R&D Strategies and Innovation: A Qualitative Assessment of P&G

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1. INTRODUCTION

In a globalised world with ever-changing trends and customers' needs, organisations must adapt to the new environment and requirements exposed by the market. This situation binds them to keep looking for new ways to meet those needs since the traditional products and methods to do so no longer give value to consumers, who are ready to pay an extra price for a good or service that provides a different experience from the rest of goods in the market. This encourages firms to push their frontiers further, trying to find real and valuable solutions by researching and developing new technology that can define the satisfaction of the new needs that customers have.

However, there are products that, for its own nature, don't have room for much improvement and change, meaning that the product remains stagnant in time, unchanged. Needs keep evolving but these products can't match them that easily because they have reached maturity and can't be substituted by another technology, at least, so far.

This paper understands and acknowledges the existence of technologies that are traditionally stagnant and mature and tries to give qualitative evidence, based on a real case, on how companies can develop these type of technologies, which have no room for improvement or change, while serving as a descriptive guide about the strategies regarding innovation that can be followed in order to make the development of such technologies and launch them to the market.

As a result, the first part of the paper deals with the definition and difference between technology and innovation, followed by the theories that explain the management of innovation strategies and the meaningful repercussions of their implementation.

Meanwhile, the second part refers to a real business case, involving the multinational company P&G and the strategies that it uses to complete the innovative projects it embarks on successfully. In other words, this part covers the empirical evidence that sustains the previous theories and gives light on how mature products can still be improved through effort and persistency, by looking for examples on databases, legal court registries and business articles and reviews about its corporate arena and the firm itself.

2. THEORETICAL FRAMEWORK

2.1. Technology and Innovation

2.1.1. Definition of Technology

The word has a Greek origin, resulting from the combination of two different words. The first one is “techné”, which means the know-how that is obtained after the exercise of a profession, and the second, “logos”, means scientific knowledge coming from the reasoning.

However, the word itself has received many other definitions. It has been defined by E. Fernández Sánchez (2005) as a system of knowledge and information, derived from the research, experimentation and experience that, together with its own methods of production, commercialisation and management, allow for the generation of new or improved products, processes or services.

Another definition is the one given by P. Morcillo Ortega (1997) in its book, *Strategic Management of Innovation and Technology*. He defines technology as a combination of knowledge, forms, methods, instruments and procedures that allow for the combination of different resources, whether they are tangible or intangible, and capabilities (know-how, talent, creativity and individual strengths) in the manufacturing and organisational processes to make them more effective and efficient.

A third definition could perfectly imply that technology is the embodiment of encoded knowledge or information, and non-encoded knowledge or experience, which can be applied systematically in manufacturing activities. This definition, given by the Austrian-born American economist J. Schumpeter (1939), becomes the basic foundation for the definition of further terms related to technology, which will be later covered in this paper.

2.1.2. Definition of Innovation

In order to define Innovation, this term, as Technology, has a lot of different definitions that try to solve the same question and do answer it in very similar ways, with quite related meanings for the same term.

Starting from the “RAE” (Real Academia Española), Innovation can be defined as the creation and modification of a product and its introduction to the market. Moreover, the Encyclopaedia Britannica, with a very similar approach, defines Innovation as:

> *“the creation of a new way of doing something,*
> *whether the enterprise is concrete (e.g., the development*
> *of a new product) or abstract (e.g., the development of a new*

philosophy or theoretical approach to a problem)".

At the same time, it also includes the diffusion of innovation in the definition of the word, as a model that gives a description about how new products, practices or ideas are introduced in the society and adopted by its members.

However, the definitions of such a powerful term should not be so mechanical, which lack the essence of the whole word. As a consequence, a deeper understanding must be explicitly described and go further along the way of comprehension.

This issue was exactly what the father of innovation tried to overcome when defining Innovation itself. J. Schumpeter stated that Innovation consisted in any manner "of doing things in a different manner", wrapping the term together with the economic world and business cycle. In other words, he specifies that Innovation has to do with changes in the way of producing, transporting, organising, entering a new market, etc.

But Innovation is not only related to economic implications, and as a result, the OCDE in its Frascati Manual, issued in 2015, with previous academic works, declares that Innovation is the group of scientific, technological, organisational, financial and commercial stages, including the investments and developments in new knowledge, that lead to, or try to lead to, the implementation of new or improved products and/or processes. This means that Innovation is a term that can also be applied, especially, to the business world, following Schumpeter approach.

Finally, even though there are many more definitions for innovation, it is interesting to go through the meaning given by Morcillo Ortega P. (1995), who understand that Innovation stands for the transformation of an idea in a new or improved selling product, manufacturing process, trade or new way of social service. This implies that Morcillo believes that Innovation is not only part of the economic sector, but can also be applied to other fields in the society, highlighting the importance of the final object, but not the consequences of its introduction to the society as Schumpeter pointed out.

2.1.3. Difference between Innovation and Technology

After giving definitions to both terms, Innovation and Technology, it may look as if they mean the same, but this is not true.

On the one side, Technology is understood as the organised knowledge oriented to the solving of a specific problem by developing something new or improved something existent. This can also be understood as the application of efficient and effective techniques, knowledge and experiences to give a solution to different situations.

On the other side, Innovation, as Sutz (1997) once described, “it is about solving problems, current or imagined, for the first time or not, by introducing a solution, new or improved, with a worldwide effect”, which is adopted by users and used for solving the primary problem that initiated the process of innovation itself, which ends up being useful.

As a conclusion, while Technology depicts the use of knowledge to create a solution for a problem that is new or improved, Innovation involves a new or improved technology that is introduced in the society and has utility for the resolution of the problem this technology is made for.

This means that the distinction that differentiates Technology and Innovation is that innovation is the technology that enters the society and reveals itself to be useful for the users that want to solve the specific problem this technology helps overcoming.

2.2. Technology Strategies

In order to implement a successful and accurate strategic management of innovation and technology, companies have to analyse the technological environment of the business, which deals with the turbulences and instability of the frequent technological changes, the competition for technology and the high level of creativity in which the business finds itself.

This analysis allows for a forecasting of the evolution of technology, with a long-term view, enabling the company to have coherence between the investments made on technology and the strategies applied. As a result, this creates value for the company.

The correct strategy must also capture value, giving the company a competitive advantage over its competitors and sustaining it. All of this to deliver value, by making the right decisions and executing the correct strategy.

As it can be assumed, the technology strategy will be part of the corporate strategy of a company, and will affect the whole organisation. Morcillo (1997) in its book “Strategic Management of Technology and Innovation” splits these strategies into three different types, each of them with a different purpose; those for exploiting technology, those involving its protection and those that are about the sourcing of technology.

2.2.1. Strategies for Exploiting Technology

This strategy is based on how a company exploits the technological and complementary resources it possesses, in order words, what a company does with the technological resources and capabilities it has under its power.

In order to do so, there are two different strategies that can be used, even though they are not mutually exclusive.

2.2.1.1. Horizontal Strategy

By using this strategy, the company is able to achieve and constitute a set of technological resources and capabilities that will not be used and exploited by the company itself, instead, the company gives them away to other companies or institutions.

Organisations that enforce this type of strategy, offer their technology to others, who will use them in their manufacturing processes and products, in exchange of monetary compensations. This means that the company that produces the technology doesn't end up competing in the industry where the products the technology is aimed for are manufactured.

This strategy is vastly used by SME, since it can be adapted more easily to the characteristics of these type of organisations. They are more flexible, opportunistic and dynamic, and at the same time, they lack financial and commercial resources to manage manufacturing processes and establishing distribution networks.

However, those organisations need to make sure they can set a continuous flow of inventions out of the technological potential they may have and the transfer of intangible resources or capabilities, can be troublesome and demanding, since they are complex, specific and have causal ambiguity.

2.2.1.2. Vertical Strategy

Those organisations that follow this strategy, create technological resources and capabilities that are exploited by themselves. The resources and capabilities are not sold or given away to third organisations, but are kept within the boundaries of the company that has come up with the new resource. This implies the development of products or services that, sometimes, will lead to the diversification of the product range of the company.

A vertical strategy is advisable when an organisation master a set of technological resources and capabilities that guarantee high expectations of return on the investment and when the organisation is the only one that has the ability to control the integration process of those resources and capabilities.

Table 1. Advantages and disadvantages of horizontal and vertical strategies.

	Horizontal Strategy	Vertical Strategy
Advantages	-Specialisation and technological of the capacity.	-The technological potential becomes more profitable.
	-Know-how.	-The organisation doesn't depend on others.
	-Less investing effort.	-More chances to grow.
		-Creation of entry barriers.
		-Closeness to final demand.
Disadvantages	-Lower revenues from the technological potential.	-Bigger risks as the company gets into more markets.
	-Successful inventions are difficult, since the firm is far from the market.	-The company can neglect the generation of new technological resources.
	-Other organisations have access to the company's source of competitive advantage.	-Need for complementary competences (production, sales, mk ...).
	-The organisation depends on others.	-Bigger financial effort.

Table 1. Advantages and disadvantages of horizontal and vertical strategies. Source: Morcillo (1997). Dirección estratégica de la tecnología e innovación, Civitas, Madrid, chapters 11 & 12.

2.2.2. Strategies for Protecting Innovation

After many empirical contributions made by respectful authors, Freeman (1974) articulated the six types of strategies that companies tend to develop to interact with each other in the market, all of them having innovation at the centre of all corporate interest. The six types are:

- Offensive: These companies constantly take risks and invest in new technological projects, mainly basing their performance on science-based activities, which means that, for them, R&D is a key part of their business, as Pavitt (1984) classified.
- Defensive: As offensive organisation do, these firms also invest in technological innovation, but much less, what means that don't try to improve the innovation of the first innovator.
- Imitative: These companies try to grow by obtaining technological resources somewhere else, by being provided from other organisations with horizontal strategies (exploitation of their technological resources), or they reduce the cost of manufacturing. Engineering is crucial.
- Dependent: They also exploit innovations developed by other organisations but they have a faster response to customers' needs and are able to adapt their offer to the demands of the market. Just like imitative firms, dependent also invest in engineering and industrial design a lot, but have no scientific and technological capabilities.
- Traditional: Their product is always the same and does not change over time, so they don't invest a lot in innovation, and just follow trends, which they adapt their products to, giving special attention to quality.

- Opportunist: These organisations identify and exploit short-them niches with a lot of accuracy and in an advantageous way, supplying products and services that don't require R&D and shifting quickly from market to market.

Apart from Freeman, another scholar who proved empirical data, who has already been named, was Keith Pavitt, who, in 1984, by looking at the productive structure of companies, came up with a different classification of companies, based on the innovative strategy of companies and how this leads to technological change, with four types of firms:

- Science-based technological change: for this type of companies, R&D is one of the most important activities.
- Scale intensive technology: Companies of this type try to reduce costs.
- Specialised suppliers: These organisations also try to cut costs but, at the same time, they are able to respond to their customers quickly to satisfy their needs.
- Supplier dominated: These companies have products that don't change over time and technological change comes from incorporated goods, such as raw materials or capital goods.

Table 2. Types of organisations.

Freeman (1974)	Pavitt (1984)
Defensive	Science-based
Offensive	
Imitative	Scale intensive
Dependent	
Traditional	Specialised suppliers
Opportunist	Supplier dominated

Table 2. Types of organisations. Source: Freeman (1974). The economics of industrial innovation, Penguin & Pavitt (1984). Sectoral patterns of technical change: towards a taxonomy and a theory, University of Sussex, Brighton.

Table 2 shows how the empirical contributions about the classification of companies depending on their innovative strategies, made by Freeman (1974) and Pavitt (1984), would related to each other.

Organisations also need to bear in mind the fact that an innovation can be copied or emulated by any other organisation, and as a result, it can lose the power to be different from the rest of the competitors, whether we are talking about a product that will be released to the market or an improvement in the internal processes of the organisation that creates values for it.

Once an innovation or breakthrough has been achieved, the organisation needs to protect the work that has been required in order to create it, and also the physical object or the intangible capacity itself, from the reach of the rest of organisations, fighting in the same industry, but also those that don't necessarily compete with the company, and just benchmark it.

There is a wide range of strategies that the company can follow to prevent its innovation from being copied by another organisation, and all of them can be introduced and implemented at the same time, without one of the impeding the company to use others at the same time.

The strategies for protecting innovation can be differentiated between 2 differing blocks. On the one hand, there is a bunch of alternatives that are classified as “informal strategies”, and on the other hand, there are some strategies that protect innovation through a legal framework.

2.2.2.1. Informal strategies

Figure 1. Types of protection strategies.

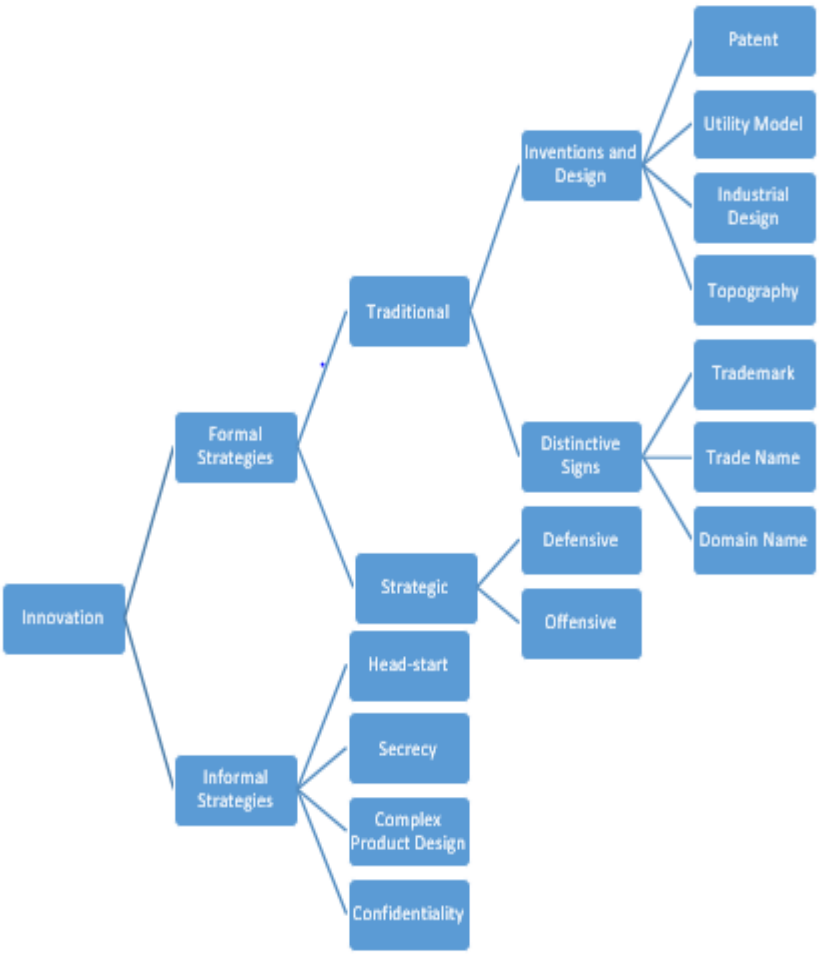

Figure 1. Types of protection strategies. Source: Adapted from Fernández (2005). Estrategia de innovación, Thomson, Madrid, chapter 4 & Hidalgo et al (2002). La gestión de la innovación y la tecnología en las organizaciones, Pirámide, Madrid, chapter 8.

These strategies are considered informal because they have no legal support behind them that define what they are made for and how businesses can use them to protect innovation, or specify the situations in which the can be adopted, considering the loopholes that they are affected by. In other words, these informal protection instruments are not guaranteed by the state, and this results in being a less effective methods under certain circumstances.

- Secrecy: This strategy has to do with the protection of the intellectual property rights by keeping it a secret to third parties, sometimes even the employees of the company.
- Head-start: As a consequence of being the first one to launch a product (innovation) or introduce it, the company can obtain a temporal monopoly.
- Complex Product Design: The innovative resources can have a set of characteristics that make it difficult to copy, such as complexity, ambiguity, intangibility, among others. With time, the

competitors can reach the organisation, so the company must keep on investing to improve the new technology, so the other competitors are left behind and don't overtake the company.

- Confidentiality: This involves a legal contract between two parties, with the commitment and obligation not to share internal valuable information with third parties.

2.2.2.2. Formal Strategies

Helping side by side with the informal strategies, are the formal strategies, which are uphold by law and legal statutes, which suppose the recognition of a property right, meaning that they are advisable especially for those businesses that cannot effectively protect their innovations through informal strategies alone.

Moreover, these strategies represent a way to assure a monopoly that allows the company to appropriate income flows form the innovation, at least for a certain time, which fosters future innovations, since companies are sure that they will get a profit from innovating and investing in new projects.

Finally, these strategies become a source of information for the wider audience about the innovation and how it can be applied to new and different solutions, while favouring economic growth in the society and the economy as a whole.

However, they also pose a problem for the society, because, since economic and social progress is a natural right for all the society, there is no reason to limit it by creating special rights for organisations to exploit it for a time period and, as a result, delay the technological progress and limit the introduction of new improvements by other companies.

Besides, these formal instruments of protection of innovation don't really guarantee the return on the investment made by the company, depending on the time needed to finish the innovation and launch it, and the protection also has the same duration, regardless of the effort and complexity of the innovation.

After going through the arguments in favour and against formal strategies for the protection of innovation, it is necessary to state the differences behind each new creation and how they can be protected by grouping them under the same classification. This process highlights two different ways of protection or classifications, all of them within the "Intellectual Property Rights", the "Copyrights" and the "Industrial Property Rights".

2.2.2.2.1. Copyrights

They are a set of rights that belong to authors, artists, producers, and other titleholders, regarding their creations, result of their effort. To be more accurate, the Oxford Dictionary defines a copyrights as:

The exclusive and assignable legal right, given to the originator for a fixed number of years, to print, publish, perform, film, or record literary, artistic, or musical material.

The duration of these rights lasts for as long as the author lives and a maximum of 70 years after his/her death, and the piece that has been created, by the sheer fact of being created, already entitles the creator to have the right, which means that the creation of this type of material has the right attached and it given to the author instantly.

These rights, apart from giving the holders economic benefits, also give moral insights, since the name of the author is recognised, he or she can decide whether his/her creation can be made public and the way to do so, and it can prevent any modification of the creation without the author's consent.

It is important to clarify that, these rights are only given if the creation is a literary, artistic or scientific creation, a derived material from original creations (translations, revisions, musical arrangements,…) or a collection (databases, anthologies).

2.2.2.2.2. Industrial Property Rights

The other classification of rights, as opposed to copyrights, doesn't legislate about the recognition of the originality of a creation that can be performed or produced by other people apart from the author. While the copyrights are reserved for the protection of creations that capture and express their authors' personality, and are unique and can be mass-produced, the industrial property rights protect creations that are related to the industry, with a clear intention, direct or indirect, to make profits, and that can be, or can be used for the mass production of goods.

Thus, the Industrial Property Rights can be used to protect those innovations generated with economic intentions by an organisation and used to get profits. Such new and/or innovative elements can be:

- Technical Innovations (inventions): This type of innovative elements includes technical rules or effects, such as products, procedures, utilities and other gadgets and devices.
- Design Innovations: This type has to do with the external appearance of an object, including the new models of a known product, new patterns or print, configurations and series.
- Corporate Identity: Intangible innovations can also be considered as industrial property when they are distinctive signs, like business designations, graphics, logos, mottos, signs and so on, can identify and differentiate a business from one another, all of this to create value for the business and make profits.

As it can be seen, there are different types of innovations that can be protected under the statutes regulating the Industrial Property Rights, which are given to the company, so it can operate and exploit them for its own profit.

However, not all these innovative elements that are considered as “Industrial Property” are protected in the same way, and there are distinctions among all of them. In Table 3 it can be seen how each innovation, depending on whether it is a design, invention or distinctive sign, has to be treated in order for it to be protected by law, under one of the formal instruments of protection.

Table 3. Types of Industrial protection.

	Inventions & Design	Distinctive Signs
Characteristics	They protect new techniques and designs.	The protect Corporate Identity.
	Temporary.	Indefinite.
	Must be exploited.	It implies "no confusion".
	Right given by each country (EU).	Right given by the EU.
Types of Protection	Patent: 20 years (Radical innovation: product or process)	Trademarks
	Utility Models: 10 years (Incremental innovation: technique or product)	Trade Name
	Industrial Design: 25 years (Incremental innovation: form of product in 3D or 2D)	Domain Name
	Topography of Semiconductor Products (e.g. microchips)	

Table 3. Types of industrial property. Source: Oficina Española de Patentes y Marcas (OEPM), www.oepm.es

Therefore, a product can be protected, following a formal strategy by issuing a patent or a utility model right, whereas a new pattern design of a product can only be protected by an industrial design right, and the name of a trademark, owned by the organisation, will be taken care of by the corresponding legislation (Oficina Española de Patentes y Marcas), which supervises the statutes about this matter.

2.2.2.2.3. Patent

A patent, as Table 3 shows, is the most popular method of protecting industrial property, when the organisation is dealing with a radical innovation. For the World Intellectual Property Organisation (WIPO), a patent can be defined as:

An exclusive right granted for an invention, which is a product or a process that provides, in general, a new way of doing something, or offers a new technical solution to a problem.

But receiving a patent for a product or a process is not easy and straightforward. Certain requirements must be met for an organisation to be able to protect a product or process, some of them regarding the “State of the Art” and others are about the technical features of the product or process.

Considering the “State of the Art”, defined by the Oxford Dictionary as “the most recent stage in the development of a product, incorporating the newest ideas and features”, for an invention to get a patent, it is necessary that it is new, which means that it is not comprised by the “State of the Art”. To have a clearer idea, Figure 2 is a simple and obvious way to explain the situation.

Figure 2. State of Art.

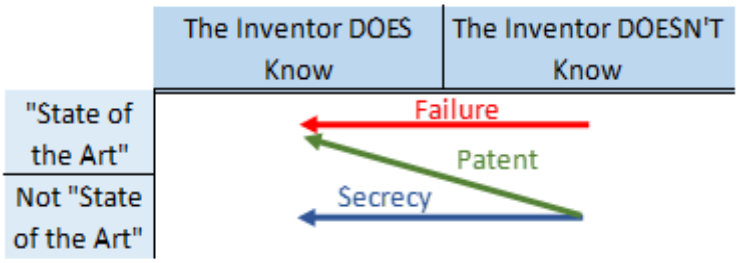

Figure 2. State of Art. Source: Adapted from the definition of Oxford Dictionary.

This figure shows that, a patent will only be granted in case that the invention is new for the inventor (because he or she had no consciousness about the invention being already existent) and the “State of the Art” had no information about it either. In case that the new invention for the inventor was already known by the “State of the Art”, then, no patent can be given to the inventor, and the product itself signifies a failure.

Moreover, the creation of this new invention must come as the result of an inventive effort, which means that the formalisation of it is not evident or observable by an expert, and it is useful for the organisation, as it has industrial application.

Once all the above requirements have been fulfilled, and the application for a patent has been submitted, the organisation that applies for the patent has to disclose all the technical information about the invention and make it public to any individual or institution that can be interested.

As it has been stated in Table 3, a patent can only be used to protect products and processes that represent a radical innovation, but it is important to specify this classification further, since in some cases, a patent can be a viable option. This is specified in the following table.

Table 4. Patenting permissions and prohibitions.

Patenting is Allowed	Patenting is not Allowed	
New products.	Products that are not considered inventions and excluded by political, economic or social reasons.	Discoveries
		Existing raw materials (lifeless or alive).
New uses for existing products.		Software (In EU is protected under copyright, but not in the US).
		New properties of known objects.
Gadgets or tools to manufacture or obtain a product.		Natural forces or phenomena.
		Literary, artistic or aesthetic pieces.
	Creations that are not allowed by political or governmental reasons.	New animal or vegetable species and the procedures to obtain them.
Manufacturing methods and procedures.		The replica of biological and genetic material.
Chemical or pharmaceutical products.		Inventions that represent risk against the public order, morality, health or life.

Table 4. Patenting permissions and prohibitions. Source: Oficina Española de Patentes y Marcas (OEPM), www.oepm.es.

2.2.2.2.4. Strategies Regarding the Protection of innovation

Besides the decisions regarding the legal strategies to protect innovation, any firm can implement and take measures to face other competitors and fend them off. This means that a specific organisation will make its best to protect its activity, fight for the market and try to keep rivalry controlled.

Companies are not isolated entities, they interact with each other, and they need to respond to what others are doing, by increasing innovation, launching new products, setting new internal processes for a higher productivity, or creating new uses for the same products, among other marketing strategies that don't regard innovation (Scherer, 1980; Karakaya and Yannopoulos, 2011).

In order to do so, companies will use different types of strategies. As Porter (1985) claimed, strategies can be either defensive or offensive. Even though he talked mainly about marketing strategies, dealing with the market and the environment, this same classification is also applicable to innovation, which, to some extent, is also part of the decisions that lead to the market.

On one side of the balance, organisations that have industrial property rights can implement offensive strategies and choose which of them are more appropriate to fight back against their competitors' actions. They can exert their industrial property rights to gain power in the market, sell their industrial property rights to other organisations to focus its efforts on others or get resources, licence property rights, cooperate with third organisations to develop a technology or even donate the industrial property rights.

On the other side of the balance, those organisations that don't have a specific industrial property right and want to, or have to, compete with organisation that do have, can also put into action other measures by using one or more of these defensive strategies:

- Apply for a licence over these rights and get the power to use them too.
- Challenge those industrial property rights that another organisation has to gain market share or market power. There are two possibilities to do so:
  - Challenge the validity of those rights legally.
  - Defend that the products the company (without rights) has are not challenging the industrial property rights the other company (the holder of those rights) possess.
- Develop a different technology, at least, different enough not to be considered as a violation of the rights the competitor holds.
- Dissuade an organisation (firm A) to make a move by showing a wide portfolio of industrial property rights, even though the company (firm B) that has this portfolio doesn't have the right the offensive organisation (firm A) does.
- Violate the industrial property rights by introducing a technology that potentially violates those rights to the market as a quick response, while benefiting from it until the legal execution happens.

As it can be seen, choosing the most adequate right to protect the property that an organisation has is only the first step. Implementing the strategy to know what instrument is the best to protect the intellectual property and apply for it, will lead to the enforcing of the offensive of the defensive strategies related to the protection of an invention.

2.2.3. Strategies for Obtaining Technology

The proposed study about the limits of the company, popularly known as "The Scope of the Firm", "Firm Scope" or the "Firm Boundaries", is a theory that has been developed around the last 30 years, and many scholars have tried to take part in the evolution of the theory and its interpretation and improvement (Klein et al (1978); Grossman and Hart (1986); Hart and Moore (1990); Holmstrom and Roberts (1998, 2010); Van den Steen (2005), among many others).

The boundaries of the firm, as a result, are made up of a series of incomplete contracts and property rights. This idea means that a firm will allocate the rights and, since contracts can be made ex ante and completed ex post, they are also considered. However, this theory is problematic when 2 or more parties are to get the ownership of the same item, so finding the balance in this situation is not easy.

This theory goes through the understanding and reasons why the company exists and when and how it has to realise and manage its activity, is that to say, when an activity has to be made internally or externally and the best way to do so. Taking the latter idea, inside the limits of the organisation, deciding how the development of the technology is going to be is one of those limits that fall within the scope of the organisation.

Making decisions about how the development of the technology is going to be carried out (whether internally or externally) is therefore and important part of the arrangements that need to be done by the organisation. In fact, deciding how the technology is going to be developed doesn't only affect the activity of the organisation, it is also part of the corporate strategies that the organisation needs to plan.

Technology, as it has been previously pointed out, can be researched and developed internally and externally. A firm can do both, as a trade-off (Narula 2001; Veugelers and Cassiman 1999), even for the same technology, when a part can be done internally and the other part externally, and it will depend on what the firm thinks is better, by analysing and assessing the possibilities and checking which is/are the most viable.

The development of technology, in turn, when it is developed externally, it can be done by acquiring a technological resource from another company (which may use a horizontal strategy for exploiting technology), this means that the organisation purchases the resource from another organisation, or the organisation can cooperate and work together with other businesses in order to use their resources in common to take advantage of them and create new technology by joining forces.

This analysis will not only include the costs associated to each possibility and the profits that it could make, it also needs to consider the technological resources available within the organisation (necessary and available investments, labour, external forces as suppliers, legal legislation, etc), the capabilities (know-how, talent and skills, communication among departments, etc) and the advantages and disadvantages that each form of obtaining technology has, as it is shown in Table 5.

Table 5. Advantages and disadvantages or internal and external technology sourcing

	Internally	Externally	
		Acquisition	Cooperation
Advantages	Protection of the firm's technological potential.	Generally faster.	
		Less risk, since the technology/source is known and less investment is needed.	
	Control over the development of technological capabilities.	Access to resources and capabilities that the organisation hasn't got (Nooteboom, 1999).	
		The only way to get some capabilities.	Faster and more flexible (Grant 1996).
	No dependency on others and specialisation (Chesbrough and Teece, 1996).	No bureaucratic costs.	Costs and risks are shared
			Easier transfer of knowledge and allows specialisation.
			Source of learning.
Disadvantages	All the necessary technological resources and capabilities cannot be developed.	Problems with the transfer of intangible technological resources and capabilities (Tsai and Wang, 2009).	
		Need for assimilating technological knowledge.	
	The development of technological capabilities is slow.	Transaction costs.	
		Technological dependency.	
	It requires a strong investment.	The technology cannot be a source of Competitive Advantage.	Third parties have access to the technological potential the company has.
	Higher risk, but success is not guaranteed.		
		Integration problems.	Coordination problems.
			Less control.
			There's no clear proprietorship over the technological resources and capabilities (Hart and Holmstrom, 2009).

Table 5. Advantages and disadvantages of internal and external technology sourcing. Source: Fernández (2005). Estrategia de innovación, Thomson, Madrid, chapters 2, 3 and 6 & Hidaldo et al (2002). La gestión de la innovación y la tecnología en las organizaciones, Pirámide, Madrid, chapters 6 and 7.

Once the advantages and disadvantages of the diverse strategies for obtaining technology have been assessed, it is important that the organisation knows all the channels available that exist for each strategy that implies external implication, since there are different ways to obtain innovation by acquiring it, as well as cooperating with other organisations.

However, there are not explicitly differentiated internal methods for obtaining technology, since there is only one possibility to do things, which is doing it on its own, based on resource allocation, control, management and interdependency of the departments involved in the process of development of a new technology.

2.2.3.1. External Strategies

External strategies of technology sourcing lead to the development of innovative technology, in other words, radical innovation, instead of incremental, in a high proportion of the developments (Padula 2008). But, in order to achieve so, organisations need to start and maintain interesting alliances with other organisations that could be beneficial (Faulkner et al, 2005; Lichtenthaler and Lichtenthaler, 2009). This expands, the knowledge of the organisation, and can help it produce and develop a higher number of technologies (Larsson et al, 1998).

2.2.3.1.1. Technology acquisition

As it has been previously said, one of the strategies of external technology sourcing is by acquiring technology outside the boundaries of the organisation. This suggests that the organisation itself hasn't contributed to the creation of such technology, and it has only bought the technology from another firm, the one who is responsible for its creation.

This strategy is characterised because it is a pure market relationship, and sporadic, which connects 2 organisations, or more, to trade something in exchange of a monetary compensation, which indicates that no interdependency relationship is created between both parties (this could hinder the transfer of knowledge).

Since the technology is available to the market, everyone can get it by paying a price for it, which means that it is not likely to be a source of competitive advantage, but the organisation can fall in a situation of technological dependency on the supplier of the technology.

Moreover, the acquired technology needs to be adapted, for it to be assimilated by the organisation. This process is often called "Harmonisation Process" (Richen and Steinhorst, 2005), and it is about fitting the acquired technology, technological resource or capability in with the internal characteristics.

Acquiring technology is not as easy as it sounds, and there is not only one way to do so, since there are five technology acquisition deals that the organisation can choose from. They are:

- Acquisition of incorporated technology: Companies need to purchase technology that will be used for their manufacturing process, as well as their own research and development activities. When a firm can't make this technology by itself, such as machinery, tools, gadgets, software and so on, the organisation needs to find it somewhere else, from other organisations.
- Free technology in the market: Sometimes technologies are available on the market for free. External entities produce these type of technologies and the access to them is free of charge, such as some software.

- Purchase of an industrial property right: The organisation buys the right to use industrial property, such as a patent or industrial designs, among others, that another firm has developed.
- Acquisition of or fusion with another company (or at least a part): This supposes that an organisation takes control of another company, fully or a part. In fact, this is the only way to get technological capabilities when an acquisition strategy is completed. The problem comes when the organisation can't retain key personnel and there is no organisational compatibility.
  - Acquisition of a company: The organisations buys another organisation, or a part, and takes control of its management, by integrating it with the core business or by leaving it as a different entity.
  - Fusion with a company: The organisation creates a third enterprise by merging with another company (or more), and figuring out the participation of each partner in the new organisation. This means that the previous separate businesses disappear, and they become unified as a new organisation.
- Recruitment of candidates with technological knowledge: The organisation hires people who know about technology and can work for the research and development of new technology, whether it is only for a project (as an associate) or it is internally hired by the firm. This is called "soft technology" acquisition (Jin, 2002), and it requires training and experience.

2.2.3.1.2. Technological cooperation

The other external source of technology is through cooperation. This way of obtaining technology is different from the acquisition because it creates a long-term relationship between two organisations or more, which keep being independent, but become interconnected, with a common technological objective that could not achieve separately and join forces to be able to achieve that goal.

It is also known as "alliances", which improves the degree of knowledge in the organisation and its reciprocal transfer (Larsson et al, 1998), while empowering the firm since it creates a combination of heterogeneous knowledge between both businesses (Hagedoorn and Schakenraad, 1994). However, this relationship has no subordination, and all the organisations involved are interdependent on the same level (Matthews and Harris, 2010), which means that there is complementarity (organisations need each other) (Cassiman and Veugelers, 2002).

It allows certain degree of specialisation, but not as much as internal sources of technology (Chesbrough and Teece, 1996), and the transfer of knowledge is also easier and faster.

It has some problems though, being the existence of transaction costs the most important one, since this problems arises as the organisations have to interact to each other. Besides, a less probable problem, but that can be much more damaging for an organisation, is the "Trojan

Horse", or in other works, the existence of opportunistic behaviour from one of the participant organisations in the cooperation agreement, meaning that it takes advantage of its position to take and absorb resources and capabilities from the other members cooperating, to use them for its own benefit (van de Vrande et al, 2007).

Just like technology acquisition, technological cooperation also has different ways to be completed and the organisation can selected the best mix of cooperation and collaboration strategies in order to achieve its goals for the research and development of new technology and inventions. There are 6 possibilities for cooperating with other organisations.

- Long-term technological contracts: These contracts bond two or more organisations in a common agreement with the purpose of developing a technology together, for as long as the contract lasts or as long as the development needs to be concluded.
- Concession contract of a licence: The licensor relinquishes the right to use industrial property to the licensee within a particular geographic location. As a result, the licensor gets revenues and benefits from the subsequent developments and the licensee receives assistance and help.
- Outsourcing: An organisation entrusts another organisation, which tends to be specialised in a specific task or more, with the responsibility to develop a technology in the name of the hiring organisation.
- Joint Venture: two or more companies create a new company (not to be confused with a merger of companies), but this company is an independent entity, dependent on all the companies involved in the setting up of this firm, and the companies involved also keep their independency from the rest. As a result, the firms possess part of the capital/shares of the new company, which is used to develop a new technology, for all of them.
- Collective collaboration organisations (consortium): A collective organisation is an entity created from multiple organisations that gather together by a binding contract through this entity. This means that they create an organisation with a goal, and they only relate to each other through it, to fulfil a technological goal that is not the goal of the participant organisations (as it happens with the joint venture), but only for the entity created.

Figure 3. Collective collaboration organisations.

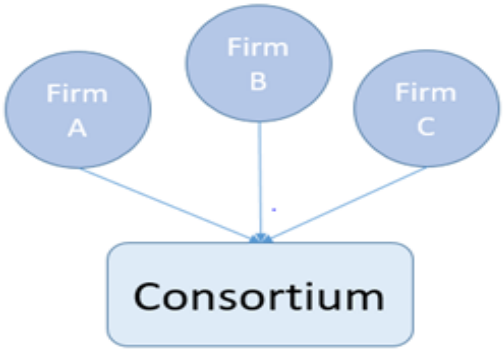

Figure 3. Collective collaboration organisations. Source: Self-ellaboration from Chesbrough (2003). Open innovation. The new imperative for creating and profiting from technology, Boston, Harvard University Press.

- Interorganisational networks: A bunch of companies are connected to each other by binding contracts of collaboration and cooperation, but they don't need to be connected to each other, which means that company A can related to B and C. At the same time company B relates to D and E and company C relates to B, D and F. This creates a network, in which all the companies are not necessarily connected to others.

Figure 4. Interorganisational networks.

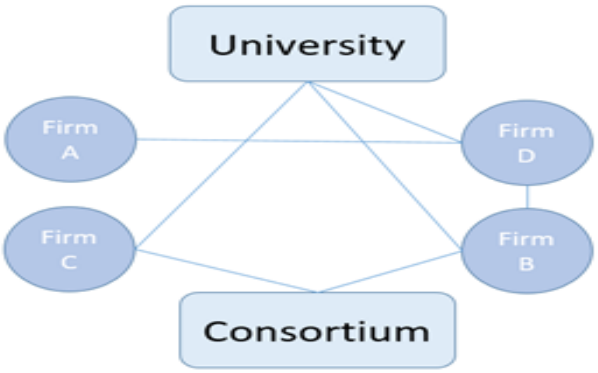

Figure 4. Interorganisational networks. Source: Self-ellaboration from Chesbrough (2003). Open innovation. The new imperative from creating and profiting from technology, Boston, Harvard University Press.

2.2.3.1.3. The process of acquisition or cooperation

Even though external strategies may not sound that difficult, this assumption is wide off the mark, because the process of implementation of them is quite challenging and tedious. The reason is that, in order to take advantage of the technological resources and capabilities that other companies have, the organisations needs to assimilate them, which depend on the "Absorption Capacity" that the business have, in other words, the ability that the firm has to recognise the value of an external technology or knowledge, assimilate it and apply it with business goals (Bittencourt and Giglio, 2013).

That's why, any firm, is advised to do a minimum of internal R&D, so they have a foundation of knowledge they can use to find and better absorb new external technologies and knowledge and invest in their abilities to absorb external technologies (Cohen and Levinthal, 1990).

2.2.3.2. Internal strategies

The other possibility for obtaining technology, an as a result, innovation, is by means of internal processes and R&D activities. This method of technology sourcing is mainly based on the core technological resources and capabilities of the organisation, which means that the organisations needs to focus on this competences in order to create (Kessler et al, 2000). At the same time, internal R&D activities also require a tight control over the activities themselves (Kessler et al, 2000).

The knowledge used for internally developed technologies tends to be more specific and exclusive. At the same time, it is also tacit, since it grows from the internal relationships and interaction and the way things are done in the organisation, which makes it difficult to interpret from the outside and imitate by other organisations (Nonaka, 1994).

This kind of specialisation on the internal resources and capabilities, that leads to a better understanding and effective utilisation of the available competences, is useful to comprehend tacit and complex technology (Bierly and Chakrabarti, 1996), creating technologies that are difficult to imitate, but internal technology sourcing is not good for dealing with uncertain, complex and quickly changing environments.

Since external technology sourcing strategies help deal with the external environment better, create flexibility and expands the knowledge base (Grant, 1996), companies should be able to implement both types of strategies, which means that they would remain flexible in highly uncertain environments while taking advantage of the internal development of technology (Vanhaverbeke et al, 2002).

2.3. R&D Internationalisation

Internationalisation of R&D is about setting up and opening a R&D unit in a different country from the one of origin of a specific organisation. As Julian and Keller (1991) defined, "Multinational R&D" is the process through which an organisation expands its activities in research and development outside the national frontiers of its original country.

This definition comes in handy, because the term "internationalisation" does cover much more than just what the multinationalisation implies. While multinationalisation accurately refers to the opening of research and development units abroad, which are owned and managed by the founding organisation, internationalisation also refers to other elements, apart from the one that multinationalisation stands for, even though, typically, in the vast majority of the past literature (Ronsdadt, 1978; Grandstrand et al, 1999), where internationalisation seems to become fused to multinationalisation, ignoring, therefore, the intrinsic differences.

This can be seen clearer by exposing the other elements that are included in the internationalisation of technology, which are the application of a technology in another country, the exchange of property rights and knowledge, agreements of collaboration, joint ventures and so on and the recruitment of globally spread-out personnel and training in R&D centres abroad.

This "multinasionalisation of R&D" is highly related to the term of "offshoring", but specifically dedicated to R&D., as Table 6 shows. It is vital not to get confused with the different terms and concepts and understand the differences.

Table 6. Property-Location matrix for R&D.

		Location (Where is the R&D Completed?)	
		Onshore (Own Country)	Offshore (Abroad)
Property or Control (Who is in charge of the R&D?)	Insourcing (Own Company)	Onshore R&D (Local R&D)	**Offshore R&D (Multinationalisation of R&D)**
	Outsourcing (External Supplier)	Onshore Outsourcing (Local Supplier of R&D)	Offshore Outsourcing (International Supplier of R&D)

Table 6. Property-Location matrix for R&D. Source: Chesbrough (2003). Open innovation. The new imperative for creating and profiting from technology, Boston, Harvard University Press.

Of course, this method of researching and developing new innovation far from the country of origin allows the organisation to benefit from a great deals of advantages it could never have if it didn't go beyond its national boundaries, but the multinationalisation of R&D also has some problems and drawbacks it brings along with it. In Table 7 there is a list of all the advantages and disadvantages of having R&D done abroad.

Table 7. Advantages and disadvantages of the multinationalisation of R&D.

Advantages	Disadvantages
Access to technological resources and capabilities abroad (skilled labour, technological facilities,...).	Higher costs (investments, communication costs,...).
Cost reduction (economies of scale and cheaper resources).	Loss of control over new projects.
New sources of ideas and international technological knowledge.	Management difficulty (cultural, labour, temporary and idiomatic differences).
Sources of funding.	
Better adaptation of the innovation to local needs.	Difficulty to integrate the results in R&D from other locations.
Better image of the company.	

Table 7. Advantages and disadvantages of the multinationalisation of R&D. Source: Hidalgo et al (2002). La gestión de la innovación y la teconología en las organizaciones, Pirámide, Madrid, chapter 10.

The advantages of the process of multinationalisation of R&D outnumber the disadvantages, but they are not equally shared by the different strategies available to achieve the fulfilment of the process. Actually, there are four strategies for multinationalisation, and they all have to do with the network that is created between the central unit and the units established in other countries and how they relate to each other.

This strategies come from the model proposed by Bartlett and Ghoshal (1990), basing the multinationalisation of the company on four different organisational structures, relating to the

development of products and services through the technological resources and capabilities of the company.

2.3.1. Centre to Global

This strategy for the multinationalisation of the R&D is based on the establishing of the main unit (the one in the country of origin) as the one responsible for the research and development of the vast majority of the projects, and then, the technology generated is passed on to the rest of the units abroad.

These units don't focus on the main development of the technology, but slightly adapt it to their local needs, provided there is the need to do so.

Figure 5. Centre to Global structure

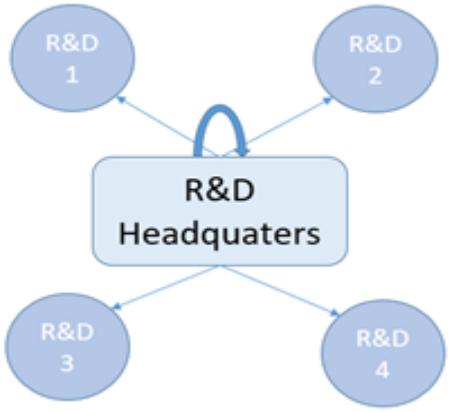

Figure 5. Centre to Global structure. Source: Adapted from Bartlett and Ghoshal (1990). The Multinational Corporation as an Interorganisational Network. Academy of Management.

Figure 6. Local to Local structure.

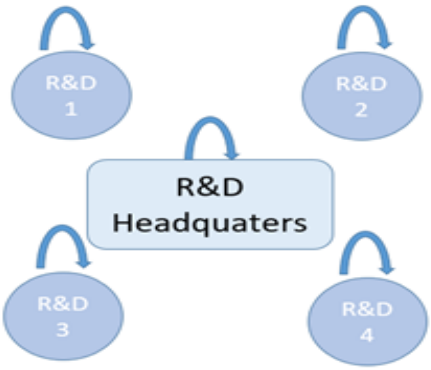

Figure 6. Local to Local structure. Source: Adapted from Bartlett and Ghoshal (1990). The Multinational Corporation as an Interorganisational Network. Academy of Management.

2.3.2. Local to Local

This strategy is recognisable because each unit is independent since each local centre carries out its own R&D, adapting what they create to their own needs.

This strategy is the contrary to the "Centre to Global" strategy and it stands out for having no or little interdependence among the centres.

2.3.3. Mixed

This strategy is some kind of a combination between the previous two strategies. All the centres are decentralised units with certain degree of independency, but they are related to each other.

This strategy, in turn, has two different possibilities, based on the same structure, but with different implementation procedures and tasks.

Figure 7. Mixed structure.

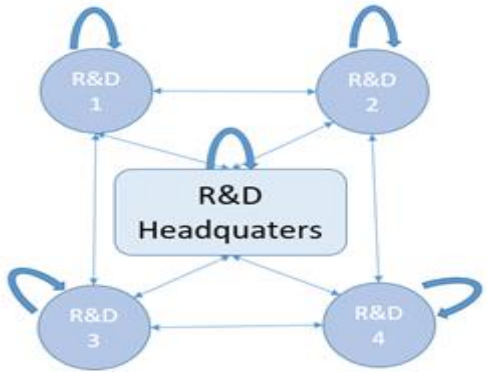

Figure 7. Mixed structure. Source: Adapted from Bartlett and Ghoshal (1990). The Multinational Corporation as an Interorganisational Network. Academy of Management.

2.3.3.1. Locally exploited

All the R&D projects are carried out in a decentralised way of working, affecting all the units, but with coordination among the centres involved in a certain project. Once a project is finished, the result is transferred to the whole organisation, through the lines of control and cooperation.

2.3.3.2. Globally linked

The research and development activities are also done in all the organisation, but each unit is specialised in a definite type of R&D, which will be later integrated in the rest of the corporation or will be used by other process of innovation in another differently specialised unit.

As it has been stated before, the benefits and drawbacks of the multinasionatilisation of R&D are not equal for all the strategies, since one strategy may feature an advantage more than another strategy, or have a disadvantages that doesn't affect the other strategies that much. Table 8 gives a clarification about the matter that is very useful for the selection of the best strategy for an organisation and its internal structure.

Table 8. Advantages and disadvantages of multinationalisation structures of R&D.

Strategy	Advantages	Disadvantages
Centre to Global	Economies of scale.	Scarce adaptation.
	Synergies.	Inefficient adoption (resistance and lack of resources and capabilities to absorb knowledge).
	Higher degree of R&D coordination (more integration, faster and without duplicities).	
	Protection of technological resources and capabilities.	
Local to Local	Diverse resources.	Duplicities.
	High adaptation to demand.	Fewer economies of scale.
		Technological resources and capabilities are not used globally.
Mixed	Combination of the adaptation to needs and access to local resources with its global application.	High degree of coordination
		High coordination and communication costs.

Table 6. Advantages and disadvantages of multinationalisation structures of R&D. Source: Bartlett and Ghoshal (1990). The Multinational Corporation as an Interorganisational Network. Academy of Management.

2.4. Drivers for Multinationalising

This increase of the rate of multinationalisation has been derived from the growing interest in having R&D units in a different countries, in order to benefit from the advantages that this type of internationalisation gives to the company and the advantageous circumstances that the company gets by researching and developing internationally. But the organisation must assess what the perfect country is to do so and get those benefits.

The selection of the country or region where the company is going to open a unit for the research and development of new technology is not an easy and straightforward decision, and the drivers for multinationalisation have to be assessed and taken into account.

There are three types of drivers that lead the company to starting a strategy of multinationalisation. The first type is at a regional or country level, based on specific geographical areas. The second has to do with the industry in which the company is operates and the third one involves the company itself.

2.4.1. Drivers for Multinationalisation at a Regional level.

These drivers are the foundation for understanding all the factors that inspire companies to set up R&D centres in foreign nations. In this case, the policies and legislations regulated in each country will create a healthier environment for innovation or hinder the opportunities for foreign companies to invest and open these centres in national territory.

An important country driver is the income and market size of the geographical area of the country or region. There is evidence that multinationalisation occurs in countries with high income, where the GDP per capita is reasonably high. Capital flows are attracted by this potential income and profitability as investments (Ekholm and Midelfart, 2004; Jensen, 2006). At the same time, the bigger the market, the more interesting it becomes, since there are more households where the developments concluded can be sold and receive revenues from.

Workforce is also an important aspect (European Commission, 2010). If there is a shortage of skilled professionals in the home country of a company, it will be encouraged to go abroad to look for workers with the required expertise and knowledge, so the company with be more keen on investing in a R&D centre abroad. Ernst (2006) demonstrated the success in India by having a surplus of people graduated in science and engineering with good knowledge of such areas.

Spillovers are another good factor that pulls companies into a specific foreign country, or to be more accurate, region, since technological hubs tend to occupy a small part of the whole area of a country. Porter (1990) argued that these knowledge spillovers serve as specialised nexus, where local competition boosts rapid innovation, just like the ceramic cluster in Castelló, which creates a brilliant example of a knowledge spillover. For Jacobs (1969), this proximity of business with the same activity allows them to transfer knowledge and share it to create innovation. Companies that want to take advantage of the knowledge and talent need to be present in such clusters (Audretsch and Feldman, 1996) where the importance of a quality education system and the presence of further education institutions such as universities are highly valuable.

Labour costs seem not to be a very important factor, but sometimes they help to make the final decision. A country with low labour costs is attractive for a company since it can save money, but it turns out to be a trade-off, because a country with low labour costs doesn't have a high GDP per capita, which are not very interesting in terms of income. It is interesting in terms of production, but empirical evidence shows that it is not that much for R&D (Booz et al., 2006; Kinkel and Maloca, 2008; European Commission, 2010). Nonetheless, when companies have to choose between 2 locations with similar features or want to open R&D centres in developing countries, this factor is influential (Booz et al., 2006; Cincera et al., 2009).

Proximity between countries can also affect a decision of multinationalisation. Countries that are closer to the home country of an organisation, since they result cheaper in terms of cross-border and coordination costs, tend to be ranked high in the list of options. Moreover, by being nearby, economies of scale can be achieved and the transfer of knowledge becomes easier (Guellec and van Pottelsberghe de la Potterie, 2001; Gersbach and Schumutzler, 2006; Sanna-Randaccio and Veugelers, 2007). Besides, culture also plays an important role, and creates the "liability of the outshidership" (Johanson and Vahlne, 2009), which refers to the lack of knowledge about the market, the customer needs and a lower degree of a correct embeddedness of the informal structure of the organisation with the formal one.

The last factor is about government stability and a fostering legislation. Moreover, adequate tax systems, infrastructure and a strong legal system draw the attention of international investment (Cantwell and Mudambi, 2000; Thursby and Thursby, 2006), as well as equality for foreign business and national ones (Guimón, 2009).

2.4.1.1. Selection of the Location

Regarding the regional drivers, they will influence the decision-making process of an organisation on where a business unit can be set up. For Gerybadze and Reger (1999), this process of multinationalisation has two phases. In the first one, the company deliberately centres the unit where the main decisions will take place, such as the definition of which strategy will be followed and the responsibilities each unit will be responsible for. In the second and last phase, a centre is considered as the main one ("Centre of Gravity"), which will normally be the same as in the first phase and coincide with the one in the country or origin, but not necessarily, where the most knowledge and resources are found and the highest value created.

The process of multinationalisation has become much more common over the years and companies all around the world and all sizes have started to have R&D units abroad. This situations occurs as a result of the improvement in communications, the changes in the labour

markets, globalisation and the merging of markets, increasingly growing competition and the change in customers' needs (Friedman, 2006; Vrontis et al, 2008).

While in the past, companies (normally in developed countries) tended to set up R&D units abroad in neighbouring countries which were also developed, the previous process has shifted this premise, and, boosted by the crisis, companies have expanded their geographical scope, by setting up R&D centres in developing countries, far from the original headquarters, being East Asia one of the best examples of multinationalisation of R&D (Edler, 2008; von Zedtwitz and Gassman, 2002). Moreover, companies in developing countries have also started to open R&D units in foreign countries, developing as well as developed.

Von Zedtwitz (2006) introduced a classification in order to segment the different types of R&D multinationalisation, by considering the type of country of origin of the investing firm and the country where its investment in foreign R&D units were being made, coming up with 4 different types of R&D multinationalisation.

Table 9. Types of R&D multinationalisation.

	Host Country: Developing	**Host Country: Advanced**
Home Country: Advanced	Type 2: Modern (e.g., Germany - China)	Type 1: Traditional (e.g., Germany - USA)
Home Country: Developing	Type 4: Expansionary (e.g., India - China)	Type 3: Catch-up (e.g., India - Germany)

Table 9. Types of R&D multinationalisation. Source: von Zedtwitz (2006). Internationalisation of R&D – Perspectives from Outside and Inside of China. AsiaCompete Ltd.

2.4.2. Drivers for Multinationalisation of the Industrial Sector.

It is important to differentiate among sectors, because investment in R&D can be very different from one another. There are sectors where investment in R&D is very high and intensive in technology, while in others, the investment is more humble. Moreover, each sectors has specific innovation processes, which means that the needs and the characteristics of a sector will not be the same as the others (Marsili, 2001; Castellacci, 2007; Peneder, 2010).

One factor regards how the knowledge in the sector is. If it is very tacit, which means that cannot be written down or hidden, and comes from experiences, emotions, observations and so on, being part of someone's consciousness and implying shared interaction, the transfer of

this knowledge will be very difficult (Cowan et al., 2000). However, it is also a driver because, since it is difficult to transfer, the company may need to go to the place where it is available.

Over time, knowledge accumulates, and innovation is dependent on such knowledge. This is called cumulativeness, and it is also a factor for multinationalisation (Marsili, 2001). If there is cumulativeness, there is R&D specialisation (centralised R&D), such as in sectors like chemicals, pharmaceuticals, telecommunications and electronics.

The protection of the property is also another factor, since those sectors where the industrial property cannot be easily protected will be reluctant to multinationalise their innovation (Cohen et al., 2000).

Finally, the last factor at this level is the connection with third parties, such as universities, suppliers and other entities gives a lot of potential to a R&D unit abroad (Malerba, 2002). Universities, for example, are a source of new knowledge and talent and suppliers help with the materials for production.

2.4.3. Drivers for Multinationalisation at the Firm level.

Companies are completely different from each other. They located in divergent regions and operate in different sectors, but at the same time, they have distinct characteristics, structure, strategies, among others. As a result, the opinion towards multinationalisation and the capabilities they have to implement it are not the same.

However, the multinasionalisation of R&D, leads to the internationalisation of other activities, such as production or sales (Birkinshaw and Hood, 1998). This is one driver at this level, with empirical data (Dogson and Rothwell, 1994; Cerrato, 2009) showing that the size of the firm doesn't matter, but bigger companies tend to do better in this sense, and those that are decentralised can benefit more from the advantages of multinationalisation.

The second and last driver has to do with the knowledge that is available abroad, and the new knowledge that can be created, known as the "asset-seeking motive" (Dunning and Narula, 1995), also called "global R&D strategy" (von Zedtwitz and Gassmann, 2002), among other names. To find that knowledge, many times tacit, companies need to become international and find it in universities, or clusters, or through clients, suppliers and competitors (Breschi and Lissoni, 2001). At the same time, the more complex a technology is, the more knowledge is required, forcing companies to move part of their R&D activities abroad (Narula and Zanfei, 2005).

2.5. Open Innovation

Table 9. Closed and Open innovation.

Closed Innovation	Open Innovation
Based on internal ideas.	Key ideas also come from the outside (e.g. universities).
Scarce mobility of workers.	High mobility of workers.
Internal R&D leads to profits.	External R&D can create a lot of value.
The finders of a technology, introduce it (finders, introducers).	No need to generate research to use it.
The first firm to introduce a technology wins.	A good business model is better that getting to the market first.
Control over property rights, so others don't use the firm's ideas.	Benefits from others using a firm's property rights, and the other way around.
No venture capital but internal entrepreneurship.	Venture capital and Start-ups are important.

Table 10. Closed and Open innovation. Source: Chesbrough (2003). Open Innovation. The new Imperative for Creating and Profiting from Technology. Boston, Harvard Press.

The concept of "Open Innovation" was coined by Henry Chesbrough in 2003 in this book of the same name. According to Chesbrough, to advance in the development of new technology, organisations can and must use external ideas, as well as internal ones, while using external and internal methods towards the market too.

It is the complete opposite of closed systems of innovation and it consists in the sourcing of technology internally and externally, and the exploitation of technological resources and capabilities both, internally and externally too.

This open innovation gives 3 different types of processes (Gassmann and Enkel, 2004), which can be used all three at the same time for the R&D projects that exist in the organisation, without them being exclusive.

The first two processes are the opposite of each other, considered by Day and Moorman (2010) as "the two paths to strategy". On the one side, the "Inside-out Approach" considers the strengths and capabilities of the firm as the long-lasting attributes that will help the firm exist. As a result, it is based on the exploitation of ideas and capabilities internally in new markets and sectors. Thus, the core competences of the company become the driver for existence. On the other side, the "Outside-in Approach" refers to the idea of including external sources of innovation, while paying attention to the outside world (customers, suppliers, investors,…) in all senses to improve the organisation's operations and do better than the competition.

Figure 8. Types of processes in Open innovation.

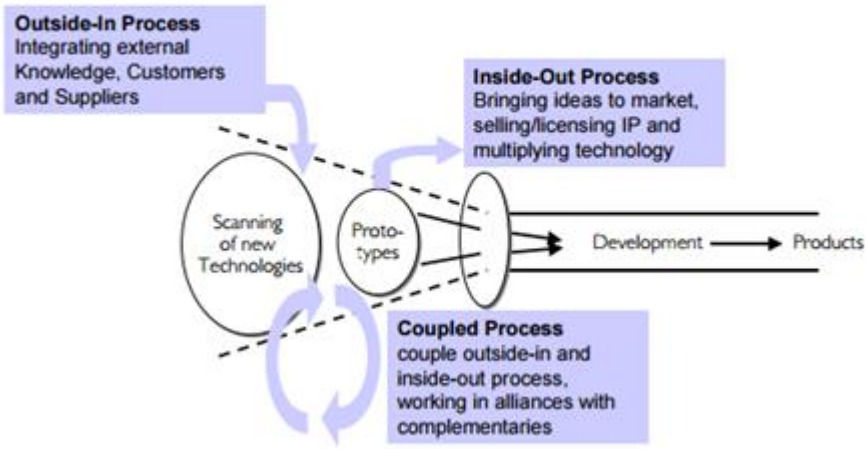

Figure 8. Types of Processes in Open Innovation. Source: Gassmann and Enkel (2004). Towards a Theory of Open Innovation: Three Core Process Archetypes. Switzerland, Institute of Technolgy Management.

Besides, there is one more type of processes, which is called "Coupled-process". This process links the previous two types. Ideas and technological competences go outside of the firm towards other organisations with whom the firm cooperates and then they go back with in form of results or further research, to use them for the firm's business, by creating alliances with the other organisations.

The concept of innovation certainly has many benefits, but it is not free form drawbacks though. The next table (Table 10) shows a list of these benefits and disadvantages, where it can be seen that positive features outnumber the negative ones.

Table 10. Advantages and disadvantages of Open innovation.

Advantages	Disadvantages
Lower cost.	Loss of control over the innovation process.
Risk sharing.	Not suitable for all sectors.
Access to multiple technological resources and capabilities	Problems with the management of industrial property.
Creativity stimulation.	Coordination difficulty with external agents (costs and time).
Faster innovation process.	Problems with the protection of competitive advantage.
Higher relaxation (outsourcing of non-strategic activities).	An organisational and cultural change is required (resistance to change).
Greater income flows generation.	
Viral marketing.	
Easier organisational change towards opener models.	

Table 7. Advantages and Disadvantages of Open Innovation. Source: Chesbrough (2003). Open Innovation. The New Imperative for Creating and Profiting from Technology. Boston, Harvard Press.

2.5.1. Types of open innovation

These processes are the core of the types of open innovation that are used for the R&D of new technology. One of them, the intraorganisational open innovation (Morgan et al., 2011), opens inwards, which means that all the people involved internally in the organisation can participate in the R&D projects by means of suggestions postbox, ideas contests, brainstorming sessions, ideas repository.

The opposite of the above is the interorganisational strategy (Vanhaverbeke, 2005), which creates collaboration agreements with external agents, such as other companies (suppliers, customers, competitors, complementary businesses), universities or technological centres.

Finally, a third strategy for open innovation is the collective or crowdsourcing (Buecheler et al., 2010), which uses massive volunteer participation and adopts self-organisation principles in order to comply with the co-creation of products and services, by organising international brainstorming sessions with users, collective funding,…

2.6. Mature Markets and Products

A mature market or industry is the one where an equilibrium point is reached and sales grow smaller until they stabilise, meaning that growth becomes stagnant and change and innovation stops, as the next illustration shows, with the mature phase being stable and flat.

Figure 9. Industry growth rates.

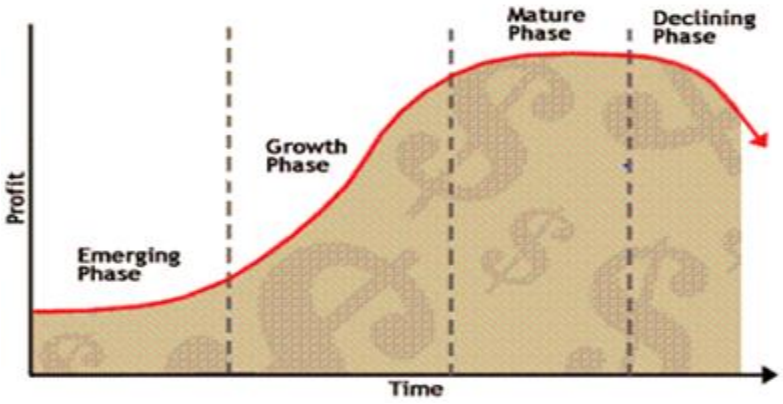

Figure 9. Industry Growth Rates. Source: Investopedia.

These markets are characterised by the absence of innovation or the existence of very little innovation. As a result, products in this market are also very mature and they have little room for technological improvement.

Richard N. Foster introduced in its book, “The Attacker’s Advantage” (1986), the statement that a specific technology cannot grow and improved endlessly, since this improvement is limited to time.

Figure 10. Product life cycle.

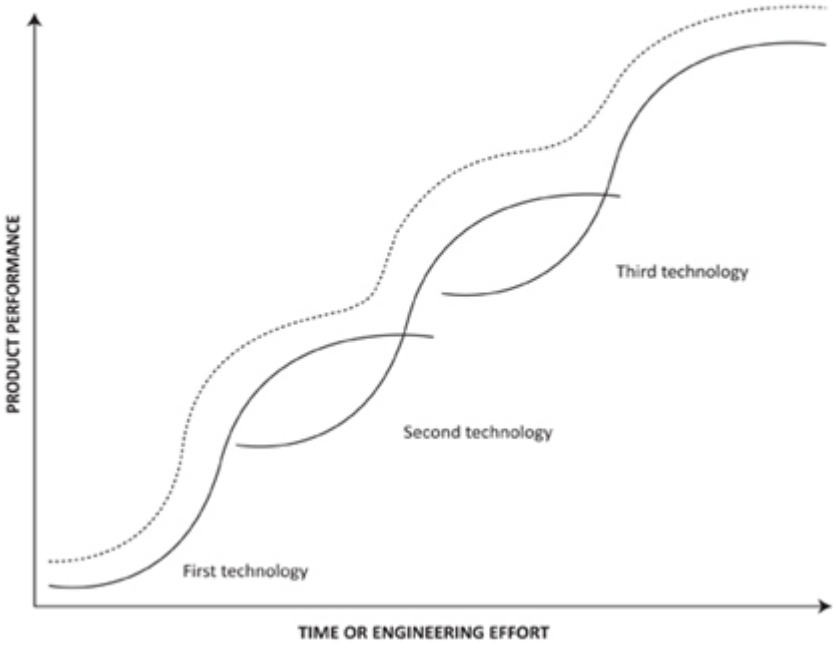

Figure 10. Product Life Cycle. Source: Richard N. Foster, "The Attacker's Advantage".

In order to represent this evolution, Foster plot a graph to represent the evolution of a technology, by representing the variable “Time” in the X axis and the variable “Performance” in the Y axis.

This showed that technologies keep on being improved over time (Emergence and Growth), until they reach a moment (Maturity) when they cannot be further developed, and the only reasonable solution is to shift to a different technology (Saturation).

Therefore, taking all the previous information into account, it can be observed that mature markets are clearly flooded with basic products, that don’t tolerate a high degree of innovation, resulting in the company having to struggle to keep sales and fight fiercely to be able to grow with the same product as anyone else in the competition with few differences.

3. CASE STUDY

The theoretical framework gives the knowledge about the strategic thinking regarding innovation and technology in a business and corporate environment.

The case study is proposed as a qualitative evidence and demonstration of the theory, applicable to reality, supporting the theoretical framework to give a complete understanding and serve as an example about the strategies regarding innovation in an organisation and how they can be completed, while helping to find the results they lead to.

3.1. Industry Description

A fantastic example of an industry that is settled around a very mature market where products have become very similar, with little differences and innovation is scarce, due to the maturity of the products, is the convenience products market. In other words, products that are bought without consumers taking a lot of time to consider the purchase.

There are a lot of different products that fall within this category, but some good examples are the ones that can be found at the supermarket, from toilet papers or shampoo to rice and pasta. All these products and mainly the same, with very little and humble differences among brands and the benefits you get form buying one type or another are imperceptible.

There are many companies behind the great variety of convenience products, some of them specialised in a specific product of line of products, and others that count with a vast portfolio of different products of different type, behind fully or partially owned firms.

Some of these companies that manufacture and sell so many products worldwide can be found commercialising products dedicated to beauty, health care, home care or food. In Table 11 there is a list of some of the most important firms around the world that supply convenience products in some of the categories that the table also shows.

Table 11. Competitors and market segments.

	P&G	Unilever	Colgate-Palmolive	Church & Dwight Co	Johnson & Johnson	Clorox	Ecolab
Beauty	Yes	Yes	Yes	No	Yes	No	No
Grooming	Yes	No	No	No	No	No	No
Health Care	Yes	No	Yes	Yes	No	No	Yes
Home Care and Fabric	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BFF Care*	Yes	Yes	Yes	Yes	Yes	No	No
Business Units	5	3	4	3	3	1	2
*Baby, Femenine and Family Care							

Table 11. Competitors and Market Segments. Source: Self-elaboration from multiple sources.

From the previous table, five of the most important companies around the world in convenience products markets out of seven have products in, at least, three of the five categories that have been selected to analyse, being P&G and Colgate-Palmolive the ones that participate in all, or the most categories. The food sector has not been considered, so that these products are very traditional, lack innovation and cannot be patented since they are made from existing raw material, and may come from new animal or vegetable species, five of the exemptions that cannot be protected under legal regulations regarding technology.

Continuing with the analysis, five of the previous companies have been taken to find further information about them and more forward in the selection process of the company that will be assessed with more depth. Table 12 shows extensive data these firms that will help to make a decision about the most adequate company to assess.

Table 12. Patents and economic factors of companies.

	P&G	Unilever	Colgate-Palmolive	Church & Dwight Co	Johnson & Johnson
Brands	+40	+400	+20	+10	+90
Patents (USA)	14.420	3.705	3.637	N.D.	2.816
Net Sales (millones $)	76.279,00	53.272,00	16.034,00	3.395,00	70.074,00
Net Revenues (millones $)	7.144,00	5.259,00	1.384,00	410,00	15.409,00
Total Assets (millones $)	129.495,00	52.298,00	11.958,00	4.256,90	133.411,00
Total Liabilities (millones $)	66.445,00	36.216,00	11.958,00	1.050,00	62.261,00
Social Capital (millones $)	63.050,00	52.298,00	44,00	973,20	71.150,00

Table 8. Patents and Economic Factors of Companies. Source: Self-elaboration from multiple sources.

Considering that the most important factors for this case study are the patents and the number of brands, ranging from the beauty to the baby care sector, the relative value of these two variables will be higher, accounting for 30% each and the remaining 40% is split among the other factors. As a result, the most similar companies in these factors are P&G, Unilever and Colgate-Palmolive.

To finish with the assessment of the main economic data of these three companies, Table 13 shows the trend in the number of patents that companies have (the number for 2014 and 2013 have been approximately computed by using the Global Innovation Index for the concerned years), the annual sales and the net profits of all three companies. The one with the highest amount on the majority of these three growth trends in the last tax year in P&G, which means that the analysis on technology and innovation will be completed for it.

Table 13. Corporate trends.

Trend 1 (Nº of Patents)	2015	2014	2013
P&G	41.000	37.802	36.101
Unilever	20.000	18.440	17.610
Colgate-Palmolive*	4.000	3.688	3.522
Trend 2 (Net Profit)	2015	2014	2013
P&G	7.144.000.000	11.600.000.000	11.300.000.000
Unilever	7.515.000.000	7.980.000.000	7.517.000.000
Colgate-Palmolive	2.789.000.000	3.557.000.000	3.592.570.000
Trend 3 (Annual Sales)	2015	2014	2013
P&G	76.279.000.000	74.400.000.000	73.900.000.000
Unilever	53.272.000.000	48.436.000.000	49.797.000.000
Colgate-Palmolive	16.034.000.000	17.277.000.000	17.449.770.000
* For Colgate-Palmolive, the number of patents is an upwards approximation worldwide of the patents granted in USA.			

Table 9. Corporate Trends. Source: Self-elaboration from multiple sources.

3.2. R&D Efficiency

The data in Table 13 can also be used to calculate the efficiency behind the patents that companies have. By dividing the patents by the amount of annual sales (Figure 11), it can be computed the percentage of participation of each patent in the sales, and if the patents are divided by the amount of net profit (Figure 12), the proportion of profits resulting from each unit patented is obtained.

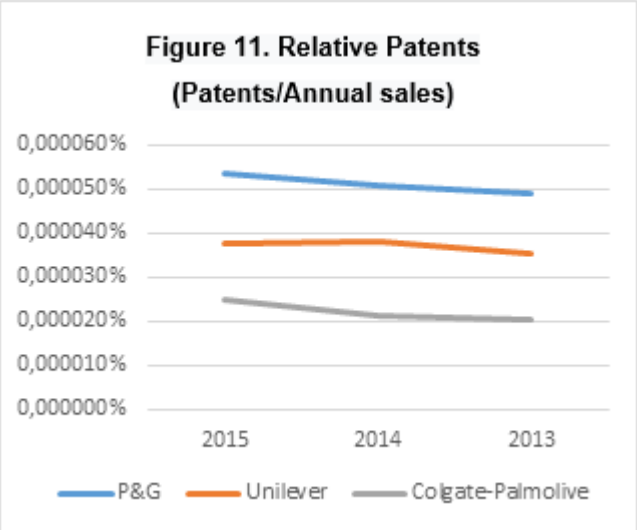

Figure 11. Relative Patents (Patents/Annual Sales). Source: self-elaboration from multiple sources.

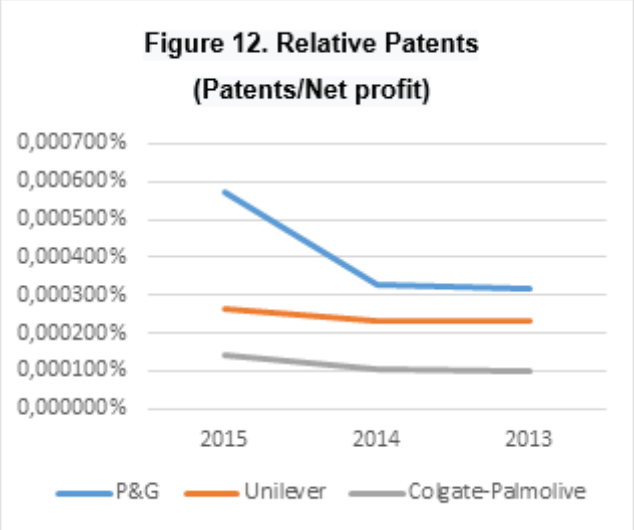

Figure 12. Relative Patents (Patents/Net Profit). Source: self-elaboration from multiple sources.

Regarding the rate of patents based on sales (Figure 11), the rate has gone up since 2013, which means that each patent is losing sales potential, in other words, it means that each patent is generating fewer sales, since one unit of sales produced is covered for an increasing proportion of patents. At the same time, the same trend is happening with the rate of patents based on net profit, which has increased over the years, especially in the last period, when it has almost doubled. This means that unit of net profits comes from a higher proportion of patents too.

However the other two competitors are doing better, especially Unilever, which is holding its position fairly well. P&G, on the contrary, is doing worse. The reason is that the company in investing in R&D and getting more patents granted, but this is not translating into a proportionate higher amount of sales or profits, even though sales have increased since 2013, while profits have plummeted in 2015, being this the reason why the rate of patents based on profits has risen so much in this tax year since 2014.

3.3. Company description

The selected organisation to assess its technological strategies is P&G because the company is one of the biggest suppliers of traditional and mature products in the world. The company is present in many countries and sells a wide range of products, resulting in the company having a lot of manufacturing processes. Since the company has a lot of products, it also owns many industrial rights to protect them, which is interesting for this paper.

From the previous analysis, at the same time, among other competitors, P&G has been selected because is the company with the biggest number of patents and the highest sales, and considering the relative patents and the loss of power of them, it is interesting to see how the company can still create value under these circumstances by implementing the technological strategies that lead to more property rights of products.

3.4. Organisational Structure.

To be able to face the challenges of being a big company that is very diversified and spread all round the world and create value for its shareholders, while meeting the financial and commercial needs the corporation deals with, the structure that adapts the best to the company is a multividisional structure.

The first level of the structure is comprised of the corporate office, headquartered in Cincinnati. This office is responsible for the corporate functions that covers the whole company, such as the decisions about the corporate strategy, governance, restructuring, allocates resources for innovation projects and improvers capabilities and internal relations.

Figure 12. P&G's organisational structure.

Figure 13. P&G's Organisational Structure. Source: P&G at us.pg.com

In the second level there are the Global Business Services, which are specialised in consulting, legal, tax and auditing, among others, and are rendered collectively to all the divisions of the company, so duplicities are eliminated and costs reduced. These services can be offered internally or by other companies (PwC, Deloitte,…).

The third level gathers the operative divisions, which are separated in segments and are in charge of the obligations that come from the corporate office, related to day-to-day operations and the business unit strategy, focusing on customers, brands and competitors, innovation of each segment, profitability and value creation. At the same time, they are also divided by the six geographic regions, which means that each region has one business unit of each type.

Finally, the fourth level of the structure is formed of Market Development Organisations (MDOs), integrated in each business unit and responsible for knowing customers and suppliers in each market where P&G is competing. For example, the beauty segment for Europe, there is an MDO for Spain that is different form the one in France or the UK.

This structure is beneficial for the company because it allows business unit directors to control the performance of the unit better, the divisions can be compared and the allocation of resources is improved and it stimulates the directors of the poorly performing divisions to look for ways to improve the situation.

3.5. Technological Strategy

3.5.1. Exploitation Strategies in P&G

P&G is a big company, located in many countries with thousands of employees and dozens of products, which uses both exploitation strategies, horizontal and vertical, to make use of the technological resources it has.

On the one side, P&G is heavily focused on the vertical strategy. An important part of the technological resources that the company possesses have been developed this way. In 2014 alone, the company invested around 2 million dollars on internal innovation.

Some of these projects have led to a toothbrush with Bluetooth technology, fabric detergent capsules for the Tide brand and the “Flexball” technology, for razors, which has undergone further improvements such as the addition of lubricant strips for a better and smoother shaving. Another example, also for the brand Tide, has been the product Tide PurClean, a detergent that is respectful of the environment, made from natural products and 100% produced with renewable wind energy.

On the other side, P&G also uses horizontal strategies, by selling resources and capabilities that are not convenient for the company or its sale will allow for the investment in other businesses, being a good example the calcium supplement for juices that improved the absorption of calcium without negative results, which was sold to Tropicana, a company acquired by PepsiCo. Moreover, another example comes from the pharmaceutical business, started in 1982, but sold to the Irish firm Warner Chilcott for 3.1 million dollars, after being too dependent on joint ventures and universities. This business was not aligned with the rest of the corporation and included products such as Actonel (bones weakness solution) or Asacol (colitis medicine), among 40 others.

But selling is not everything, the company also donates resources, like the Cox-2 Inhibitor, an aspirin patent donated to Vanderbilt University in 2000, which means that the company can take on any method in order to give away technological resources and capabilities, depending on the situation, technology and benefits.

3.5.2. Protection Strategies

3.5.2.1. Types of protection

A good protection strategy is necessary to protect the resources that an organisation possesses and has invested so much money in. P&G especially relies on the *patents* it owns, more than 41.000 granted and more than 55.000 applications worldwide.

Moreover, P&G takes it very seriously to defend its property by litigating companies that use its rights, such as Brushpoint Innovations Inc, a Canadian producer and distributor of teeth whitening products, sued in 2012 for selling unauthorised licensed products, or in 2015, when Dollar Shave Club was taken to court for infringing a razors patent P&G had.

In fact, the company has even been called “patent troll” for suing competitors so much in order to get revenues from such litigations and defend its position as a leader,

P&G is also proud of protecting the value its products gives to customers. For example, the Swiffer WetJet system, created when mops used cotton, or other material, strips or threads, substituting them for replaceable mop strips with “Nonwoven” technology. This created *head-start* benefits, maintained longer thanks to the subsequent improvements, such as the mops that didn’t allow competitor’s replacements for mop strips to work with P&G mops. This business model is called “Razor-razorblades”, which prevents competitors from imitating a patented product, but also prevents them from copying complementary merchandise.

One more example of protection strategies would be the *confidentiality agreements*. The company also uses them with suppliers and employees, and a good evidence is the 2015 court resolution against five ex-employees, who disclosed confidential information about Gillette’s projects to their new recruiter Shave Logic.

3.5.2.2. Offensive and Defensive Strategies

As it has been said above, the company is very aggressive when it comes to patent protection. This offensive strategy has resulted in the company being called a “patent troll”, but this is not the only offensive strategy that is used by P&G.

P&G also sells industrial property to get rid of rights against competitors but in favour of the purchaser. An examples is the Pringles container, used for chips, transferred to Kellogg’s when the brand was sold, created by P&G to protect the chips from breaking as in traditional packaging.

Cooperation is another offensive strategy used by P&G that will be explained further later and then the company also donates resources, as the example of Vanderbilt University or the ISA TR088.05 PackML standard software, used to improve the performance of the assembly line to reduce starting time and helps decision making, donated to the packaging industry to create a common production framework and regulations.

Regarding the defensive strategies, P&G hasn’t been involved in many case of litigations against the company, but its own portfolio of patents is a good way to dissuade competitors to take further actions against the company.

A notable case of a defensive strategy was the accusation of Lever Brothers in 1949 against P&G for a soap with a different chemical composition regarding the Levers' one, but this didn't hold them up to take actions against P&G, which lost the case since its production method was based on Lever's manufacturing method.

Another case was Hard Candy v CoverGirl, when P&G launched a make-up line based on Katy Perry through its CoverGirl division, with a design seemingly equal as the one used by Hard Candy, which reported the aggression against its industrial property, but without winning the case.

There haven't been many cases of legal challenges against P&G, or at least there are not many public precedents, but the company shows every day that it is ready to accept the challenge by using defensive and offensive strategies.

3.5.3. Strategies for obtaining technology

The firm also uses external strategies to get technological resources and capabilities, in fact, two thirds of the new technology of the company is sourced this way, for example, by incorporating purchased technology, machinery for instance, as a machine to fill and seal toothpaste tubes for P&G's Crest or Oral-B brands.

On the market there is also free technology, like the web integration for Twitter and Facebook, used by P&G to give a better customer service, by interacting with them in real time and gent valuable information to improve goods and services. But not all technology is free, sometimes P&G has acquired property rights, as Niagen, a dietary anti-age supplement incorporated in several products of the company.

Recruiting talented people from all over the world is another way to obtain technology, by means of their knowledge. The PGCareers is the perfect platform to attract international and experienced talent, while offering available positions, internships and information about admission and learning.

However, the most used method is the acquisition of or fusion with other companies. In 2015, the company disinvested in 100 little productive brands to specialise in 70 brands of 10 types, going from a wide portfolio to a brand consolidation strategy. At the same time, P&G bought Gillete, Wella, Iams or AmbiPur, in order to achieve economies of scale and develop technology that can be used for other brands (e.g. Gillete for Braun and Venus or AmbiPur for tide, Ariel or Mr. Clean).

Apart from acquiring resources, P&G collaborates for the achievement of synergies with other corporations, such as the University of Cincinnati, and its UC Simulation Center that P&G has

an agreement with, to receive talented students in its organisation and use the knowledge and experience of the centre in simulation capabilities and virtual models to apply them to manufacturing processes.

Other cooperation agreements involve the licences for the production and distribution of perfume, such as a line of fragrances by Alexander McQueen or another one by Stella McCartney in 2013. But sometimes, the company prefers to start new business projects by using joint ventures, like the joining of P&G and Clorox to create in the early 20s a commercial alliance to establish Glad, rubbish bags and plastic film and containers producer, owned at 20% by P&G.

P&G also outsources many of its internal activities to external specialised and highly valued companies that can do these activities better that P&G itself. For instance, the IT infrastructure, the development of applications and the data centres management are serviced by HP or the payroll services and travel support is rendered by IBM.

Finally, the company also works in collaboration of multiple enterprises. One way is by working with other organisations through consortiums, like the one established in Newcastle in 2011 called “Centre for Process Innovation” (CPI), formed by the centre itself, the university or Durham, Peerless Systems and P&G, which became a centre of excellence in methods and new technologies for the modification and cleaning of surfaces (CEMENT). Then, the other way is by forming interorganisational networks, which is achieved by the online platform Connect+Develop. This tool is used for P&G to communicate its technological needs and help individuals or external entities (start-ups, small or big companies, self-employed businesses,…) to get in touch with the company by submitting technological ideas and projects that P&G will assess and invest if interested.

3.6. R&D Multinationalisation

The company started its internationalisation adventure in 1930 with the purchase of the English firm Thomas Hedley, but the company has since internationalised many more of its activities and is present many more countries than it used to be.

The company not only became international by outsourcing or building production and supply centres beyond its boundaries, but it also opened R&D units in countries like Japan, Belgium or China, having around 20 R&D centres in the world nowadays for different sectors.

This off-shore R&D strategy started with the centre in Kobe (Japan), followed by multiple centres until the one opened in 2014 in Singapore, making this centre the newest and most avant-garde R&D unit for P&G. The corporation develops all the internal projects and ideas in the R&D units that are managed by the company without using external suppliers of innovation.

At the same time, all these centres are interorganised and related to each other with continuous incoming and outgoing flows of information, especially since the creation of the digital platform based on the "Enterprise architecture" technology and the intranet, called "Innovation Net", which was improved and built in the new platform for a better communication and managing.

This interorganisation means that the multinationalisation strategy that is followed by P&G is a mixed strategy, because the centres are connected to each other and the information shared within the network, but each centre is locally-focused, autonomous and decentralised, managed individually. Moreover, to be more specific, the strategy is a globally linked, because each centre is specialised in different innovation projects.

The centre in Singapore is specialised in chemical and packaging innovations, among other projects. Meanwhile, the centre in Brussels focuses on fabric and homecare innovation and the centre in Reading (UK) is specialised in technologies used for Gillette and the grooming segment as a whole.

The reasoning behind this strategy is to take advantage of the local knowledge. For example, the centre in Japan, which was opened after the purchase of Max Factor, was, and still is, oriented towards the beauty sector because the market in the western country was very demanding and consumers devoted more hours to making up. These reasons and the experience of Japanese researchers contributing to setting up the unit there, being a long-lasting lipstick the first line developed.

Apart of the units, there are "hubs" in China, Japan, India and Latin America that get in touch and manage the ideas submitted on the "Connect+Develop" platform from anywhere in the world. Depending on the needs, these hubs are specialised (e.g. the hub in China specialises on high quality materials, or in chemicals ideas in the Indian hub), connected to the rest of the company to transfer such knowledge in real time.

3.7. Open Innovation

P&G is a big company, and as it has been seen, it uses internal and external sources of technology to get technological resources and capabilities and at the same time, the exploitation is also done internally and externally, and when all four characteristics happen together, there is open innovation. In this sense, open innovation is a type of external sources of technology, mixed with internal sources, being exploited both, internally and externally.

One way to get ideas and knowledge to fulfil this sourcing of information is by relating to the inner environment of the company, in other words, using an intraorganisational innovation (inside-out) and working with employees. An example could be the twice more absorbent Bounty paper roll, which was the result of the combination of work among the innovation

centres in Singapore and Brussels, supervised by the headquarters, after an employee survey on how to improve the brand in the European homecare business segment.

Following an interorganisational innovation plan (outside-in), P&G collaborates with other organisations to develop new technologies. The platform Connect+Develop has made this a lot easier, and led to the creation of the first electric toothbrush with the help of an entrepreneur from Florida, or the development of transparent soluble films for detergent capsules used for Tide or Ariel, after collaborating with MonoSol, a soluble film producer.

The third method P&G uses is the collective open innovation or “crowdsourcing”, which involves resorting to other organisations and individuals massively and takes advantage of a worldwide “brainstorming”, used by P&G to get ideas about packaging, design, engineering or technology, representing around the 50% of the whole volume of initiatives. An example would be the consumer panel of women around the world, organised to know how P&G could satisfy their beauty and personal care needs while protecting environment, resulting in a 100% recyclable high density polythene plastic made from sugar cane and used for Pantene, COVERGIRL and Max Factor products.

All external sources of technology do not involve open innovation, but does that do, are highly profitable and P&G knows how to make the most out of it by implementing the above methods, based on their needs and situation.

4. Conclusion

Mature products are part of everyone’s daily lives and make up a big proportion of all the products that are manufactured in the world, what means that they are an important part in any economy, by creating jobs and allowing mobility of factors.

This paper has analysed what these mature products are, in terms of lifecycle, and the implications they have on innovation and the challenges they present when dealing with overcoming those challenges that are part of their nature, in order to improve the products and give them new uses.

First, the theoretical framework shows the possible strategies that companies can use to manage to create a productive environment and promote innovation, by choosing the way the company is going to focus on the innovation created, how the organisation is going to protect the technology and be assured nobody else will be able to use it and the best way to get technology for further developments, giving a guide on how companies can approach the process of innovation and develop technologies, no matter the industry or the type of product produced.

Second, companies that have grown until having a reasonable size have achieved some degree of multinationalisation of R&D, as it is the case of P&G, accepting the drivers for such process and benefiting from the advantages of partially innovating in a different country.

Third, a company that generates innovation by researching and developing technology on an internal basis only, is bound to fail. Companies that look for help beyond the organisation and accept technologies or ideas that have been acquired from other organisations or have collaborated with them to achieve such completion of a technology, have a higher success rate and can perform a better improvement for their products, as P&G does by opening the corporation to the exterior.

Finally, open innovation and the collective perspective of doing things has allowed P&G to keep innovating its mature technologies. It is compulsory for organisations to know how to research and develop both, internally and externally, getting ideas from all sources and shortlisting them, before starting those that are more likely to be completed successfully. P&G's platform Connect+Develop has certainly boosted the chances of innovating and finding new solutions for the mature products the company sells.

This paper and its study case serve as the perfect evidence that a mature product can still be innovated and improved, provided an organisation uses the right strategies to protect, get and exploit its technological resources and capabilities and it is ready to open to other organisations while also implementing internal R&D.

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