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*Innovation System: differences and synergies between Strategic
Innovation and Technological Innovation through a comparative
analysis of Apple products*

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Abstract

Many authors such as Vogel, Cagan, Boatwright in the “Arte e scienza dell’innovazione: la nuova economia delle opportunità”(2006) and Mazzucato, in “Lo stato innovatore” (2014) have argued that today innovation is the central issue for all economically advanced countries.

The objective of this thesis is to analyze the relationship between technological innovation and strategic innovation to understand the dynamics of the relationship.

The work is divided into three parts: a first theoretical part where we will treat the aspects of the two different types of innovation and synergies between them; a second part in which will be described the models and the context on which Italian politics is facing, describing the economic impact and the social value of innovation; a third part in which we will illustrate the products that have led a company like Apple to be a symbol of innovation.

In the first chapter we proceeded by analyzing the literary contributions in terms of innovation, through a historical analysis of how the concept of innovation in business and technological fields has evolved over time and the approaches used to study it. After learning what is meant by innovation, we will proceed by explaining the process transforming a simple idea into a product or service or innovative mechanism to be placed on the market. We will then make a general classification of different types of innovation, deepening the topics in strategy and technology.

In the second chapter, it will be provided an overview on the vision of innovation by Italy. We will proceed by describing the theme of Research & Development, whose public and private resources have been for years lower than those of world's largest economies. Furthermore, we will examine the effects of the use of technology on the productivity of companies and Public Administration.

In the final part, we will try to do an analysis of innovation in strategic and technological terms of the three symbol products of Apple: iPod, iPhone and iPad.

For each of these three products will be described innovations in technological and strategic terms, as well as the strategic decisions implemented by Apple for the launch of these products thanks to which the company will be able to keep constantly at the forefront, by procuring unique resources making it even stronger from the strategic point of view.

1. Innovation System

1.1 Definition of « innovation »

The definition of "innovation" given by the Enciclopedia Treccani is the following: the innovation is the concrete application of an invention or an idea. The innovation is therefore a process or a product (good or service) which guarantees better results and benefits than making social progress.

Sometimes, however, the results are not always effective compared to what we go to innovate; in this case it is referred to as "regression".

The invention is therefore the starting point of innovation. It is always the result of a project. Innovation is not limited to the technical, but exists in all sectors, although it is often linked to the technology in the form of technical and economic market progress.

In fact, sensitivity and attention to innovation, are the key to competitiveness. The innovation in this context is also a boost to consumption and therefore the demand for goods able to stimulate economic growth within a market economy.

The first economist who has dealt extensively and thoroughly innovation theme is Joseph A.Schumpeter which provided a contribution to the literature of great value, from which theories of innovation have developed.

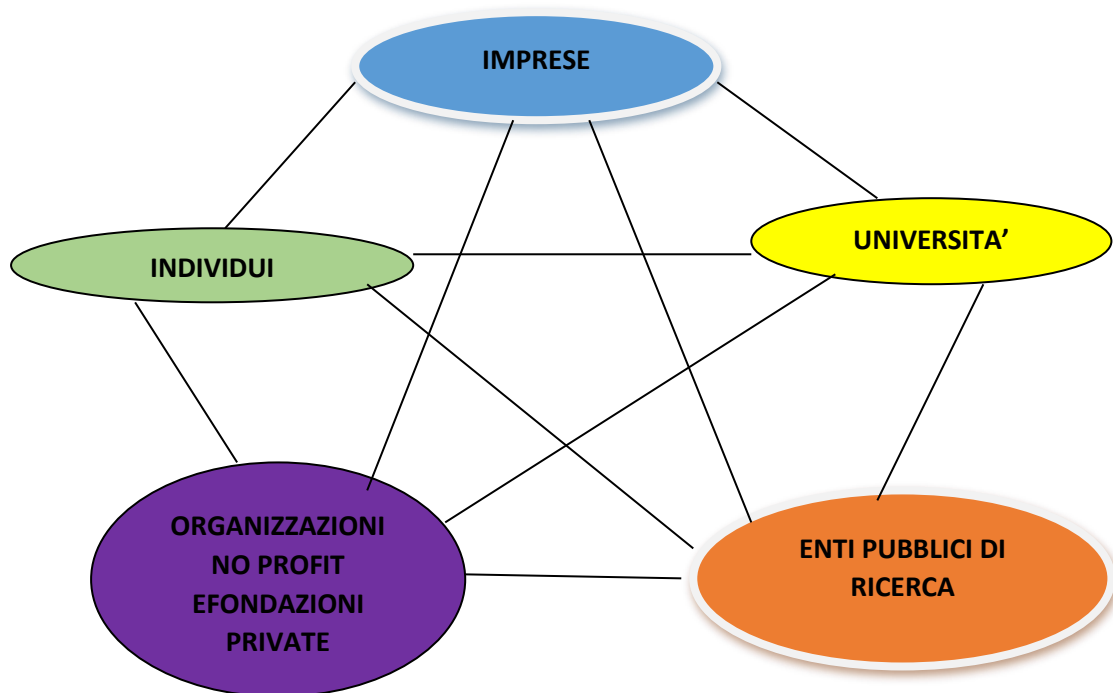
In 1902, he described the development as "a discrete phenomenon, unrelated to what can be observed in the circular flow and in the trend towards the equilibrium. It is the spontaneous and sudden change of the flow channels, the disturbance of the balance that alters and shifts the previously existing state of equilibrium".

Thus, according to Schumpeter, innovation takes the role of main driver of industrial change as a force that destroys the old competitive environment to create a completely new one. And 'then a creative response that occurs whenever the economy, a sector or companies of a sector, they offer something different, something that is outside of the existing practice (creative destruction).

1.2 Innovation Stakeholders : Sources

A key aspect of innovation is the definition of the various sources from which it may emerge.

INNOVATION SOURCES SYSTEM



Fonte: Schilling M.A., (2009), Gestione dell'innovazione, Milano, Ed. McGraw-Hill, Seconda edizione, "cap.2", p. 21.

An innovation can be generated by many different sources. First, it can be conceived in the mind of a single person, as occurs in cases of lone inventors or buyers of certain products or technologies. These last personally identify the ways to meet their needs better than they do the products that companies produce in the market, or by designing certain characteristics of a product, or a new product in its entirety.

Secondly, innovation can come from the commitment to research by public research institutions, universities, private foundations, and business incubators. A very important source of innovation, also shall be enterprises, which are facilitated in carrying out activities related to innovative processes because they have an entity of higher financial resources in respect of individuals, and management techniques able to use these resources and to finize them to the achievement of a particular shared goal. Companies are also very inclined and motivated to generate innovations in its range of products in order to differentiate themselves from competitors: the urge to innovate, makes the most advantaged enterprises to undertake innovative processes than all other subjects potential sources of innovation .

Finally, there is also another source of innovation and more relevant in terms of the ability to produce innovations, which however is not one of those first presented. It consists of the interactions and relationships establishing between the different sources of innovation.

The networks of innovators are the more effective innovation source in relation to the ability to generate technological innovations and progress.

It may be noted, therefore, that the sources of innovation are a complex system, in which each new product can be developed by one or more persons belonging to, or above all from the links and relationships between the various parties that are part of the network system of the sources of innovation.

1.3 A systematic approach to Innovation

As it is proposed by Pisano in the “Managing innovation: creare, gestire e diffondere innovazione nei sistemi relazionali”(2011), all the constituent elements of innovation have been considered as parts of a system, in which every aspect has a strong degree of interdependence on others and where every action in support of innovation diffusion must be conducted within an integrated approach.

In other words, the variables determining processes such as the diffusion of technology are manifold.

The innovation process is divided into five stages: basic research, applied research, development, production, marketing :

1. Basic research:

The first phase of the innovation process is the basic research. This is a research activity aimed to the increase of knowledge without immediate application purposes, based on the pure intellectual curiosity and the will to discover the fundamental laws that explain the phenomena of nature. The basic research explores what is unknown, extending the field of the possible, and produces general and theoretical knowledge.

2. Applied research:

In this phase, the research is aimed at obtaining certain applications results and to explore ways and alternative methods to achieve practical purposes. It produces models, methods and prototypes which will then be tested and evaluated in the next stage of development. It 'the first time in which the invention starts to turn into innovation.

3. Development:

At this point of the innovative process, the task moves from the prototype stage to the actual production phase. This phase involves a search on the production details which typically ends the absorption of economic resources. Obviously the development is conducted (mainly by enterprises) also on the basis of a commercial purpose, that is, with the aim of creating a new product or service to sell, or a new technology to be applied in the production process.

4. Production:

Here takes place the real change that brings an invention to become an innovation. In fact, at this stage, the main activity is implemented by the production processes of enterprises, in order to achieve what was conceived and developed through research in the previous three phases. Now innovation is ready to be introduced to the market.

5. Marketing:

It is the final act of the process, where innovation is commercialized on the market and includes all corporate actions related to the market intended for the placement of the final product. In this phase, the top management makes decisions regarding pricing, placement and promotion of innovation with the aim of obtaining the greatest profit resulting from the created innovation.

1.4 Different types of innovation

Now that we have provided the definition of innovation, distinguishing it from the invention and shown the transformation process linking these two similar but distinct concepts, we can classify innovation in all its types.

Assuming that innovation can vary in terms of scope, implementation times, organizational and societal impact we will try to propose an overview of the main types of innovation and their classification based on the object of innovation.

Therefore, depending on the specific object we can distinguish four types of innovation, as also proposed by Joseph Schumpeter in the "Theory of Economic Development" (1934):

- **Product innovation:** It is the introduction of a good or service, new or significantly improved, as regards its characteristics and the uses for which it is designed, including substantial improvements in technical characteristics, in the components and materials, built-in software , in the operating mode or other functional characteristics.
- **Process innovation:** It is the implementation of a method of production or distribution, new or substantially improved, including significant changes in techniques, technology, equipment and / or software.
- **Marketing innovation:** It is the implementation of a new marketing method that provides significant changes in design, packaging, in market positioning, promotion or in the product price.
- **Organizational innovation :** It consists in the implementation of a new organizational method in business practices of the company, in the workplace, organization or external relations.

Besides being able to make a classification based on the object of innovation, you can make a further distinction by focusing on the degree of novelty that innovations have obtained.

Then, as it is asserted by Schumpeter (2013) and Pisano (2011), we get three more types of innovation:

- **Radical innovation:** It involves the introduction of new products or services that can give rise to significant new companies, or be the result of severe changes across an entire enterprise, and the engine for the creation of new values.
- **Incremental innovation:** This type, differently from the first, includes editing, finishing, simplification, consolidation and improvement of products, processes, existing services and production and distribution activities.
- **Revolutionary innovations:** These innovations aim of surprises that generate in people. These innovations represent rare events, resulting from scientific and engineering insights, and therefore are considered revolutionary, realizing what many people did not think possible.

The company is the more interested body in change since it is undergone to continuous innovation (product, process, organization and marketing) in order to remain competitive. Constantly new skills are necessary and this affects both the economy as a whole, both the internal structure of the management and the relationships between companies as the trend to the integration of R & D, design, production, or mergers and acquisitions between companies, the everything for greater market presence, distribution of R & D costs, and reduction of the company risk.

The innovation process is normally triggered to withstand the pressures of competition, to adapt to changes in market demand, to meet the needs of customers, but also has the ultimate objective to increase the success of the company, making it more competitive and to sell "better", ie by decreasing prices, increasing product quality and respecting delivery times. The innovative types listed above, show a clear distinction between them provided by Oslo Manual, the document containing the guidelines for the collection and use of data on industrial innovation.

These types, though distinct, are also mutually connected; there may be, for example, an innovation process that does not generate product innovations, but it is very likely that a market innovation effects on the product to the point of generating innovation in this area, and this in turn justifies a process innovation and so on.

We can therefore say that innovation is present in all business aspects and that these are closely related to each other; but what is most important in my opinion is to possess a highly innovative company's strategic orientation at all hierarchical levels, always characterized by the pursuit of "new."

1.5 Strategic innovation & Technological innovation

Innovation can relate to, within a company, products, processes, marketing and organizational issues. However, in a constantly evolving market like the current one, it is not enough to successfully manage their companies. If you want to be the true innovators, it is necessary to implement the process of acquiring knowledge every minute of every single day.

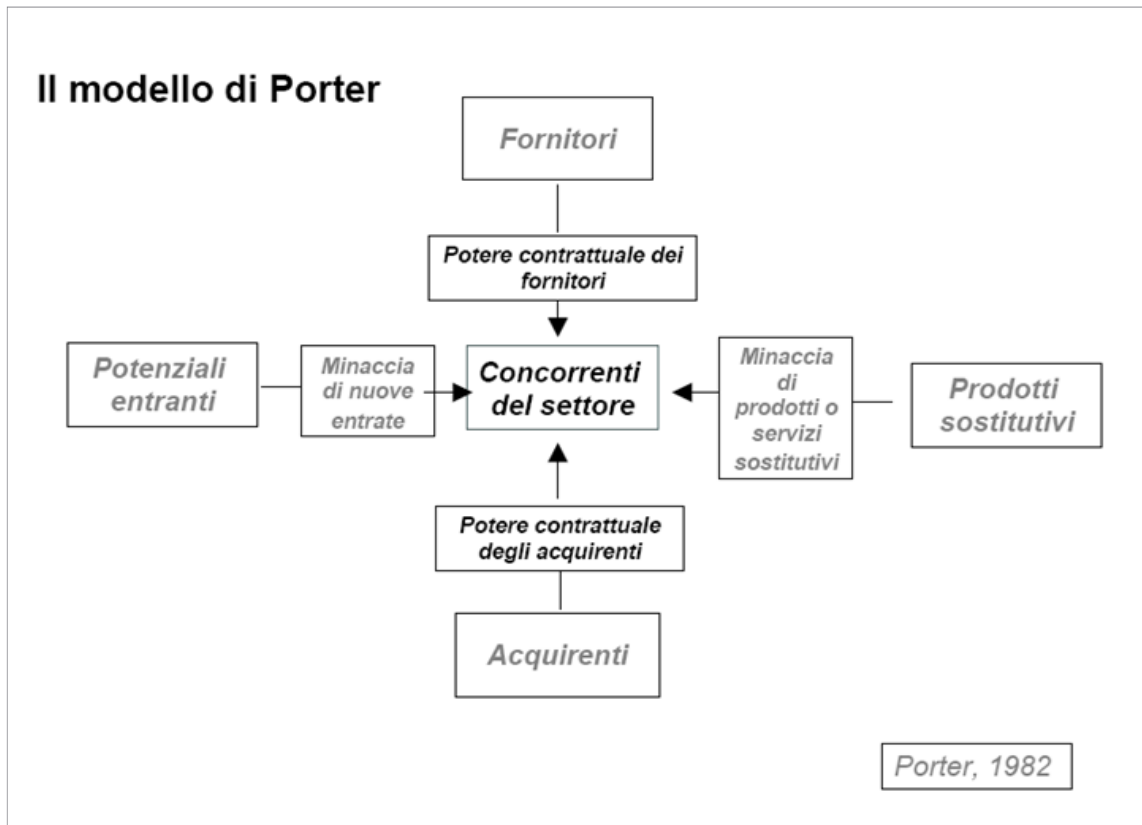
This is why some authors such as Porter (1996), Garcia (2011), Markides (1999) introduced the concepts of technological innovation and strategic innovation, as in modern economies the engine of economic growth often was represented precisely by technology and business strategies adopted by companies to distinguish themselves from competitors.

In the next paragraph, we face in detail the two arguments, highlighting the relationships that are created between them.

1.5.1 Strategic innovation

According to Porter (1996), the strategy is essentially based on the competitive positioning. The author described positioning as a marketing strategy needed to identify where to locate or relocate a business reality compared with existing services.

To assess the competitive position of the businesses rely on the "model of Porter's 5 forces", which allows the company to get a comprehensive picture on its competitive position, to make strategic decisions, to determine the behaviors and attitudes to be taken against of these forces.



Fonte: Robert M. Grant, *Analisi di settore (3ª cap.)*, in *L'analisi strategica per le decisioni aziendali*, 4ª ed., Bologna, il Mulino, 2011

Strategic innovation occurs then, when a company identifies a gap in strategic positioning and it decides to cover it through a higher value offer to the customer or improved efficiency, which could be translated as lower prices.

Taking up the now famous words of Markides in "Strategic Innovation" in 1999, which says:

“A strategic position is simply the sum of the answers that a company gives to the questions: Who should I target as customers? What products or services should I offer them? How should I do this in an efficient way?”

The companies, in order to make strategic innovation, must be adept at choosing the three fields of action (Who, What, How) in a distinctive way from other competitors and at the same time will be just as fanciful in developing innovations in all three dimensions simultaneously.

In fact, the development of an innovative strategy in a single direction, it is doomed to failure.

These aspects highlighted by Markides (1999) and Porter (1996), are closely related to another concept that characterizes the strategic innovation such as organizational innovation.

Organizational innovations are designed to create the behavioral context in which strategic innovations are developed. In order to cope with the impulses of a changing market and to renewed internal needs, nowadays it is often essential for companies to introduce changes also in the method of operation, organizational structure and modes of internal and external relations, in management and operational mechanisms and the technical and financial instruments. All of these changes is defined as organizational or management innovation.

The purpose of the organizational innovation is twofold; In fact, on the one hand the aim is to promote active and entrepreneurial behavior stimulated by a common spirit of initiative at all levels of the corporate hierarchy, and at the same time to select and support the development of innovative projects, helping to integrate them into the strategy of company.

In light of what has been said until now, we can therefore state that it is not possible to develop a strategic innovation based solely on aspects of positioning, but this must be accompanied by organizational innovations in order to be successful.

1.5.2 Technological innovation

The first definition of technology can be traced to 1972, when the American economist Nathan Rosenberg, specialized in the history of technology, described it as "that which covers the machinery, tools, and knowledge that is contained in the products and services (technology product) and machinery, tools and knowledge linking inputs and outputs (process technology).

This definition still valid today, is the first to deal with the technology not only as a process, but rather as the final result emerged from this process, in terms of products or services.

Exactly ten years later, the Italian Giovanni Dosi, professor of economics, stated in the "Technological Paradigms and Technological Trajectories" (1982) that "technology is defined as a set of knowledge that are at once practical, that is related to problems and concrete tools, and theoretical, that is not necessarily already applied but practically applicable. It also includes know-how, methods, procedures, experiences of successes and failures and even physical devices and supplies".

The technology is therefore, ultimately, a field of study that embraces tools, knowledge, product and process innovations, practical problems and conceptual problems.

Taking this definition as a reference point, we introduce the concept of innovation related to the technology.

The Treccani Encyclopedia defines technological innovation as "The deliberate activities of companies and institutions aimed at introducing new products and new services, and new ways to produce, distribute and use them".

Specifically, with regard to the economic, technological innovation it can be understood as the application, to the functioning of the enterprise, of advanced technical and scientific knowledge realizing and making available on the market

versions characterized by a considerable functional improvement or content than previous versions, such as to enable the latter gains or opening up new markets or expansion of its market share.

Essentially so technological innovation is characterized by:

- Improvement of a technology until its change
- Fulfilment of the requirements of the market constantly changing
- Opening new markets.

1.5.3 Relationships between strategic and technological innovation

One of the most common and false ideas about innovation is that it concerns mainly, if not exclusively, technological changes. Rarely a technological change takes place without also cause a change in the business model and vice versa.

The most successful companies in fact, are able to innovate acting both on business models, organizational and management, and technological progress, trying to combine these elements to create innovation.

Compared to the different types of innovation that may be relevant to identify the sources of threats and opportunities for companies, a first step in defining the competitive framework is linked to the development of the external environment analysis that helps to combine technological dimension with the strategic.

Abernathy and Utterback (1978) face this problem by introducing a model in which product innovations and process innovations evolve interdependently through distinct phases which correspond to differences in the structure of the sector and, consequently, in the source of competitive advantage.

Therefore, process innovation is defined as: the machinery system, the workforce, the definition of tasks, commodity and information flows used for the production of a good or service. Abernathy and Utterback (1978) mean the production process as a synonym for enterprise strategy and so, therefore, as a strategic innovation.

On the other hand, product innovation is understood as: any new technology or combination of technologies introduced commercially to satisfy a need expressed by the market or in line with a segment of the same.

As with the previous definition, even here the two economists use the term product innovation to refer to that which, in the previous section, was defined as technological innovation.

The use of this reference model allows us to make two types of analysis in relation to the competitive structure of the reference sector starting from the distinctive characteristics of the product and process technologies:

- On the one hand, it is possible to analyze the impact on the characteristics of the individual enterprise of the evolution of product and process technologies in the desired sector ;
- On the other hand, it is possible to analyze the evolution of the different competitive forces throughout the life cycle and development of technologies.

In modern economies, the engine of economic growth often was represented precisely by technological innovation: this component was in fact able to generate a ripple effect on other macroeconomic variables resulting in increased consumption, productivity (GDP) and occupation.

2. INNOVATION VALUE

2.1 Social value of innovation

If we look back in the history, the long period of economic history often arise from certain technological innovations cycles.

We can highlight, in particular, the historical role of the following major technological innovations:

- The first industrial revolution (1770-1830), born from the innovations in the textile industry in England,
- The spread of railways (1840-1890),
- The electrification, the chemical industry, the internal combustion engine (1890-1930),
- The mass production according to the methods prescribed by Fordism (1930-1980),
- The mass communication technologies (1980-present).

The long economic cycles is linked to the concept of technological paradigm, which is a set of guiding principles that oversee technological evolution and guide scientific and technological research in a given period. For example, the current economic cycle can be said to be dominated by the paradigm of information and communication, which began in the 1960s with the introduction of the industry's first hardware and software underlying the information age.

The advent of the information society marks the beginning of a true industrial revolution in which the growing shift from the production of traditional goods to intangible services, from the creation of a product to its design and conception determines the new centrality of knowledge, information, access to networks as creation tool of the social and economic value. ICT put in issue not just any notion of

economic value but also the perception of time and space, contributing to the phenomenon of globalization.

This industrial revolution has profoundly changed the landscape in which we live, times and ways of working, the organization of society and can help redefine the relationships and social attitudes.

We think for example to the force of change of phenomena such as:

- teleworking, which allows you to carry the 'professional distance activities, determining ways and new working time
- telemedicine, which allows you to carry out clinical examinations and diagnoses remotely making it independent of the quality of the physical place where the service is provided
- e-government, which allows everyone, citizens and businesses, to communicate with the public administration in a fast, efficient, transparent
- e-learning, which provides new flexible training opportunities and knowledge in time and place, reducing costs.
- the unlimited availability of services and information that can simplify your work and life through a more efficient and rapid management of daily activities
- the availability of new communication tools, which allow you to interact in real time on a planetary scale potentially at very low cost.

ICT can deploy their extraordinary potential of economic, social and civil growth of a Country and of empowerment of individuals who, thanks to the wise use of technology, they can become more informed and active citizens, more demanding and knowledgeable consumers, more productive workers.

2.2 Economic impact of innovation

As it is asserted in the OECD Report "Foreign Direct Investment for Development – Maximising benefits, minimizing costs" (2002), digital innovation economic impact refers to the contribution of investment in ICT both the productivity of labor, both the PTF is the

constitution of the stock of technological infrastructure required to attract foreign direct investment (FDI).

The introduction of ICT in production processes is not new of course, but it is only in recent years that there has been all over the world to a large-scale phenomenon of increase of expenditure, both for companies and for families, due to the success of the personal computer before and then Internet as work and leisure tools.

The level of penetration of new technologies in the Italian system appears historically lower than in other European countries.

The measurement of the effects of investment in IT on economic growth begins in the late '90s. Various studies have confirmed the robustness of the relationship between IT investment and productivity growth in the United States. Investments in ICT in the European Union have contributed between 30 and 40% to the growth in labor productivity over the years 90 and later.

At this point we can also consider the effects of IT on the foreign direct investment (FDI).

Our interest in this variable is derived from the important contribution that foreign direct investment can make to economic growth. According to OECD Report (2002), the main effect usually associated with them is the geographical transfer of technology that is through the links that are created between foreign multinationals and local companies, and determines a forward displacement of the efficient frontier production, with productivity, employment and income gains.

The global market of FDI has grown enormously in recent years, owing to their economy of the opening of new markets. The result was a rise in competition for the attraction of FDI and greater attention by Governments to related policies.

However, some political choices of attractions are wrong because dedicated exclusively to the investment incentives : investors should be concerned with the real economic motivation and not only the exploitation of the incentives. Therefore, policies should be targeted at improving the allocation of human and technological

capital resources, infact the transfer phenomena (spillover) are more likely to succeed when the technology and knowledge gap between local companies and foreign investors is not excessive.

Concluding, the strong growth in spending on ICT which took place from the beginning of the 90's has produced remarkable results in terms of efficiency of production processes. These effects occurred both through an increase in labor productivity both by shifting the entire frontier of technology or through FDI.

2.3 Research and Development

Today, the interpretation of innovation processes originated exclusively from the scope of research and development, is gradually giving way to the vision of "widespread" innovation. By this we mean creation processes of knowledge and innovation can not be focused exclusively on the Research but they should give value also to more informal innovation.

This widespread innovation is typical in our country, where the weakness of the classic indicators of research and development (primarily expenditure and patents) clashes with the objective capacity for innovation and creativity of our SMEs, as it is asserted by Vogel, Cagan and Boatwright (2006).

The OECD data show that the leading country in Europe for R & D investment relative to GDP is Sweden, with Finland, Germany and France. Extending the discussion in the last two decades, Italy is among the last places.

Worthy of attention is not just the amount of expenditure in research and development but its composition, closely linked to public spending, compared with a relatively modest contribution of the private sector.

According to Manual in the "Guidelines for Collecting and Interpreting Innovation Data" (2005), it is important to stress that attitudes to innovation in the enterprise sector, and therefore investment in R&D, is strongly linked to the size of the company. So the problem of Research and Development in Italy shows closely related to the socio-

economic fabric, made up in large part by a dense network of small and medium-sized enterprises. At this also it must be added the fact that in terms of R&D expenses in the big Italian companies show an inferior research intensity than the main multinational competitors.

However, the problem does not arise solely in terms of company size but also in terms of type. This means that non public investment in research are unsatisfactory not only because Italy is supporting the small and medium enterprises, but also because the Italian company has not yet been particularly interested, for its target market and its product policies, to a strong investment in research and technological innovation.

Also with regard to the total number of researchers on the labor force, Italy is one of the last places in the EU ranking.

From these data it is clear in Italy the need to face innovation activity in Research &Development in a systematic and coordinated way, trying to act on the actors involved in the R&D processes to transform the percentage of so-called "occasional innovators" in a more stable and persistent coverage, especially at enterprise level.

2.4 Innovative Finance

In order to deal at national level the global competitiveness challenge you must consider the need to increase the availability of financial resources to the service of policies for innovation.

Considering the very limited financial resources of the public system, it becomes necessary to orient the policies for development and innovation even towards the use of innovative financial instruments.

The relation between innovative financial instruments and policies for excellence is a theme already dealt, over time, at different institutional levels.

However, if it can be said acquired the relevance of innovative finance for R&D policies, less obvious are the ways of promoting these tools.

Before dealing the examination of the possible instruments to be promoted and the current best practices, as it is described in the CEPS (Centre for European Policy Studies) Report (October 2012), it is necessary to emphasize that public intervention for risk capital will be implemented through aid schemes compatible with the EC Treaty and, in the field of State aid , with the Communication from the European Commission on venture capital. Government intervention should, therefore, be no distortive of the market, contained in time and aimed at specific enterprise sectors traditionally neglected by market investors (seed capitals, start-ups and spin-offs, small and medium enterprises).

Moreover, since it is the private sector to lead the venture capital market, government intervention will have to draw as much as possible to the resources offered by the private sector, both financial and professional, avoiding the temptation to totally public initiatives. Accordingly, the public sector can take action by facilitating both the supply and the demand.

Concerning the advantages for the supply you will need to provide incentives only interventions where the limits induced by high-risk investment or combination risk and high costs undermine the private intervention.

After such clarification, according to the CEPS Report (October 2012), investment can be:

- support to costs for the patent protection ;
- the encouragement of mobility relations and exchanges between universities, financial professionals and companies;
- intervention with public resources to increase the availability of funds that can be taken with funding formulas or public co-financing of venture capital funds, or public refinancing models of private financing on concessional terms;
- action to curb the diseconomies related to small investments of difficult and expensive evaluation by facilitating the activities of *due diligence* technological activities and legal and economic evaluation;
- support for the action of informal investors;
- guarantees and co-guarantees of the public sector to private investment ;

- tax breaks on *capital gains* in the *corporate venture capital* and business angels involved in the early stages of a new business.

Next to public intervention also on the demand side, it is important to give emphasis to *venture capital* requests of university spin-offs and research centers through:

- support to costs for patent protection;
- entrepreneurship training in higher education and the use of *venture capital* in enterprises.

2.5 Innovation in Enterprises

Beyond the development and deployment of ICT technologies, it is particularly important to evaluate their intensity of penetration and usage, keeping in mind that the use of technology in the company processes is related to industrial and entrepreneurial characteristics of each country and, from this perspective, the medium-small configuration of the Italian system does not help to their deep penetration. Italy is lagging behind the other European countries, and this is confirmed by the data related to online sales processes in the B2C and B2B.

As Roberts E. B. described in the "Innovation: Driving Product, Process and Market Change" (2002), the progressive globalization of markets, the increasing complexity characterizing purchase and consumption processes in many industrial contexts, and especially the evolution of ICT increasingly reduce the life cycle of the products making increasingly risky strategies based on established products.

Following a market overview, and as already mentioned earlier, product innovations can be classified according to the degree of novelty that they have for the company and for the market.

According to Joseph Schumpeter in the "Theory of Economic Development" (1934), it is therefore possible to identify:

- really new products, radical innovations and absolute novelties for both the enterprise and the market;
- imitative products, or new products for the company, but already on the market;
- incremental innovations, the result of improvement of products already in the company;
- market innovations, the result of the creation of new market segments or entry into new markets.

Italian companies have traditionally understood the process of development and launch of new products in terms of activities to be performed independently. This view of innovation by the Italian companies is related to the perceived risk with third parties using the knowledge related to the innovative process and the high cost required to jointly produce new knowledge.

As Grant argued in *"Analisi di settore"*(2011), the market competition requires management of scientific and technology knowledge increasingly complex requiring the contribution of many actors. It is important to note in fact that when the knowledge becomes complex, the place of innovation is no longer the individual enterprise, that is inadequate, but it is the enterprises network. As demonstrated in the Italian reality, particularly for radical innovations, this complexity requires the decentralization of the innovative process and the involvement of several external actors.

Moreover, the interest of Italian companies is aimed primarily at application solutions aimed at optimizing internal processes such as ERP (*Enterprise resource planning*) Administration and finance, etc, but it begins to emerge interest in Innovative applications such as CRM (*Customer relationship management*) and Knowledge management.

One of the factors underlying the development of e-business is the 'intervention on the phases of the value chain impacting on business costs. Another element that affects the competitive advantage is related to growth opportunities. This lever, the

least understood, refers to the increase of "opportunities" business which is achieved by participating in a digital marketplace allowing the ability to interact with more actors, and to reduce transaction costs.

Italian SMEs have essentially a matrix crafts making of qualified professional work its fundamental resource. In recent years the role of technology was often secondary to the comparison of resources such as personal insight, the ability to go on international markets etc.

These factors may explain why the rate of diffusion and adoption of ICT in Italian SMEs is lower than other countries: our SMEs are inserted in an industrial system that did not require significant technological innovations and to operate in a financial system who has not found convenient the specialization in financing innovation.

An element not to be overlooked resides in the provision of innovative technological solutions. Not always in fact, the offer of courses solutions from large international companies combine the small and medium business market whose needs could be satisfied by specialized companies but small in size able to introduce innovative solutions equally.

As regards the services sector, it represents one of the major components of a modern economy. The intangible and high intensity nature of services information allows digital technologies have a key role in revolutionizing the modes of production, commercialization and delivery.

Even for services, a significant discriminant is represented by the size of the company.

According to Grant (2011), the sectors that were more open to innovation are banking, insurance, financial services, Engineering, Research & Development. ICT, all sectors with more than 50% of companies that have made significant innovations.

2.6 E-Government : innovation in Public Administration

The development of e-government project falls within the wide process of innovation and reorganization of public administration started in the 90s as part of the administrative reform of the public administration and that has set the goal of

modernizing the public administration through greater efficiency , transparency and administrative simplification improving the quality 'of the relationship with the citizen.

As it is explained by De Pietro "Dieci lezioni per capire e attuare l'e-government" (2011), E-government is recognizable as the use of information technologies in administrative processes (more generally, the ICT technologies, Information Communication Technology), introduced with the aim of providing services that meet the new requirements expressed by a deeply changed society in recent years, because of articulation and lifestyles.

In addition, the introduction of a new tool has been perceived as an opportunity to tackle the reorganization of bureaucratic process for the reduction of the complexity of the system, to the benefit of both internal users and external ones.

However, the e-gov does not only coincides with the computerization and the overall digitization of the Public Administration, but it is correct to refer to e-gov where use of innovative tecnologie clearly constitutes a valuable contribution to the improvement of services provided to end-users.

E-government is therefore the use of information and communication technologies (ICT) in administrative processes through which the PA aims to improve the efficiency the action of the public administration, improving on the one hand, the quality of public services provided to citizens and reducing the other, the costs to the community.

In summary, the e-government in Public Administration:

- Improves the administrative efficiency of the PA;
- Promotes interoperability between administrations;
- Improves the transparency of the procedures;
- Provides access to online services of all government and public services and is available 24 hours 24;
- Reduces costs and times;
- Ensures equal treatment for all citizens.

The legislative framework is regulated by the Digital Administration Code, recently updated and integrated with the New Code, Legislative Decree n. 235/2010, and by the Decree. June 30, 2003, which regulates the processing of personal data through the electronic means and the Law of 9 January 2004 n. 4 supporting the access of disabled people to tools and aiming to broaden digital inclusion policies.

Here are some among the most significant articles of the new code:

- **the right to use information technologies to government and public services managers:** the right for citizens and enterprises to use information technology to all dealings with the Public Administration and also to extend this right to the public services managers (Art.3);
- **electronic payments :** The new Code provides a set of operational tools such as credit card and allows you to make use of private entities for the collection (Art. 5)
- **the use of certified electronic mail (PEC):** all communications transmitted by PEC shall constitute notice by Registered Mail. The PA will use the PEC for communications and transmission of electronic documents with respect to persons who have previously declared their address ; it will be able to consult and extract the PEC address lists of companies and citizens who have so requested ; it will release on their institutional websites a PEC address to which citizens can turn to for any request. (Art. 6 and 65)
- **the use of digital signatures:** it is introduced the concept of advanced electronic signature, with which you can subscribe to an electronic document with a legal validity. It is allowed the market liberalization for digital signature.

3. Innovation in our hands

3.1 Portable Media Players : iPod

In 2001 Apple enters the market for music players with the iPod. Although Apple has not introduced the first portable mp3 player (EigerLabs did it in 1998), was the first to gain attention and popularity.

It became fashionable, and as mentioned above, when it was launched, there were already 43 of Apple's competitors in the market. In fact, as it is remarked by O'Grady, in "Apple Inc."(2008), the engineering skills of the company is not focused on the development of new technologies and components, but on the integration of technologies and components in innovative architecture: the extraordinary design quality of Apple products is based on technologies invented almost always somewhere on the other hand, often thanks to public funds.

The iPod, a new portable device, enabled consumers to store thousands of songs without using either tapes or cd: at the beginning of twenty-first century, it became very popular, ousting from the market other portable devices like the Walkman and Discman, Sony .

With this new application of existing magnetic storage technology Apple could challenge a giant like Sony and achieve leadership in the music and entertainment market.

The iPod's success was important for Apple especially in two aspects: first because it marked the comeback of the company after years of steady or even negative growth; secondly because it prepared the ground for the launch of a family of innovative new products based on the iOS operating system.

The success of the Californian company was ruled by the development, through a series of software applications, with a complete supply system that would allow legal

downloads of music files, the easy use of the MP3 and it was also attractive to the customer even beyond its mere functional characteristics.

Apple has managed to build a complete supply system, integrating hardware and software components, which would solve the problems of buying, storing and use of music better than they were doing the competitors, thus creating greater value for the customer.

By adopting a systematic approach Apple has managed to create greater value than other companies, which until then had focused on the functional aspects of the single product, although not building a product better than competitors.

The market has rewarded Apple because this company has succeeded in linking innovation to different dimensions thanks to an approach on a larger scale that would improve the experience of the customer's use.

The strength of the company founded by Steve Jobs is mainly linked to the ability to identify emerging technologies from great potentialities, to use advanced engineering skills to effectively integrate these technologies, and to a clear corporate vision, giving priority to the development of products for the best user satisfaction (with a strong focus on design).

The iPod click wheel, which allowed users to quickly navigate their music libraries, was one of the first attempts of Apple to implement tactile features such as finger scrolling. This technology has been implemented in all subsequent versions of the iPod Classic, until arriving at iPod Touch.

Touch screens able to recognize gestures consisting of several touches are one of the most important technologies in Apple devices and have played a key role in the launch of pocket devices like the iPod. This technology has enabled the machine-man iterating through a new interface allowing the fingers to navigate the glass surface of the LCD panels included in mobile devices.

The click wheel is not the only element of Apple products to have taken advantage of this technology: the touch screen multitouch of iPod Touch, iPhone and iPad is based

on the same principle of sliding, operated with a finger or more fingers on a glass screen.

In addition the Click Wheel and subsequent finger scrolling and multitouch-screen, a technology used by Apple, but idealized by the French Albert Fert and the German Peter Grunberg, was the implementation of giant magnetoresistance (GMR). The GMR is a quantum mechanical effect observed in layered structures thin film, which has found the most important application in the magnetic field sensors used in hard disk drives and other devices. It was precisely the adoption of these micro hard drives one of the success keys of the iPod that allowed users who used it to be able to store music pieces very "heavy" in terms of space and memory.

3.2 Smartphones : iPhone

iPhone is presented by Steve Jobs in January 2007. The device is a hybrid that incorporates the functions of three devices that have begun to be integrated together with the advent of smartphones:

- An iPod with audio reproduction capabilities, photos and videos;
- A mobile phone quad-band (GSM + UMTS HSDPA + EDGE) and Wi-Fi connectivity and Bluetooth 2.0 + EDR and equipped with 2.0 MP camera on the iPhone 2G and 3G, 3.2mp on 3GS and 5.0 mp on iPhone 4;
- A newly developed handheld with operating system derived from Mac OS X with integrated multimedia functions of browsing the Internet, watching video and GPS service.

Although smartphones were already in existence before iPhone, this product has created a new market segment, partly due to the beauty and construction quality of the device, but also (and especially) of its usability and expandability due to the App Store.

Isaacson (2011) asserted that the combination of aesthetic beauty, engineering quality and user experience, all combined with an excellent marketing campaign, has allowed

Apple to gain market share rapidly in various consumer electronics. Along with a number of other factors, the passage of the limited functionality of the touchpad with multi-touch screens, with the launch of the iPhone, has been a major leap forward in the race of Apple to the "smart phone".

The iPhone, which has become an icon, has drastically changed consumer expectations about the nature and functions of a mobile phone. It can confidently affirm that it is only with the advent of the iPhone that there was an explosion of touchscreen smartphones that we can enjoy today.

The iPhone has not simply demonstrated that the idea of a fully touchscreen device is a winning one, but also that its implementation of this technology is a step ahead of all competitors. The technical reason behind this advantage lies in the type of touchscreen chosen by Apple. The iPhone, in fact, from the beginning is characterized by a capacitive touchscreen in contrast to all devices based on Windows Mobile which use the more traditional resistive touchscreen display.

The iPhone looks very cool with its technologies and innovative hardware, but what makes a phone smart (smart is the ability to connect the user at any time to the virtual world. Another of the technological innovations in this product is the capacity to place in networking "intelligent" devices, implementing them internet, the HTTP hypertext transfer protocol and the HTML markup language.

The most recent features of the iPhone is a virtual secretary known as Siri that has introduced another revolutionary concept for the insertion of instructions, which has been integrated into a number of features and iOS applications. The introduction of Siri has sparked yet another redefinition of human-machine interaction, providing a new interface tool.

An other aspect that it is important to mention is about the strategic innovation adopted by Apple. In fact, among the aspects that have made the fortune of the iPhone there is the method of distributing the software and the iPhone itself. As Isaacson said in "Steve Jobs" (2011), the iPhone was released by Apple, at least until the 3G version, only by telephone companies chosen from the company. In this way

two objectives have been achieved: on the one hand to have available the impressive distribution network operators such as TIM and Vodafone, on the other hand put the phone operators in a position to submit offers that were intended to sell the iPhone combined with a data connection.

3.3 Tablet : iPad

The January 27, 2010 Apple presents to the world a revolutionary device. The iPad is a multipurpose instrument that aims to satisfy a variety of needs. With iPad, Apple faces new competitive spaces.

With the iPad's introduction, Apple has transformed the mobile computing industry, dominated for decades by laptops, netbooks, and so on. Offering more subtle dimensions and comfortable, with a touch screen and a large virtual keyboard, important navigation and multimedia features and broad compatibility with other products and Apple applications, the iPad actually has created a new niche in which it is absolute master.

Although iPad has revolutionized the mobile computing market, technology innovation is less visible than the iPhone and iPod. In fact iPad have been implemented the same technology used for the previous two aforementioned products, integrating only small microchips that allow portable devices to process large amounts of information and pass them through the Ram memory in nearly infinitesimal time.

It can be said that the real innovation of the iPad, is the strategy adopted by Apple to create a need that did not exist before, producing an ad hoc instrument for all users.

The tablet is not an invention of Apple, in fact, the idea is born from its main competitor: Microsoft. In the 2000s Bill Gates suggested on the market the first tablet computers, devices with first generation digitizer which integrated for the first time all of the hardware components in a structure "at hand" and highly portable compared to computers of the period. These were not successful, however, as expensive, with a cumbersome OS on touchscreen such as Windows XP, uncomfortable, and not immediate to all.

Ten years later Apple decided to present the iPad, the first tablet with multitouch touchscreen.

The iPad is one of the simplest mobile computing devices on the market, and this is the focus of its popularity. The Apple tablet has the same familiar operating system that many have already used on iPod or iPhone and allows you to use all the applications already purchased on the AppStore.

The iPad luck is triggered by a business strategy inculcated over the years, from the early products to the last, and great ability to reinvent products "hypnotizing" the public.

The success was so great to the point that most of the people who lived through the boom on the mobile Apple, with the iPad specifically, have found themselves understand the word "iPad" as a synonym for "tablet". Apple has amazed many times on the field, leaving conceiving people, including through good advertising business, which are its devices to represent sectors.

Today the era of tablet may be coming to an end, replaced by increasingly powerful smartphones, and with more and larger displays, but the iPad, as well as representing the pinnacle of this technology, will remain a milestone in mobile computing.

3.4 Differences between products

Based on what is described in the first chapter about the differences between technological innovation and strategic innovation, we try to verify the theoretical elements discussed, giving an example of how such innovations are put into practice in a company like Apple.

Concerning technological innovation, as also O'Grady asserted in "Apple Inc." (2008),

following the innovations that Apple has made to its products :

- **iPod** : The implementation of the giant magnetoresistance (GMR) is a quantum mechanical effect observed in structures in layers in thin film that allows to store music tracks "heavy" in terms of space and memory of the micro hard

disks. Furthermore, the Finger Scrolling was the first attempt to Apple to implement touch capability through the scroll wheel.

- **iPhone** : The integration of a capacitive display in addition to an operating system designed not only for the adoption of a finger interface, but also able to support the multi-touch and the consequent potentialities. These are elements that have strongly marked the iPhone from other smartphones.
- **iPad** : Although iPad has revolutionized the mobile computing market, for this product technology innovation is less visible than the iPhone and iPod. In fact iPad have been implemented the same technology used for the previous two aforementioned products, integrating only small microchips that allow portable devices to process large amounts of information and pass it through the Ram memory in nearly infinitesimal time.

Concerning strategic innovation, as said by Schumpeter (2013) and above mentioned in the first chapter, following the three types of innovation, giving the example of how such innovations are put into practice for Apple products:

1. Product innovation :

- **iPod** : Apple has managed to offer a product that would meet the needs of consumers. Indeed deploying storage technologies significantly higher than competing data and a software dedicated exclusively for music downloads, Apple has revolutionized the music industry, making the iPod the music player par excellence.
- **iPhone** : Networking is the cornerstone of the success of this smartphone. Although already existed in previous models, putting in touch the user with the virtual world by implementing the HTTP and HTML protocols, it has changed the way of conceiving the phone.
- **iPad** : For thi product, product innovation is the most obvious because Apple has managed to enter the market a product specifically designed to bring all users to the technology. Apple has managed to create a need that did not exist yet, making it easy and intuitive product that can be used by both experienced users and those still beginners.

2. Process innovation :

- **iPod** : Ability to identify emerging technologies of great potentiality such as those found in the section of the technological innovations and to use advanced engineering skills to implement them effectively.
- **iPhone** : The iPhone was released by Apple, at least until the 3G version, only by telephone companies chosen from the company. In this way two objectives have been achieved: on the one hand to have available the impressive distribution network operators such as TIM and Vodafone, on the other hand put the phone operators in a position to submit offers that were intended to sell the iPhone combined with a data connection.
- **iPad** : Process innovation is virtually zero. We can say that, thanks to the boom obtained with the two previous products, Apple has decided to keep the same policy of production and distribution because it was considered still effective.

3. Marketing innovation :

- **iPod** : Proposal for a comprehensive supply system, which allowed legal downloads of music files facilitating the purchase and definitively removing tapes and CDs.
- **iPhone** : Apps represent the true Apple marketing strength allowing iPhone to be not only a phone, but also an entertainment tool.
- **iPad** : The operating system was lightweight and designed to be operated via the touch screen from the beginning, the weight and small size made it a great travel companion.

Conclusion

In this thesis it was made the analysis of the various types of innovation, both from a purely technological point of view and observing it through a vision on the level of company strategy, showing the synergies that arising between these two aspects.

Through the first chapter in fact, we wanted to provide the general definition of innovation, differentiating it from the invention and showing the process steps transforming a simple idea into a practical application contextualized within a company strategy. For this it was essential to provide Schilling sources of innovation and highlight stages of the process that transforms an idea into an innovation practice.

Assuming that innovation can vary in terms of scope, implementation times, organizational and societal impact, we classified innovation in all its types based on the object of innovation and on the degree of novelty that innovations have obtained.

We proceeded to the description of strategic innovation and technological innovation. Through Porter's five forces model, we wanted to expose the concept of strategic innovation as the positioning or repositioning of a company. We proceeded then with the definition of technological innovation, distinguishing in product innovation and process innovation. In order to describe the synergies between strategic innovation and technological innovation, we have introduced the model of Abernathy and Utterback.

Concerning the second chapter, the analysis on which it is structured draws a systemic reading of the creation and diffusion of innovation processes and the emphasis on the fundamental role of the main actors of the system and their relationships:

- **Citizens** : Citizens, necessary resource for the innovation system, are considered the final recipients and explicit engines of innovation diffusion in

their roles as users and, at the same time, manufacturers of innovation in their professional activities.

- **Companies** : Companies, actors in the innovation creation, use innovation as a competitive lever.
- **Public administrations** : now included in the innovation system, it adopted a new internal organization in light of the potential of e-government.

In the last chapter, for each of the symbol products of Apple, a detailed description was made, listing the technological and strategic innovations and synergies between them.

The choice of Apple as a case study for this work was done on the basis of easily verifiable innovation in its products. As mentioned in the first chapter, in every successful business model there are a lot of important elements to consider.

In Apple's case, it has been found that the elements that led to the company's success are the following: Novelty, Design and Convenience (understood as ease of use).

In terms of Novelty, the company driven by Steve Jobs, is really an unbeatable giant. Its devices have helped to change the consumption habits of the market and have made the competitors some "followers" of trends launched by the company itself. It was the case of the iPod, and even more so it was with the launch of the iPhone (Apple / Samsung case is the most sensational) and the iPad.

Even the design becomes a strong point of the company's business model. In the past, technology was almost never associated with design, beauty, searching for the exterior details that would make even more appealing a technological device. However, with the arrival of Apple products everything is synonymous with beauty and trends, so that having an Apple device means to belong to a group of elected that loves technology, innovation and functionality, using graphics to high levels.

Finally, the element of convenience has allowed wide spread of its products on the market. The buying, downloading and listening to music have become more simple,

fast and more pleasant thanks to the introduction of iPod. It is for this reason that convenience does not refer to the device in the same device, which definitely has a price higher than that of other devices on the market, but in terms of advantages acquired once it is in your possession.

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