting.
A detailed description of this method can be found in the chapter on FMEA.

Target costing for services

Definition

Target costing is a cost management strategy instrument, which was developed by the Japanese auto producer, Toyota.
According to Syska (2006), a high pressure on prices and costs characterizes intensively competitive markets. Hence, prices based on costs can be forced to decrease, compromising the benefits. The target costing tool is an instrument that helps to manage this problem.
According to traditional costing, costs generated during the products fabrication or service delivery processes constitute the basis for defining the final product or service price. Target costing eludes this paradigm as it bases on the cost calculation according to the value clients find more satisfactory in products and services. The sooner the costs ceiling in the market are defined, the better, because the influence of the costs in preventive measures offers more promising results and with less expenses than during subsequent adjustments.

Target costing process

The Figure 50 shows the target costing process.

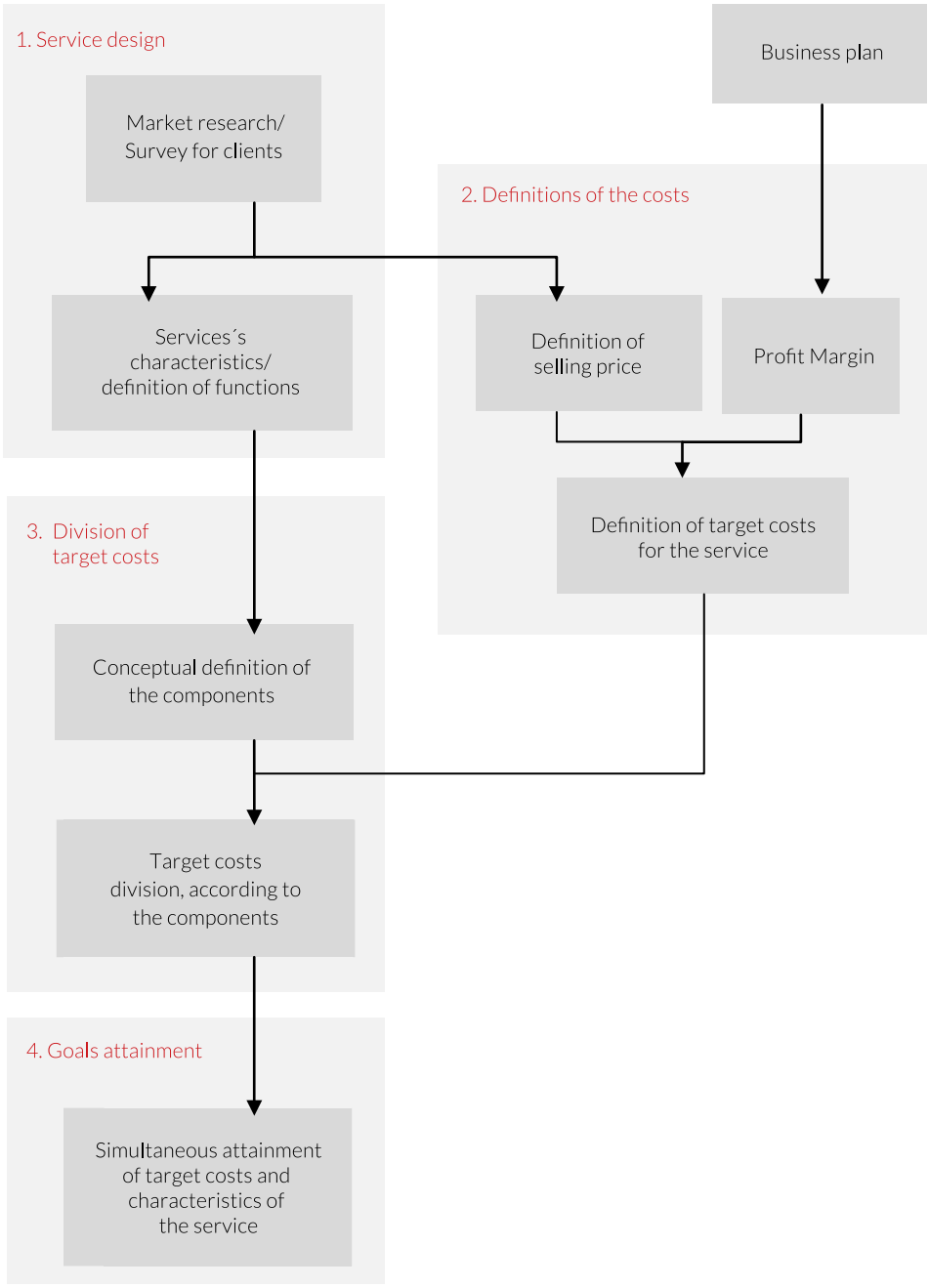


Figure 50: Target costing process. Source: Fischer (2008).

The following detailed explanation of the process is based on the analysis made by Fischer (2008) and Buczkowski (2007). An example of the application will be also included in the explanation.

Step 1: Product/Service design

This first step is in regards to the description of the fundamental properties of the product/service, i.e. the definition of its function in harmony with the client's needs. Tools already presented in previous chapters such as QFD, Service-blueprinting and morphological matrix can help to define these functions. All these tools seek to integrate the „voice of the costumer" and his needs and recommendations. In the case of an anonymous market, it is possible to identify the client's requests through market research tools such as interviews, focus groups discussions and available information (client complaints, suggestions, etc.). The goal is not only to determine the mentioned properties, but also to know the value the clients find in these sets of properties and functions.

Case study: "In-house" engineering project management training

Service planning

The following example shows the analysis of the price setting process for a training service in topics related to engineering project management. After an interview with the main customers of this type of training, we determined the characteristics of the courses to be offered. These characteristics provided the basis for conducting a second market research focused on the competitor analysis. This study showed that, on average, customers used to pay between 150 and 220 Euros per day/ assistant. Based on this information, we set a base price of 185 Euros per day/assistant.

Given that in average 15 people participate in this course and that it lasts for 8 days, the potential market price was defined by:

15 people x 8 days x 185 €/ person per day = 22.200 €

Step 2: Defining the target costs

For defining the target costs, it is possible to decide between different approaches. One can focus on the firm's costs, on the competitors' costs, as well as the achievable market price. Fischer (2008) describes five possibilities:

- „Market into company“ (Based on the achievable market price).
- „Out of company “(Based on already defined costs, where the costs projection for the new product is rooted in its accountable characteristics).
- „Into and out of company“ (Combination between market into company and out of company).
- „Out of standard costs“ (The target costs are deduced from reductions in the standard costs, i.e. the attained costs under actual procedures).
- „Out of competitor“ (Based on costs and prices of current competitors).

The overall costs should be established in such a way, that they sustain an optimal service design, i.e. satisfying quality demands and guaranteeing a competitive cost situation at the same time. In consequence, this document uses the ”market into company” method for the overall cost calculation. This method shows a higher degree of reference to the market, which well suits the fundamental principle of target costing.

Buczkowski (2007) defines a technique for the definition of the target costs (Figure 51), these are also called allowable costs. This technique is based on the target price which represents the value for our client in our service. Then, the target profit must be subtracted from the target price in order to obtain the allowable costs. This allowable costs must be compared to the standard (drifting) costs. The (standard) drifting costs describe the costs that arise from services designed under already planned, installed and potential technologies, as well as under the already adopted processes.

If the drifting (standard) costs are below the allowable costs, there is no need to adjust the former. If the drifting (standard) costs are higher, adjustments must be made.

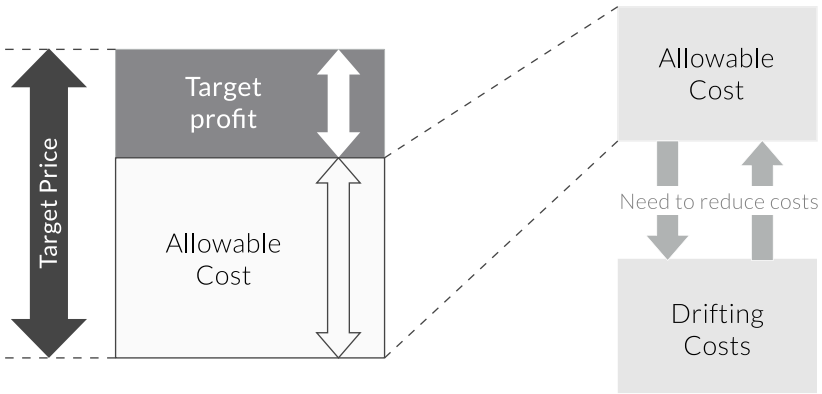


Figure 51: Definition of allowable costs. Own elaboration based on Buczkowski (2007).

Case study: “In-house” engineering project management training

Target costing

For the calculation of target costs, first, we must define the target profit margin that the company expects to have. Within the company s service portfolio, the training courses belong to those services that generate a “continuous” income stream. As the strategy in this type of services is the customer loyalty in order to achieve a long-term relationship, the profit margins are in a medium to low level, in this case, 15%. On this basis, we performed the following calculation formula for the purpose of determining the allowable costs:

€22.200 - (€ 22.200 x 15%) = € 18.870

Drifting costs optimization

ccording to Fischer (2008), allowable costs used to be much lower than the drifting (standard) costs under actual procedures. The target costs of the product are defined at some point between the allowable costs and the drifting (standard) costs. The target costs must be optimized. However, in spite of recognizing the need of optimization, a problem remains open: the way the difference between target costs and allowed costs is handled stays completely open (will the expected profit margin become lower, or must the original price be increased?). It will be necessary to deploy a procedure with consistency and transparency. When the allowable costs are not reachable, the possibility to abate the original target emerges, as shown in the decision and planning chart in Figure 52. The procedure presented in this figure has a schematic character; practical cases show an iterative process with kickbacks to the individual steps. Similarly, the decision to launch the product can also be preceded by a particular combination of the individual activities.

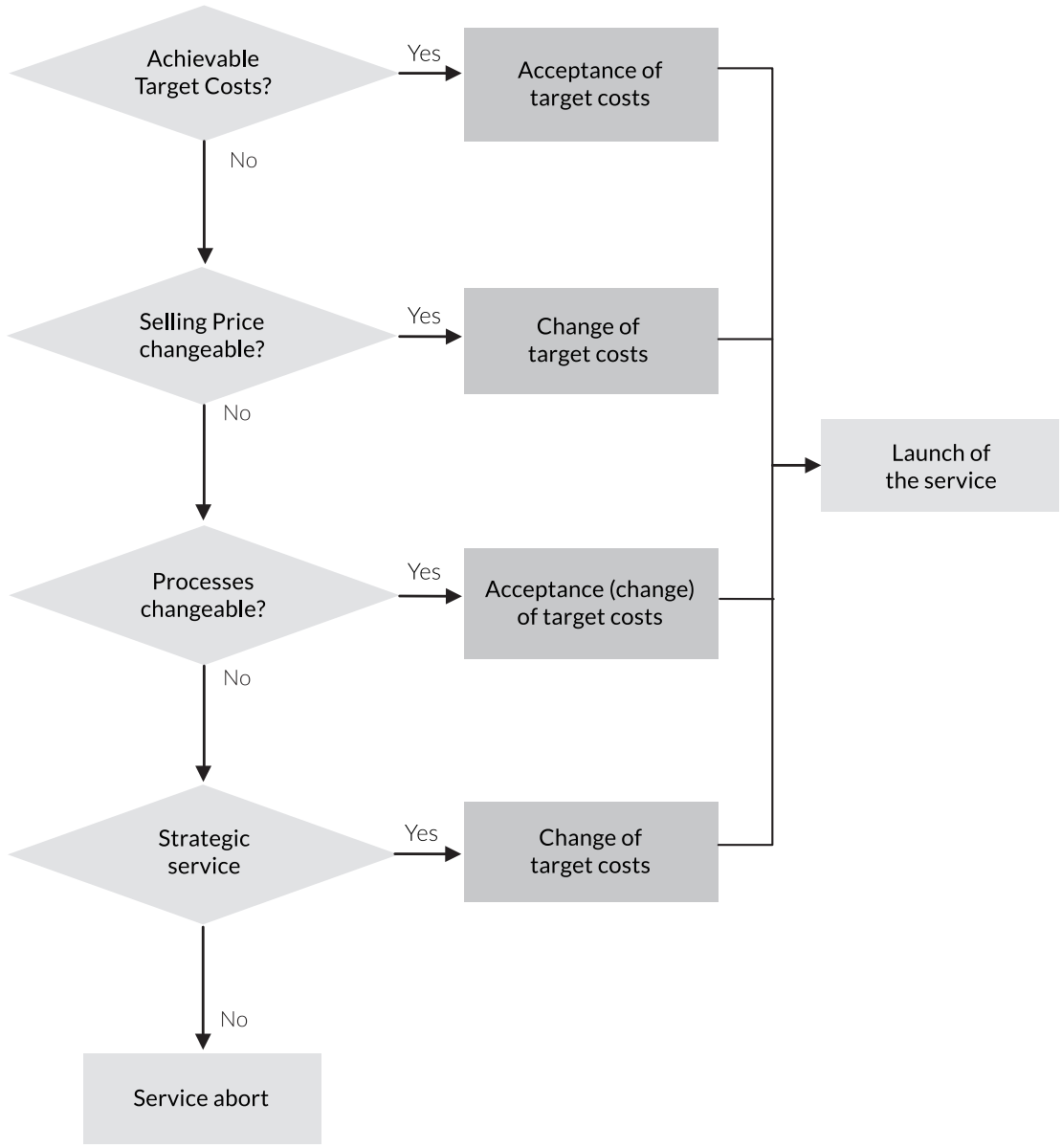
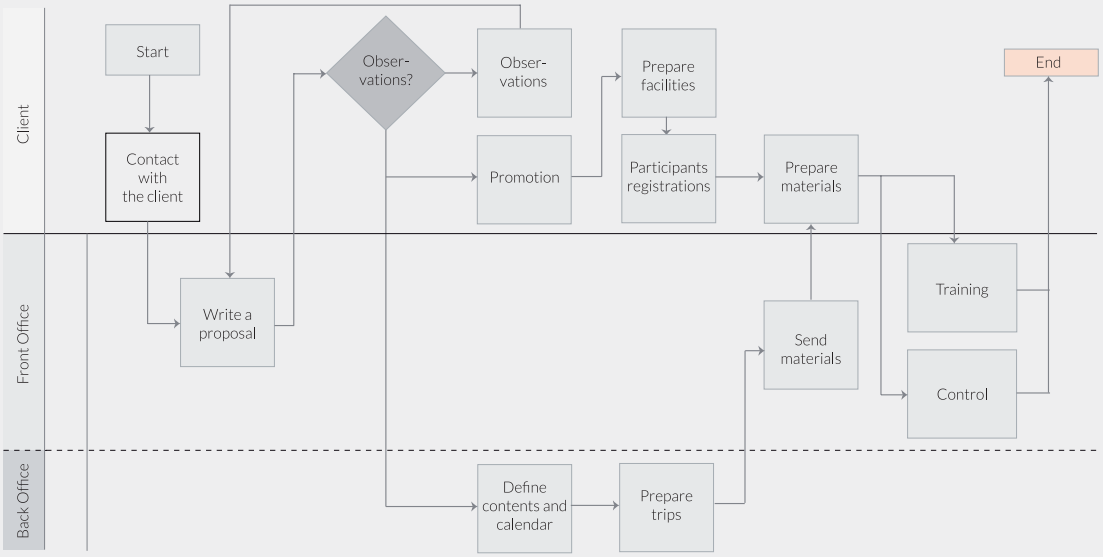


Figure 52: Procedure proposal for non achievable target costs. Source: Fischer (2008).

Case study: “In-house” engineering project management training

For the calculation of the standard costs, we used the Service Blueprinting technique (this book provides a guide for the implementation of this tool). With this technique, we defined the processes to follow for the service provision. The figure below shows the resulting Blueprint.



After the processes were defined, we performed a simulation of the entire service process in order to calculate the total costs incurred during its provision. The simulation showed that the total costs were € 19.922,39.

When compared to the allowable costs of € 18.870, one can conclude that it is necessary to adjust the standard costs in order to achieve the target costs, and therefore, the expected profit margin. After following the process presented in figure above, we have concluded that it is necessary to modify the processes that compose the service. In the following steps we will show how to identify the processes that must be improved or modified so that we can to achieve the target costs.

Step 3: Division of target costs

The standard cost optimization should be performed through a comparison of the target costs. However, the comparison of total costs will not allow us to identify components or sub-processes of our services, making it necessary to conduct these cost optimizations. Additionally, each component will have an influence of different intensity on the customer.

Therefore, it is necessary to divide into target costs and standard costs. In the case of products, this division can be based on its main components. In the case of services, this division is a more difficult task. Their intangible nature allows only the division based on the sub-processes that are part of the service. The Service Blueprinting is a tool that will graphically define the different processes of the service. Given that such processes can include activities developed by different departments of the company, it is necessary that the Blueprint is conducted by a multidisciplinary team.

Categorization of processes

The direct participation of the client in the service has a direct impact on the definition of processes within the service and, hence, on the target costing procedure. The total target costs for rendering the service are calculated for each successfully created part of the process. For this purpose, the parts of the process are categorized according to their closeness to the set of assigned activities, forming the following system:

- First grade processes have a direct relationship with the rendering of the service, i.e. with the clients. For example, the assembling of a machine by clients through service personal of the provider.
- Second grade processes have an indirect relationship with the rendering of the service, and often serve as support of first grade processes, e.g. the preparation of the assembly, rout planning and staff assignment.

Case study: "In-house" engineering project management training

Categorization of processes

With the help of the Service Blueprint developed for the calculation of standard costs, we can easily define the first and second-degree processes. In this way, first-degree processes are those that occur in the Front Office:

- Write and send the proposal
- Send materials
- Training
- Internal control during the training

Similarly, the second-degree processes can be defined as those that take place in the Back Office:

- Define materials and schedule
- Arranging travel plans

Process cost calculation

Target Costing is a market oriented tool. The costing bases on the relevance of each part of the process according to the uses (able to be quantifiable) by the clients. The higher the provision of benefits on the part of a process is, the higher the estimation of maximum costs for that part of the process.
Buczkowski (2007) introduced the process costing matrix (see table 20) to determine the percentage share of the total costs for each process. The level of contribution to the total costs is mainly based on each one of the processes involved in the customer satisfaction.
This form can be filled out following the procedure below:

- Defining the contribution of each of the identified requirements to the total customer satisfaction (second row of table 20).
- The total contribution to the satisfaction of each requirement must be divided among each of the processes, according to the level of participation of the process when covering the respective requirement.
- Finally, we must add the contribution of each process (each row) to the total customer satisfaction. These rows will be the percentage shares out of the total costs for each process.

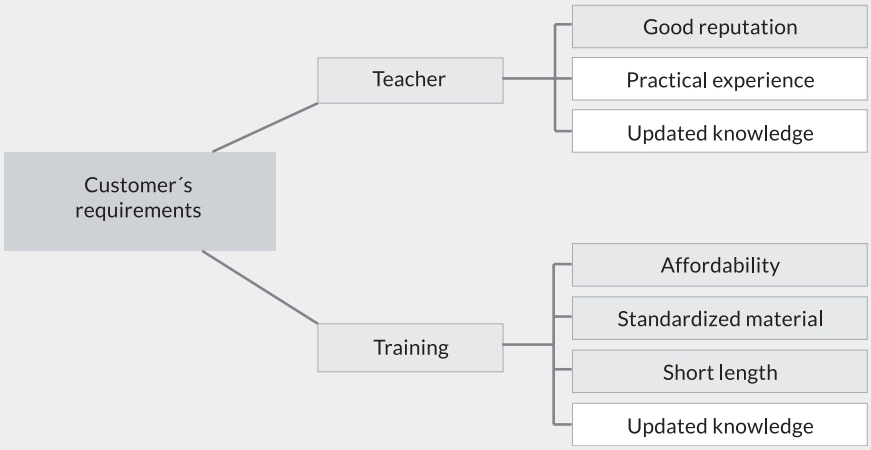
Functions	Client's requirement 1	Client's requirement 2	Client's requirement 3	Client's requirement 4	Total (in%)
Function's contribution to total use (in %)					100
Process 1					
Process 2					
Process 3					
Process 4					

Table 20: Template for a process costing matrix. Buczkowski (2007)

Case study: “In-house” engineering project management training

Process costing matrix

For the case study the client´s main requirements were identified with the help of a mental map.



From the identified requirements, the most important were determined: good reputation, affordability, standardized materials, short length. The process-costing matrix is done based on these requirements and the processes identified in the previous phase.

Functions	Affor-dability	Good Reputation	Short length	Standardized Materials	Total (in %)
Functions contribution to total uses (in %)	30	50	10	10	100
Training	20	30	5	5	60
Write and send proposals				1	1
Preparing travels	5		2		7
Define contents and schedule	5	10	3	3	21
Internal control		10			10
Submitting material				1	1

The comparison between target costs and standard costs, which is possible with help of the function-cost matrix and the previously established standard costs, reveal if and in which quantity the real costs differ from the market permitted costs. For this purpose, the target costs index is calculated for each function.

$$TC\ Index = \frac{Target\ costs\ fraction}{Standard\ costs\ fraction}$$

An index value over „one" means that the target costs are higher than the standard costs, i.e. clients estimate higher use than the cost share in that part of the process, so that the firm could potentially conduct quality enhancements. In contrast, an index value under „one" means that the target costs exceed the standard costs, i.e. clients estimate less use of the part of the process than its fraction of costs, so that a reduction of costs is necessary. However, the statements should be taken as reference, since the absolute need to reduce costs was not considered (Buczkowski ,2007).

Process	Share in the target costs (in%)	Share in the drifting costs (in%)	T C Index
Process 1			
Process 2			
Process 3			
Process 4			
Process 5			

Table 21: Table for the comparison of target costs and drifting costs for a training service. Source: Buczkowski (2007).

Case study: “In-house” engineering project management training

Process costing: costs comparison matrix

The processes identification, in which a cost adjustment is necessary, is carried out through the comparison of target costs and standard costs. The standard costs can be calculated thanks to the service simulation process. The obtained results were the following:

Process	Standard costs	Percentage
Front Office - Training	12.600,00 €	63,25%
Back office – Preparing travels	3.500,00 €	17,57%
Front Office – Write and send proposal	2.400,00 €	12,05%
Back office – Define content and schedule	800,00 €	4,02%
Front Office – Internal control during training	597,39 €	3,00%
Front Office – Submitting material	25,00 €	0,13%
Total	**19.922,39 €**	**100%**

Following the model presented above, the target cost indexes were calculated for each of the processe

Process	Share in target costs	Share in Standard Costs	Target costs Index
Front Office - Training	60,00%	63,25%	0,95
Back office – Preparing travels	2,00%	17,57%	0,11
Front Office – Write and send proposal	7,00%	12,05%	0,58
Back office – Define content and schedule	21,00%	4,02%	5,23
Front Office – Internal control during training	10,00%	3,00%	3,33
Front Office – material	0,00%	0,13%	0,00

Step 4: Simultaneous attainment of target costs and quality costs

The final step of this methodology will be the achievement of an optimum costing structure of our service. This should allow satisfying the customer needs with the resources available to the company. According to Fischer (2008), its scope is different depending on whether is about the development of new products or services or the improvement of the mimes to follow the changing market cycles.

Attainment of target costs in the frame of new service development

In this case the process will have less trouble if adjustments are made during the product or service design stage. The attainment of the target costs takes place in an iterative process, in which the service processes are revised as long as the target costs are attained
Here, the use of tools like service-blueprinting and service simulation is recommended.

Case study: "In-house" engineering project management training

Target costs achievement
The achievement of the Target costs is related to the analysis of the Target costs Index. This analysis is a benchmark to identify the processes that need to be adjusted. The cost adjustment does not imply achieving an exact match of the obtained percentages, but achieving an equilibrium between these.
Thus, the cost in which, according to their target cost index a reduction on the standard cost is needed, are:

- Training
- Preparing travels
- Write and send proposal

The processes in which the standard costs are below the target costs, and hence, more investment could be done in these processes to improve their quality are:

- Define content and schedule
- Internal control during training

The process of submitting material is dismissed from the analysis,
because its costs are very low.

For the analysis, the responsible people for marketing and training met and jointly decided the following activities:

- Standardize the proposal models and create training modules which allow to define in a more customized way the offers to the clients. This reduced the costs related to preparing the proposal.
- Define an availability schedule with trainers and come to an agreement with a travel agency to prepare the travels. This leads to a reduction in the costs of preparing travels.
- Regarding the processes of content definition, schedule and internal control during the training, even when they do not involve hig costs, currently are processes carried out with a high involvement from the clients. It has been decided to invest in e-learning tools in order to have a closer internal control during the face-to-face training and once this will be over.

While new Standard costs don t match exactly to the target costs previously defined, the costs per objective tool has allowed to recognize the points in which improvements were handed, both from the points of view of costs and quality. Once this analysis was completed, this technique was able to establish key activities, which allowed the service to be provided according to customer needs.

Process	Standard costs	Percentage
Front Office - Training	12.000,00 €	63,58%
Back office – Preparing travels	3.200,00 €	16,95%
Front Office – Write and send proposal	2.000,00 €	10,60%
Back office – Define content and schedule	850,00 €	4,50%
Front Office – Internal control during training	800,00 €	4,24%
Front Office – Submitting material	25,00 €	0,13%
Total	**18.875,00 €**	**100%**

Attainment and improvement of target costs during the market cycle

Here is the last element of target costing. The target costs for the service processes serve now as a parameter for (new) standard costs, with which compliance is sought and monitored in the relevant firm's area. At this point, after rendering the service, the accomplishment of the obtained target and standard costs (as result of the division of costs) is carried out in a continuous improvement process in order to reduce the costs even more. By the respective costs specifications, influencing variables like the learning and experience curve effects are present. It is possible to incorporate costs for future support or measures for adapting to the market or follow up cycle activities.

An array of instruments can be applied in the frame of target costing processes in addition to the market research instruments; e.g. quality function deployment as a concept for the coverage of quality and clients' requirements in the design process. The respective standard costs of the components, and the other required information about costs, should be prepared with the costs calculation system of the firm.

Project management

Reasons for a good project planning

Given the incessant shortening of product and technology life cycles, competition in terms of time grows and becomes more intense. Time has become a crucial success factor for companies and projects, as launching new products and services as soon as possible is worthwhile in most markets. This is because the early entry to the market allows to set higher prices, to catch more customers and to produce larger quantities, therefore, reducing unit costs. Consequently, the invested capital is recovered faster, its use is more intensive and generates higher profit. This advantage in terms of time also makes it possible to focus the innovative potential in other areas.

This motivates to accelerate innovation processes. However, this often leads to higher development costs and to face higher risks and acceptance barriers due to the early introduction of the products and services to the market. Determining the optimal time to enter the market (time-to-market) is a result of marketing and project management. This will determine the duration that the project can afford and the starting point, progress and completion deadlines, meeting the company's internal conditions and the external market requirements.

Project planning represents a forecast of the development of a project. This requires a precise definition of goals. The objectives related to the costs, time, and desired results must be formulated in a realistic, clear, understandable and verifiable way.

To set realistic goals of time and deadlines, it is essential to have a well -founded planning of the flow and the course of the project. In this way, resources and time periods can be allocated. This makes it possible, in turn, to distribute scarce resources among different projects. The time planning of a project consists of:

- The determination of the total project duration.
- The determination of the beginning and the end of tasks and the definition of important events (milestones).
- The comparison of the required time frames with the necessary ones and the introduction of measures to shorten the total project duration according to the objectives.
- The establishment of the timeframe required and its articulation with the available recourses as well as the achievement of balance in the workload.

Time planning provides the shortest possible time for implementing a project and ensures that there are no interruptions that can lead to delays and inefficiencies.
To achieve the expected results, it is necessary to follow the steps of time planning:

- Explain in detail the work and the sequence of the project in work packages (tasks) and isolated procedures (activities).
- Predetermine the needed working times necessary for the tasks according to groups of professions and the requirements of equipment and material.
- Determine the effective work time based on the number of employees and their workload distribution.
- Determine the possibilities of cooperation for the project implementation
- The provision of critical points (critical events and their deadlines) taking into account the internal and external demands

The project planning process

In order to reduce complexity, the project must be divided into tasks (work packages), and for this, it is necessary to identify the work packages that can be left under the responsibility of certain areas for their implementation. This can be done through the brainstorming technique or with the help of a mental map. The purpose of this division into tasks is the preparation of planning the sequence through the identification of actions or activities which, in turn, are necessary to complete the tasks. Another result of the division is the determination of the precedence conditions (predecessor-successor relationships) between tasks.

- Tasks can be recognized and identified considering the following aspects:
- Jobs (function or action to be performed)
- Objects (products or product types)
- Range of action (decision or implementation)
- Range of the overall process (planning, implementation or monitoring)
- Relationship with the target (directed eventually or immediately to meet the final goal)
- Use of specialized working means
- Use of certain profession, specialized disciplines or qualification levels
- Regional specificity

The instruments for the division of the project into tasks are the project structure plans and activities listings-

Project structure plans and activities listings

The project structure plan is a task allocation tool. The major tasks are distributed between tasks and work packages. They form a hierarchical structure of tasks, which may have several levels of division. How detailed should the division be, depends on the size magnitude of the project.
Experience has shown that it is very practical to try the following sequence:

1. First, one makes a division by objects (e.g. components or parts what may be listed separately).
2. Then, a division by functions (division into work packages that may be included in separate areas or functions)
3. Finally, a division of the work packages according to flows and phases is overlapped.

The following figure shows a combined project structure plan.

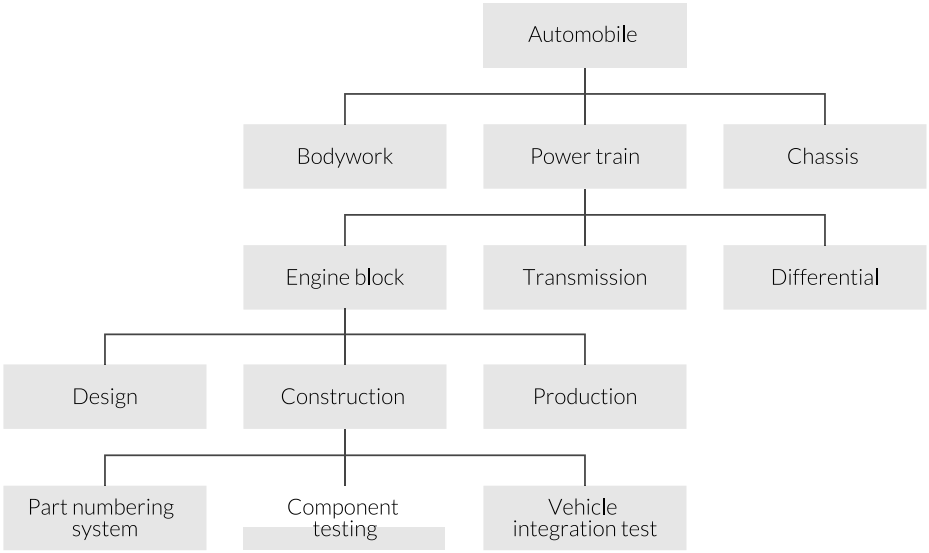


Figure 53: Example of a project structure plan. Source: Adapted from Rinza (1994).

The preparation of activities listings increase the level of detail of a project structure plan by putting the activities in a sequence. An activity must be understood as the smallest unit that contributes to the implementation of at least one task.
An activity is an event that requires time, has a start and an end point, lasts at least a unit of time, demands certain skills, generates costs and can be clearly assigned to an organizational unit.
To define the listing, it is essential to first identify all the necessary activities. Then, an analysis of the

precedence between activities must be conducted in a way that becomes clear which activities can be started after the previous one has been completed. Here, the predecessor-successor relationships are inspected. There are different types of precedence relationships, for instance:

- Technological type: (e.g. heating a material before working with it)
- Organizational type: (e.g. staff training before the production phase)
- Economic type: (e.g. delivery times according to contracts)

The implementation timelines for each activity must be set in the following step with the help of standard values or time estimates (which should be as accurate as possible) and those responsible for accomplishing such activity.
As an example, the following table shows a simplified task list of a software development project.

No.	Activity	Responsible Managers	Duration	Predecessor (No.)
1	Problem analysis and goal setting	Customer support, Product development	1	-
2	Development of the solution to the problem by establishing a logic of functions and data	Product development	1	1
3	Development of algorithms	Product development	2	2
4	Implementation: translation into a programming language	Product development, Programmers	3	3
5	Correction of errors through the comparison between what the software has projected and what it has achieved	Product development, Programmers, Reference customers	2	4
6	Documentation of the procedure for the user	Product development, Programmers, Reference customers, Customer support	3	4
7	Execution of the software on the practical application	Programmers, Customer support	2	5,6
8	Maintenance and adjustment of the listed software	Customer support	12	5,6

Table 22: Example of a task list. Source: Adapted from Pleschak and Sabisch (1996).

Bar chart

The most common tool used in practice is the bar chart, also called Gantt chart. From the beginning of the project structure plan or the activities listing, to each activity is assigned a starting point, a duration and an end. In this matrix form of representation, time (seconds, minutes, hours, days, months, etc.) is presented on the horizontal axis, while the activities are listed on the vertical axis eventually with the corresponding people responsible for them. The activities represented by charts are subject to the precedence relationships.

This tool can be complemented with the introduction of milestones, which are nothing more than checkpoints to compare the situation that should be with the real situation. Then, corrective decisions are made or actions are taken to complement, enhance or modify the process of the project. This tool is suitable for rather small projects, with a low level of interconnection among its activities.

Network maps

Another possibility to graphically present a project is the network map, which contributes to the project planning process and contains events, timelines and precedence relationships. The strength of this tool is that it makes evident the dependence and chronological sequence of the activities.

Each box in the graph represents an activity. In the flowchart, from left to right, we can recognize the predecessor activities from the successors and which activities can be parallel executed.

Each box shows the following information:

Name of the activity	
Predecessor activity	Predecessor activity
Start date	Start date

Figure 54: Content of the network map boxes. Source: Lenk and Zelewsky (2000).

This tool can also set buffer times and the critical path. Buffer times are understood as a kind of time reserve. It is the amount of time an activity can be delayed without extending the total duration of the project. Instead, the critical path (generally represented by thicker lines or of another color) shows the activities that cannot be delayed or take longer than planned, because if they do, they can prolong the total duration of the project.

This method is very useful for more complex projects and with a greater degree of interaction between its activities. Among the most commonly attributed advantages for the project are the visualization of complex dependencies, parallel activities and the sequence of the entire project. It is also an advantage regarding the need of more precision in planning activities which leads to a greater efficiency. The changes that are intended to be introduced into the project become clearly visible together with their consequences and implications. The latter, allows, in turn, developing different versions for comparison. By presenting the precedence relationships so clearly, this tool increases the sense of responsibility of those who have been assigned to perform the task and thus, fosters teamwork and a stronger coordination.

Technology Roadmaps

Definition

Roadmaps were originally developed by MOTOROLA in the 70's in order to align the development of their products and their supporting technologies.
The technology roadmaps (TRM) are part of a methodology that guarantees the alignment of investments in technology and the new development of capabilities, so that they are able to make capital out of future market needs.
This is a tool that brings important support to the innovation manager, allowing her/him define the firm's technological evolution in advance. The tool takes the relationship between technologies, their products and services as well as the relationship with the target markets into account.

Fields of use

Roadmaps can have different applications. According to Phaal et al. (2001), these can be classified into 8 areas:

Planning of products:

This is the most common technology roadmap. In this case, the different generations of manufactured products are tied to the necessary technologies for their development.

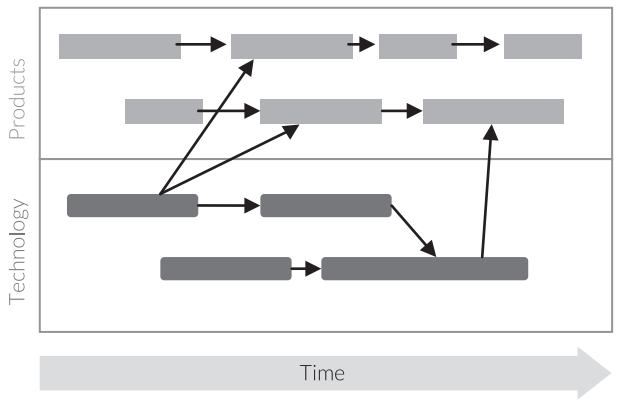


Figure 55: Product planning roadmap. Source: Phaal et al. (2001).

Planning of services and capabilities:

The focus is on how the technologies foster the firm's development of capabilities that permit the rendering of the service.

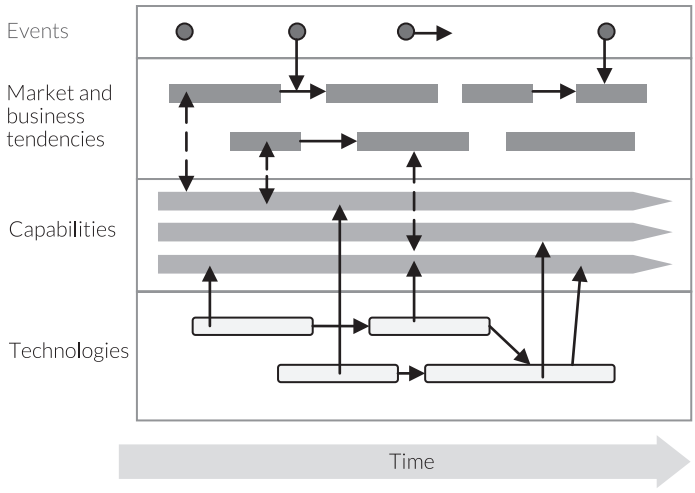


Figure 56: Planning of services and capabilities roadmap. Source: Phaal et al. (2001).

Strategic planning:

This kind of Roadmap assesses the different opportunities that markets and business tendencies can offer, at strategic level.

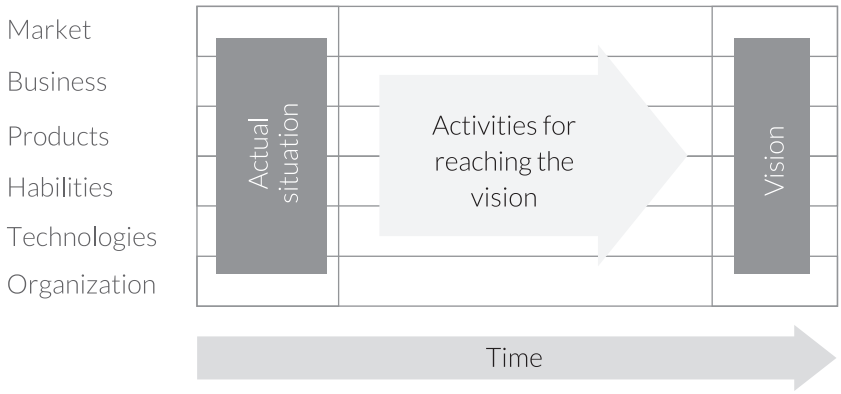


Figure 57: Strategic planning roadmap. Source: Phaal et al. (2001).

Long run planning:

In this case, roadmaps are often used at regional and national levels, where planning is projected long-term.

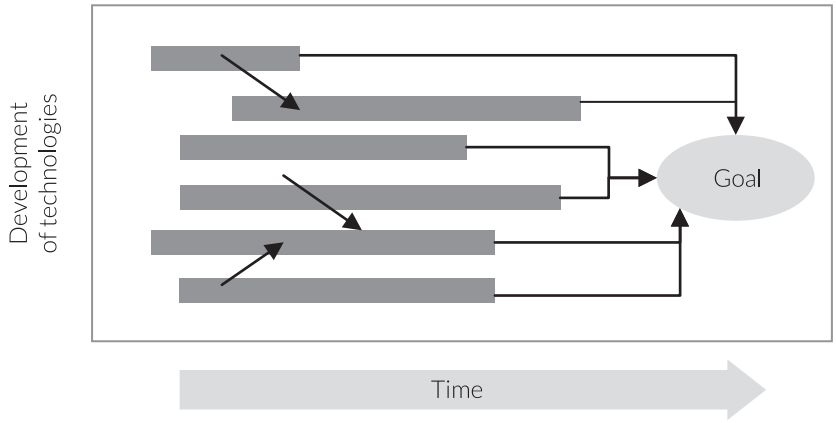


Figure 58: Long run planning roadmap. Source: Phaal et al. (2001).

Capabilities and knowledge planning:

Here, Roadmaps let the firm align its knowledge capabilities and business goals.

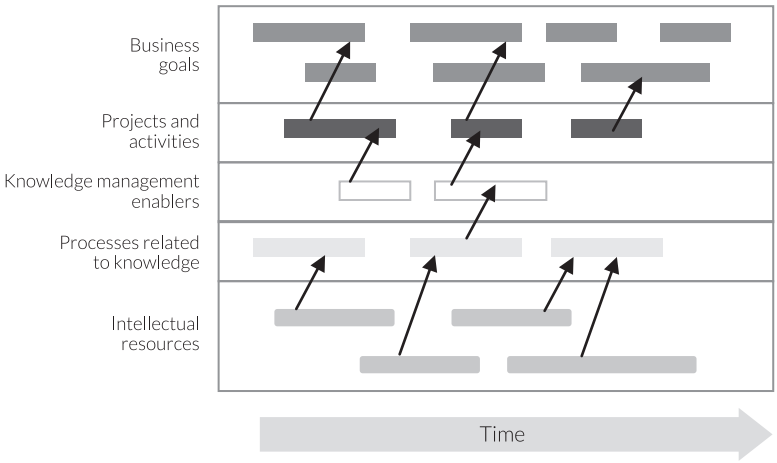


Figure 59: Capabilities and knowledge planning roadmap. Source: Phaal et al. (2001).

Project planning:

The roadmap can also align the different project activities, e.g. R&D projects with technological development.

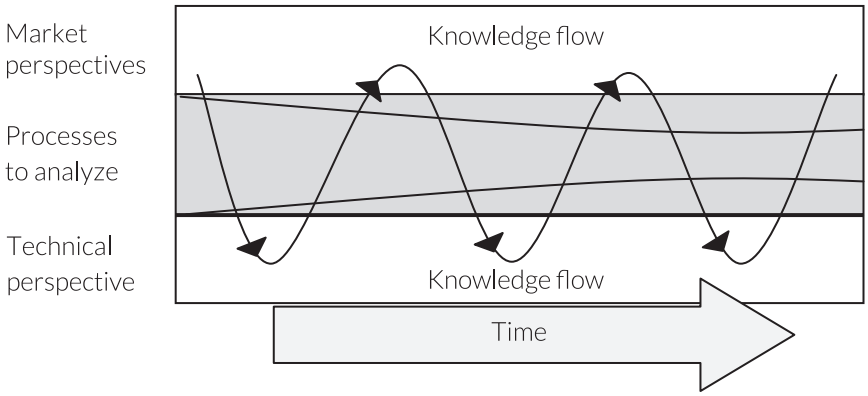


Figure 60: Project planning roadmap. Source: Phaal et al. (2001).

Process planning:

Roadmapping permits managing knowledge and focusing on a particular area of the firm.

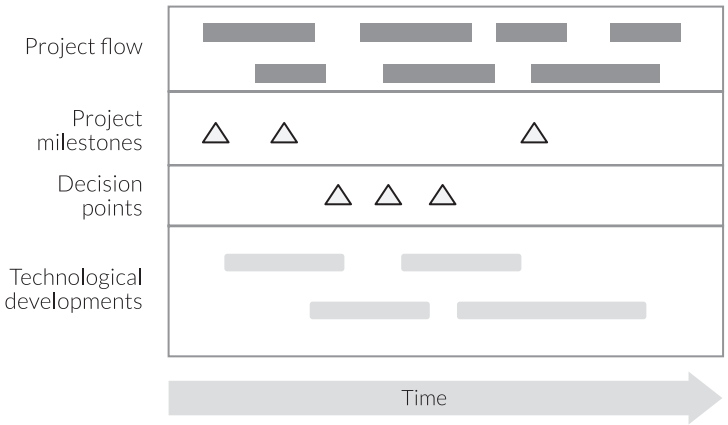


Figure 61: Process planning roadmap. Source: Phaal et al. (2001).

Integration planning:

Through this roadmap, it is possible to have a vision about integration and evolution of the technology, and how they combine with products and systems in order to create new technologies.

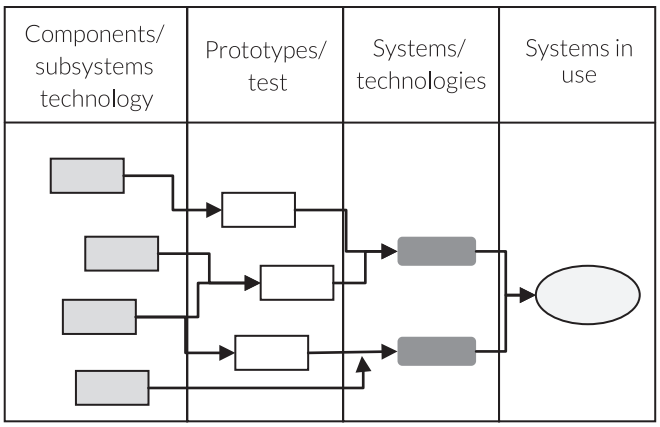


Figure 62: Integration planning matrix. Source: Phaal et al. (2001).

Innovation roadmap's development process

The objective of this subchapter is to illustrate the methodology for developing technology roadmaps. As previously seen, there are different kinds of roadmaps; nevertheless, this guide will focus on the design of a technology roadmap for planning products, which will be named innovation roadmap because of its capital use. These roadmaps are formed by six core steps (Nippa & Labriola, 2008):

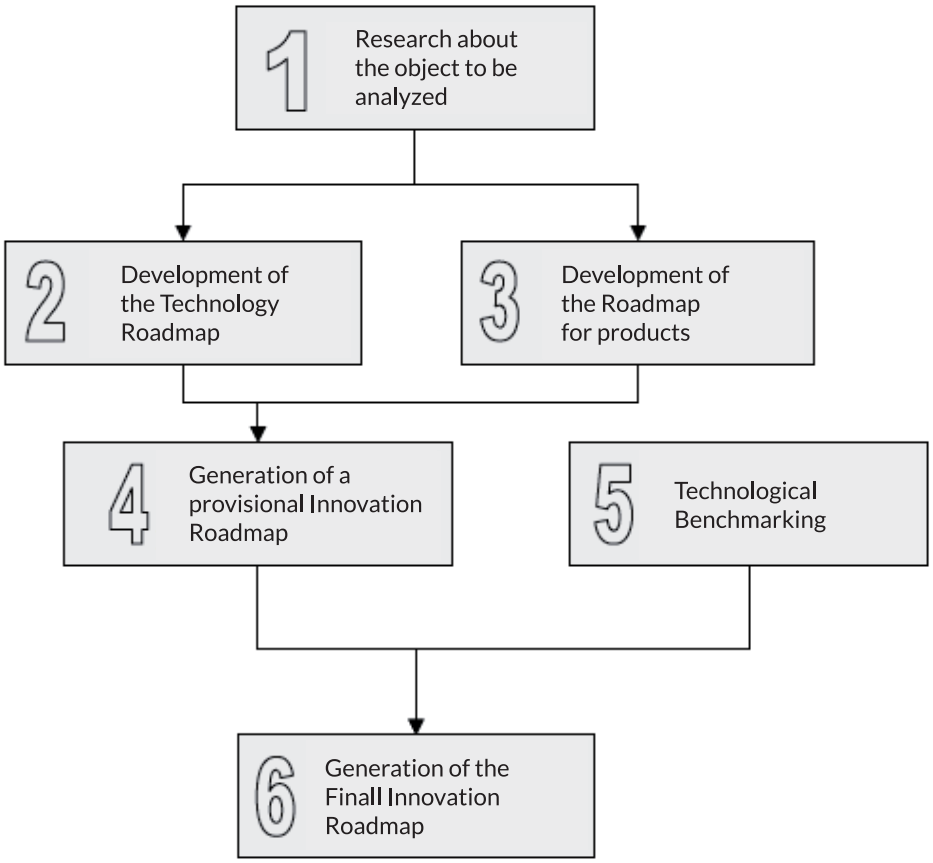


Figure 63: Generation process of an Innovation Roadmap, according to Nippa & Labriola (2008)

The following description of the model is based on Nippa & Labriola (2008) and Specht & Behrens (2008).

Step 1: Restricting the scope of research

This is the first step of roadmapping. Here the objective is defined: which future development will be analysed with the roadmapping methodological framework. The object to be analysed will be linked to relevant technologies for its development, as well as to the related products that the firm aims to offer in the future.

Step 2: Development of the Technology Roadmap

The technology roadmap shows the most relevant technologies that permit the development of the analyzed object, while taking the time factor into account.
For this analysis, technologies must be taken into account, especially the ones available within the Roadmap's time scope (Specht & Behren, 2008). Accordingly, future developmental approaches must be established for three technological categories (Nippa & Labriola, 2008):

- Current technologies in the firm, which are included or serve as base for other products, or which are part of previous innovation plans.
- Technologies intended to be developed in the medium and long run.
- Technologies able to be developed by external providers of technology.

In addition, dynamics of technology development, like technologies' life cycles, must be taken into account. Particularly, relevant tendencies of the market as well as the tendencies of consumers' needs are dynamics that can deeply influence the rhythm of development of these technologies.

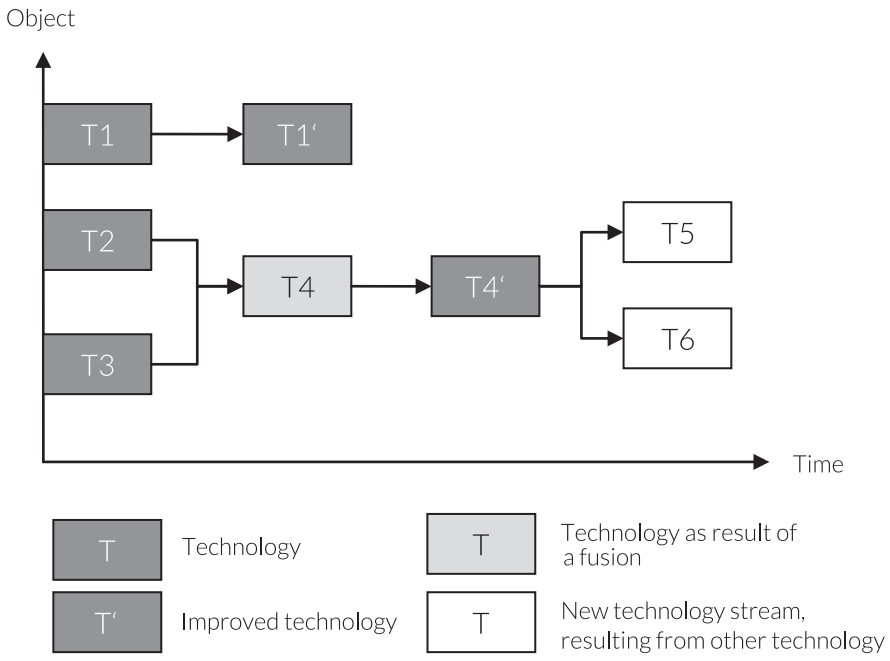


Figure 64: Basic structure of a Technology Roadmap.

Step 3: Development of the roadmap for products

Because of their closeness to the market, the sales and marketing department must adopt the leading role for the development of roadmap for products (Nippa & Labriola, 2008), which will be simultaneously developed with the technology roadmap.

Conversely, as in the technology roadmap, where the presence of an expert in marketing accompanying the development is necessary, the roadmap for products must have an expert in technology for collaborating with the development of the roadmap.

According to Nippa & Labriola (2008), in the development of the future scenario for the product analysis, two groups must be considered:

- The concepts of the firm’s products: which parts can be improved in the future as a result of some related technological development? The products' use is based on the concept of incremental innovation.
- The concepts as a result of the analysis of future market and client’s requirements. This kind of product use is related to radical innovations.

The dynamics of the market is another factor to think about when developing the roadmap for products. Although this dynamic depends on several factors, the development of clients is the most important one. This dynamic has a direct influence on the product development speed. Research results by Nippa & Labriola (2008) showed that the market launch of products based on incremental innovations must be faster than products based on radical innovations. This happens because this kind of innovation is being „waited for" by consumers, thus, they must be immediately available for the clients.
As in the technology roadmap, it must be considered that the products could merge or separate for forming different categories of products (see Figure 65)

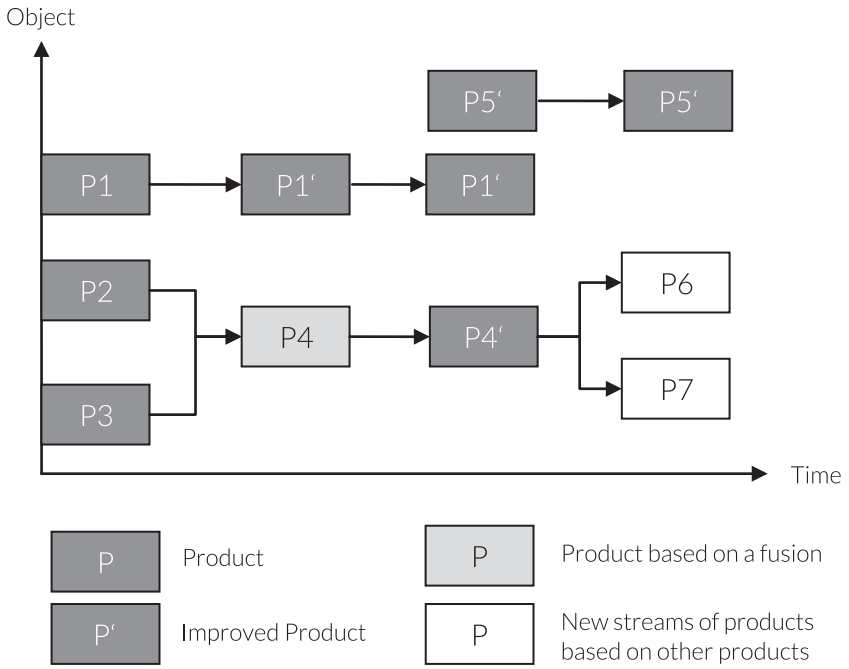


Figure 65: Basic structure of a Product Roadmap.

Step 4: Generation of a provisional Innovation Roadmap

In this step, the synchronization of the technology roadmap and the roadmap for products is accomplished. Generally, this task must be carried out by the marketing department or any equivalent area.
According to Nippa & Labriola (2008), there are two ways of synchronization:

- In the first way, the time point in the distant future for the materialization of technology development plans is defined, but not the definitive relations between technology and products. Then, products and technologies that do not have a technological complement must be found, and respectively eliminated.
- A second way of synchronization is based on adjusting the time period of the development of technologies, to the planned point of launch to the market of the related products. In the case that the time for developing the technology that supports the product to be launched is not enough, the development of this product can be eliminated or market launch can be postponed to the future.

According to Labriola (2007), the synchronization of these two roadmaps can result in the following consequences:

- The acceleration of critical technological development
- The deceleration of not-so-important technologies
- Start-up of external technological acquisition activities
- Removal of technological developments that are not so significant for the firm
- Advance on the development of products, which technological development has occurred before it was expected.
- Postponement of innovation plans that are associated to important technologies, which will be developed and acquired later than expected.
- Amplification of product development plans.
- Removal of product concepts, from the non-viable technologies.

Finally, the objective of synchronization is to define what technologies are going to develop the product's functions, which will make it possible to satisfy specific needs of clients.
In the following figure, after the synchronization, it has been established that to develop the product P4' it is necessary to have the T1, T5, and T6 technologies ready. Technology T1 is necessary for generating the FP4 function, and T5 and T6 technologies are necessary for generating the FP4' function'.

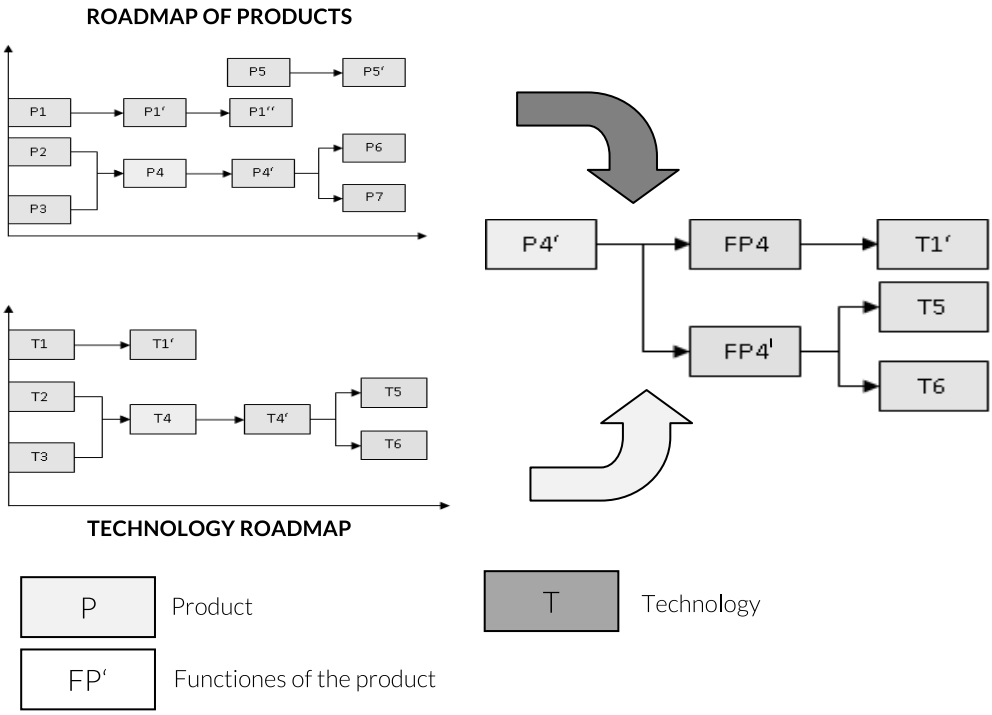


Figure 66: Example of Technology and Product Roadmaps' synchronization.

Step 5: Analysis of the competitors' technology and innovation

This analysis intends to identify the time point in which the competitors will probably launch innovations that are similar to the ones planned by the firm. In some economic sectors it is very difficult to find information related to the time points for the launch of innovative products. Therefore Nippa & Labriola (2008) defined some „signals" which could be detected, which indicates in an indirect way how the competing technology is developing:

Patents published by competitors or the presentation of their products' prototypes.

Another source of information is formed by the mutual providers and clients. A lot of times, competitors conduct customer and provider surveys in order to identify the right point to launch their innovative products to the market. They use surveys to prove their own Technology Roadmaps. This is how the firm can indirectly access this data.

On the other side, the firm must not abandon the efforts for obtaining direct information about the time points for launching to the market. As an example, many firms communicate to their partners and clients their technology development plans as an instrument of their marketing strategy. In addition, information

about firms' innovation plans is exchanged during fairs and trade shows. The search for development standards is an important source of information for the analysis of technological competition, especially in products that are developed in networks (e.g. in the telecommunication sector).

Step 6: Generation of the final Innovation Roadmap

With the collected information from the competitors' technology and innovation analysis, it is possible to make adjustments that have an influence on the development of in-house technologies and products to the provisional roadmap.

Once the adjustments are done, the final innovation roadmap can be divided into innovation plans (projected to the medium run) and innovation projects (projected to the short run).

Failure Mode Effect Analysis (FMEA)

Definition

n the case of many services, the definition of quality standards at a level of 99,9% may be insufficient. Given the high involvement of the customers and the constant contact with them during the service-providing process, failures in the developing the process of addressing the customer requirements may have harmful consequences for the company. In general, it has been established that a dissatisfied customer communicates his discontent to at least 10 potential customers, while a satisfied customer shares his positive experience with maximum to 5 other potential customers. This highlights the importance of the attention that must be paid to taking care of the quality of the service provision (Eversheim et al., 2006). Here, the Failure Mode Effect Analysis (FMEA) is presented as one of the most suitable tools for the detection of potential failures in complex systems. According to Stamatis (2003), the FMEA in services is a method to identify potential or known failures and makes it possible to implement corrective actions before the first real service is provided, the service that is no longer being tested.

Application fields

Overall, the FMEA in services can be applied to any type of service. As examples, we can mention the following areas:

- Companies that work with hazardous materials or where safety is very important: this is precisely the type of companies where the concept of „zero defects" is essential or the success in the provision of services.
- Facility maintenance companies: this method helps to plan preventive maintenance based on the machinery failures analysis.
- Financial institutions: they are a typical example of service companies. The FMEA allows to analyze the possible failures in the different type of monetary transactions made by customers.
- Government institutions: the increase of the public service processes productivity is a point in which this methodology can be efficiently implemented.
- Health services: is a field in which failure rate minimization is very important due to the serious consequences they could bring.

- Accommodation service: the intensive contact with the customers during the provision of the service makes the possible failures analysis indispensable.

Phases of the FMEA

The development process of and FMEA in services is developed in two phases: the preparation phase and the application phase.

The preparation phase

The preparation phase starts at the time of the service definition. The reason for this is that the more the features of the service are based on the customer needs, the lower the probability of their un-satisfaction during the service provision process. In addition to this factor, there is the need for proper understanding of what the service should provide and therefore, an adequate definition of its design specifications. All these conditions can be fulfilled with the help of an appropriate application of the service creation process and the use of the appropriate tools to support it.

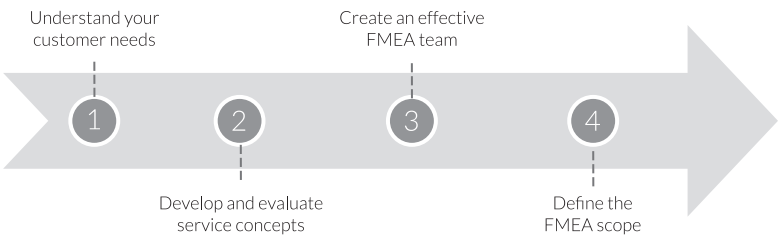


Figure 67: Preparation phase of the FMEA.

The first two steps are focused on the conception and the design process of the service. In a customer-focused approach, these processes must be based on the analysis of the voice of the customer (VOC). These initial processes can be implemented with the help of other tools such as the benchmarking and the quality function deployment (QFD) for the customer requirement analysis and the service blueprinting for the design of the service. Once the service has been defined, a leading team for the FMEA process must be formed. This team must be multidisciplinary and must involve between 4 and 6 people. The roles and functions to be distributed are:

- **Team leader:** the principal function is to coordinate the participation of the whole FMEA team. The person performing this role must have good management skills and must be able to lead the team without being authoritarian.
- **Champion or sponsor:** the person who allocates the resources and the support necessary to for the development of the team meetings. He/she promotes the interaction among team members, shares the authority with them and does the necessary tasks in the preparation stage.
- **Facilitator:** the most knowledgeable person in the development process of the FMEA. Among the responsibilities are keeping the team members informed about the procedures to follow and ensures that all participants are involved.
- **Recorder:** the person leading the documentation of the team work. Primary responsibility is keeping the FMEA table up to date.

Once the FMEA team has been established, the next step is to determine its scope. In this way, the analysis can be limited to a particular sub-process of the service, for example, the process of initial contact with the customer, the service provision process and the process of handling customer complaints, etc. This scope must be made very clear to all the FMEA team members.

Implementation phase of the tool

Once the requirements of the preparation phase have been covered, we proceed to apply the FMEA tool. The process described below is based on the definition of a suitable format for the presentation of the results and the severity, occurrence and detection rating. In the case of the rating presented in this guide, it only exposes an initial reference provided as an example. The rating can be subsequently adapted for every company, so that it can reflect its needs.
The process to follow consists of 7 steps that are shown in the figure below.

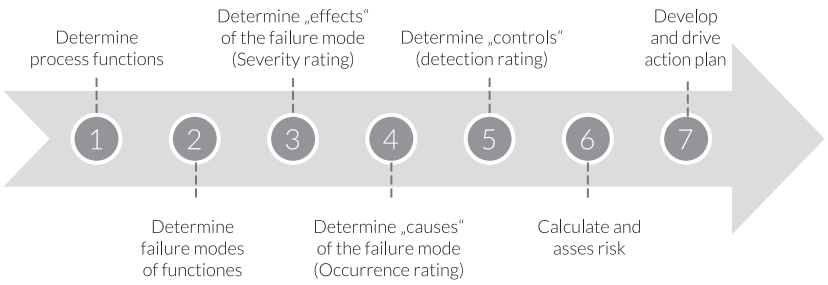


Figure 68: FMEA development process.

Table 23 shows the fillable model form to document the FMEA process.

Process Function	Potential failure mode	Potential effect of failure	SEV	Potential Causes	OCC	Current controls	DET	RPN	Recommended actions	Resp.	Actions taken	pSEV	pOCC	pDET	pRPN
Processes to be reviewed	Possible failures of the processes	Impact of failures on customers	Severity of the failures	Possible causes of failures	Frequency of failure occurrence	Controls implemented to prevent failures in the processes.	Probability of failure detection through the use of controls	Risk priority number	Actions to reduce RPN	Responsible person for action execution	Actions taken to reduce RPN	New severity rating	New occurrence rating	New detection rating	New risk priority number

Table 23: Form to develop the FMEA.

Development process of the tool

Each one of the 7 steps shown in Figure 68 will be explained in detail in the following paragraphs.

Step 1: Determining the process functions

This step consists on identifying the different roles involved in the processes to be analysed. This can be carried out using tools such as the service blueprinting. The objective is to identify those functions in which the process could fail. This requires an analysis of the process as it really is and not how it should be.
The function must be described in such a way that it can be easily construed. For its definition, we should seek to use active verbs and appropriate nouns whose combination can adequately describe the service to be provided, for example:

- Contact the customer
- Receive customer order
- Prepare invoice.

Step 2: Determining the potential failure modes

In the case of services, there are many possible sources of failure. However, we have identified several factors that must be taken into account when making the failure analysis in services. In this situation there are two types of failure modes (Stamatis, 2003):

- Evaluation (testing/inspection): to accept or refuse good or bad services respectively.
- Process: customer concerns, incorrectly rendered and/or forgotten services.

It should be possible to identify the potential failures of each function identified in the previous step. As a support, the function can be defined in a negative form, for example:

- It is not possible to contact the customer
- Calculation error in the invoice.

Step 3: Determining the potential effects of failure

When we speak of potential effects, we refer to the consequences of failures that can occur during the service provision. If the service under analysis is already in progress, the effects can be found in documents such as the suggestions form and customer complaints.
Typically, this is a very sensitive topic in companies because many employees do not want to admit their errors in the processes. For this reason, it is necessary to maintain an open and truthful communication during the development process of the FMEA. The multidisciplinary and multifunctional character of the FMEA team facilitates this task (Stamatis, 2003).

	Severity of effect	Rating
Extreme	The failure is serious and will lead to an irremediable loss of customers.	10
		9
High	The customer is greatly annoyed by the failure, he will complain immediately.	8
		7
Moderate	The customer is unhappy, yet he will not complain.	6
		5
		4
Low	The customer will identify the failure but will not feel unsatisfied because of it.	3
		2
None	Customers will not perceive the failure.	1

Table 24: Scale to determine the severity degree of the effect.

When defining the effects, their severity must be determined as well. The severity is a subjective measurement of how „bad" or „serious" is the effect of the failure (El-Haik and Roy, 2005). The severity degrees can be calculated with the help of a 10 level scale measurement (see Table 24.).

Step 4: Determining the failure modes

This step will establish the causes that have produced a certain failure. Each cause is associated to an effect produced by the failure. The sources of theses causes may be diverse. However, they can be classified into 5 categories:

- Staff: the personnel that is involved in the service provision.
- Material: the material used during the service provision.
- Process: refers to the sequence of activities necessary to provide the service.
- Equipment: the equipment or machinery necessary to provide the service.
- Work environment: refers to the external factors that can have an influence on the normal development of the service.

To facilitate this classification of causes and their relation to their effects, we can use the „fishbone" diagram also known as Ishikawa diagram. In Figure 89 there is an example for the delivery service of orders made to an online store. In this case, the effect of the failure is the delay in the delivery of the order.

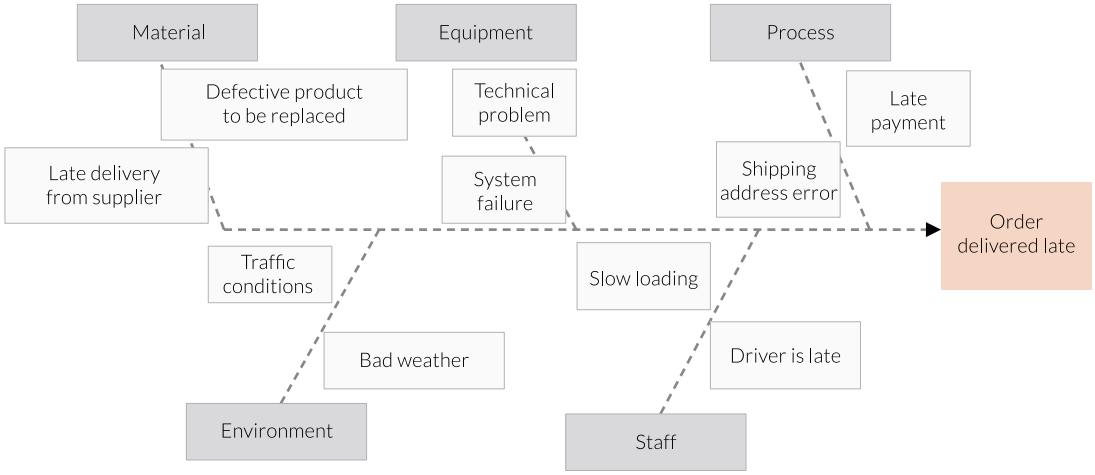


Figure 69: Example of the Ishikawa diagram.

Regarding the causes, our main concern is their probability of occurrence in order to avoid them. To do so, we will use a 10 level scale (see table 25).

	Probability of occurrence	Rating
Very high	The failure is almost inevitable.	10
		9
High	Most failures are due to this cause.	8
		7
Moderate	The failure occurs occasionally but can be avoided.	6
		5
		4
Low	Sporadic occurrence of the failure.	3
		2
Remote	The failure is not expected to occur.	1

Table 25: Scale to determine the probability of occurrence of a failure cause. Source: Hoeth and Schwarz (2002).

Step 5: Determining the controls

When we speak of current controls, we refer to the different procedures established in the company to detect the causes of failures or the failure itself, before or after the provision of the service.

The controls can be as simple as checklists of activities or labeling systems for materials or as complex as temperature control systems for food or data control computer systems.

The evaluation of the probability that these controls detect the causes of failures is associated to the determination of controls. Table 26, shown below, defines a reference scale to perform this assessment.

	Probability of detecting the cause of failure (Detection)	Rating
Very low	There are not known controls to detect the failure.	10
Low	The controls have a remote probability of detecting the failure.	9
		8
Moderate	The controls could detect the failure.	7
		6
		5
High	The controls have a good chance of detecting the failure.	4
		3
Very high	Failures are detected automatically.	2
		1

Table 26: Scale to determine the probability of decting a failure. Source: Hoeth and Schwarz (2002).

Step 6: Calculation and evaluation of risks

This step consists first, on calculating the risk priority number (RPN). This number can be calculated using the following formula:

This simply makes it possible to classify the failures, in order to have a reference point (the highest RPN indicates a greater preference) to initiate improvements to the process.

At this point, we can start determining the activities that must be carried out to eliminate the detected failures with a higher RPN and those that have a simple and inexpensive solution. The action plan to be defined should always assign a person responsible for each activity.

Step7: Development and implementation of the Action Plan

Once the action plan has been defined, the next logical step is its implementation. Since there can be changes during the implementation of the plan, we must keep a track of the activities that were really undertaken and the date they were completed on.

Once the action plan has been fully implemented, the severity, occurrence and detection ratings for each failure will be recalculated. These „improved" ratings will result in new RPN's that imply a new classification of risks. With this new categorization, a new action plan can be initiated. This cycle will continue until the FMEA decides that all the necessary corrective actions have been taken.

This chapter presented in detail the process to implement the FMEA in services. As we could see, the active involvement of all the FMEA team members is very important. However, it is even more important that the process is not conducted only once, the team should meet regularly to reassess the new possible failures that may arise, whether it is in services already or new services that could be developed by the company.

Investment evaluation methods

Net Present Value method

Using a discount rate (unlike the static method), the cash flows resulting from the purchase of a product will be included in a mathematical model in a differentiated manner, taking into account the time in which these flows occurs.

The discount rate used is not equivalent to the real interest rate in the market, but it represents a minimum rate of return desired by the entrepreneur. The observation of annual periods is very common. However, with the use of standard software like Microsoft EXCEL, it is possible to have an accurate estimate, daily if desired, of the impact that income and expenses can have at any given time.

The basic principle of the net present value (also simply referred to as NPV in the literature and software applications) is to transfer all the cash flows to a common point in time: time 0; that is, the time of the product purchase. The later a cash flow occurs, the more devalued it will be when bringing it to time 0 due to the action of the discount factor:

The discount factor contains the number of periods in which the future cash flow will occur (= number of years) and the interest rate and represent the degree of the loss of advantages due to the time elapsed.

The formula for the Net Present Value C0, referred to as NVP is:

$$C_0 = -P_t * (1+i)^t - P_0 + \sum_{t=1}^{n} (I_t - P_t) * \frac{1}{(1+i)^t}$$

Where:

P =	Payment (currency)
I =	Income (currency
t =	Time (years)
i =	Minimum rate of return desired (%)
n =	Useful life of product (years)

Here, it is important to note that P and I are liquidity variables and are in the formula exactly at the time in which the payment flow occurs.

Variables that do not generate cash flows such as depreciation do not have any influence. The same applies to paid interests, because the formula already comprises and interest rate, and with an eventual financing of the investment.

The net present value is easily calculated with Microsoft Excel using the NPV function included in it. It applies the following formula:

It is important to make a correct interpretation of the NPV: the monetary advantage of the investment from the perspective of the present time or time 0 (that is, the time of purchase of the product) compared to a financial investment of the same amount in the capital market with an assumed interest rate i.

This interpretation is somewhat abstract and hinders the correct understanding of the method. Furthermore, there are often errors in the interpretation, in the sense that it is considered as a result of the profit generated by an investment. However, it is „only" about the additional advantage that the investment offers compared to an investment of the same amount in the capital market.

In any case, the net present value is an indicator through which we can compare very well different products or variants of products from a supplier and its competitors from the perspective of the customer. In any case, it is evident that a purchase by the customer offers and additional monetary advantage, compared to savings, when the NPV result is greater than 0.

We must put ourselves in the place of the buyers or the customers and get to know or calculate their incomes and payments.

Another method, the internal rate of return, shows how high the return on the invested capital is in the example.

Internal Rate of Return (IRR)

The return on an investment can be calculated on the same mathematical basis: by equating the NPV formula to zero and developing the equation, we obtain the interest rate based on the same assumptions and the same principle, to value less payments and subsequent returns than those that occur earlier.

$$C_0 = 0$$

$$0 = -P_t * (1+i)^t - P_0 + \sum_{t=1}^{n} (I_t - P_t) * \frac{1}{(1+i)^t}$$

The term on the right side implies a number of roots, the longer we use a product, the more roots it will have and therefore, some of a higher degree. This can lead to the lack of a mathematical solution for the formula, or that the solutions are not easy to calculate. In this case, the solutions will have to be determined by interpolation. But, also here, Microsoft EXCEL provides a function that makes it easier to calculate the internal rate of return (IRR).

Elimination of behavioral barriers

Barriers to innovation

Barriers to innovation are obstacles that inhibit, influence or avoid the establishment of a suitable environment and the appropriate management of the elements that constitute the dimensions of the promotion of innovation and thus, represent impediments to innovation itself.

These constraints may be originated within the entity or outside of it. Examples of external barriers are the difficulty on the access to external financing, the lack of intellectual property rights protection, etc. To overcome these exogenous barriers, the company must adapt itself to the environment and seek for solutions using different strategies. However, internal barriers are obstacles that impede or hinder innovation to a large extent. Many of these barriers are rooted in the culture within the organization, and this influences the behaviour of the stakeholders in the company. Such behaviour, at the same time, determines the organizational culture by perpetuating it or turning it in repetitive cycles.

Barriers within the organization are usually interrelated and interact with each other, forming a complex interweaving of obstacles that can result in vicious cycles of repetitive behaviour, trapping the organization into a status quo that impedes, decelerates or remove effectiveness of the innovation processes. This is why it is so important to generate changes in the culture of the organization through the removal of the behavioural barriers.

There are three main types of internal barriers: those related to an organization that is not favourable to innovation, the inadequate allocation of resources and most importantly, the barriers related to behaviour. This guide aims to solve the latter. For this, we present tools for the measurement of the cultural disposition to innovation, which will help to identify behavioural problems that must be overcome. Then, it will indicate concrete actions to overcome these barriers.

Importance of culture of innovation

Among the intangible elements that have a major influence on innovation and its results is the organizational culture. This determines the manner in which its members assume their roles, face the different tasks, set their goals, design their strategies and cooperate or compete to materialize them. In simple words, the culture is derived from the way of doings things beyond the quality and the relevance of the

formal rules that the organization has, as these will be ultimately interpreted and assumed within the cultural framework of the organization.

The direct relationship between organizational culture and climate affects factors such as trust, not so much in terms of the security regarding the capabilities of those involved, but rather in terms of the expectation that they have about the opportunistic behaviour from other members, or about internal competition influenced by the perception and interests of each stakeholder involved. In this way, trust determines the levels of cooperation and commitment in the organization and its sub-structures, whether they are permanent as the departments or temporary as the teams formed for a project.

On the other hand, culture has a temporal dimension as it originates from recognizable patterns in the history of the organization, for example, from the way of exercising authority and communication, from the readiness to accept changes, challenges and commitments and from the importance attributed to certain areas, among others. It is not surprising that this impulse of the past tends to outline the future path, and this often results in barriers to innovation. Culture determines therefore, behaviours and intangible factors inherent to innovation such as the predisposition to creativity, lateral thinking limits or the tolerance of risk and failure. This influence is also visible through more tangible means such as assigned funds or staff and the attribution of greater or lesser importance to innovation activities.

The links between the culture and the dimensions and elements that promote or, at least, make innovation possible within an organization are complex. To give some structure to this multiplicity of factors and behaviours that make part of the culture of the innovation topic, a three-point model gathers them and classifies them into success factors (see Figure 73)

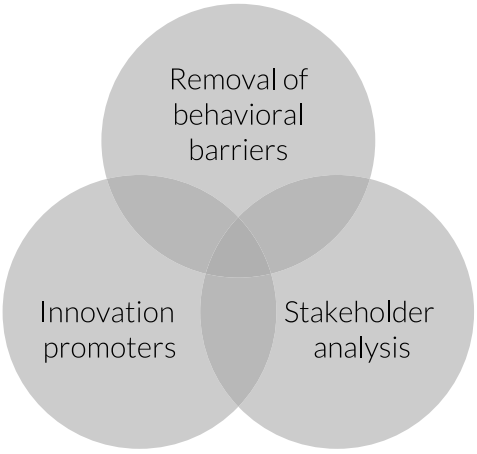


Figure 70: Success factors in the development of innovation culture in the organization.

Behavioral barriers

Behavioural barriers are the most critical issue, because they often directly influence the occurrence, elimination and impact of other barriers such as the inadequate allocation of resources and the inappropriate design of the structure. These barriers are usually found in all the levels of the organization and especially, between levels, departments and teams.

In the chapter, culture for innovation, there is a more detailed explanation of the different types of behavioural barriers. However, it should be noted that most of these barriers have effects on the resistance to change and on the perceptions of individuals and groups, and ultimately influence again the behaviour of groups and individuals.
The behavioural barriers can and must be overcome in order to pave the way for innovation. This can be accomplished only when these barriers have been clearly identified. It is necessary to work on the other two critical factors to be able to conquer these obstacles.
This tool for the elimination of behavioural barriers and the encouragement of a culture for innovation assumes a sequence of actions to achieve this:

1. Measurement process of the innovation cultural disposition towards innovation.
2. Identification of barriers and solutions.
3. Analysis of stakeholders.
4. Incorporation of innovation promoters.

Step 1: Measuring the cultural disposition towards innovation

The first step towards improving the culture and overcoming the barriers is the measurement of the cultural disposition to innovation. This will achieve transparency and a common understanding of the barriers that must be eliminated taking into account their relative importance and the time frames in which they have to be overcome.
Preconditions for a successful change are the willingness of the managers to change and the real disposition to support initiatives to systematically remove barriers, taking into account the social characteristics of the organization, because the company, as any other organization, is composed of people. It is for this reason that many internal barriers are based on behaviour.

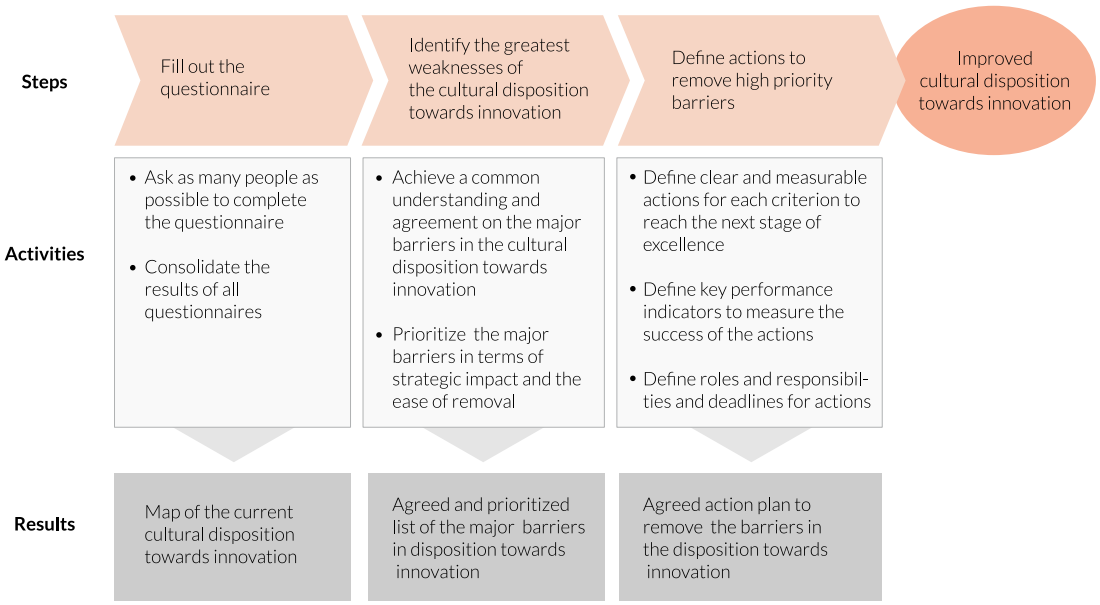


Figure 71: Measurement process of the cultural disposition in regard to innovation. Source: A. T. Kearney (2007).

The following table is a questionnaire which displays the evaluation of the company's cultural disposition to innovation within the company:

Criteria	Very often	Sometimes	Rarely	Never
The organization encourages the staff to be creative				
The managers support the initiatives suggested by the staff				
The organization carries out observations to find ways to be more innovative				
The staff is ready to accept changes in how the work is done				

The organization has not been able to successfully introduce new things in the past (e.g. ISO 9002, etc.)				
There is constant communication between the managers and the staff				
The work culture support the implementation of new ideas				
Managers do not like to implement new things				
The „Status Quo“ is more important to the organization than the „constant change“				
The team cohesion is promoted more by the staff than by the managers				
Managers do not communicate with each others				

Table 27: Questionnaire for measuring the cultural disposition to innovation. Source: A. T. Kearny (2007).

Step 2: Simultaneous identification of barriers and solutions

The best way to identify barriers is through working sessions in which those involved are participating. The goals of this activity are the following:

- Achieving consensus on the behavioural barriers that must be changed
- Confirming the underlying reasons
- Defining the effects for the organization
- Define the required interventions for the specific behavioural changes

For this, it is recommended to organize a workshop with the following stages:

1. Introduction to the objective of the workshop
2. Identification and definition of the behavioural barriers to be changed
3. Barrier analysis
4. Determine the required interventions

Given that many times the participants need to be motivated to comment on problematic issues, the moderator or facilitator of the workshop should be a neutral person. If there are internal political tensions or intense rivalries in the company, it convenient to hire a consultant specialized in the facilitation of workshops.

Step 2.1: Identification and definition of the behavioural barriers to be changed

Based on the results obtained from the questionnaire applied, we can start by suggesting behavioral barriers that are evident. Qualitative interviews can also be carried out; that is individual conversations in advance with the employees. The results of these interviews must be summarized and systematized to be presented at the workshop. However, participants should be asked to suggest or name the barriers that they consider important at the time. This can be done through the use of cards that will be deposited into a box, in that way, if it is necessary, the suggestions can even be anonymous.

Step 2.2: Barrier analysis

In order to start the analysis and the discussion, it is necessary to show the findings from the qualitative interviews and the applied questionnaires. It is advisable to lead the participants to discuss on the following aspects or topics:

- Personal and behavioural barriers to be changed
- Related official and unofficial rules
- Consequences on employee behaviour.

It is necessary to allow reasonable time for discussion and questions as we follow the material. The example below gives an idea of how to show the barriers and the information related to it:
Barrier: the need of being recognized and having a god network leads to poor results and a weak discipline

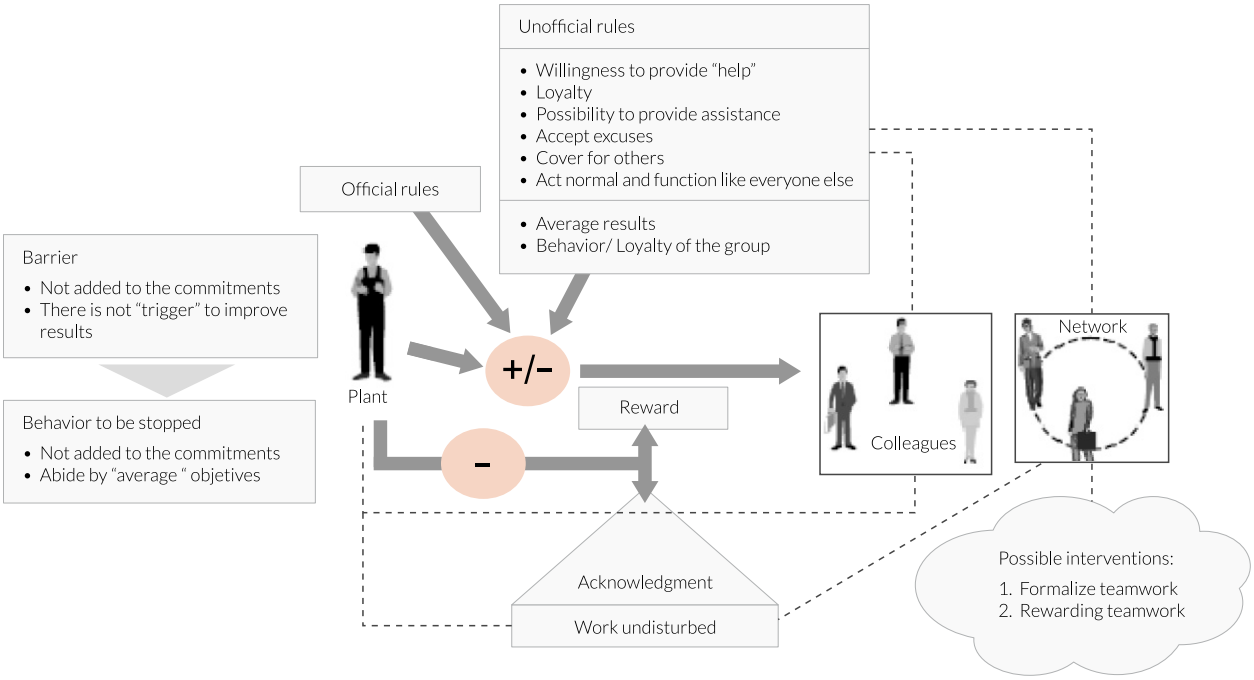


Figure 72: Example of the systematic analysis of behavioural barriers. Source: A.T. Kearney (2007).

For presenting and analyzing the barriers from the perspective of unofficial rules or habits that have been established in the company, we can create a diagram that relates these unofficial rules, its aspects, and the barrier they contribute to, as it is shown in the following example which analyzes the problem of a short-term vision:

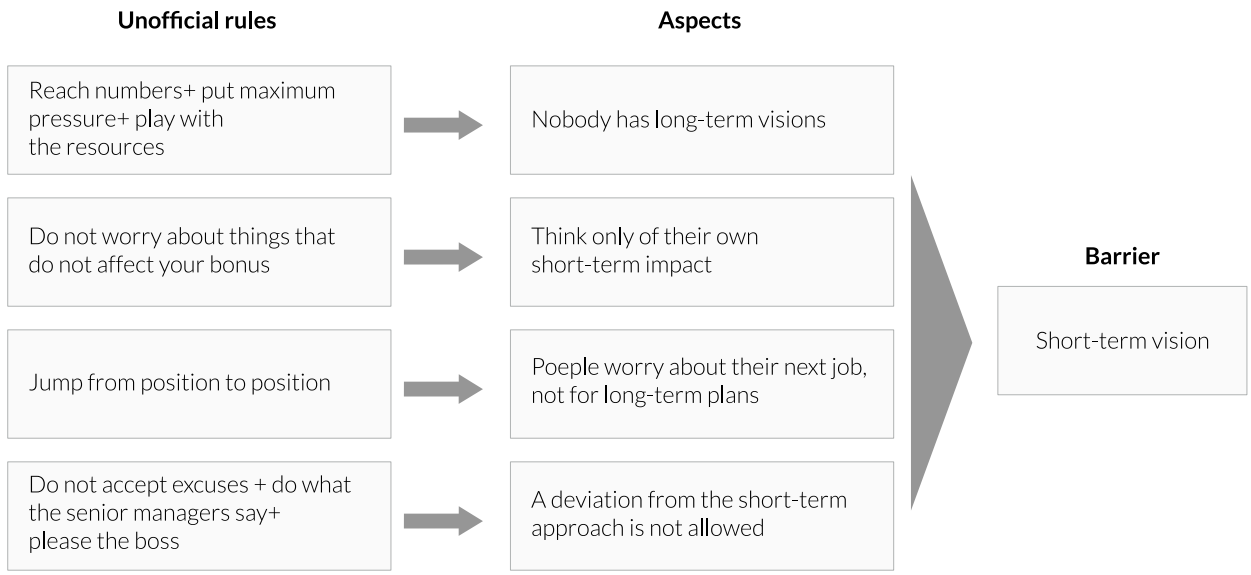


Figure 73: Example of the analysis of unofficial rules, aspects and barriers. Source A.T. Kearney (2007).

To conclude this part of the workshop, it is necessary to determine the cause-effect relationships of the barriers, in other words, the why of these barriers and their consequences.

At the time of giving instructions for this part of the session of the analysis, it is convenient to form groups, define the topics for each one of them, indicate which results are required and how they should be presented and finally indicate the time available for the group work.

The teams must analyze the reasons of the barriers. However, to understand the cause and the effect can be complicated and requires repetitive steps. The material is complex and is not obvious to customers. Metaphors and other elements can be used to describe the causes and effects.

It is important that the facilitator classifies and helps groups to focus their efforts on clearly defining the problems and not on trying to solve them. This is done at a later stage of the process.

The teams can employ the brainstorming technique for the reasons, writing them on cards and then putting them together.

Finally, to close the analysis section of the workshop, the information generated by the groups is systematized and the results are shown in front of all the participants. In order to move to the next stage of the process, we must establish which behavioural barriers of those that have been identified must be solved first. For this, they can be placed in a matrix that combines its strategic importance with the ease of removing them as shown in Figure 74.

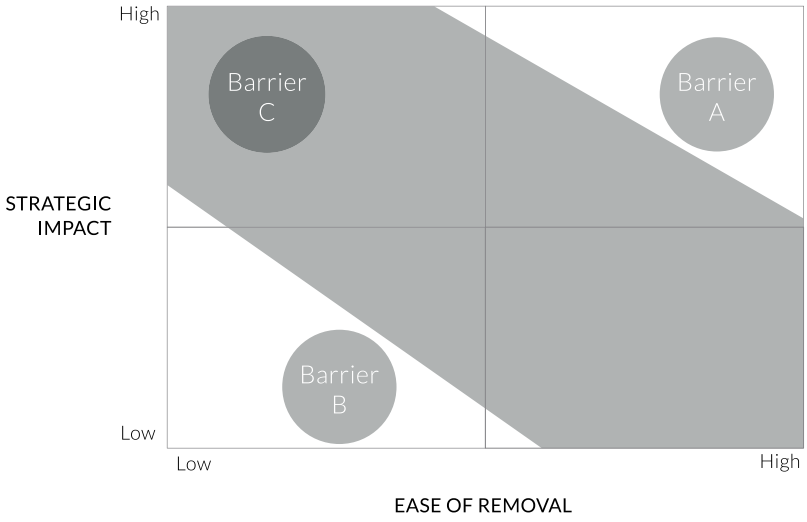


Figure 74: Prioritization matrix of barriers. Source: A. T. Kearney (2007).

Step 2.3: Determining the required interventions

Once the consequences of certain behaviours have been discussed and we have identified which behaviours should be encouraged and which ones should be stopped, we can formulate concrete actions or measures to address the prioritized behavioural barriers.
The following figure displays a sequence that can be used to specifically define these interventions:

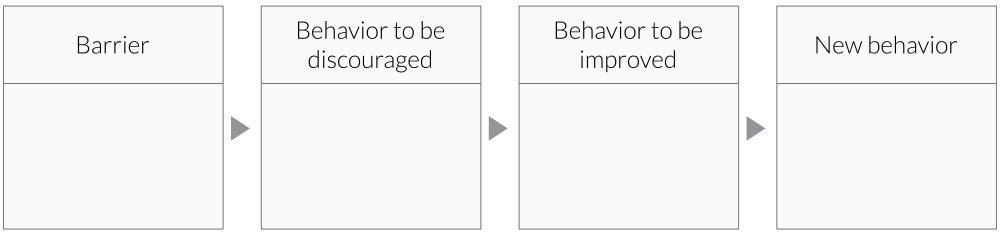


Figure 75: Process to determine the required interventions. Source: A.T. Kearney (2007).

After completing this activity, the workshop must be concluded, and the part of the process in which the company is at the moment should be explained to all the participants.

Step 3: Stakeholder analysis

As previously explained, companies are often faced with resistance to change, which in turn is based on the behavioural barriers. To analyze the reason and source of these barriers, all the stakeholders involved in an organization that are relevant for innovation must be studied. The required interventions that were defined in the workshop will help to identify the stakeholders that are connected with those barriers and solutions. The following figure shows an example of the typical process of the stakeholder analysis. It also provides a structure to systematize the information required for the analysis.

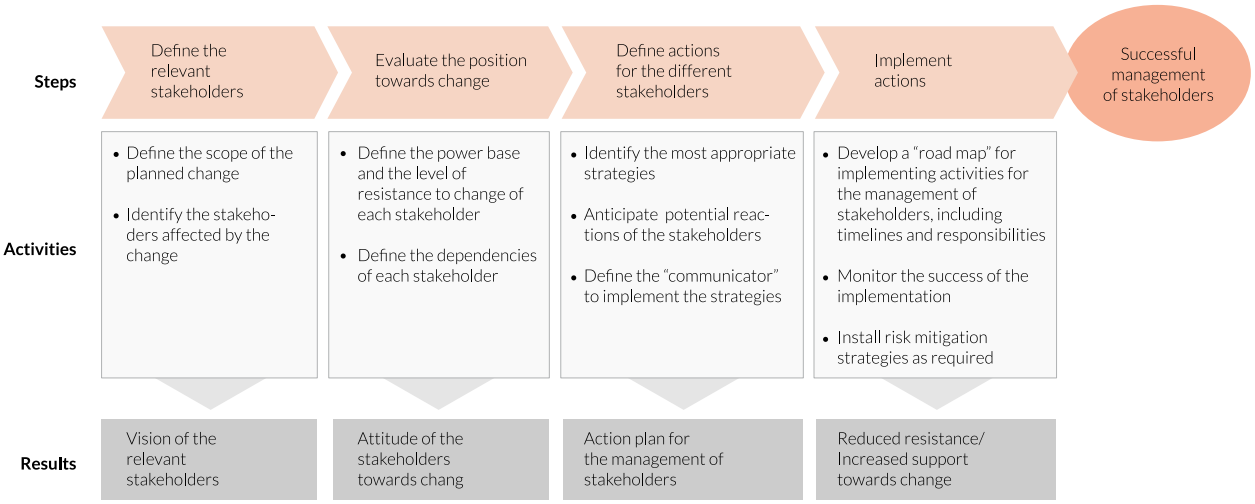


Figure 76: Process of the stakeholder analysis. Source: A. T. Kearney (2007).

The analysis should be focused on the attitude of the stakeholders towards change and their base of power and influence within the organization. For this, it is necessary to know in depth the attitude of each stakeholder towards other members. One of the critical factors for a good evaluation and analysis is the good knowledge of the informal structures of an organization, because in many cases the power and influence on people are based on these structures, beyond their formal positions and roles. This means that some relationships have more to do with the sympathy and antipathy among members, common personal characteristics or goals and with simple preferences, play sometimes a role and they are difficult to detect, but often very important (see Figure 77).

Other factors that influence power and relationships are the length of service at the company, the professional profile and the shared experiences. Some of these factors directly influence the trust levels of individuals towards others.

The identification, assessment and analysis must be developed through activities especially planned for this purpose, e.g. a new workshop or session.

It is very important to visualize the relationships of the stakeholders, because these are the limitations to the performance and behaviour of the people. The following figure gives an example of how to present these relationships and their nature.

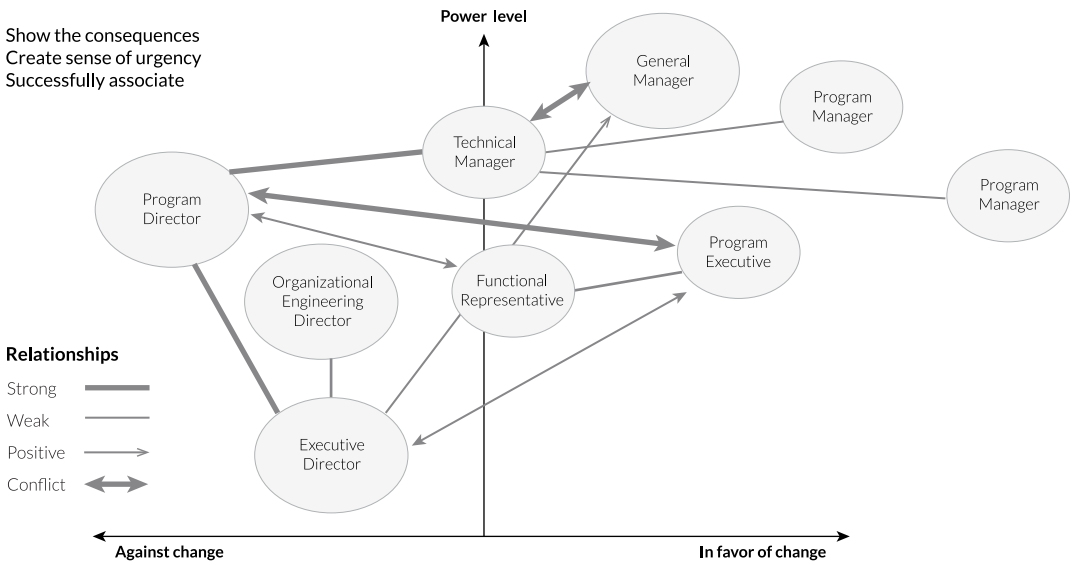


Figure 77: Stakeholders relationships. Source: A. T. Kearney (2007).

Actions of the drivers of innovation

The drivers of innovation are individuals or groups of individuals that facilitate the removal of barriers to innovation and in doing so raise the level of motivation and increase the chances of a successful implementation of the changes and hence, the innovation projects.

These drivers are committed to the innovation process at a very personal level and their role inspires other members of their organization to assume changes in behaviour, improving in this way the innovation culture.

The drivers of innovation usually have strong leadership skills and personal traits that turn them into people that are very respected and listed to more due to their ability of persuasion, their argumentation, and knowledge than just by the mere exercise of authority. In this way, they achieve results and assume key roles such as:

- Increase the general trust, also among stakeholders
- Mediation between fears and prejudices about the innovation processes
- Establishment of communication bridges in structures blocked by conflicts or mistrust, opening the way for building positive relationships
- Moderate the discussion of new ideas and approaches
- Equilibrium, mediation and conciliation between pre-existing and new relationships and structures.

The main challenge of the driver is to facilitate an open discussion about the barriers and the reluctance of employees regarding the innovation processes.
The following figure differentiates the steps-activities and the work processes of the driver of innovation.

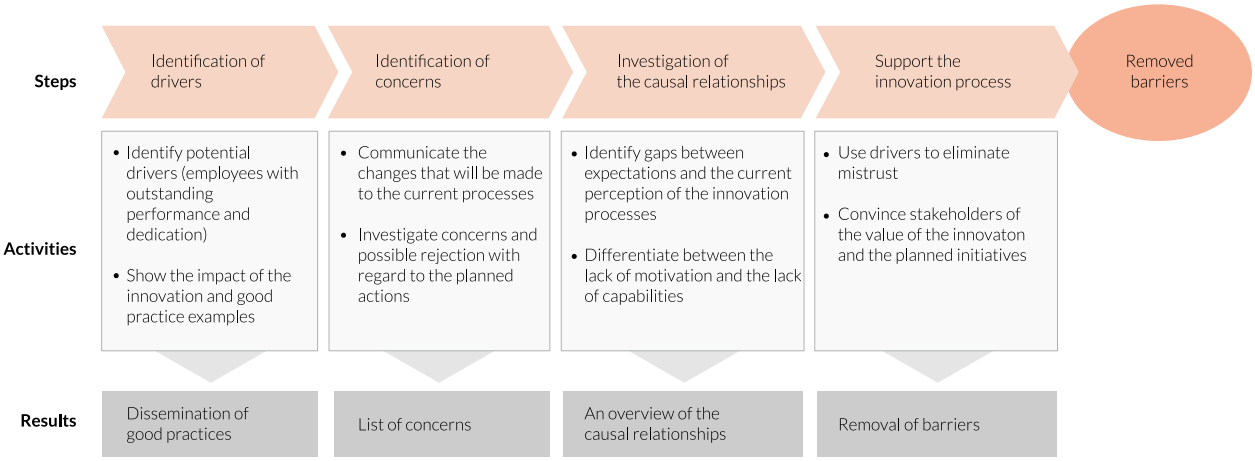


Figure 78: Work process of the driver of innovation. Sources A. T. Kearney (2007).

Among the critical factors of a driver or a team of drivers are their willingness and their ability to support the innovation process and reduce concerns. This requires that the driver or drivers have well developed communication skills, an abstract reasoning ability and a temperament that generates sympathy but that is at the same time firm. Obviously, a prerequisite is that the structure which has been determined for the innovation process allows the integration of drivers. This depends more on the decisions, the conviction and the commitment of the senior management. From there, the driver or teams of drivers of innovation will achieve, step by step, the removal of behavioral barriers, then the unfavorable organizational barriers and finally, the misallocation of resources.

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