COPENHAGEN BUSINESS SCHOOL

Msc .

STRATEGIC MARKET CREATION

The Role of Sales Department in the Development of Radical Innovations

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Master Thesis by

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Introduction

The literature about innovation abounds of material related to the development process of innovative products, focusing especially on the phases of idea generation, product design, prototyping, market test and launch; though there is not enough close examination of an important topic such as the level of involvement of the sales\marketing function in this process.

Therefore the general aim of this thesis is, to analyze the level of involvement of the sales\marketing department in the development of new products (and in particularly of radical innovations in industrial markets), more specifically:

- Give basic definitions about the concept of the innovation and of innovation process.
- To analyze the different models of innovation developed in the literature.

- To define the level of power and influence that the sales manager\sales department has on the development of the new product.
- To understand in which phases of the innovative process take place the involvement of the sales department.
- To make a specific comparison between the role of marketing in the development of new products in B2C and B2B markets.
- To analyze the role of marketing in industrial markets by analyzing the new process development of a Danish biotech company.

Research Questions

Basing on this premise it seems opportune investigate further on these topics and, consequently, to propose these research questions:

- Is the sales\marketing department involved in the development process of innovative products? Or is simply responsible for the market launch of the outcome of such process, without any possibility to get involved?
- In the market launch phase, there is the need for the sales\marketing department to develop specific competences for particularly innovative products (or radical innovations)?
- The role and the impact of marketing decisions about new product development are the same in the B2C and B2C context?

Main contents

In order to effectively answer to the research questions, various topics about innovation has will be introduced and investigated throughout this work.

First of all, the aim of the **first chapter** is to give a definition of innovation through the analysis of the various definitions that could be

found in the literature. In particular the general definition that best fits the complexity of this phenomenon is the one gave by the OECD 1991 study on technological innovation. This definition is important because remarks that innovation is an iterative process and that exist various types of innovation according to the degree of innovativeness of the product. Furthermore, in this chapter, is analyzed the difference between radical and incremental innovation and a framework for defining innovation is presented.

In the **second chapter** will be discussed the various models of innovation development process. Every model is differentiated among the others about the relationships between the functions involved in the development process, the workflow models, the feedback flows, and the composition of the development team. The reason behind this analysis is to confront these various models and an one that was used to develop a radical innovation in a company operating in the biotechnology industry.

The **third chapter** is focused on the role of marketing in the process of new product development. In this chapter is analyzed the role of marketing specialists in each phase of the new product development, focusing on the front-end activities, the marketing research activities and their limitations and the launch phase, that have been found to be the ones in which the marketing function is the most involved.

Finally in the **fourth** and last **chapter** the focus will be in the role of marketing in the development of industrial innovations, that present relevant differences with its role in developing consumer oriented products. Furthermore will be analyzed the case of a Danish company operating in the biotechnologies industry called Upfront Chromatography A/S, based in Copenhagen that developed an innovative process for protein extraction. The main aim of this analysis is to compare with the existing literature the innovation process and the role of the marketing function and to analyze the differences founded.

In the conclusions the results of this analysis will be exposed.

Research Method

The methodology followed to answer to the research questions is based on the research, comparison and critical review of the literature about the complex phenomenon of innovation, in particular:

- Radical innovations;
- New Product Development Processes;
- Strategies and tactics for launching of new products;
- Project management;
- Dynamics of industrial markets.

Furthermore a specific business case has been analyzed. The methodology followed in this research was mainly based on:

- In depth interviews with representatives of both sales\marketing department and technical department, pertaining the points quoted in the research question;
- Comparison of the Upfront's new product development models and selling practices with the existing literature.

Chapter 1: Definition of Innovation

1.1 Definition of innovation

Innovation, the process of bringing new products and services to market, is one of the most important issues in business research today. Innovation is responsible for raising the quality and lowering the prices of products and services that have dramatically improved consumers' lives.

By finding new solutions to problems, innovation destroys existing markets, transforms old ones, or creates new ones. It can bring down giant incumbents while propelling small outsiders into dominant positions. Without innovation, incumbents slowly lose both sales and profitability as innovative competitors past them. It provides an important basis by which world economies compete in the global marketplace (Hauser, Tellis, & Griffin, 2006).

Innovation is also a broad topic, and the research about this issue has proceeded in a variety of different disciplines including: engineering, marketing, organizational behavior, strategic management, operation management, quality management, technology management and economics.

Due to the great extent of these studies the usual definition of innovation: "*all of the stages from the technical invention to final commercialization*", seems to be too generic and there is a clear need to find a new one that is univocal and emphasize both the sides of idea generation and the business exploitation.

According to Roberts (Roberts, 2007), innovation is composed by two parts:

1. The generation of an idea or invention, and
2. The conversion of that invention into a business or other useful application.

Basing on these two key points, Roberts provide a really simple definition that includes the aspects of invention, development and business exploitation:

Innovation = Invention + Exploitation. (Roberts, 2007)

The invention process covers all efforts generated in the idea generation process aimed at creating new product\service concepts and getting them to work. The exploitation process includes all stages of commercial development, application and transfer, including the focusing of the concepts toward specific objectives, evaluating those objectives, downstream transfer of research and/or development results, and the eventual broad-based utilization, dissemination and diffusion of the technology-based outcomes (Roberts, 2007).

Another exhaustive definition of innovation could be taken from the 1991 OECD study on technological innovations, that best captures the essence of this topic from a perspective embracing all of the disciplines involved: "*Innovation is an iterative process initiated by the perception of a new market and\or new service opportunity for the commercial success of the invention*" (OECD, 1991).

This definition addresses two important distinctions (Garcia & Calantone, 2002):

1. The "innovation" process comprises the technological development of an invention combined with the market introduction of that invention to end-users through adoption and diffusion.

2. The innovation process is iterative in nature and thus, automatically includes first introduction of a new innovation and reintroduction of an improved innovation. This iterative process implies varying degrees of innovativeness and thus, necessitates a typology to describe different situations.

Once costumer needs are understood and the organization's strategies for innovating are in place, then begins the executional part of innovation with the implementation of that strategy that begins with the idea generation phase, pass through the concept design, market test and manufacturing process and end with a, hopefully successful, commercial product (Hauser, Tellis, & Griffin, 2006).

1.1.1 The typologies of innovation

A review of the existing literature propose a wide range of different types and classifications of innovation, including basic, radical, disruptive, discontinuous, next generation, incremental, imitative, new to the company, new to the world, and others.

Due to the complexity of the phenomenon, no universally accepted typology exists, but despite the numerous definitions and classifications, in the majority of the literature, only two types are taken in consideration: *incremental* and *radical*, in some cases with additional descriptors providing insight into the nuances of the innovation process.

An *incremental innovation* represents a relatively small and continued improvement to an existing technology, so that the cumulative impact of incremental innovations can be quite large as represented by an S-curve of progress. They can be easily defined as products that provide new features, benefits, or improvements to the existing technology in the existing market (Garcia & Calantone, 2002). Incremental innovations are important for two main reasons: first as a competitive weapon in a technologically mature market, however, these improvements typically

approach diminishing returns based on reaching some fundamental limit imposed by the physical nature of the core technology; and second, because of streamlined procedures based on existing technology can help to alert a business in good times to threats and opportunities associated with a shift to new technology plateau.

Incremental innovation can occur at any stage of the new product development process. At the conceptualization phase, R&D may use existing technology to improve an existing product design. At the mature stage of a product's life, line extensions may result in incremental innovations (Garcia & Calantone, 2002).

Radical innovation have been defined as innovation that embody a new technology that results in a new market infrastructure. If a new industry results from a radical innovation (i.e. the world wide web), new firms and new customers also emerge from that innovation (Garcia & Calantone, 2002).

In contrast to the incremental type, a radical innovation represents a dramatic, major, improvement based on a discontinuity in the type of core technology and magnitude of application performance achieved.

Most often, radical innovations have no clearly defined performance specification or market as first conceived (Dismukes, 2005), instead creates a demand previously unrecognized by the consumers. This new demand cultivates new industries with new competitors, firms, distribution channels and new marketing activities; thus an iterative process of technology push and market pull is typically involved during the product development process, where product specifications and cost are examined and debated by supplier and customer, and finally concurrently defined leading to eventual market acceptance.

Radical and incremental innovations have such different competitive consequences because they require quite different organizational capabilities. Organizational capabilities are difficult to create and costly to adjust. Incremental innovation reinforces the capabilities of established

organizations, while radical innovation forces them to ask a new set of questions, to draw on new technical and commercial skills, and to employ new problem-solving approaches.

1.1.2 Framework for defining innovation

The distinction between radical and incremental innovation has produced important insights, but it is fundamentally incomplete. There is growing evidence that there are numerous technical innovations that involve apparently modest changes to the existing technology but that have quite dramatic competitive consequences in term of market performance.

Existing models that rely on the simple distinction between radical and incremental innovation provide little insight into the reasons why such apparently minor or straightforward innovations should have such consequences (Henderson & Clark, 1990).

A framework designed by Henderson and Clark (Henderson & Clark, 1990) for defining innovation is an important tool that can provide the right criteria to define and distinguish between different type of innovations.

The unit of analysis of this framework is not the new product as whole, but the product system that is the combination of the components by which the product is formed and the linkages between the core concept and the components. According to the authors a component is as a physically distinct portion of the product that embodies a core design concept and performs a well-defined function (Henderson & Clark, 1990).

The logic behind the framework is that the innovativeness of a product can be defined in term of innovativeness of the product concept and innovativeness of the way the concept is linked with the components.

The main factors of the model are the "core concepts" of the product (they can be *reinforced* or *overturned*) and the "linkages between the core concepts and the components" (they can be *changed* or *unchanged*).

The result is a 2x2 matrix where the four quadrants are:

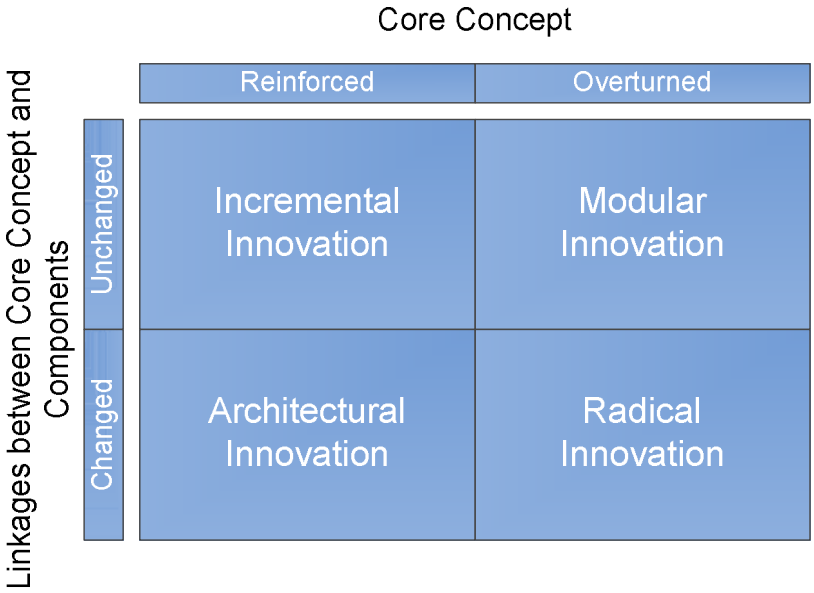

Figure 1: Framework for defining innovation[1]

1. **Incremental Innovation**: where the core concept are reinforced and the linkages with the components are unchanged.
2. **Modular Innovation**: where the core concepts are overturned but the linkages with the concept and the components are unchanged.
3. **Architectural Innovation**: where the core concepts are reinforced and the linkages with the components are changed.
4. **Radical Innovation**: in this case the core concepts of the product are overturned and the linkages with the components are radically changed or new.

Framed in this way, radical and incremental innovation are extreme points along both dimensions. Radical innovation establishes a new dominant design and, hence, a new set of core design concepts embodied in components that are linked together in a new architecture. Incremental

[1] Henderson, R. M., & Clark, K. B. (1990). Architectural Innovation: the Reconfiguration of Existing Product Technologies and the Faliure of Established Firms. *Administrative Science Quaterly* (35), 9-30..

innovation refines and extends an established design. Improvement occurs in individual components but the underlying core design concepts and the link between them remain the same (Henderson & Clark, 1990).

In between there are two intermediate kind of innovation: the *modular innovation* is an innovation that changes only the core design concept of a technology without changing the product's architecture.

The *architectural innovation* that is the reconfiguration of an established system to link together existing components in a new way. This does not mean that the components themselves are untouched. Architectural innovation is often triggered by a change in a component that creates new interactions and new linkages with other components in the established product. The important point is that the core design concept behind each component, and the associated scientific and engineering knowledge, remain the same (Henderson & Clark, 1990).

1.2 Innovation vs. New Product

Due to the complexity of the argument it is also significant to make a clear distinction between the definition of *innovation* and the definition of *new product*.

In the case of a new product it is relative to what preceded the product. Moreover, the overwhelming majority of so-called new products are development or variations of existing formats (Trott, 2005).

This further classification comes from the different points of view between the "technologists" and the "marketers": the firsts will probably stick to the amount of new technology contained in the product or to the innovativeness of the product architecture. The second category will, instead, look towards the creation new customers needs or at least meeting in innovative ways the old ones; which is more important than a mere scientific breakthrough. Indeed, the long term commercial success of the company should be guiding the principle on which product decisions

are made. However, in some industries, the development of knowledge and subsequent scientific breakthroughs can lead to possible product offerings that would help some sections of the population. Commercial pressures alone would still prevent these new product from being offered.

There have been may attempts to classify the new products under the commercial point of view. However it is worthy of note that only 10% of all new products are truly innovative (Trott, 2005). These products involve the greatest risk because they are new both to the company and to the marketplace. Most of the product activity is devoted to improving existing products (Trott, 2005).

1.2.1 Classification of New Products

Booze, Allen and Hamilton (1982) propose a commonly accepted classification that aims to clarify the innovativeness of a product under the company and market point of view.

1. **New to the world products**: these represent a small portion of all the new products introduced to the market. They are inventions that usually contain a significant development in technology, such as a new discovery, or manipulate existing technology in a very different way, leading to revolutionary new designs.
2. **New product lines (new to the firm)**: these products are new to the firm, but not to the market. They provide to a company the opportunity to enter into an established market for the first time.
3. **Additions to the existing line**: this category contains new products that are not so different from the ones the company is already offering in a existing line.
4. **Improvements and revisions to existing products**: these new products are replacement of existing products.

5. **Cost reductions**: this category of products may not be viewed as "new" under the market point of view, because they offer no new benefits to the consumer rather than possibly a reduction of price. However, under the firm perspective, the ability of offer similar performance while reducing production costs provides enormous value-added potential. Indeed, frequently this category provides the greatest financial rewards for the firm (Trott, 2005).
6. **Repositionings**: these are essentially the discovery of new application for existing products. This has more to do with branding and consumer perception rather than technical development.

According to this kind of classification a lifecycle of innovation can be drawn. *New to the world products* are usually launched by large companies with substantial resources, especially technical or marketing resources. Other large firms react immediately developing their own version of the new product (*new product lines* and *additions to existing lines*). Many medium and small sized firms compete with the innovator developing their own new product or improving the existing ones (*improvements and revisions*). As competition intensifies, companies will compete in the market for profits. The result is determined by the efforts to reduce the costs in order to increase those profits. Hence there is a phase of re-designing the production process in order to obtain *cost reductions*.

Chapter 2:
New Product Development Models

2.1 Definition of Product Development Model

A process is a sequence of steps that transforms a set of inputs into a set of outputs. A product development process is a sequence of steps or activities that a company employs to conceive, design and commercialize a product. Many of these steps are intellectual and organizational rather than physical. Some organizations define and follow a precise and detailed development plan, while other may not even be able to describe their own process. Furthermore every organization has its own development process that is slightly different from the other organizations, as well as the same company can use different model for different projects.

2.1.1 Utility of a Product Development Model

A well defined development process is useful for the following reasons (Ulrich & Eppinger, 2004):

1. **Quality Assurance**: a development process specifies the phases a development project will pass through and the checkpoints along the way. Following these checkpoints wisely will assure the general quality of the project.
2. **Coordination**: a clearly articulated development process acts as master plan which defines roles of each of the players on the development team. This plan informs the members of the team when their contribution will be needed and with whom they will need to exchange information and materials.

3. **Planning**: a development process contains natural milestones corresponding to the completion of each phase. The timing of these milestones anchors the schedule of overall development process.
4. **Management**: a development process is a benchmark for assessing the performance of an ongoing development effort. By comparing the actual events to the established process, a manager can identify possible problem areas.
5. **Improvement**: the careful documentation of an organization's development process often helps to identify opportunities of improvement.

2.2 Project Teams

Unlike some other internal operations, the development of new products is not an exclusive of one single department, and it is because the variety of different functions and departments involved that this process is difficult to manage.

Product development is an interdisciplinary activity requiring contributions from nearly all the functions of a firm; however, three functions are almost always central to a product development project (Ulrich & Eppinger, 2004):

- **Marketing**: the marketing function mediates the interactions between the firm and the customers. Marketing often facilitates the identification of product opportunities, the definition of market segments, and the identification of customer needs. It is also responsible for arranging the communication between the firm and its clients, sets prices and oversees the launch and the promotion of the product.
- **Design**: the design function leads the definition of the physical form of the product to best meet the customer needs. In this

context, the design function includes *engineering design* (mechanical, electrical, software, etc.) and *industrial design* (aesthetics, ergonomics, user interfaces).

- **Manufacturing:** this function is primarily responsible for designing and operating the production system in order to produce the product. Broadly defined, the manufacturing includes also purchasing, distribution and installation.

Different individuals within these functions often have specific disciplinary training areas.

Several other functions, including finance, sales and legal are frequently involved on a "part-time" basis in the development of a new product. Beyond these broad functional categories, the specific composition of a development team depends on the particular characteristics of the product.

Few products are developed by a single individual (Ulrich & Eppinger, 2004), but rather the companies prefer to use teams composed by different individuals with different backgrounds. This introduces the notion of a group of people working as team developing an idea or project proposal into a final product suitable for sale.

Intuition suggests that inter-functional communication is important to new-product development. New products will be more successful if R&D and engineering understand customer needs, marketing understands technological capabilities and constraints, and both understand the implications for manufacturing and competitive strategy (Griffin & Hauser, 1992).

The vast majority of large firms create new project teams to work through this process. From initial idea launch, the project will usually flow and iterate between marketing, technical and manufacturing groups of specialists (Trott, 2005). These *project teams* are coordinated by a *team leader* that could be drawn from any of the functions of the company and

can be thought of as consisting of a *core team* and an *extended team* (Ulrich & Eppinger, 2004). In order to work together effectively, the core team usually remains small enough to save elasticity and fastness in the decision process. Usually the members of this team are taken from the three functions described above. The extended team, instead, will consist of a wide range of persons with different specializations and backgrounds that will collaborate occasionally with the core team, they could come both from the inside of the company or from the outside like suppliers, consultants and, in some cases, customers.

A product development team is the scheme by which individual designers and developers are linked together into groups. The links among individuals may be formal or informal and include, among the others, these types (Ulrich & Eppinger, 2004):

- **Reporting relationships**: give rise to the classic notion of *supervisor* and *subordinate*. These are the formal links most frequently shown on an organizational chart.
- **Financial arrangements**: individuals are linked by being part of the same financial entity, such as that defined by a particular budget category or profit-and-loss statement.
- **Physical layout**: links are created between individuals when they share the same office, floor, building or site. These links are often informal, arising from spontaneous encounters while at work.

Any particular individual may be linked in several different ways to other individuals, for example an engineer may be linked by a reporting relationship to another engineer in a different building, while being linked by physical layout to a marketing person sitting in the next office. The strongest organizational links are typically those involving performance evaluation, budgets and other resource allocations.

2.2.1 Managing a Project Portfolio

A firm's overall profitability results from the portfolio of products it commercializes over time and across product lines. Managing the portfolio means making repeated, coherent strategic investments in markets, products, and technologies. Because not all projects survive the development process, some firms simultaneously initiate multiple projects that target the same market, but do so using different technical approaches. For these firms, optimal pipeline structures (how many projects to initiate using different approaches) can be modeled as depending upon the magnitude of the business opportunity, cost (by stage) of developing each project, and survival probabilities of the project at the completion of each stage (Hauser, Tellis, & Griffin, 2006).

2.3 New Product Development Process

The product development emerging view in the industry is an end-to-end process that draws on marketing, engineering, manufacturing and organizational development.

The early stages on new product development are usually defined as idea generation, idea screening, concept developing and concept testing. They represent the formulation and the development of an idea prior to its taking any physical form (Trott, 2005). The subsequent stages involve adding to the concept the work of those are involved in the development (manufacturing, engineering, product designers and marketers) and taking decisions regarding how to best realize the product, the material to use, possible designs, and the potential market evaluations.

The organizational activities undertaken by the companies as it embarks on the actual process of new product development have been represented by numerous different models (Trott, 2005). These models have attempted to capture the key activities involved in the process, from the idea generation to the commercialization of the product.

The majority of the literature tend to synthesize the process as an eight phase linear model (Trott, 2005) regardless for the major differences and the different focuses existing in the new product development of the various industries.

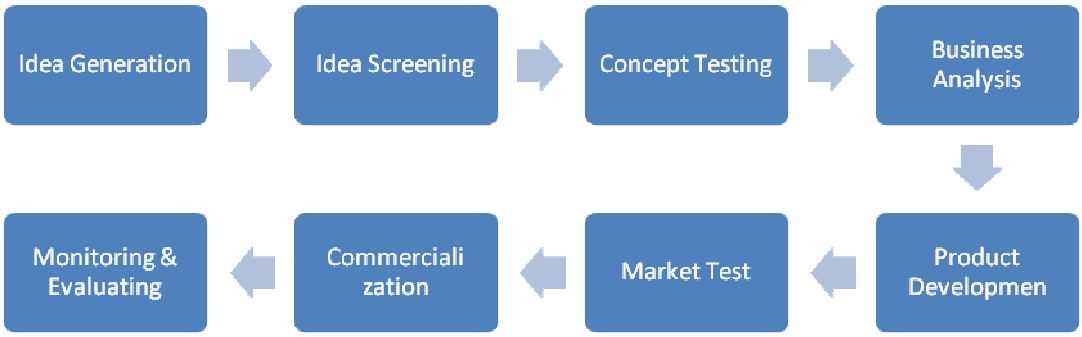

Figure 2: Linear product development process[2]

The core of this process is the *product development funnel of opportunity identification*, design and engineering, testing and launch. The funnel shape of this model recognize that, for a single successful product, there will be many failures, although some may be recycled, reworked and improved to become in future successful products. The funnel also recognize that the most successful firm are the ones that are not working in only one project, but have multiple product concepts in the pipeline at any given time, forming a portfolio of projects.

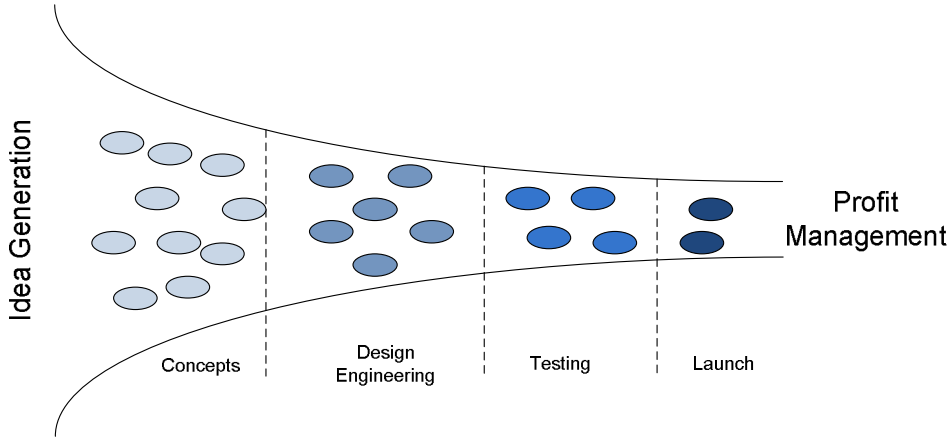

Figure 3: The funnel of opportunity identification[3]

[2] Adapted from: Trott, P. (2005). *Innovation Management and New Product Development.* Harlow: FT - Prentice Hall.

Risk is inherent in product development: few of the many concept will be transformed in a real product and the information need to evaluate alternative concepts is often imperfect, difficult to obtain and hard to integrate in the organization. For each success, the process begins with 6 to 10 concepts that are evaluated and either rejected or improved as they move from opportunity identification stage to the launch phase (Hultink, Hart, Robben, & Griffin, 1999).

2.4 The Fuzzy Front-End

The Fuzzy Front-End is an area where there is a significant degree of uncertainty and stays in the organization along with the new product development process. This is true particularly for discontinuous or new-to-the-world type of innovations. This is considered to be the earliest phase of the product development phase and is meant to denote all time and activity spent on an idea prior to the first official meeting of the development team to discuss it (Reid & de Brentani, 2004).

The fuzzy front-end activities them self can be distinguished in early activities and late activities regardless for the type of innovation. The early activities are mainly related to problem\opportunity structuring and\or identification\recognition, information colleting\exploration and "up-front homework" (Reid & de Brentani, 2004). Late activities are seen as involving aspects of idea generation and concept development, continued information collection, and informal prescreening with possibly some initial fund allocation for exploring a new idea.

Conceptually, early decisions in product development processes have the highest level of risk and there is no doubt that the fuzzy front end of a product development process has a big effect on a product's ultimate success. In this stage a firm can identify the best market opportunities, technological innovations, or set of unmet customer needs,

[3] Adapted from: Hauser, J., Tellis, G. J., & Griffin, A. (2006, November-December). Research on Innovation: A Review and Agenda for Marketing Science. *Marketing Science*, 687-717.

in order to determine the direction of the new product path; the better understanding of these elements can lead, in the remaining steps of implementation, to a competitive advantage.

We focus on two aspects of the fuzzy front end: ideation and the special issues associated with moving radical innovations through the fuzzy front end.

2.4.1 Idea Generation

The idea generation (ideation) has been recognized as a critical start to the product development process. In this phase creative processes, from brainstorming to structured approaches based on memory-schema theory encourage participants to "think outside the box".

Many of the theories being developed and explored, such as schema theory or context effects, might inform the effectiveness of idea generation methods and procedures. More recently, research has been done on three methodologies developed to create structure within ideation: templates, TRIZ, and incentives (Hauser, Tellis, & Griffin, 2006).

A template is a systematic mean of changing an existing solution into a new solution. Templates consist of smaller steps called "operators:" exclusion, inclusion, unlinking, linking, splitting, and joining. For example, the "attribute dependency" template operates on existing solutions by applying the inclusion and then the linking operators. Other templates include component control (inclusion and linking), replacement (splitting, excluding, including, and joining), displacement (splitting, excluding, and unlinking), and division (splitting and linking).

TRIZ (Theory of Inventive Problem Solving) is another "in-the-box" system used widely by product development professionals. Based on patterns of previous patent success, TRIZ has been applied by product development teams to resolve trade-offs between a limited set of "competing" physical properties.

2.4.2 Radical Innovation in the Fuzzy Front End

With step-change leaps in performance or cost reductions, radical innovations have the potential to provide the firm whit the profits and long-term competitive advantage. However, rather than starting from market needs, radical innovation frequently starts from technology capability. These projects, due to their technology development nature, spend a long time in the fuzzy front end.

The research suggests that it is important to identify the customers and markets who will find the innovation most appropriate first and to find ways to query these customers about concepts and technologies that are outside their realm of experience. There are many challenges, relative to incremental products, when moving these technologies from the laboratory to the market.

2.5 New Product Development Models

There are many streams in the new product development theories making the literature and the research about this argument very varied and fragmented. Brown and Eisenhardt (1995) have tackled this problem, proposing a framework that group the various theories into three main streams, that have been developed around three key research findings: *Rational Planning, Communication Web, Disciplined Problem Solving*.

The *rational planning* is a planning methodology that should be applied by the management in the development of new products within the organizations; the main focus on this stream is the business performance and the financial performance of the product.

The *communication web* studies the use of information and sources of information by product development teams. The focus of this stream is on the effects of communication on project performance (Brown & Eisenhardt, 1995).

Disciplined problem solving stream focuses on how problems encountered during the product development process were overcome, and tries to examine the various phases and the wide range of factors involved.

The contribution of Brown and Eisenhardt (1995) is very important to make order among the various theories and studies, but offers little help under the point of view of a manager that on how he or she should organize and manage the workflow of the innovation process.

Another classification taken from the work of Trott (2005) could be useful in terms of practical applications. This classification includes:

1. Department-stage models;
2. Activity-stage models;
3. Cross-functional models (teams);
4. Conversion-process models
5. Response models;
6. Network models;
7. Decision-stage models.

2.5.1 Departmental-Stage Models

Departmental-stage models represent the early form of new product development models (Trott, 2005). These can be shown as based around the generic innovation model already cited before, where each department is responsible for a specific task.

They are usually represented in this way: R&D department provides new interesting technical ideas; the engineering department then take these ideas and develop possible prototypes; the manufacturing department explore a viable way to produce in series the prototype and then the marketing department will take in charge of the commercialization. This workflow is conceived as an insular model were each department works without any contact with the other departments,

and the project is seen as input from the previous department to transform into an output for the following department.

It is now widely accepted that this insular departmental view of the process hinders the development of new products (Trott, 2005). The process is usually characterized by a great deal of reworking and consultation between functions. In addition market research provides continual inputs to the process. Furthermore, control of the project changes on a departmental basis depending on which department is currently engaged in it.

2.5.2 Activity-Stage Models and Concurrent Engineering

These are similar to the previous one, but they emphasize the activities conducted rather than departmental divisions. They also facilitate activities through the use of feedback loops, something that is not considered in the departmental models. The latest evolution of the activity-stage models have also emphasized the possibility of simultaneity of the processes or the parallel development of different technologies with the same aim: the most efficient will become the "official" new product.

2.5.3 Cross-Functional Models (Teams)

Common problems that occur within the product development process centre around communications between different departments. In addition, projects would frequently be passed back and forth between functions. Moreover, at each interface the project would undergo increased chances, hence the lengthening of the product development process. (Trott, 2005)

The approach with the *cross-functional teams* tend to limit these limitations by having a dedicated team with people representing the various function of the company. The use of these cross functional teams

require a fundamental modification on the company's structure: it puts emphasis on the use of project management and interdisciplinary teams.

2.5.4 Conversion-Process Models

This models view the development of new products as a set of numerous inputs to be put into a "black box" where they are converted into an output. For example, the inputs could be customer requirements, technical ideas, and manufacturing capability and the output would be the product. The concept of variety of information inputs leading to a new product is difficult to criticize, but the lack of any detail elsewhere is the biggest limitation of such models (Trott, 2005).

2.5.5 Response Models

These models focus on the individual's or organization's response to a new project proposal or a new idea. This approach has revealed additional factors that influence the decision to accept or reject new product proposals, especially at the screening stage (Trott, 2005).

2.5.6 Network Models

The most recent thinking on the subject of innovation processes are the network models.

These models are based on the studies of Nonaka and Takeuchi (1995) about the building and the transmission of knowledge from a variety of different inputs such as marketing, R&D and manufacturing. This knowledge is build up gradually over time as projects progress form initial ideas (technical breakthrough or market opportunity) through development.

Essentially network models emphasize the external linkages coupled with the internal activities that have been shown to contribute to successful product development. There is evidence that external linkages

can facilitate additional knowledge flow into the organization thereby enhancing the product development process.

These models suggest that new product development should be viewed as a knowledge accumulation process that requires inputs from a variety of sources.

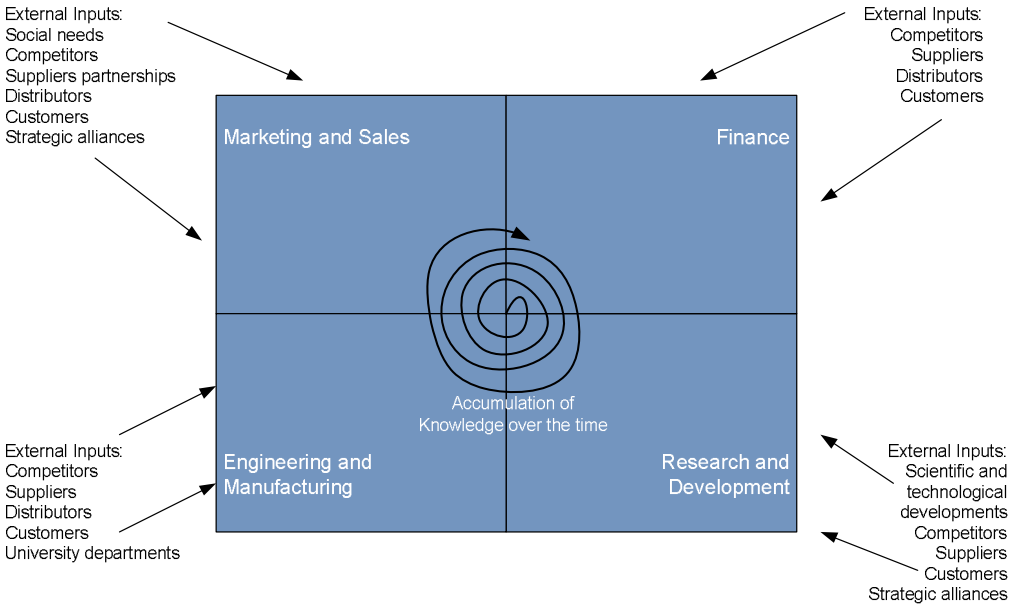

Figure 4: A network model for new product development[4]

2.5.7 Decision-Stage Models

These models represent the new product development as a series of decisions that need to be taken in order to progress the project (Cooper, 1990). Like the activity-stage models, many of these models also facilitate iteration through use of feedback loops. However, a criticism of these models is that such feedbacks is implicit rather than explicit (Trott, 2005).

The most famous of this type of model among the professional is the *stage-gate* model, elaborated by Robert Cooper in 1990 that is illustrated in the following paragraph.

[4] From: Trott, P. (2005). *Innovation Management and New Product Development.* Harlow: FT - Prentice Hall.

2.6 Cooper's Stage-Gate Innovation Model

Most firms organize their work of product development as a series of gates in a process that became known as "*stage-gate model*" (Cooper, 1990).

Stage-gate systems simply apply process management methodologies to the innovation process. The stage-gate system recognize that product innovation is a process, and like other processes, can be managed.

Usually in this kind of methodology the innovation process is sub-divided into a number of *stages* or work stations. Between each work station or stage there is a quality control checkpoint or *gate*. The stages are where the work is done, the gates ensure that the quality is sufficient. The entrance to each stage is a gate; these gates control the process and they are characterized by a set of deliverables or inputs, a set of exit criteria, and an output. The inputs are the deliverables that the project leader must bring to the gate. A set of deliverables is specified for each gate, as is a set of quality criteria that the product must pass before moving to the next work station. The criteria are the items upon which the project will be judged, the hurdles that the project must pass at that gate to have the same opened to the next stage. The outputs are the decisions at the gate, typically a Go\Kill\Hold\Recycle decision, and the approval of an action for the next stage.

The project leader drives the project from stage to stage, gate to gate. Each project leader is required to provide the specified deliverables and meet the stated at a given gate. He or she is well aware of what inputs are required to "pass" the next gate and organizes the team to meet the input requirements of the upcoming gate (Cooper, 1990).

Figure 5: The stage-gate model of innovation[5]

The implementation of stage-gate system requires certain organizational changes within some firms. No longer can projects be handed from department to department, but a team leader must carry the project in all stages. A second organizational change for some firms is the involvement of senior management as gatekeepers. Successful product innovation requires significant resources demands the commitment of top management. Gates manned by senior managers are not only essential to gate ways systems; they build in top management involvement and commitment (Cooper, 1990).

The spiral model is a modified version of the stage gate model. In this model the product development team cycles quickly through the stages from opportunity to testing. The theory of spiral processes puts a premium on speed while forcing the team to get the engineering and the market feedback quickly and often. This process has many feedbacks loops and, more importantly, the entire process is repeated many times as the product "spirals" to completion (Hauser, Tellis, & Griffin, 2006).

The discussion and debate in the field has reached the stage where research is necessary to determine which process is best to which context; for instance, for less complex projects a simplified stage-gate model can be used. According to Hauser et al. (Hauser, Tellis, & Griffin, 2006) there are at least six dimensions that have to be taken in

[5] From: http://www.stage-gate.com/knowledge_pipwhat.php

consideration when choosing the product development process that can allow the best result in given conditions:

1. Fast vs. slow industry clock speed,
2. Innovation within a current business vs. opening a new space,
3. Radical vs. incremental innovation (in technology and/or costumer needs),
4. High modularity vs. low modularity,
5. High product complexity vs. low product complexity,
6. Physical goods vs. services.

Fast vs. Slow Clock Speed

Sequential processes have been successful in slow-moving industries such as consumer packaged goods, whereas spiral processes are being adopted by some fast-moving industries such as software and high technology. Some degree of sequential completion is required in a number of businesses affected by regulatory agencies (Hauser, Tellis, & Griffin, 2006).

Current Business vs. New Business

Innovation supporting current business lines is constrained by strategy, potential cannibalization, brand image, existing engineering and manufacturing resources, and current marketing tactics. Sequential processes can draw on engineering, customer, and market knowledge.

However, innovation launched into the "white space" between business units often requires new resources, new knowledge, new strategy, and new ideas. The innovator must learn quickly about segments or customer needs and preferences. Spiral or overlapping processes may encourage and enable rapid experimentation and knowledge acquisition to innovate into this white space (Hauser, Tellis, & Griffin, 2006).

Radical Innovation vs. Incremental Innovation

Most product development efforts result in incremental innovations Sequential processes are effective for developing evolutionary products. Radical innovation often requires developing products with an entirely new set of performance features. As a result, the unknowns and risk are enormous compared to those in incremental development (Hauser, Tellis, & Griffin, 2006).

High vs. Low Product Modularity and High vs. Low Product Complexity

When the design of a product or service can be decomposed into more or less independent components (a highly modular design) and/or when the product design is not complex, sequential processes may work well. Such high complexity or integration requires intermediate "builds" to effect integration and test the boundaries of component performance. High integration and high complexity often require spiral processes (Hauser, Tellis, & Griffin, 2006).

Physical Good vs. Services

The majority of all research on sequential product development processes has focused on physical goods. There has been less research on development processes for services, which are intangible, perishable, heterogeneous, simultaneous, and coproduced (Hauser, Tellis, & Griffin, 2006).

2.7 Characteristics of Successful Product Development

Despite the innovation model chosen, successful product development result in products that can be produced and sold profitably. Yet profitability is often difficult to assess quickly and directly.

Five more specific dimensions, all of which ultimately related to the profit, are commonly used to assess the performance of a product development effort (Ulrich & Eppinger, 2004):

1. **Product quality**: is ultimately reflected in market share and the price that customers are willing to pay.
2. **Product cost**: product cost determines how much profit accrues to the firm for a particular sales volume and a particular sales price.
3. **Development time**: determines how responsive the firm can be to competitive forces and to technological developments, as well as how quickly the firm receives the economic returns from the team's effort.
4. **Development cost**: it is usually a significant fraction of the investment required to achieve the profits.
5. **Development capability**: it is an asset the firm can use to develop products more effectively and economically in the future.

An high performance along these five dimensions should lead to a commercial success; however other performance criteria are also important. These criteria arise from the interest that stakeholder have in the company including the members of the development team, other employees, and the community in which the product is manufactured.

Chapter 3:
Role of Marketing in the Innovation Process

3.1 Role of Marketing in the Innovation Process

The previous chapters of this work have outlined the definition of innovation[6]; some of the necessary conditions for the innovation to occur; and have shown some of the various new product development models that are represented in the existing literature[7]. Although important, however, these elements alone are not sufficient themselves to the development of an innovation; this is because, as any other internal organizational process, the innovation process has to be managed by people. The concepts strategy, marketing and technology have to be organized and coordinated effectively.

The marketing mix is a set of variables that are to a large extent controllable by the company, normally referred as "four Ps": product, price, place and promotion. All four factors allow some scope for innovation: product innovation results in new or improved product and services, and may change the basis of competition; product innovation allow some scope for premium pricing, and process innovation may result in price leadership; innovation in logistics may affect how a product or service is made available to customers, including distribution channels and nature of sales points; innovations in media provide new opportunities for promotion (Tidd, Bessant, & Pavitt, 2005).

[6] Cf. Chapter 1.
[7] Cf. Chapter 2.

When an organization has adopted a proactive approach to new-product development, the first step in implementing it is to identify areas of opportunity. This effort is divided in two further steps: in the first step, markets and their associated technologies are defined and opportunities with them are assessed. Then specific ideas are generated to tap the potential of these markets and the firm's competitive advantages. When this opportunity identification phase is complete, design work begins based on the evaluation and refinement of the idea as a physical and psychological entity that delivers benefits to the consumer (Urban & Hauser, 1980).

According to Urban & Hauser (1980) the process for developing a new product can be conceptually reduced to five essential steps:

1. Opportunity identification;
2. Design;
3. Testing;
4. Introduction;
5. Life-cycle management.

Opportunity Identification

At the opportunity identification phase, effort is made to find markets that are growing, profitable, and vulnerable. This requires capability to forecast global demand and technology. Opportunity identification includes approaches that describe a market in term of its structures and its component segments. This step identifies opportunities that match the strengths and the capabilities of the innovative organization.

With an understanding of the market and technological potential, the next task is to generate creative ideas to tap this potential. By understanding idea sources and creative group processes, the organization generates ideas that integrate the specific engineering, R&D, production, and marketing inputs. The ideas are in form of high potential

concepts that may ultimately become successful products. The output should stretch the realm of feasibility and be targeted carefully to match the strategic opportunity.

Design

In the design phase, these new ideas are evaluated and refined to produce a product with physical and psychological attributes that indicate a high probability for success in the market. Creative R&D and development engineering occur in this phase as well as the identification of a strategic positioning and the marketing plan for the new product.

The design effort begins whit the newly generated ideas, selects the ideas with the greatest potential, and refines them to fulfill the market needs. The key concept here is that preliminary technical and market ideas, no matter how good change and evolve as the result of an iterative cycle. The actual number of iterations in the development process steps would depend on the product. Each iteration provides better information, refines the product concept and move it closer to a marketable product.

Service and industrial goods also pass through iterative stages that come closer and closer to what will be presented in an actual test.

Testing

Testing begins with separate testing of the components of the overall product strategy. Once component of the strategy are refined they are tested together.

In some industries, like services or industrial good, a market test is very difficult to implement. In those cases a market pre-test research could be useful.

Introduction

Once a product has been tested, it is ready to be introduced.

If the firm anticipates rapid competitive entry, it will want to introduce the product quickly and establish a firm position in the market.

But if the firm feels that it has significant lead on its competitors, or it does not have capital to support a full-scale introduction, or if there is some risk involved in the projected customer base, it may introduce the product on a market-by-market basis or what is called "roll-out".

During the introduction, whether it is rapid or roll-out, the firm must monitor and manage the marketing strategy. Even the most carefully designed and tested product can run into trouble in a national introduction. Variations in customers tastes over time or across regions, unanticipated competitive reaction, troublesome channel of distribution, or even crises like a material shortage or production quality problems or product quality problems can all act to undermine the success of full-scale introduction.

Life-cycle Management

After long time efforts a relevant money investments, the product can be successfully launched to the market. The profits rewards for this effort must now be returned to justify the risk of the investment of developing a new product. Maximizing profit requires an effective decision support system. Precise calibration of market response through statistical analysis, experimentation and management science models can help managers to increase the profits for the product. Price, advertising, sales effort and promotion strategies require change to improve profitability as the product moves through the mature phase of the life cycle.

At the end to the maturity phase, either the product must be repositioned through product innovation (incremental innovation[8]), or managed through its decline phase to harvest its remaining profit potential. If is to be rejuvenated, the new product development process is repeated to find the best target market and design to revitalize the product's life-cycle.

[8] Cf. paragraph 1.1.1

Carefully analyzing these steps it's easy to understand that marketing and selling people can have a great influence on the whole process, especially in the front end activities[9] where market research plays a fundamental role.

Marketing focuses on the needs of customers, and therefore should begin with an analysis of customers requirements, and attempt to create value by providing products and services that satisfy those requirements.

The greater amount of marketing resources a firm invests in the development and in the launch of a new product, the higher is the probability of success. Marketing efforts for the new product accelerate diffusion process, and speed up the adoption rate. (Debruyne, Moenaert, Griffin, Hart, Hultink, & Robben, 2002).

3.1.1 Market Research

During the development of new products, the role of sales and marketing function is relevant in different aspects; in first instance for its basically function: the *market research*.

Given the inherent risk an complexity tied to the develop and the launch of a new product to the market, managers have asked for many years if this risk can be reduced through the marketing research. Advocates of marketing research argue that such activities ensure that companies are consumer-oriented. In practice, this means that the new product are more successful if they are designed to satisfy a perceived need rather than if they are designed simply to take an advantage from a new technology. Indeed, the danger that many companies wish to avoid is the development of products without any consideration of the market (Trott, 2005).

The issue of market research is controversial (Trott, 2005). The marketing literature has traditionally portrayed the new product

[9] Cf. paragraph 3.2

development as essentially a market/customer-led process, but paradoxically, many of the major market innovations appear in practice to be *technologically driven*, to arise from a technology seeking a market application rather than a market opportunity seeking a technology (Trott, 2005).

The role of marketing research in new product development is instead more questionable with major product innovations, where no market exists (Trott, 2005) because of two reasons:

- First: is potential customers are unable to understand adequately the new product, then the market research will most likely provide negative answers.
- Second: frequently customers have some difficulties in making explicit their needs.

Confronted with a radically new technology, consumers are not able to understand what needs the technology can satisfy because they may not be able to link physical product characteristics to the outputs of the innovation.

In case of discontinuous or radical innovation the use and validity of traditional market research is questionable and some researchers (Trott, 2005) argue that such approaches may even discourage the developing of radical innovations. It may be also argued that for major innovations a smaller amount of market research is needed. This kind of approach is characterized by the so-called technology push innovation model. Products that emerge from this model are generated with little consideration for the market, in some cases a market for these products may not even exist.

3.1.2 Limitations of the marketing research techniques

Despite the importance of the market research in gathering the necessary information for an affective new product development and launch, many of the standard marketing tools and techniques are of

limited utility for the development and commercialization of novel or complex products or services. A number of weaknesses can be identified (Tidd, Bessant, & Pavitt, 2005):

- **Identifying and evaluating novel product characteristics**. Marketing tools such as *conjoint analysis* have been developed for variations of existing products or product extensions, and therefore are of little use for identifying and developing novel products or applications.
- **Identifying and evaluating new markets or businesses**. Marketing techniques such as segmentation are most applicable to relatively mature, well-understood products and markets, and are of limited use in emerging, ill-defined markets.
- **Promoting the purchase and the use of novel product and services**. The traditional distinction between consumer and business marketing is based on the characteristics of the customers or users , but the characteristics of the innovation and the relationship between developers and users is more important in the case of novel complex products and services.

3.2 Front-end activities

The opportunity identification and the design of the new product[10] demand more coordination among the functions than any other phase; for this reason the marketing and sales function can have a major impact given to the feedbacks that the direct contact to the market can give.

The various activities done during these phases can be defined according to Ulrich & Eppinger (2004) as *front end activities* and they consist of all the activities between the idea generation and the development plan.

The front-end activities are (Ulrich & Eppinger, 2004):

[10] Cf. paragraph 3.1

- **Identifying customer needs**: the goal is to understand customers' needs and effectively communicate them to the development team. The output of this step is a set of carefully constructed customer need statements, organized in a hierarchical list, with the importance weightings for each need.
- **Establishing target specifications**: specifications are precise descriptions of what a product has to do. They are the translation of the customer needs into technical terms. Targets for the specifications are set early in the process and represent the hopes of the development team. Later these specification are refined to be consistent with the constraints imposed by the team's choice of production concept. The output of this stage is a list of specifications. Each specification consists of a metric and a target value for that metric.
- **Analysis of competitive products**: an understanding of competitive products is critical to successful positioning of a new product and can provide a rich source of ideas for the product and production design. Analysis of competitive products is also called *competitive benchmarking*. Competitive benchmarking is performed in support of the specifications activity as well as in support of concept generation and concept selection.
- **Concept generation**: the goal of this activity is to analyze systematically the different product concepts that may be applied to meeting the customer needs. Concept mix includes of external search, creative problem solving within the team and systematic exploration of the various solution fragments that the team generates.
- **Concept selection**: is the activity in which various product concept are analyzed and sequentially eliminated to identify one preferred concept. This activity is strongly related to the funnel of opportunity identification, where a bunch of different initial

product concepts are progressively reduced to few or only one relevant concept[11]. The process usually requires several iterations and may initiate additional concept generation and refinement.

- **Refinement specifications**: the target specifications set earlier in the process are revisited after a concept has been selected. At this point, the team must commit to specific values of the metrics reflecting the constraints inherent in the product concept.
- **Economic analysis**: while usually the economic analysis is always showed as a later activity, an early economic analysis will always be performed before the project even begins. The team, often with the support of a financial analyst, builds an economic model for the new product. This model for the new product. This model is used to justify continuation of the overall development program and to resolve specific tradeoffs among development costs and manufacturing costs.
- **Project planning**: in this final activity of concept development, the team creates a detailed development schedule, devises a strategy to minimize development time, and identifies the resources required to complete the project.

The major results of the front-end activities can be usefully captured in a *contract book* that contains the mission statement, the customer needs, the details of the selected concept, the product specifications, the economic analysis of the product, the development schedule, the project staffing and the budget (Ulrich & Eppinger, 2004). The contract book serves as agreement between the various functions that give their human

[11] Cf. paragraph 2.2

resource contribution to form the core team; and between the team and the senior management of the enterprise.

3.3 Market launch

Once a firm has a good understanding of technological evolution, it needs to decide how to exploit that evolution given its own resources and portfolio of products, the resources and strategies of its rivals, and the dynamics of consumer demand.

One of the best ways to achieve competitive advantage and gather monopoly profits is to lead the curve of technological evolution and protect one's lead by patents. However, gaining patent protection is not always possible. Even with patent protection, rivals can find ways to innovate around a patent. Thus, practically, most entry decisions also must consider the potential for and patterns of likely defense by competitors (Hauser, Tellis, & Griffin, 2006).

According to Urban and Hauser (1980), launching is 'the difficult task of ''making the product happen'' in the market'. In other words, if the launch is successful the product becomes established. Various other researchers have also emphasized the critical role of the launch stage (Debruyne, Moenaert, Griffin, Hart, Hultink, & Robben, 2002), (Hultink, Griffin, Hart, & Robben, 1997), (Sandberg, 2002), (Hultink, Hart, Robben, & Griffin, 1999).

Investment in the innovation may be considerable by this time, and the risk of rejection is still quite high. Therefore, it seems rather natural that anticipation plays a role in ensuring that the innovation will be accepted at the launch stage. Customer reactions are often anticipated through market research before the launch[12] (Sandberg, 2002).

The situation may be quite different for radical innovations, however. According to a study by Hultink et al. (Hultink, Griffin, Hart, &

[12] Cf. paragraph 3.1.1

Robben, 1997) the degree of product innovativeness influences the decisions made in the launch process. Consequently, it has also been argued that it may sometimes be better with very disruptive innovations to be faster onto market and to strive for only minimal market acceptability, rather than to pursue a complicated combination of not-so-relevant product attributes. Market preparation, which is aimed at getting the market ready for the innovation by building awareness, is particularly strongly emphasized in the literature.

Understanding how an innovation works, however, or getting information on yet unobservable benefits, does not make it less complex or the benefits more observable. It is, rather, the pre-launch information focusing on the relative advantage and compatibility of the innovation that seems to have the biggest direct influence on trial and adoption.

Positioning the benefits against those of other products is likely to improve understanding of the relative advantages.

Using opinion leaders for word-of-mouth communication, and reference sites as a means of acquainting the customer with product benefits, seem to be common in launching disruptive innovations. Moreover, the more disruptive the technological capability inherent in the innovation, the greater is the need for market education. With disruptive innovations, market education may be even more directed towards communicating a vision of the future than with the nature of the technology itself. Thus, at the launch stage the key issue seems to be that the market accepts the new innovation (Sandberg, 2002).

This compatibility between the innovation and the market may be achieved by making customer-required modifications after the launch, or by anticipating these requirements through market research, for example. Even though both of these strategies seem to be widely used during the launch of disruptive innovations, the literature has emphasized even more the role of active market preparation, like building awareness in the market and educating customers about the innovation to be launched.

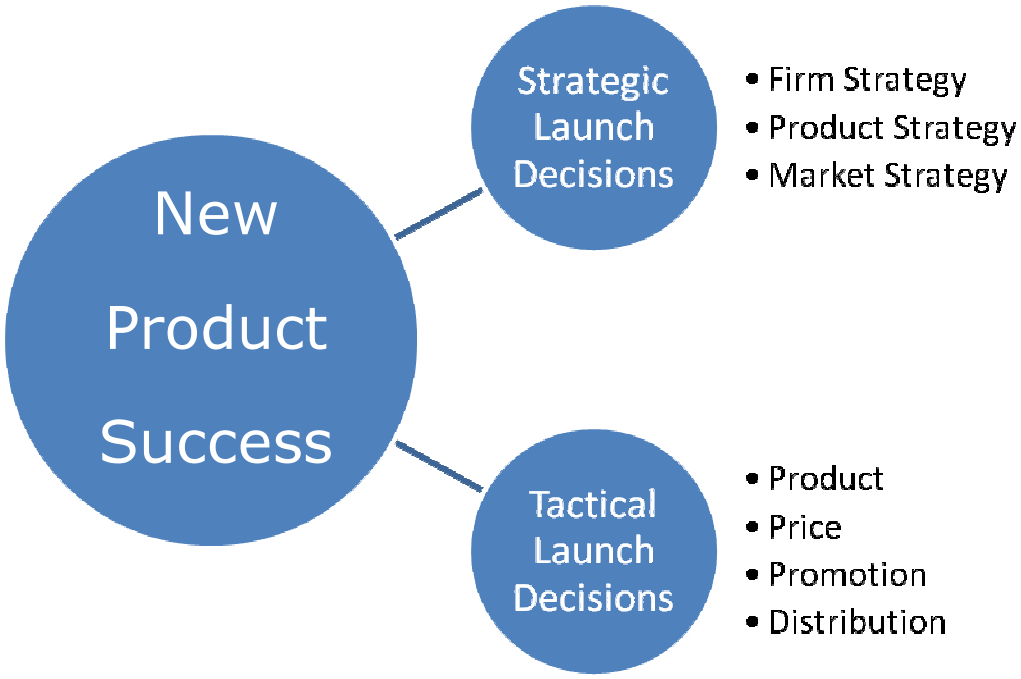

Figure 6: Defining launch decisions and their impact on new product success[13]

3.3.1 Strategic launch decisions

Strategic launch decisions are those considered to take place before the physical development of the product and are derived from literature in new product strategy and even firm-level strategy. These decisions include the firm's overall orientation towards its NPD efforts (firm strategy), the nature of the new product to be developed in terms of design and technical content (product strategy) and the nature of the market into which the new product will be launched and the competitive position of the new product (market strategy) (Hultink, Hart, Robben, & Griffin, 1999).

Taken together, these decisions are equivalent to the Cooper's (1993) stage-gate protocol[14]. As such, they set the parameters within which the new product will compete: as a technological innovation in the category or as a cost-reduced version or a new improved version in the category, to give a few examples.

[13] Adapted from: Hultink, E. J., Hart, S. J., Robben, H. S., & Griffin, A. (1999). New Consume Product Launch: Strategies and Performance. *Journal of Strategic Marketing* (7), 153-174.
[14] Cf. paragraph 2.6

These strategic launch decisions, made at an early stage of development, have an impact on which of the tactical launch decisions are most likely to maximize profitability over a product's life cycle.

Once made, these strategic decisions are difficult or expensive to change later in the NPD process and, therefore, the tactical decisions are likely to be made to align with them (Hultink, Hart, Robben, & Griffin, 1999).

3.3.2 Tactical launch decisions

Tactical decisions central to the actual commercialization of the new product cover the traditional elements of the marketing mix: the level of marketing (and other) investment, the breadth of product versions launched in the market, the nature and scope of services offered alongside the product, how and where to distribute and promote the product and, finally, its price (Hultink, Hart, Robben, & Griffin, 1999).

However, as described above, the initial choices and direction chosen for the new product govern these tactical decisions. Consequently, the alignment of the two sets of decisions is likely to influence the success of the new product in the market, since a new product launch, like other marketing strategies, is based on a mix of elements which should be mutually reinforcing.

The conceptualization of a complete launch strategy therefore consists of both strategic and tactical launch decisions, which together influence the success of the launch. However, the precise nature of these two sets of launch decisions, how they are applied and to what effect in consumer markets is unclear, partly because of the tendency of previous studies to use different combinations of strategic and tactical launch variables and partly due to a majority of studies reporting only business-to-business product launches.

3.3.3 Targeting innovative adopters

Targeting increases the diffusion rate, provided that the firm targets the right people. Conversely, targeting the wrong people may inhibit diffusion completely.

Innovative adopters seem to be a natural target group for most disruptive innovations at the launch stage. They consist of two different groups of people: innovators and early adopters (Sandberg, 2002):

- *Innovators* appreciate innovativeness for its own sake and are genuinely interested in learning about new innovations. They just want to try it in order to see whether it works. Thus, they are adventurous and also accept setbacks. They play a gate-keeping role in the innovation diffusion process, which makes them an important target group.
- *Early adopters* are visionaries who are looking for breakthrough improvements to their current productivity and customer service. They want to be the first to exploit the innovation with which they can achieve a new competitive advantage. They are not very price sensitive, which makes this group easy to sell to. In addition, they are often very willing to serve as very visible references.

After all, these people are respected among their colleagues because of the successful use of new ideas and, in order to guarantee this esteem in the future, they are willing to make decisions on disruptive-innovation adoption earlier than their peers. They represent a challenge to the innovative firm, however, in that they are also very demanding in terms of both innovation properties and time frame.

It is worth emphasizing that innovators and early adopters require partly different approaches to market proactiveness. Market preparation is used to make them aware of the innovation and skilful in using it properly.

Building on awareness is rather easy among this group since they actively seek knowledge of new disruptive innovations. Both innovators and early adopters are often eager to participate in conferences and seminars, but require different programs. The former are eager to know more about the technical capabilities, whereas the latter want reliable evidence of the promised overall benefits. Consequently, these same differences should be reflected in the education of early innovators about the innovation. The education will be effective as long as it emphasizes the technical details for the innovators and the potential for the early adopters (Sandberg, 2002).

Pre-launch market research targeted at innovative adopters is likely to be rather stimulating since they eagerly participate in the product development and are particularly pleased to play a part in the innovation process. On the other hand, market research may also be rather demanding because early innovators in particular often insist on various modifications, which quickly begin to tax R&D resources (Tidd, Bessant, & Pavitt, 2005).

The post-launch benefits and drawbacks in terms of reacting to the requirements of this group are rather similar as when market research is conducted before the launch. Early innovators, however, usually do not represent typical customers, and it might therefore be more beneficial to target other categories of potential buyers after the launch.

Chapter 4: Role of Marketing in Developing Industrial innovations, the Upfront Chromatography A/S Case

The last part of this work is focused on the marketing contribution during the product development process of an industrial product, the differences of its role in consumer oriented markets and industrial markets and, in the end, a case of a Danish biotech company is presented in order to give an empirical example on when\where people with marketing and sales competencies have the possibility to give their contribution.

4.1 Role of Marketing in Developing Industrial Innovations: Comparison Between B2B and B2C Markets

Innovation and new product development process are context dependent (Trott, 2005). That is, the management of the process is dependent on the type of product is being developed. A simple, but none less useful, way of looking at is to make a distinction between the wide range of activities involved in the development of a new product into technical and marketing activities.

Under this perspective it becomes clear that industrial products (product developed for use by other industries) have many different considerations from the consumer oriented products, such as for instance food and beverage products. In the latter case there will be much more emphasis on the marketing mix tactics such as packaging or promotion, whereas an industrial product has been designed and built following

extensive technical meetings with the costumer concentrating on the functional aspects of the product.

Clearly, in between these two extremes the balance of activities is more equal.

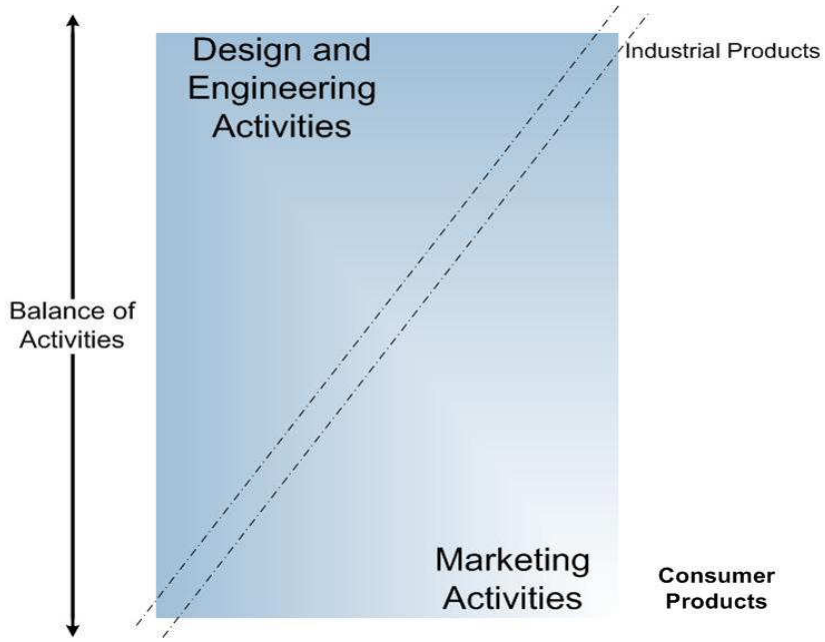

Figure 7: Classification of new product activities across different industries[15]

Another difference between consumer products and industrial products could be the initial input of the development process: usually for the industrial products there is a technology-push approach to the development process, while more often there is a market-pull approach to the development of consumer products (Trott, 2005).

Adopting a technology push approach to product development can allow a company to target and control premium market segments, establish its technology as the industry standard, build a favorable market reputation, determine the industry's future evolution and achieve high profits. It can become the centerpiece in a company's strategy for market leadership, but it is however costly and risky. Such an approach requires

[15] Adapted from: Trott, P. (2005). *Innovation Management and New Product Development.* Harlow: FT - Prentice Hall.

to develop and commercialize an emerging technology in pursuit of growth and profits. To be successful, a company needs to ensure that its technology is at the heart of its competitive strategy.

This is particularly true for companies operating in industrial B2B markets, where the competition between the various players is lined out not only by the marketing mix politics (that have less importance than in the B2C markets), but mainly on the technological level achieved during the development phase and the quality and quantity of information about the results of the process that they communicate to the customers.

On the other hand, also the customers present different features from the ones in the B2C environment. In industrial markets they are not anymore individuals, but organizations with a rational decision process. For these reasons this kind of market is characterized by:

- Relatively few, information rich buyers;
- Products often are being customized and involve protracted negotiations regarding specifications;
- The buyers are usually expert in the technology of the new product.

As result, these kind of markets are characterized by a mayor level of information symmetry about the practices adopted and about the technologies applied.

In situations of low information symmetry (typical of B2C markets) consumers have difficulty in understanding the core technology of the product and to articulate their needs and any additional benefits sought. Conversely in situation of high information symmetry customers are readily able to understand the core product and hence are able to articulate their needs and a wide range of additional benefits sought (Trott, 2005).

Cooper (1984) found that successful new industrial products were launched into high growth markets with high potential and relatively few

competitors. Yoon and Lilien (1985) showed that new industrial products were more successful in their first year after launch where the number of competitors is small and the level of competition low. According to Hultink et al. (1997), the most successful industrial product launches were more innovative than competitors, were focused on niche markets and were launched into markets where the number of competitors was low. Equally, careful targeting, avoiding head-on clashes with competitors and placing the new product into growth markets have been hallmarks of new consumer product successes, while many new consumer products are modifications and brand extensions, launched into mature markets where the number of competitors is already high.

This brief review of the characteristics of the industrial goods markets compared with the consumer market leads to the following conclusions:

1. **Firm strategy**. Existing research into business-to-business markets suggests that being innovative and technology-led are the organizational drivers of successful new products. New consumer products, however, are likely to be launched into markets where competitive rivalry is based on a number of activities, rather than a sole focus on technology (Hultink, Hart, Robben, & Griffin, 1999).
2. **Product-related decisions**. In business-to-business markets, the tendency towards greater numbers of expensive, technical and complex items, together with more "rational" and multiple buying influences intensifies the need for a new product to deliver unique features, to be innovative and to perform unique tasks for a customer. It is claimed, however, that product innovativeness and uniqueness is short-lived in consumer markets where a majority of new products are modifications of the previous ones. In other words, there is a lack of clarity in the role of product-related strategic launch

variables concerning the launch performance of new consumer products.

3. **Strategic market decisions**. Business-to-business markets are typically more concentrated markets, with longer-term relationships and relatively few buyers, all of which point towards a launch strategy focusing on careful targeting and a customized approach to new product launch.

4.2 Role of Marketing in Industrial New Product Development

The context described above and its characteristics concur to reduce the importance and the impact of the marketing and sales function during the front end activities of *concept generation*, *concept selection* and *refinement of specifications*[16]. Instead there is more room for the marketing research phase (specially for competitor mapping activities and analysis if their products) and for marketing expertise during the targeting and launch phase.

In any case, the greater the amount of marketing resources a firm invests in the development of a new product, the higher its probability of success. Marketing efforts for the new industrial product accelerate the diffusion process, and speed up the adoption rate of the new product. They also stimulate superior long-term market performance (Debruyne, Moenaert, Griffin, Hart, Hultink, & Robben, 2002).

Highly sustained products launches attract the market's attention (Hultink, Hart, Robben, & Griffin, 1999). In introducing new products in the market place, innovating firms must allocate substantive resources to communication of the product innovation, in order to enhance the product visibility.

The visibility of launch and distribution investments of new industrial products differs from the consumer products because is very often focused

[16] Cf. paragraph 3.2

on the development of new channels; as such they do not involve an intrusion on a competitor's traditional "playground". Many of these investments also happen outside the eyesight of competitors. Promotion investments on the other hand are targeted on customers, and directly intervene with the competitors' effort to promote their products.

4.2.1 Targeting strategy

The targeting strategy the company employs for a new product determines the number and identity of competitors that are directly affected by the new product launch. As such, it represents the scope of the innovative and competitive action.

- If the company employs a **selective strategy**, it selects multiple market segments. For each segment selected, the firm customizes its marketing activities and therefore clearly attacks the competitors in that segment.
- An **undifferentiated strategy** targets the whole market with the same product and marketing mix. Consequently, an undifferentiated targeting strategy possess a wide scope but none of the competitors is directly affected to a very great extent. It can thus be expected that the likelihood of competitive reaction is smaller than is the case when a selective strategy is employed.
- Finally, a **niche strategy** is specifically designed to satisfy a particular customer group whose needs may be insufficiently addressed by other competitors. As such, a niche strategy deliberately selects those market segments where rivalry is low, partly because larger competitors are not interested. Therefore, the likelihood of competitive reaction is expected to be small as compared to other targeting strategies.

4.3 Upfront Chromatography A/S Company Profile

Upfront Chromatography A/S is a Danish biotech company with the main focus on customized industrial processes development. The company has built his own reputation as the leading provider of commercially applied separation services for the isolation of food ingredients additives, industrial enzymes, nutraceuticals and healthcare products from industrial process side-streams.

The main activity is developing and selling technological platforms for separation and isolation of biomolecules, most often proteins, through its patented technology called EBA (expanded bed absorption). The main strength of this product stays in the disposability of the columns in which the main part of the process take place. These disposable columns are pre-sanitized, pre-packed, do not require cleaning validation and do not generate cross-contamination during the process; for these reasons they are cost\time saving.

Basing on these characteristics, we can say that this technology provide two important benefits to its users:

- The first benefit that is the possibility to turn what is usually considered as waste stream into revenue stream by isolating biomolecules that can be sold as ingredient or additive to various industries (from feed and food industry, to pharmaceutical and nutraceuticals industries).
- The second advantage stays in the disposability of the columns where the most of chromatography process take place. This characteristic give to the user the possibility to save both time and money, because using the old chromatography technology (called packed bed absorption) there was a great waste of these two resources in cleaning, sterilizing and drying the columns for their re-use.

The reasons why this company has been selected as object of study are mainly tied to:

- The *nature of the market* in which they are operating, that is an industrial market; where the kind of relationship between the actors not based on the simply purchasing transaction, but more on the development of a partnership, and there is an high degree of information symmetry between the actors.
- The *nature of the product* that they place on the market, which can be classified as a radical innovation[17] because opened the use of chromatography system to new possible applications. The *development process* of the EBA technology and the launch phase which have peculiar characteristics, and the role and impact of the marketing and sales function in the decisions took during this process.
- The *role of the marketing function* that is quite limited due to the nature of the market in which the company is operating, but still very important.

The methodologies through the analysis has been developed are based on qualitative in-depth interviews to both technical and marketing representatives about their role in the company, the development process of the new chromatography system and about the role of marketing on it; and story-telling about the experience of the writer in the company as intern with the role of sales and marketing manager assistant.

4.3.1 The Nature of the Market

The market toward which Upfront is offering its product is a B2B market. As described above[18] the industrial markets are characterized by a more sophisticated costumers, that act not as physical persons but as

[17] Cf. chapter 1.
[18] Cf. paragraph 4.1

business entities, have deep knowledge of the core technology and demand for an high degree of customization.

These conditions forced Upfront to transfer people with scientific background from laboratories to the sales and marketing department with function of sales representative, and assign the persons with marketing specific background to tasks such as: communication, public relations and preparation of press releases, market analysis, competitive intelligence and competitor mapping, profiling of perspective clients and organization of the firm participation in fairs and trade exhibitions on the industry.

According to the Business Development Manager Morten Aae Olander the reason beyond this choice is the high technological complexity of the product that actually prevent people without a specific technical background to be effective in the selling process.

"Once you are basically skilled [in the biotechnology field]*, there is no need for extra training modules" – M. A. Olander, Business Development Manager.*

On the other hand Upfront itself is providing to its clients a training program for their sales representatives concerning the outcome of the chromatography process (such as proteins, complex molecules, food additives, etc.). They decided to do that mainly to the clients operating in the food ingredients industry because in that context there is need for more clear specifications about the nature of the product and the process by which is produced.

They are also providing training program to the their official distributors' sales force, in order to enhance the effectiveness of the selling process.

"In one of the process conducted with Pall Corporation, Upfront assume training for sales and marketing representatives of Pall, specially to who will be involved in the distribution and marketing of Upfront's disposable columns" – N. Clark, PR and Marketing Manager.

4.3.2 The Nature of the Product and the Development Process

According to the Marketing and PR Manager Natalya Clark: "[…] *Upfront develops and manufactures innovative products and technologies for extraction and recovery of bioterapeutics, functional biomolecules, macromolecular complexes, and even living cells, directly from bioreactors and industrial side-streams*". As can be argue the nature of this product is complex and for this reason it is difficult to define it as radical or incremental innovation.

It is also difficult to collocate this innovation in the Enderson & Clark (1990) framework for defining innovation[19]. Technically speaking this should be defines as *incremental innovation* because it's based on a pre-existing technology and is directed basically to the same market, but due to the significantly improvements realized whit the introduction of the disposable columns, the applications of Upfront's chromatography system are increased. Furthermore, adding the attribute of the disposability of the columns (that are a fundamental part of the whole process), the configuration of the product has changed, giving as result an *radical innovation*.

It's also unclear whether the source of this innovation was a market pull or a technology push input because as main drivers of this innovation the respondents pointed out: on one hand the discover on a need that was inefficiently satisfied, or unserved market segments; and, in the other hand, there was the will, by the company founders, to improve the existing technology:

"[…] *we are pushing our technology to a certain market and certain players. On the other hand these companies have interest to create more value using our technology. So when they hear about the value that can be created they involve themselves in project with us*" – M. A. Olander, Business Development Manager.

[19] Cf. paragraph 1.1.2.

"*The driver of the innovation was an identified market need and the opportunity to improve the existing technology to meet the market need*" – A. Limhe, Technical Director, Founder.

The development process of the Chromatography system could be summarized in few phases:

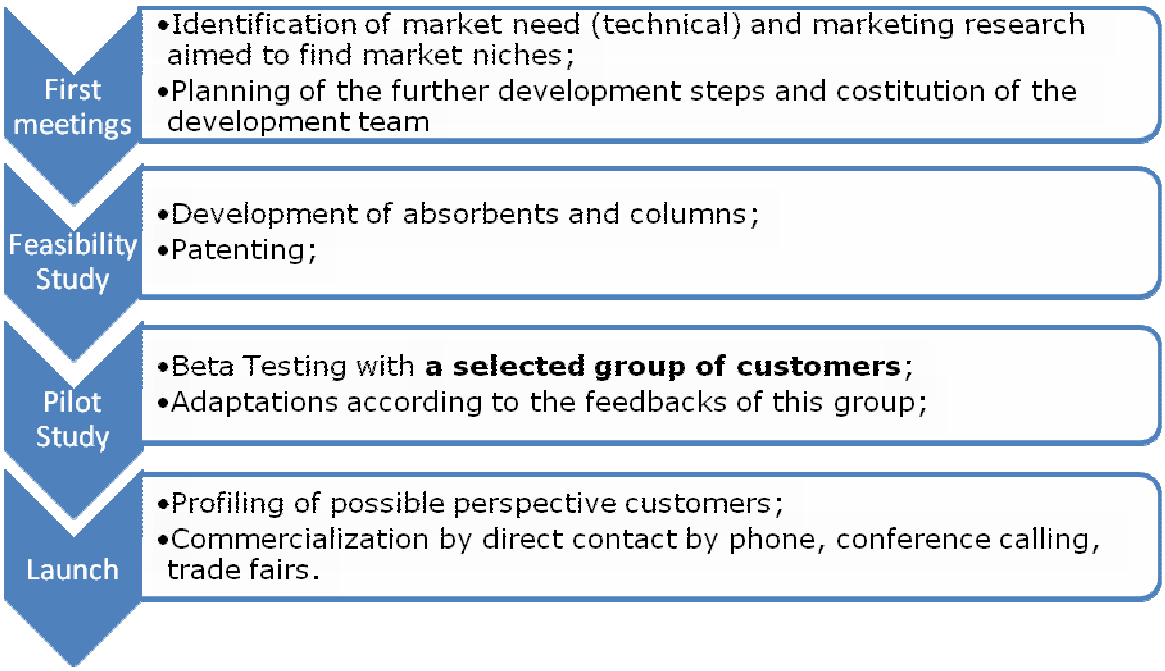

Figure 8: The Upfront's new product developing model[20]

According to the interviews, the entire organization of the development process (phases, activities to be done during each phase, modality of feedback reporting, economical analysis and team formation) has been planned during the front end activities. The outcome of this planning activity has been codified and formalized in a ISO certified disciplinary system and it has been strictly followed during the entire process.

Development process phases and tasks

Comparing the process adopted in Upfront to the different theories illustrated in the paragraphs 2.5 and 2.6, it can be pointed out that

[20] Our elaboration based on the interviews.

although there are many different possibilities illustrated in the literature, no one of the models proposed matches exactly with the work flow of the company analyzed.

The models that could explain the best the Upfront's workflow could be both the *Network Models*[21] and the *Stage-Gate Model*[22].

The Network model because in this model is emphasized the role of every entity involved in the project in terms of inputs and contribution of knowledge. In the development of EBA Chromatography each part involved (technical department, marketing department, engineering and customers) gave a specific contribution according their specific area of specialization. The involvement of a selected group of customers during the beta testing phase represented an external linkage that gave the possibility to the development team to apply immediately the modifications and the enhancements suggested by this group that can be defined, according to Von Hippel (2005), as *lead users*.

Concerning the comparison with the Cooper's Stage-Gate model, also the Upfront's model has been organized in stages where in the end of each one there is a gate control that performs a quality check-up of the output.

In the **First Meetings** the marketing and the technical people were performing various kind of research aimed to identify the technical needs of perspective customers and marketing research aimed to identify not served or inefficiently served market niches. The gate control of this stage was focused on find:

- On the technical side an efficient technology that could bring more benefits than the existing one;
- On the marketing side to find profitable market segments.

[21] Cf. paragraph 2.5.6.
[22] Cf. paragraph 2.6.

In the **Feasibility Study** only the technical team, in conjunction with the technicians coming from the lead users, focused on the development of absorbent and columns and, after reaching an effective and efficient result, patenting it. The gate control was, indeed, aimed in successfully patenting the new technologies.

Furthermore, in the **Pilot Study** the activities were focused on the beta testing by the lead users and the adaptations to the product according the feedbacks of this group. This was one of the most difficult and time consuming phase because of the willing of the team to make the disposable chromatography process available for a wide range of industries, form the food and feed companies, to the pharmaceutical and nutraceuticals companies. The gate control of this phase was centered in finding a good compromise in terms of needs of the different industries that could use their product and elaborating a wide range of scales of columns.

Finally in the **Launch Phase** the marketing function came back with a main role by finding and profiling possible perspective costumers, scanning the market for possible competitors, elaborating communicational campaign in the specialized press and websites, organizing the participation of the company in trade show and fairs, and finally supporting the selling process.

About the selling activity the most interesting particular to point out is the background of the sales representatives in Upfront is not economical\marketing, but scientific. This choice was based on the need to have available people that could answer immediately to specific questions tied on the process, and was quite expensive and difficult to train sales people with commercial background with notions of biotechnology. According to M. A. Olander, Business Development Manager: "[The participation of people whit marketing\selling background] *turned out as a disaster. The technical message is quite complicated and the audience is composed by technical people interested in technical stuff,*

so it is difficult for a person with commercial background only to manage the development phase and keep the customers on track".

The whole developing process took three years.

Project team

According to the vision of Ulrich & Eppinger (2004) the people participating in the project formed a core team composed by lab technicians, engineers and expert biotechnologists with the appointment of a project leader who was the person that first saw the possible advantages of the new technology. Then an extended team was formed with support functions; this team was composed by R&D representatives from a selected group of customers, marketing representatives (which role will be further investigated in the next paragraph) and the financial function which had the double role of fund raiser, finding venture capitalist that would contribute to the project and controller of the developing costs.

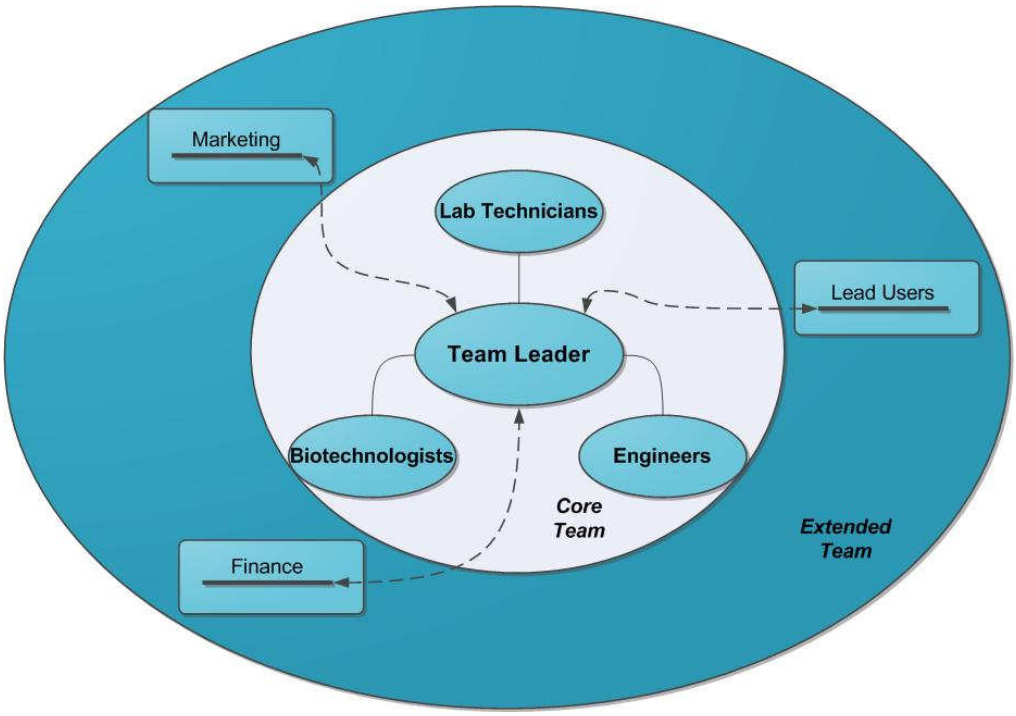

Figure 9: The composition of the development team in Upfront[23]

[23] Adapted from: Ulrich, K. T., & Eppinger, S. D. (2004). *Product Design and Development* (Third ed.). New York: McGraw-Hill.

4.3.3 The Role of the Marketing Function in UpFront

In the interviews conducted, it is evident that the role of marketing function was mainly tied to the front-end[24] activities, with market research of opportunities, competitors mapping and profiling of possible perspective customers; as well as it has been involved in the launch phase for the communication activities, PR activities and coordinating media coverage. The involvement in the selling phase was not direct but mainly aimed to the preparation of the company to the participation in international trade shows and exhibitions.

The exclusion of the marketing function from the core of developing process and from the direct selling activity is well explained by the respondents. The direct question about this topic got always the answer that the kind of process does not allow persons with specific marketing background to give an effective contribution because usually the sales negotiations are conducted with the customer's top management and R&D representatives. Furthermore it was much effective to train with sales techniques people with the specific scientific background.

As result the main role of the marketing function is basically to drive the company in the search of perspective customers by identifying their technical needs related to their specific market segment, in other words a targeting activity[25]. The result of this search is usually a detailed report about the possible client containing its basic figures such as the kind of industry in which it is operating; its main products, by-products, and side-streams; and in which way the Upfront's technology could contribute in its activities.

"*The role of our marketing department, during the development phase, was limited to scan the market looking for possible new segments to cover with our offer and to report all the information discovered to the Business Development Manager*" – A. Lihme, Technical Director, Founder.

[24] Cf. paragraph 3.2
[25] Cf. paragraph 4.2.1

As mentioned above, the main marketing responsibilities are also tied to PR and communication activities and the organization of the company participations in international trade exhibitions and fair, that represent the main point of contact of Upfront with the market.

According to the Marketing and PR Manager Natalya Clark, the main responsibilities of are: "*To develop the annual marketing and communications plan in conjunction with sales; write articles, press releases, website content, brochures content based on input from sales; identify, plan and organize company participation in trade shows; coordinate activities and conduct networking; perform market research and monitor competitors' activities and positioning; achieving timely and frequent media coverage of the company activities*."

4.4 Conclusions

The interviews with the representatives of Upfront Chromatography A/S and the personal experience of the writer of this thesis contributed to profile the role and the contribution of marketing and sales function in a industrial company and to compare this profile with the main axioms proposed in the literature about the complex phenomenon of the innovation.

The literature reviewed in this thesis touched the most important aspects tied to the complex phenomenon of the innovation.

First of all the most important definitions of innovation have been presented and analyzed and has been made a comparison between this definition and the definition of "new product". Furthermore has been presented a framework for the definition of innovation, in order to allocate according to the literature the innovative product presented in the case.

In the second chapter there is a review of the most important notions about the new product development process. This review included the analysis of the composition of a development team and the

presentation and critics of various new product development models, focusing in particular on the Cooper's stage-gate model of innovation.

In the third chapter the focus was on the role of marketing in the innovation process and in which phases the marketing function could give its contribution to the development of a new product. As result it can be pointed out that this function can give potentially its contribution in all the phases of the process, but it's necessary to make a distinction between consumer markets and industrial markets. In the consumer markets marketing detain a central role in innovation development, including the phases of: opportunity identification, design, testing, introduction and life cycle management.

Finally in the fourth chapter the focus was on describing the role of marketing in the industrial markets and the comparison of the literature with the evidences founded during the analysis of the company.

Concerning the nature of the innovation what has been discovered is that the various frameworks and classifications are mainly tied to the academic world, and they are little took in consideration by the managers and the engineers working in the company. The reasons standing behind that are:

- In one hand the academics needed to develop several frameworks in order to organize in different categories the various types of new products that are launched into the market. In simple words they are an ex-post frameworks of analysis.
- In the other hand companies in developing innovative product, most often are not driven by the willing to develop a radical or incremental innovation, but they think about to develop a product that could deliver a competitive advantage against the competitors, by conquering a mayor market share, targeting an unserved market niche or creating a new market. Of course

the most effective way to do that is to develop new products with new patentable technology.

In Upfront Chromatography A/S, they decided to develop the new system because they had a double perception: the perception of a possible further development in the existing chromatography technology (from "packed bed absorption" to "extended bed absorption"); and the perception of market segments that were demanding for more efficiency in the technology and the possibility to extend the usage of the technology to new market segments. At the question whether the input for starting the development was "market pull" or "technology push", most of respondents answered "both".

Concerning the kind of development process, the company planned and implemented their own development plan, ISO certified, without taking in consideration any of the development plans presented in the literature review. Again the conclusion that could be derived is that the academic world developed the various frameworks of analysis presented in this work with the aim to explain the process rather than to regulate it. Of course some of the scholars such as Cooper developed models of innovation in order to advise the companies but, especially in the industrial market is quite difficult to implement a pre-packed and standardized model of innovation.

"*We developed our system according to our ISO system, every step was clearly stated in that document*" – Steen Petersen, Project Manager for Biofuel Applications.

After carefully analyzing their phases, the various activities into the phases and the feedback loops it can be concluded that in the industrial markets the development of industrial products are strictly competence of technical and R&D departments while the marketing department is relegated to the research activities at the beginning and the launch activities. According to the literature, this configuration seems to be very

common in the B2B market, where the decision process is more rational than the B2C and the products contains an high degree of technology. Also for this reason is important to point out that in Upfront the sales representative are only people with scientific Degrees, the reasons for this choice are:

- The sales negotiations usually are carried out with the top management and the R&D department of the client company;
- It would be really costly and time taking to train sales force with commercial background with biotechnology notions;
- At the opposite would be more easy to train people with biotechnological – scientific study background with sales techniques.

"*There will be a specific training for the sales representatives about sales techniques*" E. Lihme, Technical Director, Founder.

Concerning the role of the marketing department as already stated above, this function did not have a central role during the core phase of the product development process. It seems that the influence and the impact of marketing decisions are limited to the front end activities, like market research, competitor mapping and competitive intelligence, and in the last phases concerning the launch and the measurement of the results. Also the communication is one of the main tasks of marketing, but in Upfront case the developing of a communication plan meant to produce articles and press release to distribute to the specialized press and coordinate the participation of the firm in industry events.

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