
The Innovation Concept

1.1. The characteristics of an innovation process

An innovation process is a production activity which takes place prior to the design process.

We would define such a process in the following way:

An innovation process is the gradual materialization of new ideas guided by the projection of a very uncertain future, in terms of its methods of use and the returns on investment that they will produce.

The process starts with a meeting of “ideas” and “needs” of a population that wishes to carry out a given activity.

The “ideas” refer to using scientific, technological or methodological results from fundamental or applied research, or certain components of products or existing services, in order to create new “features” which respond to specific areas of society not currently covered or not yet catered for well enough. The targeted population of beneficiaries must be sufficiently large and have sufficient financial resources to ensure the expected returns on investment.

These new “features” often lead to changes in the organization of the population which receives the innovation. They can change habits and destabilize the current order. Moreover, satisfying needs by “supplying a service” which includes an innovation can create further needs. A consumer process then develops, and initiates the development of new economic exchanges.

EXAMPLE 1.1.—

Remote cardiology is the result of an idea based on using new information technology to create a permanent connection over large distances, with the use of satellites, between a patient suffering from a serious cardio-vascular illness and a medical team responsible for the patient’s treatment.

The need is clear. The information technology exists. The idea was to connect this technology with medical treatment.

The creation of an innovation process brings together the human resources within a company, which promote the idea, understand the needs and have the skills necessary in the field of information technology.

The way in which the innovation is constructed is dependent on the material resources used (cardiac electrodes, defibrillator, software contained within the defibrillator, transmitter, external switch controlled by the patient, methodology of purchasing satellite services, ergonomic information receiver for cardiologists) and on the way the features of the service are defined (providing the cardiologist with accurate and reliable information for to give a remote diagnosis, locate the patient, get in touch with him quickly, etc.).

The service includes a connection between the patient and a permanent remote supervision service for making a pre-diagnosis. He transmitted the information at a team of caregivers on the spot for make-out the diagnostic and care.

This new supply of services created through innovation in turn gives rise to other needs regarding remote treatment for the evolution of other illness which require urgent intervention.

As mentioned above, the “promoters” of the ideas and “needs” are part of the human resources responsible for the development of the innovation.

“Innovation” and “innovation process” are terms which are frequently used to express the evolution of the resources that human develops in order to satisfy his needs.

Our goal is to offer a methodology designed to integrate a quality process into an innovation process in order to ensure, over time, the most cost-effective competitiveness possible: from the project which creates the innovation and makes it economically viable, to the production system for the products and services which will benefit from this innovation and, finally, to the products and services when they are brought into the market.

These particular quality processes are known as “competitive quality processes”.

An innovation process can be represented in the following way:

We voluntarily end the innovation process before the decision is taken, by the company management, to implement the innovation by undertaking product or service designs which will incorporate the innovation, and the

design of the production system. Here, we depart from the innovation process and start the design process. It is still considered in some companies that the innovation process only ends with an “innovation on the shelf”.

An innovation process consists of the following steps:

- deciding to foster new ideas to help the progress of the company;
- bringing about the emergence of an idea which may provide a response to a need of society;
- briefly characterizing products or services which could benefit from the innovation;
- identifying possible clients for these future products or services;
- characterizing future uses for products or services which would incorporate the innovation;
- creating experimental drafts which represent the idea as accurately as possible;
- conducting initial feasibility tests on the future products or services;
- deciding to initiate prospective studies on how to use the idea to benefit the company;
- conducting prospective studies on possible socioeconomic uses for the innovation, and its impacts on the company and its position;
- deciding to guarantee the ability of the company to mobilize the resources necessary, internally and externally, in order to fully realize its innovation process;
- identifying future stakeholders in the innovation project;
- conducting studies on the nature and feasibility of exchanges with future stakeholders in the project necessary for it to be fully realized;
- deciding contractual issues with these stakeholders, and building a processor to carry out the innovation process;
- building a processor responsible for carrying out the innovation process and an external communication network;
- deciding to progressively design drafts which give a more accurate representation of the idea;
- progressively designing these drafts to accurately represent the configuration of the innovation;
- deciding to carry out prospective studies on the socioeconomic impacts of the future products and services which will incorporate the innovation;

- progressively designing drafts which give a representation of future products and services to incorporate the innovation, by describing, in particular, the future “interfaces” of the innovation with other components of these products and services;
- conducting tests on the drafts of future products or services, at various steps in their production, on future clients and on all future stakeholders in the production system for the products and services;
- conducting performance tests on future products or services;
- creating a rationale to aid decision-making, which examines the probable socioeconomic impacts of implementing the innovation;
- deciding to guarantee the ability of the company to adopt a production system for the future products and services;
- more precisely identifying stakeholders who will contribute to the development and production of future products and services which will incorporate the innovation;
- designing drafts of the production and distribution systems for the products and services;
- conducting studies on the ability of the company to design production and distribution systems for the products and services which will incorporate the innovation by taking into account the configurations of the various definitive drafts of the innovation;
- creating a rationale to aid decision-making, which details the feasibility of implementing the innovation;
- deciding to validate the innovation;
- examining the steps to take to ensure the intellectual protection of the innovation.

Box 1.1. *Characterization of an innovation process*

COMMENT 1.1.– Each of the previous steps can be carried out several times. An innovation process is carried out “in loops”. It is possible, at any time, to question ideas, observations or previous decisions.

We detail below the meaning of the terms used.

With this representation of an innovation process, it is understood that

An innovation is an original way of developing a socioeconomic activity by attempting to find a new way of satisfying the needs of the society.

There are various definitions for the concept of innovation. It would certainly be interesting to recall them by trying to identify and characterize the points of view which form the basis of such definitions. We leave this work to one side in order to focus on the crux of our question regarding the characterization of a competitive quality process integrated into an innovation process.

An innovation process can take on very different forms depending on the context in which it is carried out (size of the company, sector of the economy, creation of a company through innovation, etc.).

A quality management specialist does not have the competency to directly influence project leaders in choosing the most optimal methods to carry out innovation processes. They must only focus on those actions which make the best possible use of the specific production mechanisms for “quality” within the innovation process and prevent them from hindering the creativity which is at the heart of its added value. The specialist’s role is to design and implement a quality process which is integrated into the innovation process, providing it with the most effective support to help it achieve economic success. However, the information produced by this quality process can help improve the performance of the innovation process as it proceeds or when it is reproduced, when the configuration of the production system is redefined.

To be able to integrate a competitive quality process into an innovation process, we need models which represent the various concepts which are involved.

In the previous model describing an innovation process we can observe five main categories:

- creative research;
- decision-making;
- impact studies;
- feasibility studies;
- organizing production processes.

Box 1.2. *Main categories which make up an innovation process*

Creative research is a highly fragile area of the innovation process. It is greatly influenced by the conditions in which it is carried out and must be afforded a considerable amount of freedom. It is creative research which produces the most significant portion of added value within the innovation process.

Creative research are involved in the following stages of the innovation process:

- bringing about the emergence of an idea which may provide a response to a need of society;
- creating experimental drafts which provide a more accurate representation of the idea;
- progressively designing drafts to accurately represent the configuration of the innovation;
- progressively designing drafts which give a representation of future products and services to incorporate the innovation, by describing, in particular, the future “interfaces” of the innovation with other components of these products and services.

Box 1.3. *Creative research*

Impact studies can be described in the following way:

Impact studies are involved in the following stages of the innovation process:

- briefly characterizing products or services which could benefit from the innovation;
- identifying possible clients for these future products or services;
- characterizing future uses for products or services which would incorporate the innovation;
- conducting prospective studies on possible socioeconomic uses for the innovation, and its impacts on the company and its position;
- identifying stakeholders who will contribute to the development and production of the future products and services which will incorporate the innovation;
- conducting tests on the drafts of future products or services, at various steps in their production, on future clients and on all future stakeholders in the production system for the products and services.

Box 1.4. *Impact studies in the innovation process*

These studies attempt to predict the socioeconomic consequences of the innovation. These impacts are predicted by studying similar cases or by carrying out tests based on simulations or experiments. In this way, the predictions of impacts can be made credible.

As for feasibility studies, these can be characterized in the following way:

- Feasibility studies* are involved in the following stages:
- conducting initial feasibility tests on the future products or services;
 - identifying future stakeholders in the innovation project;
 - conducting studies on the nature and feasibility of exchanges with future stakeholders in the project necessary for it to be fully realized;
 - conducting performance tests on future products or services;
 - conducting studies on the ability of the company to design production and distribution systems for the products and services which will incorporate the innovation by taking into account the configurations of the various definitive drafts of the innovation.

Box 1.5. *Feasibility studies in the innovation process*

These studies attempt to anticipate how to capitalize on opportunities, and how to account for restrictions, in order to achieve the socioeconomic objectives which justify the investments to be made.

It is essential to anticipate the ways that the innovation could be used in the future in order to prevent directors from leaving the innovation “on the shelf”.

Some stages of the innovation process are in the field of organization, and they are the following:

The *organizational stages* are the following:

- building a processor responsible for carrying out the innovation process and an external communication network;
- creating a rationale to aid decision-making, which examines the probable socioeconomic impacts of implementing the innovation;
- designing prototypes of the production and distribution systems for the products and services;
- creating a rationale to aid decision-making, which details the feasibility of implementing the innovation;
- examining the steps to take to ensure the intellectual protection of the innovation.

Box 1.6. *Organizational stages*

Finally, decision-making stages are key at every step of the process. They can be identified in the following way:

The *decision-making stages* are:

- deciding to foster new ideas to help the progress of the company;
- deciding to initiate prospective studies on how to use the idea to benefit the company;
- deciding to guarantee the ability of the company to mobilize the resources necessary, internally and externally, in order to fully realize its innovation process;

- deciding contractual issues with these stakeholders, and building a processor to carry out the innovation process;
- deciding to progressively design drafts which give a more accurate representation of the idea;
- deciding to carry out prospective studies on the socioeconomic impacts of the future products and services which will incorporate the innovation;
- deciding to guarantee the ability of the company to adopt a production system for the future products and services;
- deciding to validate the innovation.

Box 1.7. *Decision-making stages in the innovation process*

These stages are always sensitive because the risks associated with them often involve high criticality levels which are not always accurately estimated.

It is necessary to segregate these various operations because they rely on different logics and means. It is generally impossible to offer a common planning model for these various operations in spite of there being some clear precedence relations. Each situation requires a specific plan.

An innovation process must remain extremely flexible to quickly adapt to uncertainties and new opportunities which emerge during the process. This is characterized by:

- a rough initial characterization of the final product;
- unrestricted evolution of this characterization as the innovation production process progresses;
- uncertainty regarding the configurations of successive drafts representing the evolution of the innovation process;

- the necessary evolution of the “dynamic architecture” of the system which follows the production process according to how results are used to benefit the innovation;
- imprecision and evolution of guidelines for the management of the process;
- the necessary pooling of information resources and decision-making partnership;
- uncertainty regarding the impact on future users’ satisfaction;
- uncertainty regarding investments to be made.

These specificities may seem to imply that it is dangerous for a company to commit to such projects. In reality, in the current economic context, a company established in an industrialized country which does not innovate has little chance of survival, except if it is positioned in a strategic niche not threatened by competition for emerging countries, or if it has such a strong historical reputation that it has become timeless. In this particular case, the company is well protected against the competition, and must instead evolve slowly and gradually so as not to destroy those products and services which have earned it such a reputation.

Such vagueness, uncertainty, arbitrariness and imprecision mean that the innovation process must be very flexible and reactive in order to constantly adapt to the often unpredictable information which is produced to act as a guide in the process.

The specificities of the innovation process show that significant risks are involved. Nevertheless, it is generally the only way to put products on the market which are more attractive than those of competitors, and to encourage consumers to spend a larger portion of their purchasing power to obtain them.

These specificities show that it is impossible to apply the traditional mechanisms for controlling risk within a process in order to bring its criticality down to acceptable levels. These mechanisms rely on methods which attempt to reduce the uncertainty at the source by identically reproducing what gave the best results in the past. They abolish levels of freedom necessary for individual and collective creation which are the basis of all innovations.

Finally, it is impossible to give a definitive *a priori* definition of the “dynamic architecture” of the innovation production systems. The emergence of new ideas throughout the innovation process shapes its evolution and can considerably modify its initial “dynamic architecture”. Those responsible for carrying out the innovation process must always be able to modify this initial definition in order to successfully realize the production of the innovation, according to the opportunities which emerge from the creation of new ideas during the previous stages of the innovation process, and the new risks arising when these opportunities are taken. Such management of the innovation process is particularly sensitive because it requires a number of variables which are often not initially included in the supervision plans to be observed, while at all times preventing any restriction of the actions promoting the creativity which produces the innovation’s added value.

This management requires a high level of vigilance, an ability to rapidly understand and interpret the signs which indicate the emergence of unexpected risks and a “culture” within the company which allows for the rapid estimation of “the hope of profits created from opportunity of implementing an idea” and “the criticality of predictable

risks before it is implemented, or indicated during its implementation”, in order to undertake corrective actions as soon as possible that lower the criticalities to acceptable levels while minimizing the loss of hoped-for profits.

The management architecture for the production of an innovation must be in “matrix” form, as with any complex project. The “horizontal” organization of a management system, which ensures the direction of the project, must consist of a considerable ability on the part of the company’s general management to delegate responsibility. This delegation must be compensated by precise management of the layout of intermediary results presented during project review stages. Regulation of the innovation process cannot be self-governed, as with other production processes. Members of the project team producing the added value in the innovation process must focus on the creation of this value. The project manager must most often delegate responsibility to the quality service. However, the partial results of this regulation must be scrupulously addressed during project reviews, and alerts must be followed by responses as soon as possible.

Broadly speaking, the models that we propose are based on the fundamentals of “general systemics”.

1.2. Review of basic conceptual definitions in “general systemics”

Above, we have described a number of concepts which are consistently at the heart of developments which will follow, and it is useful to be able to define them accurately.

1.2.1. *The concept of a process*

The term “process” is given to any series of events linked over time which has the following properties:

- all events contribute to the same end result;
- all events start at a moment called the “initial time” of the process;
- all events take place before a given time called the “end point” of a process;
- the series of events linked over time obeys some kind of organizational framework;
- every process can be broken down into component sub-processes.

1.2.2. *The concept of a processor*

The term “processor” is given to a dynamic system which includes human resources. It is activated by these human resources and its activity is led by a specific “managerial” organization.

COMMENT 1.2.– Every process is carried out by activating a processor. A processor can carry out a number of different processes.

1.2.3. *The concept of functionality*

A “functionality” is the ability of a processor to transform a system when it is activated. The system can be the processor itself.

1.2.4. *The concept of a function*

A function is the transformation of a system.

COMMENT 1.3.– By activating a functionality of a processor, a function is carried out.

1.2.5. *The concept of configuration*

The “configuration” of a system is the architecture of its resources which may be human, material, information-based, organizational, financial and temporal, coupled with its “functional” potential (a collection of its functionalities).

1.2.6. *The managerial architecture of a processor*

The human resources of a processor have a specific organization which influences other resources (material, information-based, financial and temporal).

In general, three main components of this architecture can be distinguished:

- “pyramid” managerial organization;
- “horizontal” managerial organization;
- support services.

“Pyramid” managerial organization, at the company level, is responsible for its overall “dynamic equilibrium”. This is what determines the socioeconomic position that the company must attempt to occupy. This is what distributes the resources among the various processors. This is what sets the objectives that each processor must reach. This is what fulfills the company’s legal and administrative responsibilities. This is what controls the way in which internal relations between the processors and communication between the processes are carried out. It is partially present in every “processor” and is visible in the “hierarchical” levels within the processor. The organizational figure of the company’s management usually shows this “pyramid” structure. A company can have several

hierarchical levels. The number of levels depends largely on the size of the company.

“Horizontal” managerial organization is specific to each process. It is also known as the “operational management” within a company. This is the organization directing the creation of added value for the company which will be visible to its clients and will therefore allow the company to develop exchange relationships with its external stakeholders in order to acquire and build up its reputation. It is directed by the process leadership, and brings together the human resources supplied by “professions” or “support services” to carry out the actions in the process. The features which characterize the authority, responsibility and assistance of this leadership to its human resources are determined by the contracts that it agrees with the representatives of the “professions” or “support services”. In general, three levels can be distinguished in this type of organization:

- process leadership;
- the representative of each working group carrying out a task in the process;
- each individual in the working groups.

The support services are “cross-cutting professions”, which are involved in all activities within the company. They help all stakeholders in a company carry out specific cross-cutting activities such as supplying resources, coherence and efficiency of the interfaces between the various company departments, the coherence of its activities and the overall conformity with specifications imposed by regulations or laws.

Among others, they bring together the “personal” function, the administrative function, the “quality” function, the function responsible for the maintenance of material resources, the “marketing” function and so on.

1.3. Evaluation criteria for the success of an innovation

It would be tempting to say that the success of an innovation can be measured by its effect on fulfilling the company's policy. However this evaluation criteria demand too much time to ascertain whether an innovation has been successful and whether an innovation can, because of its success, encourage the company to change its policy.

The main criteria used to evaluate the success of an innovation process are as follows:

- The main evaluation criteria for an innovation process include:
- the evolution in market uptake in terms of volume;
 - the speed and size of returns on investment;
 - the evolution in the purchasing value given by the market to the products or services which incorporate the innovation;
 - the evolution in the attraction to the innovation compared to that of competitors' products or services;
 - the nature and extent to which the innovation provided an answer to society's evolving needs;
 - the level of contribution to the enhancement of the fundamental image of the products or services which incorporate the innovation, or to the fundamental image of the company;
 - the level of enhancement of the "expertise" and culture of the company;
 - the ease of finding and using this new "expertise" necessary for the production of new products and services;
 - the time taken to introduce the products or services which incorporate the innovation into the market;
 - the contribution of the innovation to the fulfillment of the company policy.

Box 1.8. *Criteria for a successful innovation*

There are certainly additional criteria, and some companies find it necessary to personalize these criteria.

These criteria can be subject to a predictive estimation process at the start of the innovation process. This estimation is periodically re-evaluated during the process to guide decisions or, after decisions are taken, with regard to continuing or terminating the process or correcting the direction of the process. At the end of the process, a final estimation can serve as an objective to evaluate the success of an innovation during the lifespan of a product or service which incorporates it.

In general, it is possible to allocate one or several quantifiable indicators to each of these factors.

The predictive nature of the innovation's performance evaluation is traditionally represented by attaching to each quantifiable indicator an estimation of its value in terms of "confidence intervals".

This estimation carries risks for the stakeholders investing in the innovation project. These risks are linked to the uncertainty of the information used in its formulation, and to its predictive nature. Each stakeholder must assess their own "risk benefit ratio" according to the evolution of the estimations as the project progresses.

1.4. Drivers of socioeconomic exchange for an innovation process

An innovation process is a project which relies on a great number of exchanges between the central system which creates the process's added value and its environment. The central system is a processor, which has human resources often called the "project team". In small businesses (SMEs), this team is sometimes very small with just one or two

people. As soon as there is more than one, a project leader is nominated. He has full operational managerial delegation in his relations with the other members of the project team. The project team generally changes very little during the innovation process. All other components of the processor can evolve according to the needs which emerge as and when the configuration of the innovation changes.

To introduce the model for drivers of socioeconomic exchange, it is necessary to define the meaning of the concept “stakeholder”.

The “stakeholder” of a processor is any socioeconomic agent which carries out exchanges with the processor.

Box 1.9. *The concept of a stakeholder*

The project team is a particular class of stakeholders in the process. It needs to enter into relations with a large number of other stakeholders to supply the processor with resources.

Apart from the architecture of the processor’s human resources which changes little during the innovation process, the other components of its configuration can significantly evolve as the project advances. These changes occur through exchanges between the processor and its environment.

In a general way, the organization of the various stakeholders in a processor can be modeled by the concept of “strategic areas of activity”.

A strategic area of activity consists of:

- a service package which the company offers to its clients;
- a company processor which produces this service package; (Business Unit – BU)
- a family of stakeholders who make up the clientele for the service package; (Market)
- a family of stakeholders who produce certain components in the service package within the “BU”; (Workers)
- a family of stakeholders external to the “BU” who provide certain components for the service package, or resources which are then processed by the company in order to produce these services; (Providers)
- a family of stakeholders who invest in the company hoping to make a profit from the production of these services; (Investors)
- a collection of surrounding parties who are connected to any of the above stakeholder

Box 1.10. *The concept of strategic areas of activity*

Hence, the following figure results:

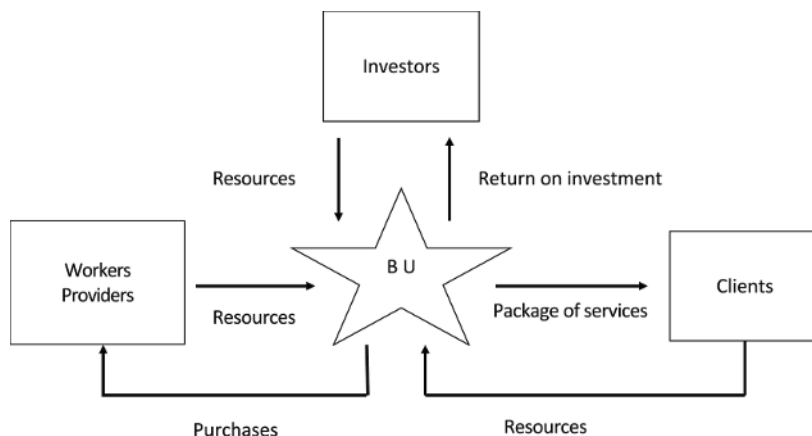


Figure 1.1. *Strategic area of activity*

The driver of socioeconomic exchanges in the innovation process can be described in the following way:

The driver of socioeconomic exchange of the innovation is made up of:

- a processor built around a project team and which produces the added value;
- an area of strategic activity connected to this processor;
- a future area of strategic activity connected to the “BU” which can economically benefit from the innovation and which, in particular, contains the class of clients in the previous area of strategic activity;
- a network and a flow of exchanges between the processor and its stakeholders;
- a communication network and flows of information between the processor and its surrounding parties;
- networks of exchanges of information, products, services and money between its stakeholders, or between its stakeholders and certain connected parties.

Box 1.11. *The concept of a driver of socioeconomic exchange*

In order to undertake a competitive quality process, it is first necessary to describe these significant components which make up the driver of socioeconomic exchanges of the innovation.

It can be noted that the driver of socioeconomic exchanges consists of two strategic areas of activity: one which connects all stakeholders to some aspect of the innovation process, and another which will connect all the stakeholders to be involved in the future exchanges which the company must undertake to benefit from the innovation. In the second case,

the hypothetical future projection affects the way the innovation process is carried out.

The second strategic area of activity is a model of the organization of exchanges between the various levels of clients in the first strategic area of activity.

The first strategic area of activity can be broken down in the following way:

The strategic area of activity connected to the innovation processor is made up of:

- a package of services that the processor offers to members of the company's BU which will benefit economically from the innovation; (Project offer)

- the innovation processor itself; (Production system for the innovation process)

- the strategic area of activity of the BU which arranges the clients of the innovation processor;

- the family of stakeholders who produce the package of services; (Project team)

- the family of stakeholders, external to the project team, who provide certain components of the service package, or resources which are then processed by the project team to produce these services; (Project providers)

- the family of stakeholders who invest in the project hoping to benefit economically from the innovation; (Project investors)

- a collection of parties connected to any of the above stakeholders and which have an indirect effect on the project.

Box 1.12. *The strategic area of activity of an innovation process*

The second strategic area of activity can be described in the following way:

The strategic area of activity of the future BU which will utilize the innovation is made up of:

- the service package which the BU will offer to its clients by utilizing the innovation; (Supply)
- the processor which will produce the package of services; (BU)
- the family of stakeholders who will make up the future clients of the service package; (Potential market for the innovation)
- the family of stakeholders who will produce certain components of the service package in the “BU”; (Workers)
- the family of stakeholders external to the “BU” who will provide certain components for the service package, or resources which will then be processed by the company in order to produce these services; (Providers)
- the family of stakeholders who will invest in the BU hoping to benefit from the production of the services; (Investors)
- a collection of related stakeholders who are connected to any of the above stakeholders.

Box 1.13. *The strategic area of activity of a business unit utilizing an innovation*

COMMENT 1.4.– It may seem that the strategic area of activity of the innovation processor has a particularly complicated organization with its clients. In reality, this complexity is present for the majority of service production processors. They generally have a stream of potential clients.

1.5. Clarifications on certain actions in an innovation process

1.5.1. *Managing the configuration of an innovation process*

One of the fundamental rules of managing an innovation process is commonly referred to as the “*management of its configuration*”.

It is characterized by the periodical organization of project reviews which consist of answering and recording the responses to two questions:

– What information has been produced since the last project review which contributes to providing:

- an update on the latest configuration of the draft, which embodies the evolving ideas at the source of the innovation, intended to guide the future design of the product or service to incorporate the innovation;

- an update on the latest configuration of the processor draft which will create the future product or service;

- an update on the probable impacts on relations between the company and given stakeholders;

- the risks of not achieving these impacts and an estimation of their criticality levels.

– What actions should be earmarked in order to supplement the configuration of previous drafts, to refine the impacts on relations between the company and its stakeholders, and to reduce the risks of not achieving such impacts to acceptable levels?

Managing the configuration at each stage of the project includes: the progress of the evolution process, the choices which steer the continuation of the process and the reasons for these choices, the objectives to fulfil, the resources to assemble and the scheduling of tasks to carry out.

Those involved in an innovation process often struggle to carry out this configuration management properly. They feel that they are wasting time, even though they are convinced of the merits of such actions. Progress can only be tracked by using a knowledge base acquired previously, and by tracing the mechanisms which allowed this knowledge to be accumulated.

1.5.2. *Creative research*

An innovation process becomes official in a company when an order is given from the management of that company. This order is given through a proposal which consists of:

- an idea which could satisfy a need within society;
- a prospective vision of how to design a product or service incorporating the idea which could be used by the population;
- an approximate prediction of the benefits that the company could receive as a result of the socioeconomic impacts of the innovation.

This proposal provides the input data for the creative research process.

As discussed above, creative research consists of the following stages in the innovation process:

- bringing about the emergence of an idea which may provide a response to a need of society;
- creating experimental drafts which provide a more accurate representation of the idea;
- progressively designing drafts to accurately represent the configuration of the innovation;
- progressively designing drafts which give a representation of future products and services to incorporate the innovation, by describing, in particular, the future “interfaces” of the innovation with other components of these products and services.

The stakeholders involved in this task have evolving resources. They are the only ones responsible for presenting the updates to the project backer. These updates are given during the project reviews which validate the progress at

each stage in the creative research process. It is possible for each stage not to comply with previous predictions since these are simply working hypotheses. Innovation processes are not set in stone. Managers have a significant amount of freedom to modify their direction at any time according to opportunities or problems which arise during the process.

A program can consist of several areas of “creative research” which open up a relatively wide field of research, while nevertheless remaining fixed on the same objective.

This objective generally remains vague. It is an “idea” which becomes more precise as the process advances.

In summary, it is possible to characterize the architecture of a creative research processor in the following way:

- the end result is an “objective” expressed by an approximate idea;

- the division of sub-processes is structured into different areas of “creative research”;

- each sub-process becomes more precise as the process advances;

- the processor has a variable geometric layout arranged around a “hub” of interactive resources which remains unchanged and constitutes the basis of the innovation driver;

- each “hub” has a stable “horizontal” managerial organization led by a project manager;

- some of the hub’s resources and the flexible components of the processor are provided by specialized departments within and outside the company;

- these departments are reservoirs of resources which can supply the processor, or constitute sub-processors, depending on the project manager’s decisions;

– when these departments are within the company, they have a pyramid- or matrix-shaped managerial organization according to the specificities of the departments and the size of the companies;

– the relations between the project manager, the directors of these departments and managers of the support services which operate through different areas of the project usually have a pyramid-shaped managerial structure led by company's general management;

– some support services, such as the quality service, assist the project manager in maintaining the overall coherence of the processor carrying out the innovation process.

The chain of events at the various steps of the creative research process can be described by the following figure:

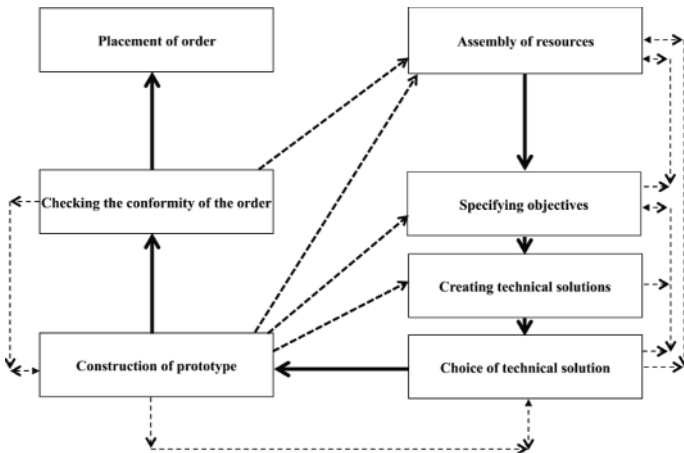


Figure 1.2. *Model of the steps of the creative research process*

Figure interpretation:

A new supplementary order can be created according to the conclusions gathered regarding the conformity of the creative research results to the initial order.

The assembly of resources necessary for the creative research to be carried out can occur at any time during the process depending on the results at the stage designed to specify the objectives to be met, the choice of technological or methodological solutions to be incorporated into a draft and the difficulties encountered in the construction of the draft.

The specific objectives of the creative research process can be redefined depending on the difficulties encountered in order to stop the technical or methodological solutions being developed, and according to the problems encountered to construct the draft of the solution identified.

These problems can also lead to research into new technical or methodological solutions or an examination of the technical or methodological solution being implemented.

Finally, checks carried out on whether the draft conforming to the original order can lead to the construction of a new draft with an alternative structure.

The results of one or several creative research programs can carry over to the materialization, whether physical or not, of a creation which can incorporate new functionalities within a product or service that the company could put on the market as part of its development policy or to reposition it on the market in relation to its competitors.

These results are often called “off-the-shelf” innovations. Their description is relatively accurate.

In general, the continuation of the innovation after the creative research phase is not systematic.

Innovation processes can be interrupted for a given amount of time (stop time), because the company management deems it unnecessary to immediately commit to new investments. The configuration stage of the innovation

provided by the creative research program does not convince the company that there is a major momentary opportunity in continuing the development of the innovation to eventually include in the company's offer of services.

In order for the innovation activity to continue or restart, several factors need to come together:

– the innovation is based on one or some new concepts which are similar to other which have been successfully introduced in some products or services which do not respond to the same market needs; (Trend extension effect)

– the innovation initially seems to respond to a need identified through marketing, to which the market attaches a great amount of value and which is not yet being satisfied either by the company's current products and services, or by competitors; (Marketing breakthrough)

– by creating a break with the past, the innovation improves certain features of the company's product or service which are at the heart of the "company image"; (Image consolidation)

– the innovation substitutes a new technology for one or several others in a product which could eventually offer new performance levels for several functionalities or reductions of manufacturing, delivery or maintenance costs. (Technological breakthrough)

COMMENT 1.5.– It is possible for several of these "opportunity factors" to be present in a single innovation at the same time.

1.5.3. *Studies on the impact of a new innovation*

The configuration of an idea, resulting from creative research, however attractive it is for the team who contributed to its creation, requires impact studies to be

carried out on the probable benefits or risks for the company if it takes the decision to use these results to design new products or services.

Above, it was noted that impact studies consist of the following stages:

- briefly characterizing products or services which could benefit from the innovation;

- identifying possible clients for these future products or services;

- characterizing future uses for products or services which would incorporate the innovation;

- conducting prospective studies on possible socioeconomic uses for the innovation, and its impacts on the company and its position;

- identifying future stakeholders for the innovation project;

- identifying stakeholders who will contribute to the development and production of the future products and services which will incorporate the innovation;

- conducting tests on the drafts of future products or services, at various steps in their production, on future clients and on all future stakeholders in the production system for the products and services.

One of the first parts of the study to be carried out examines the possible impact on the company's policy of including the innovation in an offer of services or products.

An innovation can cause a company to reconsider its strategic areas of activity. It may allow the company to access new market sectors by new offers, or to put forward a new offer which is significantly different from the previous one in the same market sector.

Every innovation also causes an evolution of the company's expertise. The nature of this impact regards the changes in qualifications and expertise of the staff, new technology to be introduced to the company, infrastructure changes to be undertaken, a redirecting of investments and so on.

In the same way, an innovation can modify the company's image or the offers in one of the strategic areas of activity. These changes to the image can represent opportunities to modify the company's policy.

Subsequently, it is necessary to very quickly establish the various stakeholders with which the company needs to develop new exchange relations in order to capitalize on the innovation and achieve the expected profits. These may be financial backers, providers, future consumers, future staff to recruit, etc.

It is also necessary to quickly envisage how these relations can be created for the company to make the profits which comply as best as possible with its policy. At this stage, it is simply a case of establishing the "staging" of these relations, in the theatrical sense of the term.

These scenarios help to identify some of the opportunity and risk factors which may arise in exchanges which the stakeholders targeted by the innovation.

This process can consist of the following stages:

- identifying all impact factors which could be considered as opportunities or risks that the innovation could produce either directly or indirectly in future relations with stakeholders, for the benefit or detriment of the company;
- specifying the nature of the benefits and risks, and providing an estimation of the related positive or negative

predictions concerning returns on investments, by clearly showing the uncertainties in these predictions and the reasons why they occur;

– carrying out a sub-process of investigation, for each opportunity or risk factor, finalized by a description of their effects and an estimation of their probable contribution to the profits or losses for the company. Each sub-process has a predefined field of investigation. It must also show the main components in the future scenarios concerning the emergence of opportunity or risk.

The processors which carry out the sub-processes are made up of resources which belong to several departments (marketing, specialists in the new technology involved in the innovation, logistics, quality, etc.).

The draft tests on possible relations with stakeholders are essential in order to validate the relevance of these impact studies. The drafts can take very different forms depending on the nature of the relations to be established. It must be ensured that the information broadcast during these tests cannot be used by competitors.

1.5.4. *Feasibility studies in the innovation process*

A feasibility study is designed to check whether the use of the innovation by the company is realistic. It examines, in advance, how to assimilate the results of the creative research and the impact studies in order to design, mechanize and then provide the new products or services chosen to incorporate the innovation.

Above, it has been shown that feasibility studies include the following stages:

– conducting initial feasibility tests on the future products or services;

- identifying future stakeholders in the innovation project;
- conducting studies on the nature and feasibility of exchanges with future stakeholders in the project necessary for it to be fully realized;
- conducting performance tests on future products or services;
- conducting studies on the ability of the company to design production and distribution systems for the products and services which will incorporate the innovation by taking into account the configurations of the various definitive drafts of the innovation.

These stages are the most sensitive ones in the innovation process. The goal is to anticipate the directions of the processes of design, mechanization, construction, supply and use while taking into account opportunities, updated during impact studies. This anticipation can only be effective if it involves stakeholders who will contribute later in these various processes and who have experience in introducing an innovation into a new product or service.

The goal is also to reduce the risks which initially appear to limit the ambitions that the results of the creative research produced.

These feasibility studies can re-examine the results of the “creative research” so as to reduce the risks of failure in the use of the innovation, without losing out in terms of opportunities highlighted previously. It can also give rise to new opportunities.

When the company’s management decides to do this type of feasibility study, it gives an order to the project manager, allocating to him the necessary resources and establishing more precise objectives than those which described each

“innovation area” earlier on in this decision-making process. Deadlines are also imposed so that the feasibility study ends before the design launch of the new products or services which will incorporate the innovation.

The technical stages in a feasibility study are the following:

- the first sequence, before the design process starts, consists of anticipating the opportunities and risks associated with the stages of understanding, adopting and using the results of the creative research by those in the processor who are responsible for designing the new product or service;

- the second sequence consists of designing an initial supervision plan to implement during the stages of pre-study and study of the design process. It will be responsible for spotting new opportunities and capitalizing on them, but also for detecting new risks, and controlling their criticality;

- the third sequence consists of anticipating opportunities and risks associated with the stages regarding the design of construction processors and the delivery of the new product or service (mechanization of the product construction and the implementation of related services);

- the fourth sequence consists of designing a second supervision plan, to be implemented during the stages of mechanization, construction and delivery to the market of the new product or service. It is responsible for spotting the emergence of new opportunities and capitalizing on them, but also for detecting new risks, and controlling their criticality.

Supervision plans establish how added value is produced in the stages of design, mechanization, construction and delivery to the market of the future products or services which will incorporate the innovation, but also how exchanges will take place with stakeholders in the part of

the company responsible for the various capitalization and innovation stages.

In summary, the feasibility study on the introduction of an innovation into new services or products is intended to anticipate risks of failures and of not keeping opportunities at bay, before their design and the plan for their construction and delivery.

It helps to clarify the decision of the company management on the use of the innovation, as described by the creative research results, in the design of new products or services.

It also gives future project managers, for the products or services, the systems which will be responsible for constructing, implementing and delivering them to clients, as well as methods for limiting the risks of not achieving their objectives, and capitalizing fully on opportunities to ensure optimal returns on investment.

The processors which carry out these studies are led by the project manager of the innovation process. He makes frequent use of other human resources from the design and mechanization processors. As a consequence, the human resources of these processors are mainly of variable structures and are made available to the project manager. At any moment, he may need the opinion of the collaborators participating in the creative research program.

This project manager leads the feasibility studies by also entering onto the “territory” of the design team in order to ensure optimal use of the added value produced by the innovation process.

He reports to the company management which requested the feasibility study and provides information to those responsible for the design and industrialization in the future.

1.5.5. The decision-making stages of the innovation process

As in any project, the decision-making stages are crucial. It is at this stage where the risks are the highest. A decision is always the choice to carry out an action by anticipating future events using the information available. The more that information is available which helps to predict the future, the more the risks of making mistakes are reduced. However, researching information carries a cost and takes time. Innovations cannot always wait. Commercial windows are becoming narrower and narrower to make an innovation profitable. Competition is always fierce, and methods of consumption and technological resources evolve extremely quickly. Decisions are therefore always taken with partial results. Decision makers must always be visionaries.

Our suggestion for the segmentation of decisions makes the task easier.

Decisions must always be taken during the project reviews.

As above, the decision-making process suggested is as follows:

- deciding to foster new ideas to help the progress of the company;
- deciding to initiate prospective studies on how to use the idea to benefit the company;
- deciding to guarantee the ability of the company to mobilize the resources necessary, internally and externally, in order to fully realize its innovation process;
- deciding contractual issues with these stakeholders, and building a processor to carry out the innovation process;
- deciding to progressively design drafts which give a more accurate representation of the idea;

- deciding to carry out prospective studies on the socioeconomic impacts of the future products and services which will incorporate the innovation;

- deciding to guarantee the ability of the company to adopt a production system for the future products and services;

- deciding to validate the innovation.

In an innovation process, going back to a decision is not a mistake. It is better to modify a decision when the situation requires rather than to persist with a mistake so as not to “lose face”.

1.6. Classification of innovation processes

Innovation processes can be carried out in companies which are relatively predisposed, in terms of culture and time, to the specific mechanisms which are involved.

1.6.1. *Three types of company*

- Companies which are created through innovation (incubation); (E₁)

- Companies which periodically carry out innovation processes; (E₂)

- Companies which constantly innovate. (E₃)

The companies which belong to the first class have no company history and therefore have no company image, culture or infrastructure. The innovation process is the first process that they are undergoing, mainly relying on a “task force” managerial organization, led by the project promoter. These companies must seek out related support services which are now essential to ensure the survival or development of a company. The success of their innovation

process is heavily dependent on the competencies of these external services.

The companies in the second class cannot implement a permanent department specifically dedicated to innovation. The process is often periodically integrated into design or mechanization processes which, due to their repetitive nature, are more standardized. It is carried out by a “task force” which frequently draws from its surroundings ideas which are well developed and often protected by patents. In other cases, the process is started by one person, or a small team, which releases a new idea which deviates from the company’s typical practices. These companies have recognized specialized “expertise” which is the basis of their image. Creativity mainly relies on this shared expertise which helps to forge a common interest throughout the company. The innovation must be prepared to expand this expertise and must contribute to strengthening their image. These restrictions limit the capacity of an innovation process to start afresh except in the case of a new trend in society (a fashion, for example) which naturally highlights the company’s expertise and automatically encourages it to undergo an innovation process. There are consequently high chances of success and the risks are relatively low when the company has a culture of “project management”.

The companies belonging to the third class have an organization which is specifically dedicated to innovation. This organization tends to become burdened by the weight of feedback and its efficiency is limited by the lack of spontaneity in its creativity. They are able to produce new levels of expertise or images by dividing up the new activities created by an innovation process which can open significant and sustainable new markets. These new markets allow these companies to guarantee their future by aligning their developments with important social trends leading to economic development.

1.6.2. *Types of innovations*

Innovations are of the following types:

1) the creation of a new product or service which responds to a need which is as yet unanswered; (Type I)

2) the introduction of new functionalities into an existing product or service which allows it to better respond to a need which is only partially satisfied; (Type II)

3) the introduction of new technology into a product which improves the performance of previous functionalities; (Type III)

4) the introduction of new practices into an existing service which improves the performance of previous functionalities. (Type IV)

1.6.3. *Correlations between types of innovating companies and types of innovation*

Experience shows that there are correlations between the types of innovating companies and types of innovation. They are shown in the table below:

	I	II	III	IV
E ₁	x			
E ₂		x	x	x
E ₃	x	x	x	x

Table 1.1. *Correlations between types of company and types of innovation*

From now on we will only distinguish between two types of situation. The first includes the innovations which create new products or services (creation). The second includes the innovations which lead in some way to an evolution of existing products or services (modification).

EXAMPLE 1.2.–

- the invention of the steam train, GPS and prosthetic hip replacements are type I innovations;
- the creation of the mobile phone and related services, remote cardiology and bank card payment are all type II innovations;
- the electrification of the rail network, disk brakes on cars and the introduction of ceramic prosthetic hip replacements are all type III innovations;
- fast food, attending doctors and the sub-contracting of postal services in rural areas are all type IV innovations.

The distinction between the different types of innovation is important for several reasons:

- there are different triggers for the different types of innovation;
- the processes which carry out the innovation projects consist of different stages;
- the risks connected to the various innovations differ;
- the stakeholders in the processes carrying out the innovation projects do not have the same profiles;
- the impacts on the changes to behavior, attitudes and consumption methods are different;
- the impacts on the organization of the consumption process are also different.

1.6.4. *The specificities of type I innovations***1.6.4.1. *The triggers***

For type I innovations, the triggers are “creators” able to identify needs which have not yet been answered in a population ready to expend a lot of energy in order to satisfy

it, and connect them with an idea expressed by the draft of an original system configuration which could give a credible response to these needs partially or in full.

The creator is often in direct contact with the population which is experiencing the need or needs. It is even frequently a member of this population. Its research is guided by the awareness of the significance of such a need or needs. For instance, type I innovations in medicine are generally triggered by doctors who know technicians or engineers. The doctor is the “idea promoter” and the engineers of the company are the “developers” of the idea. They form a pairing which triggers the innovation process.

It can be observed that this type of innovation is often triggered by a pairing made up of “idea promoters” and “developers”. The director of a research and development department for a large consortium, which has registered more patents than any other in France in the last few decades, often noted that the innovation processes were always triggered within his company by what he called “shock pairings”. This refers to an idea promoter and a developer who are known within the company as often being in conflict and to whom a targeted innovation mission is entrusted regarding a need identified by marketing.

We often heard other research and development directors saying that the best innovations within their companies were often triggered by a group of enthusiastic individuals who carried out the creative research in private, alongside their official professional activity and with few resources.

A type I innovation can give rise to a new company. Today, there are structures which facilitate the creation of this type of company (“incubators”).

1.6.4.2. *The processes*

The creative research stage of a process producing a type I innovation is fundamental. It consists of several disconnected sequences interspersed with “dead time”.

Each sequence is carried out by a specific production system which can differ from one sequence to the next. The output data of a sequence can differ from the input data of the following sequence.

These processes are very long and highly unpredictable. Several innovations can be developed from each sequence. There are high risks of failure.

A company cannot take on all the sequences and necessary funding by itself. Generally, public authorities participate in financing this type of operation. Research must be carried out alongside. This often requires several scientific problems to be overcome in order to access more fundamental research.

Only when there is a convergence between the results of fundamental and applied research can a type I innovation emerge.

There are high risks linked to the decision to design a product or service which embodies a type I innovation. This cannot be taken without in-depth impact and feasibility studies. The system configuration results from the different sequences of creative research, which are difficult to predict and change from one sequence to the next. It is therefore not desirable to start these studies too early on. Moreover, the variety and quantity of information to be gathered and processed in these studies means that they cannot be carried out simultaneously, but one after the other, because the results of the first can significantly influence those of the second.

1.6.4.3. *The nature of the risks*

The risks linked to type I innovations are highly unpredictable because of the significant amount of new ground being covered by such innovations. Risks are therefore permanently anticipated throughout the various sequences in the creative research process, and impact and feasibility studies. They can be risks of any kind.

The anticipation or even the prevention of risks is extremely difficult. Therefore, controlling risks depends largely not on restrictions to creativity but on observing and correcting as quickly as possible intermediate results that could produce final results which do not comply with the expectations guiding the decision taken at the launch of the innovation process.

1.6.4.4. *The stakeholders who produce the innovation*

The stakeholders who participate in projects for type I innovations belong to inter-disciplinary teams which combine researchers, developers and well-informed consumers of products or services with similar functionalities to the future creation. These stakeholders belong to different structures which have decided to pool their skills and resources to carry out this type of innovative projects.

Today, these initiatives are promoted by the creation of competitiveness clusters.

1.6.4.5. *The impacts on consumption methods*

In general, type I innovations have impacts on the development of land, social evolutions and some aspects of individual behavior of a large sector of the population. Their entry into consumption systems is gradual, and requires the creation of a new environment adapted to the use of the innovation which must be envisaged and designed at the same time as the innovation.

For the innovation to be well received, it is necessary to carry out work on all areas of the consumption system so that the innovation is able to respond to the essential need of future consumers.

This type of innovation must consider “attractive” functions, but also “repelling” functions especially connected with changing habits, or even “unintended” functions which cause disturbance, for instance, to other methods of consumption or lifestyles.

For instance, the emergence of large superstores, as opposed to small shops, gradually changed the organization of service to the individual. Changes in consumption methods were gradual, with significant changes in land development, and “self-service” considered, by some consumers, as repelling factors. This innovation led to the disappearance of some social links between shopkeepers and customers, but also between the customers themselves.

1.6.5. Specificities of type II innovations

1.6.5.1. The triggers

For type II innovations, the role of circumstances is a little different. They are often created by a company which already exists and has a marketing department able to identify a need which is only partially satisfied by the company’s products or services, or those of competitors. Moreover, satisfying this need will lead to a strengthening of the company’s image by giving rise to profitable areas of originality compared to the competition.

The company then assembles its creators to research solutions, firstly functional and then technical, by fully capitalizing on the expertise of the company, or those with similar practices and culture.

In the agro-food sector, moving from a high-fat dairy-based product to a lighter version while keeping the same flavors is a type II innovation.

This innovation is only of interest if the company has or wishes to have an image based on the production of healthy foodstuffs. In this case, it must have a structure which is able to permanently carry out innovation processes with this strategic aim so that in the long term the market naturally associates the company name or some of its brands with the idea of “food which maintains or improves health”.

Generally speaking, type II innovations are only profitable if they align with a long-term strategy for strengthening the company’s image or for creating a new image. The company must therefore have a permanent structure which constantly undertakes innovation processes in compliance with the defined strategic direction, and which gradually builds a network of relationships with specialized providers especially with certain research centers.

1.6.5.2. *The processes*

The processes which produce type II innovations are extremely varied. They generally depend on the size of the innovation(s) involved in the project.

Firstly, it is necessary to distinguish between single- and multi-innovation processes.

For instance, a project focusing on the car of the future is a multi-innovation type II project. The first GPS integrated into a car was also a type II innovation. The combination of a medicine with an innovative device which transports the medicine to its target to treat an illness is another type II innovation.

The processes which carry out this type of innovation are characterized by the fact that they use existing technology

and they adapt it to integrate it into an existing product in order to enhance the functionalities of a product to better satisfy a major need of the market.

These processes are fully carried out by the company.

The risks of not achieving the expected performance of the new functionalities remain, as do the risks of not satisfying the needs as the market would have liked. Even more seriously, the company can also make a mistake in terms of the importance that the market attaches to the response provided to this need. It is also possible for more unexpected situations to arise: the new functionalities give rise to new needs which obliterate the interest in satisfying previous needs.

We will also see later that the introduction of new functionalities intended to be attractive to the market also introduces new repellent functions which prevent a successful entry into the market. In this case, the innovation is a commercial failure.

The introduction of a quality process in this type of innovation process is particularly essential for ensuring, above all, a better containment of the various risks.

The creative research stage of the innovation process does not generally require supplementary scientific research. The technologies or methodologies are known, but have not yet been used to perform these expected functionalities.

However, creative research must focus on the significant and various restrictions imposed on the project which are due to the fact that the innovation needs to be integrated into an existing product or service. It also often needs to be integrated into an operating system of a product or service which has become established, and operating habits which need to be taken into account. This collection of restrictions is a limiting factor to the creative research stage and must

be taken into account as early as possible in order to avoid modifications during this stage of the innovation process, which often entail significant consequences on managing risks, costs and deadlines.

These observations highlight the need to carry out feasibility studies in parallel with creative research by scheduling joint project reviews for these two stages in the process.

The feasibility study process can be more standardized since it is reproduced almost identically with one introduced to the next within the same company. It is possible to improve its performance by capitalizing on feedback produced.

Impact studies must start before the creative research and continue alongside it until the results of the creative research are configured. It is only with the final configuration of the innovation, deemed feasible and compatible with all the restrictions imposed by the existing configuration, that it is useful to research all the opportunities to grasp to optimize the value of the innovation.

1.6.5.3. *The nature of the risks*

The risks attached to type II innovations can be more easily anticipated and located. However, it is important to remember that a product is a complex system. Any integration of a new functionality can have direct or indirect effects on other functionalities even if they are not seemingly connected. In the same way, in order to grow the functionalities of a service, malfunctions can be caused to another aspect of the process by creating cause–effect links between certain actions contributing to its production, without this being clearly visible. In general, this type of innovation is created in companies which have decided to focus on innovation to build an image to differentiate themselves from their competitors. In this case, innovations

occur frequently. By using feedback, it is possible to locate the main areas of risk and anticipate them.

1.6.5.4. *The stakeholders who produce the innovation*

The stakeholders participating in projects focusing on type II innovations are generally engineers or technicians from the same company who belong to a department specialized in the production of this type of innovation. Their source of inspiration may come from other workers in the company or externally by practicing “economic intelligence”. The marketing services generally participate in these projects to identify the commercial target and to provide information on consumption methods of the target markets and the state of the competition.

1.6.5.5. *Impacts on consumption methods*

Type II innovations have less impact on social structure than type I innovations. However, in general, they have a significant impact on a limited and targeted sector of the population of future consumers (market sector). They can cause a significant change in certain professions by modifying practices and enhancing some activities which rely on the innovations integrated into the products or services and which are central to the profession.

For instance, remote cardiology modifies the organization of care and strengthens the role of some staff members who assist cardiologists. The cardiologists themselves are more involved in the prevention of cardiovascular diseases than in the past.

The introduction of in-built electronics in cars caused changes in terms of diagnoses, requiring significant investments from mechanics, and led to an evolution in the knowledge and expertise of repair shop staff.

1.6.6. Specificities of type II and IV innovations

1.6.6.1. The triggers

For type III and IV innovations, functionalities are already characterized and the innovation is limited to researching technology or new practices for the company to use on the product or service, which may have already been tested in other contexts. Therefore, the triggers are usually technicians or engineers responsible for “economic intelligence” within the company.

In the competitive context which we find ourselves in today, every company must constantly research type II and IV innovations, in order to guarantee its future. It can draw sources of inspiration from the dynamics of global technological and social changes.

These innovations, which can generate significant returns on investment, do not entail great risks for the company. They are limited to identifying, among its non-competitive environment, the use of new technologies and methodologies and to studying their transfer into the field of application of the functionalities of the products or services that the company wishes to improve in order to strengthen its competitiveness.

The trigger of these innovations is the combination of a clear need to evolve the performance of certain functionalities of the company’s products or services, and the discovery of “off-the-shelf” solutions by observing dynamics of evolutions in the company’s surroundings.

The benchmark can be an excellent trigger for this type of innovation.

1.6.6.2. The processes

The processes for type III and IV are identical. The functionalities of the product or service are unchanged, but

the objective of the innovation is to significantly increase the performance of certain functionalities by introducing new technologies and methodologies.

Creative research is limited, as before, to identifying existing technologies or methodologies by taking advantage of feedback regarding their use in other contexts, and to introducing them into a new configuration of the product or service to improve certain aspects of their performance.

As a result, the objectives of this research are well defined right from the start of this process. Uncertainties regard the performance of these new technologies in a new setting, the impacts on how to carry out a service and to ensure it is appreciated by beneficiaries.

The creation is limited to adjustments which are based more on a perfect knowledge of a technology or methodology than on imagination. Specialist expertise plays a key role in carrying out this type of process.

The impact study is essential in this type of innovation. It allows the project team to identify, as best as possible, the expertise created by capitalizing on feedback on the introduction of technology or methodology in other circumstances. They can then attempt to use similar situations to save time and better contain risks.

This study must also ensure that the new configurations of products or services are well perceived by future consumers as having real innovations which justify their attraction. Indeed, technological or methodological transpositions can be seen as simply gadget add-ons without offering any new usage value.

The feasibility study mainly examines how to introduce new practices which are based on different cultures.

1.6.6.3. *The nature of the risks*

The risks attached to type III and IV innovations are identifiable and, in general, are treated in the same way as those which are produced by type II innovations. It is common for an innovative project to combine type II, III and IV innovations.

1.6.6.4. *Stakeholders who produce the innovation*

The stakeholders who participate in the projects for type III and IV innovations are workers within the same company or workers for the company's providers. The directors increasingly encourage their providers to co-produce this type of targeted innovation with them, using a set of functional specifications. Major new risks can emerge at this stage. These are due to a lack of experts in the project team specialized in the new technology introduced into the innovation. It is the provider who has the expertise rather than the company. The company must ensure that it keeps hold of this type of expertise in order to maintain the leadership role in its relations with the providers. The company can also assemble its employees on a wider scale so that they become the drivers of proposals of this type of innovation (participative innovation).

1.6.6.5. *Impacts on methods of consumption*

Type III innovations have a weaker impact on consumption methods. They mainly affect the way of delivering product maintenance and after-sales services. They make products more robust and focus consumers' attention on the uses that they can make of these products – they have fewer concerns over the way the products they use work. The performance of the products' technical functions then becomes obligatory. Any drop in performance of these functions cannot be tolerated.

Type IV innovations are often intended to increase the consumer's comfort or passiveness when they co-produce a service with a contractor. When they affect services associated with products, they facilitate the use of the product.

1.7. Conclusion

The information developed in this chapter confirms the particular complexity and variety of innovation processes.

Every innovation process is a complicated project aiming for radical change. It is a "one-shot" process which can rely to a greater or lesser extent on feedback as a guide. The value of the innovation is closely linked to the significance of the risks and opportunities which emerge during the process. Containing these risks is not the same as "avoiding the risks", but identifying them relatively quickly, accepting to take them regardless of their initial criticality and gradually attempting to reduce the criticality to acceptable levels. The permanent opposition of "needs", "creation" and "production", based on three very different logics, is absolutely necessary.

The integration of a competitive quality process into the innovation process is therefore a complex action which must take into account all the specific characteristics of the process and the processor carrying it out. It is necessary to examine all these specificities in order to design the individual configuration of the quality process to be integrated into the innovation process.

Although these specificities entail different methodological implementations from one process to the next, in order to obtain the desired level of quality, it should be noted that they are based on the same logical principles. It is these principles that we will look at to identify and characterize in the next chapters.